EDITORS

Aniello Aloia - Domenico Calcaterra

Albina Cuomo - Angelo De Vita - Domenico Guida

Parco Nazionale del Cilento, Vallo di Diano e Alburni

MINISTERO DELL'AMBIENTE E DELLA TUTELA DEL TERRITORIO E DEL MARE

European Geoparks

Proceedings

of the 12th European Geoparks Conference

National Park of Cilento, Vallo di Diano and Alburni Geopark- Italy
4-6 September 2013

Geoparks

an innovative approach to raise pubblic awareness about geohazard, climate change and sustainable use of our natural resouces .

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GLOBAL GEOPARKS NETWORK

European Geoparks

Edited by
Aniello Aloia, Domenico Calcaterra, Albina Cuomo, Angelo De Vita, Domenico Guida

Graphics and layout: National Park of Cilento, Vallo di Diano and Alburni

ISBN 978-88-907281-4-3

This documents may be cited as follows:
Aloia A., Calcaterra D., Cuomo A., De Vita A., Guida D. (eds) (2013): *Proceedings of the 12th European Geoparks Conference*. National Park of Cilento, Vallo di Diano e Alburni – Geopark- Italy 4-7 September 2013, 332 p. **ISBN 978-88-907281-4-3**

All papers in this publication were presented during the *12th European Geoparks Conference and were submitted to peer review by referees.*
Refering has been exended by editors to typographical errors or to graphic quality as far as this was possible.

12th European Geoparks Conference2013

National Park of Cilento, Vallo di Diano e Alburni – Geopark- Italy 4-7 September 2013

Organized on behalf of the European Geoparks Network by
National Park of Cilento, Vallo di Diano e Alburni – European and Global Geopark

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FOREWORD

The National Park of Cilento, Vallo di Diano and Alburni - Geopark has the honor of hosting the 12th European Geoparks Conference (4-7 September 2013), when the global development strategies of the European and Global Geoparks Networks assume an important role in the world. Geo-hazards and climate change strongly affect all human activities and can severely condition the future of humanity. In this framework, geoparks and scientists – coming from different backgrounds – can greatly help society in better understanding how to face natural geo-hazards and to manage a sustainable use of natural resources.

This conference aims to:

1. verify how Geoparks can direct the scientific knowledge of the academic community on these items;
2. understand how the Geoparks address these issues in the educational system;
3. disseminate the role of Geoparks on the public awareness and sustainable use of natural resources.

Our Geopark represents a harmonic integration between Man and Nature: geodiversity, biodiversity, Greek cities and ancient towns, ancient abbeys, castles and country houses set in an unspoilt nature. Our territory is a reserve of the Biosphere MAB program (1997); it was declared a UNESCO World Heritage Site as a “cultural landscape” of global significance (1998); it obtained the recognition as European and Global Geopark (2010); Cilento, representing Italy, was given the recognition to the Mediterranean Diet by UNESCO (16th November, 2011).

This territory is a true living laboratory in which to experiment the many opportunities of sustainable tourism and to combine the protection of nature and geo-biodiversity with the development of social, cultural and economic development of local communities.

The 12th European Geoparks Conference will be held in Ascea and the choice of the Conference location was not casual. In present day, Ascea is a modern, touristic small town surrounding the Archaeological Park of “Elea”, the ancient Greek city renamed as “Velia” by the Romans, one of the cradles of the western philosophy and civilization, where the philosophers Parmenides and Zenone founded their school. The excavations of Elea have been recently included in the UNESCO World Heritage. The long and complex Elea-Velia-Ascea history probably represents the first cultural, social and economical global “network” in the ancient world and testify an actual “paradigm” of cohabitation between man and geo-hazards. In fact, since its foundation, the town experienced natural disasters due to landslides, inundations, earthquakes, probably tsunamis, which strongly conditioned its social and economic development. Tradition tells us how Parmenide, as nature philosopher. understood type and dynamics of local geohazards, as teacher, raised public awareness and, finally, as policy-maker, suggested planning and design measures intended for the natural risk mitigation.

The success of the 12^{th} EGN Conference event is demonstrated both by the presence of 400 delegates coming from 41 countries of 5 continents and by the huge number of submissions received, more than 150 short papers, all examined by a referee. Some 33 of these papers were selected and to published in the *Rendiconti Online della Società Geologica Italiana*, an electronic journal of the Italian Geological Society, which was founded in 1881, representing one of the oldest scientific association of geosciences in the world.

The short papers included in this volume give a reasonable idea of the variety of topics related to a modern integration among geodiversity conservation, geohazard mitigation and sustainable uses of the natural georesources.

I want to close this short presentation with my warmest and sincere thanks to all the colleagues from the European Geoparks Network, who gave me the opportunity to organize this Conference.

However, the Conference would not have been so successful without the support of the Organizing and Scientific Committees, of the Geopark's President and Director, Amilcare Troiano and Angelo De Vita, and, last but not least, without the friendly help of Domenico Calcaterra, Nicola Catino, Alba Cuomo, Domenico Guida, Angelo Marsicano and Renzo Valloni. All these people believed in me and I sincerely thank them.

Dr. Geol. Aniello Aloia - Geopark Manager
National Park of Cilento, Vallo di Diano and Alburni-European and Global Geopark
Chair of the 12^{th} European Geoparks Conference

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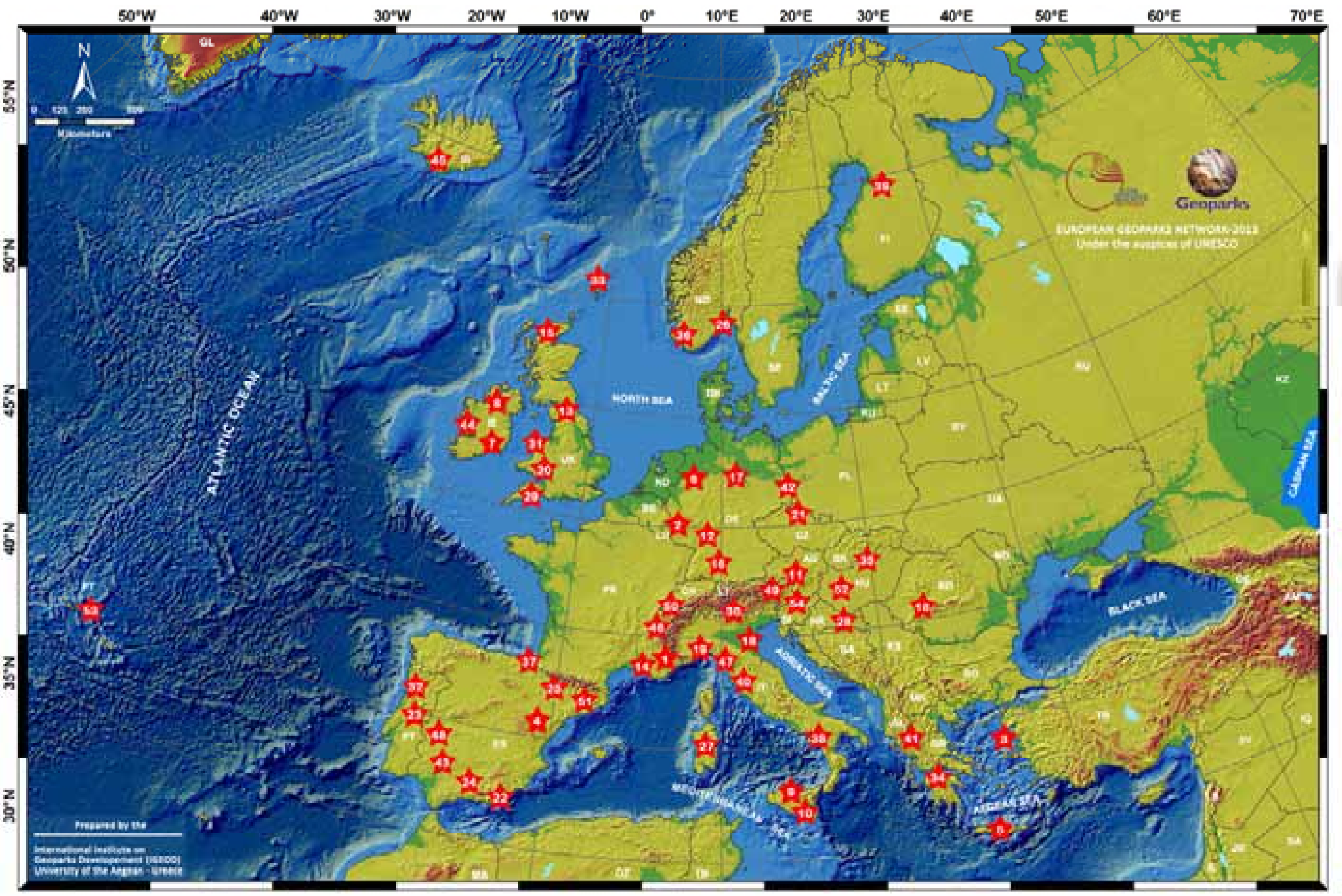
Staff of National Park of Cilento, Vallo di Diano and Alburni – European Geopark, Italy: Piazza S. Caterina 8 84078 Vallo della Lucania (SA) - Tel: +3909747199246 - Fax +3909747199217 - C.F. 9300799 0653 – info@egnconference2013.cilentoediano.it a.aloia@cilentoediano.it



European Geoparks Network Map

1. Réserve Géologique de Haute Provence – France; 2. Vulkaneifel European Geopark – GERMANY; 3. Petrified Forest of Lesvos – GREECE; 4. Maestrazgo Cultural Park – Aragon, SPAIN; 5. Psiloritis Nature Park – GREECE; 6. Terra.Vita Nature Park – GERMANY; 7. Copper Coast Geopark– IRELAND; 8. Marble Arch Caves European Geopark– NORTHERN IRELAND, UK; 9. Madonie Geopark – ITALY; 10. Rocca di Cerere – ITALY; 11. Nature Park Steirische Eisenwurzen – AUSTRIA; 12. Nature Park Bergstrasse Odenwald – GERMANY; 13. North Pennines AONB – ENGLAND, UK; 14. Park Naturel Régional du Luberon – FRANCE; 15. North West Highlands – SCOTLAND, UK; 16. Geopark Swabian Albs – GERMANY; 17. Geopark Harz Braunschweiger Land Ostfalen Geopark – GERMANY; 18. Hateg Country Dinosaurs Geopark – ROMANIA; 19. Beigua Geopark – ITALY; 20. Fforest Fawr Geopark – WALES, UK; 21. Bohemian Paradise Geopark – CZECH REPUBLIC; 22. Cabo de Gata – Nijar Nature Park – Andalucia, SPAIN; 23. Naturtejo Geopark – PORTUGAL; 24. Sierras Subbeticas Nature Park – Andalucia, SPAIN; 25. Sobrarbe Geopark – Aragon, SPAIN; 26. Gea Norvegica – NORWAY; 27. Geological, Mining Park of Sardinia – ITALY; 28. Papuk Geopark – CROATIA; 29. English Riviera Geopark – ENGLAND, UK; 30. Adamello – Brenta Nature Park – ITALY; 31. Geo Mon – WALES, UK; 32. Arouca Geopark – PORTUGAL; 33. Shetlands – SCOTLAND, UK; 34. Chelmos Vouraikos – GREECE; 35. Novohrad - Nograd Geopark - HUNGARY and SLOVAKIA; 36. Magma Geopark – NORWAY; 37. Basque Coast Geopark, Pais Vasco – SPAIN; 38. Parco Nazionale del Cilento e Vallo di Diano, Campania – ITALY; 39. Rokua Geopark – FINLAND; 40. Tuscan Mining Park – ITALY; 41. Vikos – Aoos Geopark – GREECE; 42. Muskau Arch Geopark - GERMANY/POLAND; 43. Sierra Norte de Sevilla Natural Park, Andalucia – SPAIN; 44. Burren and Cliffs of Moher Geopark - REPUBLIC OF IRELAND; 45. Katla Geopark – ICELAND; 46. Massif du Bauges Geopark – France ; 47. Apuan Alps Geopark – ITALY; 48. Villuercaas-Ibores-Jara Geopark – SPAIN; 49. Carnic Alps Geopark – AUSTRIA; 50. Chablais Geopark – FRANCE; 51. Central Catalunya Geopark – SPAIN; 52. Bakony-Balaton Geopark – HUNGARY; 53. Azores Geopark – PORTUGAL; 54. Karavanke/Karawanken - SLOVENIA & AUSTRIA

Oral and poster presentations will be planned on the following topics

1. **Geoparks and Geo-hazards**
2. **Geopark and Climate Change**
3. **Sustainable use of our natural resources in Geoparks**
4. **Education and comunication in the geoparks**
5. **Geoparks and international cooperation and Sustainable Tourism**
6. **Geoheritage and Geotourism in Africa: A tool for sustainable development**
7. **Aspiring Geoparks**

Place

The 12th European Geoparks Conference will be held at Alario Foundation in ASCEA MARINA, Province of Salerno - Campania Region - Italy


ALARIO BUILDING
Via Parmenide
Via Guglielmo Oberdan
PARMENIDE THEATER
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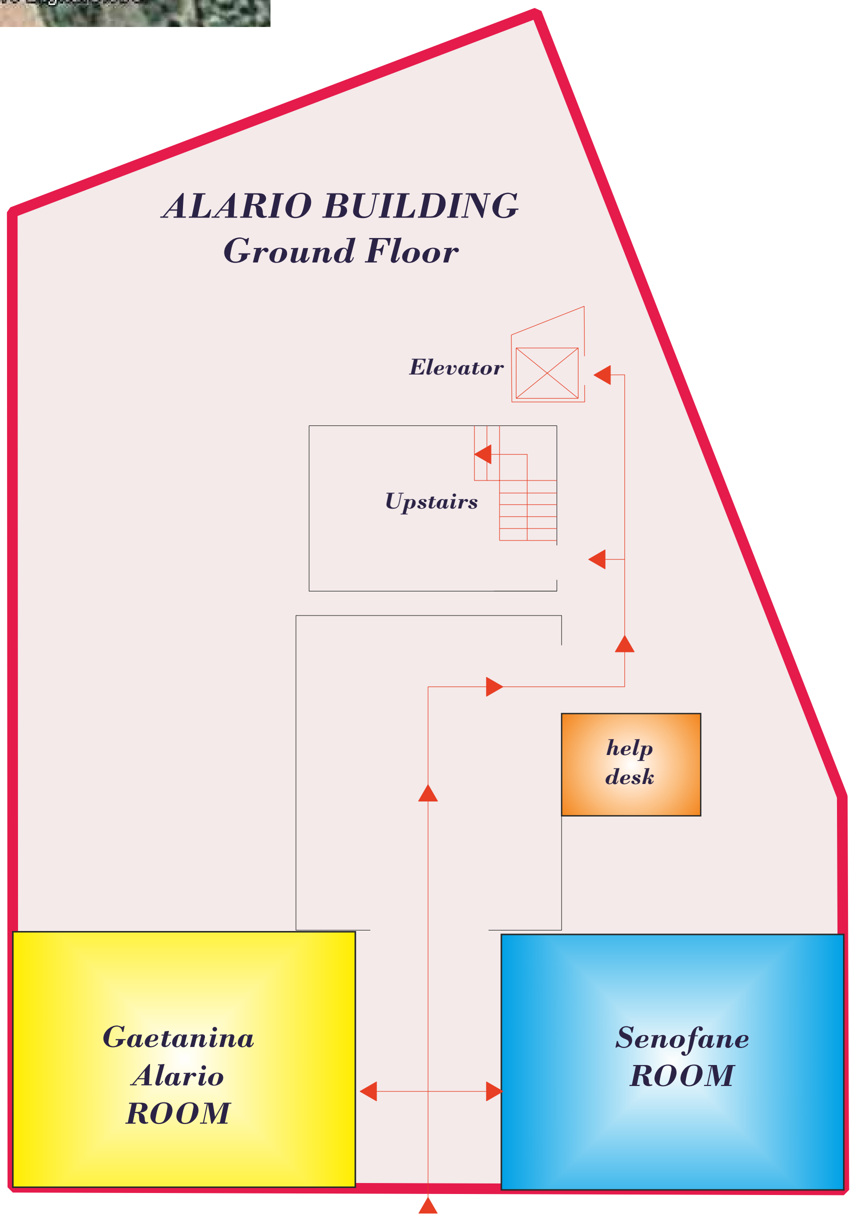
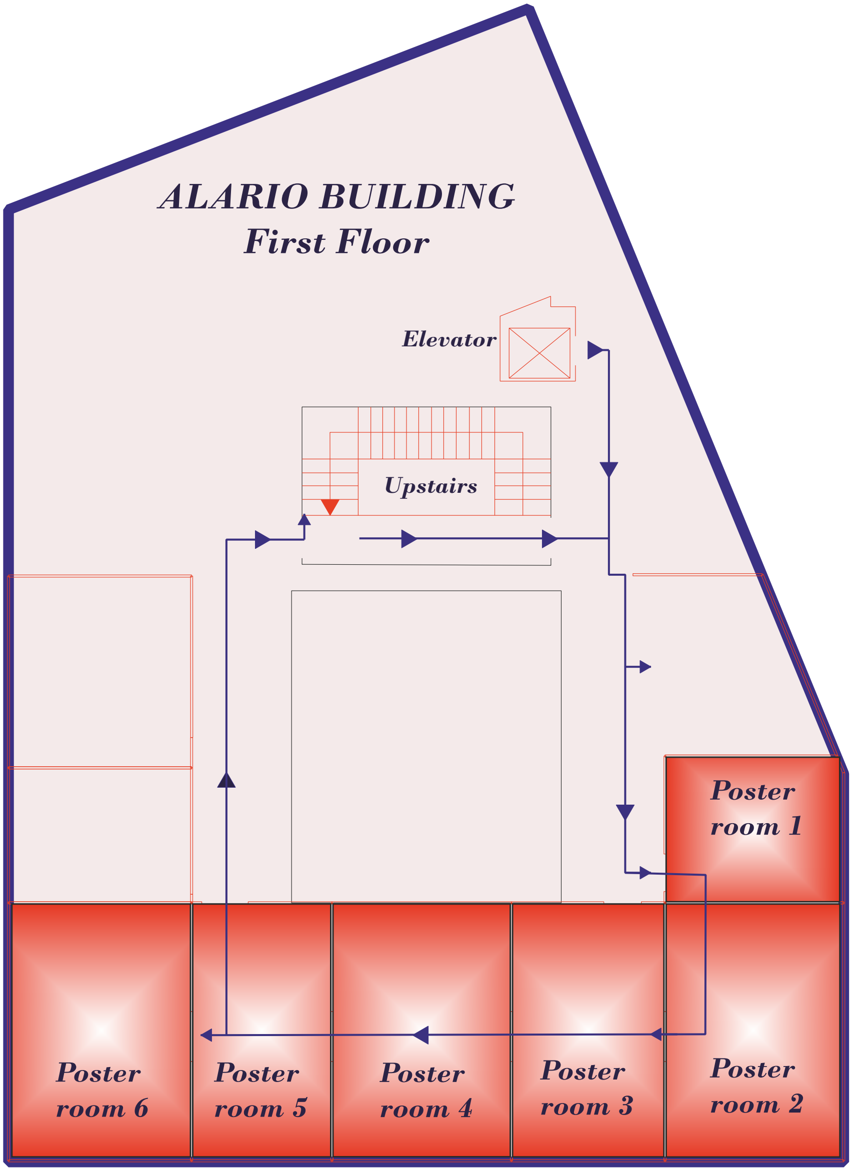

ALARIO BUILDING
Ground Floor
Elevator
Upstairs
help desk
Gaetanina Alario ROOM
Senofane ROOM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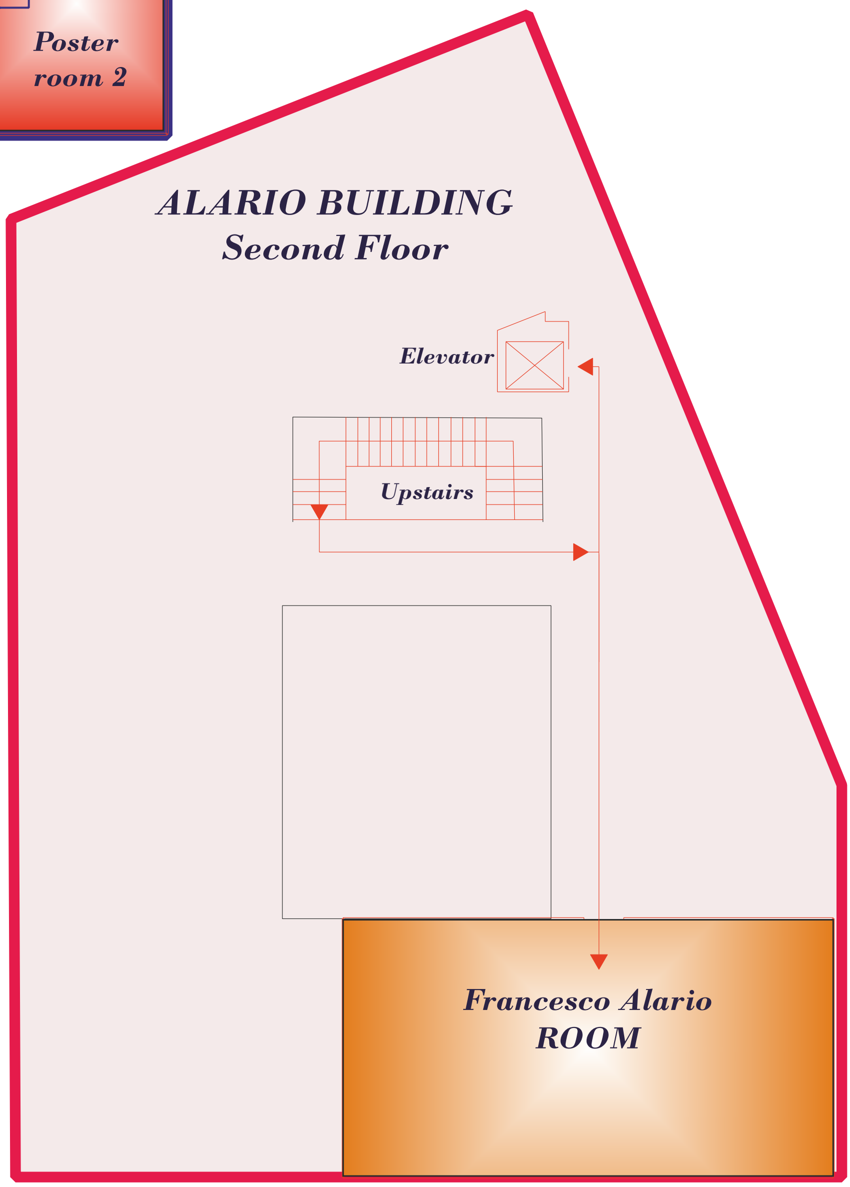
Poster room 2
Poster room 3
Poster room 4
Poster room 5
Poster room 6


ALARIO BUILDING
Second Floor
Elevator
Upstairs
Francesco Alario ROOM

12th European Geoparks Conference - Programme

September 4 - Wednesday

08:00	Opening of the conference desk at the "Alario Foundation"
	ROOM: Parmenide theater
08:30	Official opening of the Conference - Welcome by Anilello Aloia (Chair of Conference) and by Authorities
10:00	Keynotes (***Chairpersons Guy Martiny and Domenico Calcaterra***)
	Patrick Mckeever
10:30	**Coffee-break**
11:00	Keynotes (***Chairpersons Guy Martiny and Domenico Calcaterra)***
	Angelo De Vita
	Domenico Guida
	Setsuya Nakada
	Nikoals Zouros
13:30	**lunch**

Parallel sessions of oral communications

	ROOM: Parmenide theater	ROOM: Francesco Alario	ROOM: Senofane	ROOM: Gaetanina Alario
	Sustainable use of our natural resources in Geoparks	**Education and communication in the Geoparks**	**Geoparks and international cooperation and sustainable tourism**	**Aspiring Geoparks**
	Chairpersons **Andreas Schueller** **Renzo Valloni**	***Chairpersons*** **Artur Abreu Sa** **Maurizio Burlando**	***Chairpersons*** **Nickolas Zouros** **Maria Cristina Giovagnoli**	***Chairpersons*** **Mel Border** **Alessio Valente**
14:30	Geological map with thematic elements and submerged landscape map of the National Park of Cilento vallo di Dianoand Alburni - European and Global Geopark. An example of using CARG Project data. (Muraro C. , Papasodaro F., Lettieri M. , Guida D., Aloia A. , Todisco F.)	The environmental education project "Save the energy": example from Adamello Brenta Geopark (Scalfi A. , Beltrami V. & Masè V.)	Geo2Nor- Northern georoutes (Gentilini S., Barton R. , Thjømøe P.)	Kras – Carso, aspiring cross-border Geopark between Slovenia and Italy (Stupar M., Ravalli R., Fedrigo K. , Kljun M.)
14:45	Geoheritage and history of gold digging in Ivalojoki River valley, northern Finland (Johansson P. , Karkola V. , Launonen K., Seurujärvi J. & Syrjänen I.)	On communication strategies of Shennongjia Geopark in tourism destination competitiveness Domain (Yu J.)	Rokua Geopark – developing local economy (Krokki V.)	On expedition in the Aspiring geopark the Hondsrug -the Netherlands- (Posthumus C.)
15:00	Geological heritage in the Alto Ribeira State and Touristic Park (São Paulo State, Brazil) : inventory and quantification of geosites (Rodrigues Ferreira A. , Santos Lobo H. A.& Jesus Perinotto J. A.)	The Fossil Heritage of the Geopark Carnic Alps linked to Google Earth (Schönlaub H.P.)	From the Via GeoAlpina Project to a New International Project Aimed at Promoting Geotourism and a Future Granite Geopark in the Italian-Swiss Central Alps (Mazzoleni G., Garofano M. , Pasqua C.)	Itinerary geological between the municipality of Piedecuesta to La Mesa de los Santos (Santander), use of geological heritage (Mantilla E. , Villabona J. J.)
15:15	Historical stone and marble in the Apuan Alps Geopark (Italy): a local strategy on the sustainable use of a non-renewable resource (Bartelletti A. & Amorfini A.)	Nordic geoguide school (Aarre G.)	Positive effects of Molina and Alto Tajo Geopark Aplicatión for the territory (Martínez J. A. , Monasterio Cruz J. M., Carcavilla L.)	Integrating intangible cultural heritage into the geopark; stories of the land, nature and lifestyles of the people of the Oki Islands Geopark (Nobe K., Sadkowsky T.)
15:30	Using Radon-222 as a Naturally Occurring Tracer to investigate the streamflow-groundwater interactions in typical Mediterranean fluvial-karst landscapes: interdisciplinary studies in the Campania region -southern Italy- (Guida D. , Guida M., Guadagnuolo D. , Cuomo A., Siervo V.)	The public opinion of the teachers about the mineral exploitation in São José de Itaboraí Basin – Itaboraí -Rio de Janeiro State, Brazil- (Sá dos Santos W. F. & de Souza Carvalho I.)	Contributions of the Azores Geopark to the geotourism development in the archipelago (Machado M., Viveiros C. , Lima A. & Almeida Lima E.)	Agro-environmental land management in the aspiring Geopark of Minorca: highlighting and promoting sustainable use of natutal ressources through the very first georute (Quintana R. , Poch J. , Pérez M., Febrer A., Marí S. , Juaneda J. & Orfila J. L.)
15:45	Geotouristic "Babina" path as an example of sustainable development in the Muskau Arch Geopark (Koźma J., Sandak D.& Bieniasz J.)	Recovery and enhancement of the historic route "Camino Real del Azogue" (Royal Trail of Mercury) in the Geopark Sierra Norte de Sevilla -Spain- (Gil Toja A. , Pérez de Guzmán Puya R. & Mellado Jiménez S.)	TERRA.bikE: E-bike charging stations as a new element in the geotouristic infrastructure of TERRA.vita (Escher H., Fisse N. & Kluttig T.)	Maps and guide of geo-environmental and geo-cultural fieldtrips in Ischia island -Italy- (Giulivo I. & Monti L.)
16:00	**Coffee-break**			

	ROOM: Parmenide theater	ROOM: Francesco Alario	ROOM: Senofane	ROOM: Gaetanina Alario
	Sustainable use of our natural resources in Geoparks	**Education and communication in the Geoparks**	**Geoparks and international cooperation and sustainable tourism**	**Aspiring Geoparks**
	Chairpersons **Joan Poch** **Mariana Amato**	***Chairpersons*** **Andreas Shuller** **Antonio Duarte**	***Chairpersons*** **Martina Paskova** **Charalampos Fassoulas**	***Chairpersons*** **Alicia Serna Barquero** **Francesco Chiaramonte**
16:30	Integration of the geoheritage management in environmental and land-use policies (Almeida Lima E., Lima A. F., Brilha J. , Calado H. & Nunes J. C.)	Three-dimensional ground penetrating radar surveys at Grotte dell'Angelo, Pertosa, (SA), Southern Italy (Catapano I. , Loperte A., Satriani A., Larocca F.)	Quality Coast and Quality Destination, new standards for sustainable tourism. How to cooperate with the European Geopark Network? (Pejcic M. , Salman A. & Van den Ancker H.)	Emilia Romagna Apennine Geopark Project-ERAGP-(Gentilini S.)
16:45	How to involve local communities in the construction of a geopark (Fenger P. H.)	Scotland's Geodiversity Charter: a step forward for Scottish Geoparks (Lemon K., Barron H. F. & Gordon J. E.)	Best practice in co-operation between the European and Global Geopark Muskau Arch and the World Heritage Fürst-Pückler-Park Muskau (Kupetz M.)	Geoheritage, Geoconservation, and aspiring Geoparks in Morocco, focused on the Zenaga inlier: Current situation (Ezzoura E. , Nasser E. , Margarete B., Vic S., Khadija O.)
17:00	Project Idea "100% renewable natural areas (RE-NATURA)" (Petrick K., Escher H., Thjømøe P.)	EGN Homepage Review – A Comparative Approach (Schönlaub H. P.)	Geotourism in Ireland: examples from the Irish Global Geoparks Lemon (K. & Gatley S.)	Developing a geopark at the eastermost end of Crete: Sitia Nature Park (Fassoulas C. , Staridas S. , Perakis V. & Mavrokosta C.)
17:15	Building up a dinosaur identity in Miravete de la Sierra -Maestrazgo Cultural European & Global Geopark, Teruel, Spain- (Alcalá L., Santos-Cubedo A. , Mampel L., Ferrer R., Espílez E. & Hernández Á.)	Communicating geoparks at the portuguese parliament – exhibition and conference about the portuguese geoparks (Silva E. & Sá A. A.)	Earth Sciences divulgation, geoheritage and landscape approach: the project of the Geologiro d'Italia (Farabollini P., Graziano G., Lugeri F., Lugeri M. & Lugeri N.)	Aspiring Saarte Geopark – a candidate to become the first EGN/GGN member geopark in Estonia (Bubukin V.)
17:30	Geomorphological map as a key approach for enhancing the natural and cultural heritage of the Apuan Alps Regional Park area and surroundings -Tuscany- (Baroni C. , Bini M. , Coltorti M. , Fantozzi P., Guidobaldi G., Nannini D. , Pieruccini P. , Ribolini A. , Salvatore M.C.)	Educational Games in geoparks: a case from Gea Norvegica Geopark -Norway- (Dolven J. K., Johansen O. R. & Aamundsen A.)	Developing Compelling Visitor Experiences in Geoparks Example of the Burren & Cliffs of Moher Food Experience (O'Dwyer T.)	Geopark North – an initiative to establish a geopark in the Ofoten district, Nordland County, Norway (Markusson E. , Sandøy R., Roll A. M. , Normark H., Slettjord L. & Jenssen T. A.)
17:45	The coastal karst landscape of Sardinia: knowledge, perception, promotion and fruition (Carboni D. , Benedetto G.)	Monitoring and valuing the European geological heritage: operational uses of satellite applications (Fiore G.)	Development of Geotourism in cross-border Geopark Karavanke /Karavanken (Suzana F. Š. , Mojca B. , Gerald H. , Primož V., Lenka R. , Uroš H., Walter P.)	The geological heritage of the Appennino Lucano Val d'Agri-Lagonegrese National Park: a fist step toward the proposal of a new geopark (Bentivenga M., Geremia F., Palladino G. & Prosser G.)
18:00	**End of the first day scientific sessions**			
20:00	**Dinner and cultural event in the center of Ascea town**			

September 5th - Thursday

Parallel sessions of oral communications

	ROOM: Parmenide theater	ROOM: Francesco Alario	ROOM: Senofane	ROOM: Gaetanina Alario
	Education and communication in the geoparks	**Geoparks and Geo-hazards**	**Geoparks and Climate Change**	**Sustainable use of our natural resources in Geoparks**
	Chairpersons **Jetta Weber** **Hans Peter Schònlaub**	***Chairpersons*** **Setsuya Nakada** **Domenico Guida**	***Chairpersons*** **Kirstin Lemon** **M. Patrizia Positano**	***Chairpersons*** **Ingeborg Klepp** **Maurizio Lazzari**
09:00	The multi-touch book version of the Villuercas-Ibores-Jara Geopark Geosites' Guide as a touristic and educative tool (Barrera J. M. , Gil J. and López J.)	Activities to increase public awareness about geohazards in Beigua Geopark (Burlando M. , Firpo M., Castello G. , Mangini I., Queirolo C. and Saettone M.)	Geo-hazards and climate change policies in the Geopark of Central Catalonia (I Costa F. C.)	Discharge-electrical conductivity relationship in the Ciciriello Torrent, a reference catchment of the European Cilento, Vallo Diano and Alburni European Geopark (Southern Italy) Cuomo A. & Guida D.
09:15	Geology for all": a map-guide for observing geological resources in nature -Sierras Subbéticas Geopark- (González L. G. , Barquero A. S.)	The Protection and Utilization of "Yuntai Landform" (Jian-hua F., Xin-hao L., Yu-qi D., Zheng Z.)	Effect of the North Atlantic Oscillation on groundwater recharge in karst aquifers of the Cilento Geopark -Italy- (Manna F.,Allocca V., Fusco F., Napolitano E., De Vita P.)	Using synthetic DNA tracers in environmental waters: effect of filtering (Foppen J. W. and Bogaard T.)
09:30	The school contests promoted by the portuguese national forum of geoparks: a reality with increasing impact in the school community (Silva E. , Rocha D. , CatanaM.M. & Sá A.A.)	Mechanical properties of plant species of the Cilento and Diano Geopark flora relevant for slope stability (Di Tommaso T., De Falco E. & Amato M.)	Orographic barrier in the climate change prespective at regional and sub- regional scale: Campania region and Cilento Geopark (Cuomo A. , Guida D., Palmieri V. & Rossi F.)	Geology of Beaujolais, northwestern Lyon, France. From stone to the heritage and to popular knowledge (Rousselle B., Besombes C., Barbary A.)
09:45	Collecting the memories of fluorspar miners in the North Pennines Area of Oustanding Natural Beauty & Geopark, England (Pickett E., Forbes I., Forbes P. & Diment N.)	"GeoVision" project: how to increase both knowledge and awareness on natural hazards in the Massif des Bauges Geopark -French northern Pre-Alps- (Hobléa F. , Gallino-Josnin S.)	Big thermal events and climatic cyclicity in the Basque Coast Geopark´s geosites: a great laboratory to understand the geological point of view of the climate change (Hilario A.)	Stone constructions in Geoparks and their relations to Intagible Heritage: A preliminary study (Fassoulas C. & Martini G.)
10:00	A booklet for guiding geology teachers on the field in the bauges geopark, france (Renau P., Peisser C., Lansigu C., Higel J.)	A geomorphological GIS-based approach to flood risk perception in the design and management of a geopark (Magliulo P. & Valente A.)	Tuning of Modern and Late Pleistocene Beach and Coastal Dune Deposits of Palinuro -Italy- (Valloni R. and Aloia A.)	From cave to land: a model of local development (Gay V. , De Mauro A.)
10:15	Challenges and strategies for Geoconservation in Madagascar (Andrianaivo L.)	Rocky cliff landslide hazard: the Capo Noli Promontory case study -western Liguria, NW Mediterranean Sea- (Scarpati A., Pepe G., Mucerino L. , Brandolini P. & Firpo M.)	Markers of palaeo sea level in rocky coast of Patagonia -Argentina- (Bini M., Consoloni I., Isola I., Pappalardo M., Ragaini L., Ribolini A. & Zanchetta G.)	The map of the marine landscapes and habitats of Cilento, Vallo di Diano and Alburni Geopark. Linking geo- and bio-diversity with a multiscalar approach (D'Angelo S., Di Stefano F., Fiorentino A., Lettieri M.T., Russo G.F. & Violante C.)
10:30	**Coffee-break**			

	ROOM: Parmenide theater	ROOM: Francesco Alario	ROOM: Senofane
	Education and communication in the geoparks	**Geoparks and Geo-hazards**	**Aspiring Geoparks**
	Chairpersons **Kristin Ragnes** **Nicoletta Santangelo**	***Chairpersons*** **Tony Ramsay** **Pantaleone de Vita**	***Chairpersons*** **Pasquale Li Puma** **Sebastiano Perriello Zampelli**
11:00	Cementing the Arouca Geopark (Portugal) extension through the Montemuro Mountain geological and intangible heritage (Rocha D., Neves R. , Sá A.A. & Duarte A.)	Coastal erosion processes: the case study of the beach of Cala del Cefalo - Geopark of Cilento and Vallo di Diano, southern Italy- (Valente A. , Aloia A., Monaco M. & Peduto F.)	Creation of a geopark; an analysis of municipal planning and alignment of the administration in the process of creating the aspiring geopark Odsherred (Vejre H., Lemkow N., Kristensen L.S., Primdahl J.)
11:15	Azores Geopark and the Regional Strategy for Environmental Education (Silva C., Garcia P. & Lima E.)	Facing children's psychological burden in case of an earthquake or volcanic disaster through training and knowledge: RACCE project (Fassoulas C., Zouros N, Boldrini F., Kourou A., Tzvetanski T., Nave R. & Martini G)	Aspiring Geopark Costões and Lagunas of Rio de Janeiro a potencial area to promote a sustainability model proposed by UNESCO (Vasconcelos G. , Mansur K., Vasconcelos C. and Dos Anjo S.)
11:30	School Contest "Water that unites us": an example of cooperation between Geoparks and Biosphere Reserves of UNESCO" (Silva E. , Ribeiro R., Pereira F, Costa M.P., Lima E. A. & Lopes P.)	The Sea Cliff Mass Rating geomechanical classification for the rocky coastal management plan (Lucchetti A. , Brandolini P. , Robbiano A. , Firpo M. & Faccini F.)	Terras de Cavaleiros Aspiring Geopark: An outreach strategy based on the typology of visitors (Pereira D. , Pinto B. & Marc S.)
11:45	Free Wi-Fi transforms El Hierro into the world's first Smart Island (López de Ávila A., Muñoz N. & García S.)	Geomorphological constraint and boundary effect on Posidonia oceanica meadows (Ferrari F., Montefalcone M., Schiaffino C.F., Bianchi C. N., Corradi N., Morri C., Vacchi M.)	Aspiring Kula Volcanic Geopark - Eart Heritage Protection and Promotion (Gumus E. , Zouros N.)
12:00	North America's First Geopark – Education & Communication in the Geopark (Fullerton J. , Logan A. , Bremner G. , Miller R. and Buhay D.)	Assessment of coastal erosion in beach-dune system in Western Sardinia (Pilloni M. and Ginesu S.)	Geopark projects in Finland (Nenonen J. & Tervo T.)
12:15	ApuanGeoLab: a new educational structure in the Apuan Alps Geopark -Italy- (Ottria G. , Amorfini A. & Bartelletti A.)	Education and scientific divulgation on the management of land-related risk in agriculture and livestock farming in the Cilento Geopark MIdA Integrated Environment Museum (Amato M., Bove R., & D'Orilia F.)	Aspiring Geoparks in the Czech National Geoparks Network (Pásková M.)
12:30	Formative mechanisms and process of landforms as the main theme of science popularization activities in Zhangjiajie Global Geopark of China (Qing Huang H., Zhang X., Song H., Xiao S.)	"Garins' landslide". From a geohazard to a touristic and pedagogical geosite (Desbois J.L., Costabloz V.)	Sesia - Val Grande Geopark candidate member 2012 (Bagnati T.)
12:45	"Geosite of the Year": cooperation of stakeholders in the development, management and promotion of the Úrkút Palaeokarst Nature Conservation Area in Bakony–Balaton Geopark, Hungary (Knauer A.)	Origin of high radon levels in karst spring mixed waters – the case-study of the Capodifiume spring group, National Park of the Cilento and Vallo di Diano-European Geopark - Southern Italy- (Guida A., Guida M., Guadagnuolo D. , Cuomo A., Knöller K., Schubert M., Siervo V., Aloia A.)	Reykjanes Geopark project – A peninsula still being born (Jónsson E. S., Guðmundsson S. & Kristinsdóttir B.)
13:00		**lunch**	

September 5th - Thursday

15:00 Sessions of Poster discussion

First Floor of Alario Building

ROOM	COD	Authors	Title
Poster ROOM 1	1	Converti F.	Knowing and representing knowledges networks:analysis and methodological
	2	Amato M., Di Tommaso T., De Falco E., Marena C. & Di Blasio P.	Environmental education in the Cilento Geopark: ateliers and a book series at the “Grotte di Pertosa e Auletta” geosite
	3	I Costa F.C.	Websig, a tool for management and disclosure of geological and mining heritage at the Geopark of Central Catalonia
	4	Rodrigues J., De Carvalho C. N. & Catana M.M.	Geoschools Project teaching modules: Teaching Geosciences in the Field - Geoparks and Geosites
	5	Qian L., Mingzhong T.	The analysis on classification of china national geoparks and probe into the information construction
	6	Doucek Mgr. J.	GEOSCIENCES project - the way to rebirth geology at the Czech elementary and high schools
	7	Andrasanu A.	Linking geoparks to education and research at university of bucharest
	8	Ciobanu C., Andrasanu A.	Space and time perception and the geopark communities
Poster ROOM 2	9	Cunaccia V.	A “fossil free” Park
	10	Bini M., Mascioli F. & Pranzini E.	Geomorphological hazard and tourist use of rocky coasts in Tuscany (NW Italy)
	11	Guazzi E. , Amadei L.	Occurrence of Sphagnum in the Apuan Alps (Tuscany, Italy)
	12	Fabbrocino S., Paduano V, Todisco F., Muraro C. , Lettieri M.T.	Geological features and groundwater resources in the Cilento, Vallo di Diano and Alburni National Park
	13	Fiorillo F.	Comparison of long karst spring discharge series
	14	Brandolini P., Faccini F., Pelfini M. & Firpo M.	A complex landslides along the Eastern Liguria rocky coast -Italy
	15	Ginesu S., Sias S. & Valente A.	Assessment of landslide risk of the coastal cliffs of Capo Caccia and Punta Giglio - northwestern Sardinia, Italy-
Poster ROOM 3	16	Shibata T.	An Example of Geopark Management which Encouraged Local Residents' Voluntary Activities
	17	Schiaffino C.F., Cevasco A. & Ferrari M.	Alternative tourism ideas for Finale Ligure (Italy)
	18	Lazzari M.	Geosites, cultural tourism and sustainability in Gargano National Park (southern Italy): the case study of the La Salata (Vieste) geoarchaeological site
	19	Queirolo C., Burlando M., Firpo M., Galassi U. and Mazzeo A.	iBeigua: innovative interactive tool to promote Beigua Geopark
	20	Akbulut G., Ünsal Ö.	The geopark and geotourism potential of levent valley(malatya/turkey)
	21	Raffaelli N., Viviani F., Guazzi E.	“On the trail of the Mouflon”: an example of how to promote nature tourism in the Apuan Alps Geopark
	22	Lóska J. & Kéri I.	Tourism developmental project in the Novohrad – Nógrád Geopark – based on the Hungarian Goverment’s decision

ROOM	COD	Authors	Title
Poster ROOM 4	23	Tsiolakis E. , Morisseau E., Zomeni Z. & Kassianidou V.	The genesis of "Cyprus-Type" sulphide deposits, their occurrences around the Troodos mountain and its exploitation since antiquity played a significant role to the mining heritage of Cyprus
	24	Klee N. , Lutz M.	Monts d'Ardèche Geopark Project: reconnecting people with the geoheritage
	25	Nunes J.C. & Lima E.A.	Ranking and Classifying the Azores Islands Geosites (Portugal)
	26	Lugeri F.R., Farabollini P., Amadio V., Giannella G. & Aldighieri B.	Landscape, wine and enhancement of territory
	27	Mateo Mederos M.E.	Lanzarote Geopark Project. Identification of the Area. Geological Heritage
	28	Ezzoura E., Nasser E., Abdeloihab C., Amal E., Abdelouahed L.	The first geotrail in Doukkala-Abda aspiring geopark (Morocco): a tool for local sustainable socio-economic development
	29	Badrikolalo N., Jazani E.M.	Developing knowledge and rising awareness on geoheritage and geotourism of Iran: A glance to the function of the Public Relations of the Geological Survey of Iran (GSI)
	30	Poggi E., Queirolo C., Burlando M. and Poggi F.	Geosites inventory in Liguria Region and in Beigua Geopark: updating activities
	31	Yelie W.	The longevity, an immaterial geo-heritage in Fengshan, Leye-Fengshan Global Geopark
	32	Bottazzi J.	Dark circles and recent discoveries in Fengshan, Leye-Fengshan Global Geopark
	33	Alexandru Andrasanu, Cristian Ciobanu, Ionut Savulescu	Development of ppf concept in hateg country dinosaurs geopark
	34	Benado, J., Brilha J., & Schilling, M.	The geoheritage of the Cajón del Maipo Geopark Project -Chile
Poster ROOM 5	35	Colosimo F., Infelise E.	Applying: valle del crocchio geopark
	36	Xuejun C. , Zhonghui Z., Fengjun D.	Ruyang Gooup Geological Heritage Characteristics and Geopark Construction in the South Rim of North China Platform
	37	Bloise L.	Main geological brief - geomorphological pollino national park: protection and enhancement
	38	Karkut J.	Geoparks in east africa – exploring some of the challenges and opportunites to adapting the model in ethiopia
Poster ROOM 6	39	Guisse A., Siby S. & Ngom P.M.	The role of universities in the creation of geoparks in West Africa: the Senegalese example.
	40	Roelfs G.	About Tills and erratics in the Aspiring geopark Hondsrug (the Netherlands)
	41	Golež M., Majcen T.	A step forward to a new geopark
	42	Belij S, Mladenović M. , Marković S. B., Vasiljević D. A. , Timotić D.	Preliminary proposal of the geopark network in Serbia: strategic and rationale approach
	43	Mohsen H.	Nature, geological and mining reserves of jebel zaghouan: potential of recovery a geopark
	44	Rabrenović D., Mojsić I., Bejli S., Mladenović M., Doslic A.	Geodiversity the National Park Iron Gates serve to form the Geopark
	45	Kavčič M. G., Režun B., Peljhan M, Stupar M.	Visibility of idrija geopark
	46	Gilstad M.	Norway
		17:00	**End of poster session**
		19:00	**Closing Ceremony in the geo-archeological site of Elea-Velia**
		20:30	**Dinner in the geo-archeological site of Elea-Velia**

12th EGN Conference 2013 PROGRAMME OF FIELD TRIP		
Friday 2013/06/09	***Field Trip N. 1 - From the Capodifiume Springs to Castelcivita Caves***	
	08:00	departure from Ascea
	09:00	arrival to Capaccio Paestum: visit Capodifiume Spring (pietrified springs) and by bus Paestum Temple
	11:00	departure from Capaccio
	12:00	arrival to Castelcivita: visit caves and the Castecivita historical villge- lunch
	17:30	departure from Castelcivita
	19:00	arrival to Ascea
	Field Trip N. 2 - Bussento Hydro-Geomorphological Karst System	
	08:00	departure from Ascea
	09:30	arrival to Caselle in Pittari: visit Geovirtual Museum and "la Rupe sinkhole"
	11:30	departure from Caselle in Pittari
	12:00	arrival to Casaletto Spartano: visit "hair of Venere" spring and Geo-Biodiversity monitoring system - lunch
	15:30	departure from Casaleto Spartano
	16:00	arrival to Morigerati: visit the historical village, museum of rural life and the "Oasi"
	17:30	departure from Castelcivita
	19:00	arrival to Ascea
Saturday 2013/07/09	***Field Trip N. 3 - Boat trip along the Cilento coast - from Ascea to Camerota***	
	08:00	departure from Ascea
	08:15	arrival to Casal Velino harbour
	08:30	departure from Casal Velino to Camerota by boat and visit south cilento coast- lunch at "Infreschi" pocket beach in Camerota
	17:30	arrival to Ascea
	Field Trip N. 4 - From Vallo di Diano to Angel Caves	
	08:00	departure from Ascea
	09:30	arrival to Vallo Di Diano: visit Geologicl site and Cherthouse of Padula- lunch in Teggiano
	14:30	departure from Teggiano
	15:00	arrival to Angel Cave: visit caves and MIDA museums
	17:30	departure from Angel Caves
	19:00	arrival to Ascea

keynotes

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

Characteristics of recent geohazards and roles of geoparks

Nakada S.([a])

([a]) Earthquake Research Institute, the University of Tokyo, 1-1-1 Yayoi, Bunkyo-ku, Tokyo, 113-0032 Japan. E-mail: nakada@eri.u-tokyo.ac.jp

ABSTRACT

Knowledge on our dynamic planet and resultant, unavoidable geohazards is inevitable to all people living in geohazard-prone areas of the Earth for minimizing disasters. Lacking communications among scientists, bureaucrats, and local societies sometimes have brought serious disasters from geohazards. Geoparks can promote good communications by utilizing themselves as suitable stages for learning the dynamic history of the Earth. Education for disaster-prevention after understanding about blessings from the nature becomes more effective to reduce risks from geohazards.

KEY WORDS: earthquake, education for disaster-prevention, hazard map, tsunami, volcanic eruption.

INTRODUCTION

A famous sentence by Prof. Torahiko Terada is "*a natural disaster strikes when people lose their memory of the previous one*". Disasters are results of hazards. Especially low-frequent but large natural hazards (geohazards), such as mega earthquakes, large tsunamis and large eruptions, take place rarely during our lifetime. However, such natural hazards are repeated as far as dynamic movement of the Earth continues. Geohazard is considered as an important issue that the geopark community deals with, together with the climate change issue. It was mentioned first as one of key issues of geoparks in 2008. The Osnabrüch Declaration of the 3rd International UNESCO Conference on Geoparks stated; "*Recognizing that communication is the key to our success, the global geological community should continue to work together in communicating the importance of geological issues, such as geohazards and climate change, to society and recognize that geoparks are a valuable tool in doing this*". Furthermore, the Shimabara Declaration of the 5th Conference in 2012 stated; *"Our Earth brings us blessings including natural resources and beautiful, inspiring landscapes. However it can also occasionally generate large disasters such as earthquakes, tsunamis, volcanic eruptions, landslides, and floods. Education about our dynamic planet in geoparks is a most effective way to help our local communities understand how to coexist with nature which occasionally generates geohazards."* The latter declaration was issued only one year after the mega-earthquake and tsunami hazards in Tohoku, Japan, on 11 March 2011.

Here, I would like to summarize the recent hazards related to earthquakes and volcanic eruptions, and discuss on the roles of geopraks to minimize disasters caused by these geohazards.

VOLCANIC HAZARD

During the time of the 4th International UNESCO Conference on Geoparks at Langkawi, volcanic ash was drifted over the northern Europe by the eruption of Eyjafjallajökull, located in Iceland, in the Katla geopark. This led to air travel disruption in the global scale for a week between April and May 2010. Although this eruption was trivial in the volcanological meaning, it induced relatively large economical loss. This is a good example showing that, even if a geohazard is small in scale, it can develop into an extensive disaster which gives damages/impacts also to people not necessarily living in areas directly threatened by geohazards. Another good example from ancient time is the eruption at Lakagigar, occurred again in the Katla geopark, in 1783. 25% of Iceland human population was killed during this eruption, and emission of a huge amount sulfur gas from this volcano brought a serious worldwide temperature drop. Its resultant crop failures in Europe killed a few tens of thousands people (e.g., Oppenheimer, 2011).

Large-scale volcanic eruptions had generated serious climate changes in global scale during these 100 thousand years. The largest, catastrophic eruption occurred at Toba in the northern Sumatra, Indonesia 74,000 years ago. Most of humankind disappeared due to the global-scale temperature drop more than 10 °C by this eruption (Robock et al., 2009). Further documented large eruptions are Tambora in 1815 and Krakatau in 1883, both occurred in Indonesia. The latter eruption that occurred on a sea island generated a big tsunami, sweeping the coasts of western Java and southern Sumatra and killing 36,000 people (Siebert et al., 2010). This number was largest in the tsunami disasters recorded historically before the Sumatra tsunami disaster in 2004.

Hazards related to volcanic phenomena are diverse compared with earthquake hazard. The main differences of volcanic hazard from other geohazards are that the former brings blessings to our lives, and that it may fascinate us by its marvelous and beautiful phenomenon. Volcanic (magmatic) activity creates beautiful landscapes and brings mineral resources in geological scale, geothermal energy and hot spar. Volcanic ash from eruptions becomes fertile soil for agriculture. Even if we meet hazards from volcanic activity, rather they provide us many blessings.

EARTHQUAKE AND TSUNAMI HAZARDS

Cracks and displacement of the earth surface together with strong vibration accompany earthquakes. Moreover, landslides and tsunami hazards are commonly triggered by earthquakes. Typical landforms created by earthquakes include faults and coastal terraces, the latter of which are formed by repeated uplifting during earthquakes. An earthquake that occurs near an ocean trench release the seaside from the stress accumulated in geologic time; that is, the seaside of the continent such as Japan continues to be dragged with the oceanic plate that is sinking under the continent. Terraced rice-fields on mountain slopes in Asia may be found in places where landslides occurred (Fig. 1). Especially, the slopes covered thickly by loose, volcanic materials are easy to collapse in heavy rains. Strong shaking caused by earthquakes triggers sliding of wet slopes (Fig. 2).
Earthquakes with 9.0 magnitude class occurred rarely but throughout the ocean trenches surrounding the Pacific Ocean (Satake & Atwater, 2007). It seems strange that most Japanese seismologists believed that earthquakes with 9.0 magnitude class would never occur. However, a 9.0 magnitude earthquake occurred off the Tohoku region near the trench on 11 March 2011. Seafloor of the continental side close to the trench slipped suddenly along an extensive fault plane by this earthquake (Fig. 3). It generated huge tsunamis that attacked the ocean coast of Tohoku (Figs. 4 and 5). The tsunami run-up of tsunami reached about 40 m high (Satake et al., 2013). Although the total number of casualties was much smaller than

Fig. 1 – A wintery scenery of terraced rice-field in San'in-Kaigan Global Geopark, developed in a landslide area. Photo courtesy of the Uheyamamai Project.

Fig. 2 – A landslide (1.7 km x 0.7 km) triggered by 7.2 magnitude earthquake on 14 June 2008, in Kurihara city, Miyagi Prefecture, taken soon after the event date. The ground surface collapsed consists of young volcanic formations from neighbor volcanoes. Photo courtesy of the Asia Air Survey Co. Ltd.

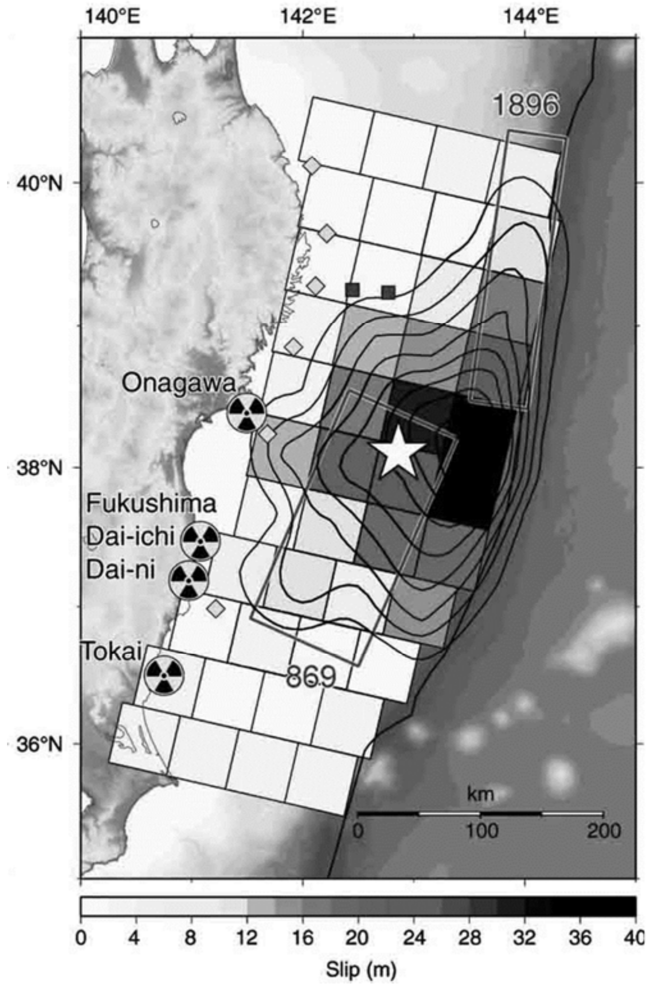


Fig. 3 Fault slip distribution for the 11 March 2011 earthquake, modeled based on the geophysical data (Figure 6b of Satake et al., 2013). The white star indicates the epicenter of the earthquake. The contour interval of fault slip is 4 m and the largest slip is about 40 m. Diamonds and squares are wave gages. Faults modeled for the AD869 and AD1896 earthquakes together with locations of nuclear power plants are also shown.

Fig. 4 - A tanker washed ashore by the 11 March 2011 tsunami in Kesennuma city, Miyagi Prefecture. It was conveyed more than 600 m from the wharf. Photo taken by Azusa Tonotani in August 2012.

Fig. 5 - Taro Kanoko Hotel, which escaped tsunami of 11 March 2011 in Miyako city, Iwate Prefecture. Tsunami reached up to the third floor of this hotel and washed away all houses around it. It stands within the area protected by a 10m high embankment. Photo taken in August 2012.

Fig. 6 - Monument to the AD1933 tsunami, standing in the area washed by the 11 March 2011 tsunami. All houses here were again washed away. This monument notes; (1) pay attention to tsunami when an earthquake occurs, (2) take refuge to higher places when tsunami comes, and (3) do not reside in the danger zone. Photo taken in Ohtsuchi, Iwate Prefecture in August 2012.

that of the Sumatra tsunami in 2004, the Tohoku tsunami caused another serious problem; it hit the nuclear power plants and radiation leakage happened due to loss of cooling function in the nuclear reactors (Fig. 3).

Two stories can effectively show how different can be the behavior of people living in areas threatened by geohazards.

In 2002, the Earthquake Research Committee in Japan reported that a tsunami >>5.7m high could have hit the Pacific coast of Tohoku where nuclear power plant sites was locate. The report was based on the geological evidence of AD869 tsunami deposit near the sites. However, the report was ignored in the Central Disaster Prevention Council in 2004, and the Council forbade the Committee to open the information of a possible high-tsunami. Furthermore, Tokyo Electric Power Co., Inc. denied the evidence of tsunami deposit based on its own survey just before the 11 March 2011 event (Shimazaki, 2012).

The northern part of the Pacific coast in Tohoku experienced the tsunamis disaster at least two times within about 100 years before March 2011; the tsunami run-up was as high as 30 m in both 1896 and 1933. They made the monument of the disaster and left its documents to memorize their experiences and to convey to next generations (Fig. 6). Casualties of tsunami involved 83 % in the population of Taro town, Miyako city, in 1896, whereas they were 20 % in 1933 and 5 % in 2011. The decrease in casualties results from local people's activity in which they formed monuments and conveyed their experiences to the younger generation to minimize future damages, although 210 lives were taken by the latest tsunami.

The first case may result from attitudes of people of official positions and companies, who had lacked the scientific knowledge on natural hazards. On the other hand, the second one is a sort of a success story of the local community that could face coming hazards correctly.

TO MINIMIZE RISKS FROM GEOHAZARDS

In general, risks from hazards are explained in the risk reduction curve, which shows a negative relationship between the event probability and the consequence (the amount of damage) (Fig. 7). The potential risk from disasters can be moved into the risk retention region by reducing either the event probability or the consequence. Since reducing the event probability of natural hazards is impossible, reduction of the

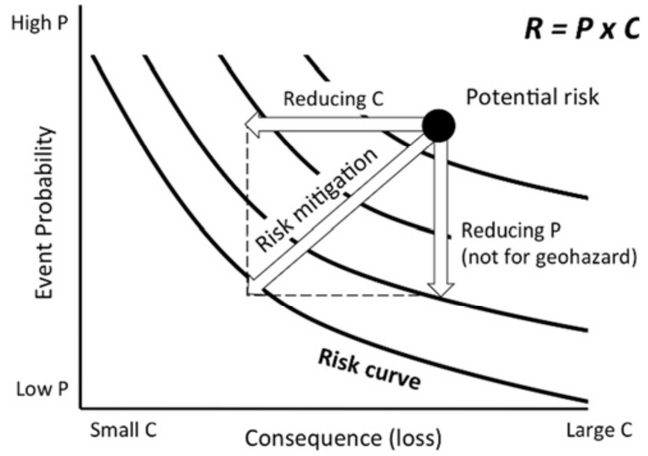


Fig. 7 - Risk curves for hazards shown in terms of event probability (P) and consequence (C). Commonly risk reduction is possible by reducing both P and C. Reduction of risks from geohazard is possible only by reducing C, such as crisis management, preparing hazard map, education for disaster prevention and so on.

consequence is the main countermeasure to minimize risks. The latter is possible by, for example, crisis management before and during the events, preparation of hazard maps, and disaster-prevention education/practices. Buying insurance on houses against natural disasters (e.g., earthquake insurance) and strengthening constructions are also counted among the effective measures.

In the areas with potential natural disasters such as earthquakes, tsunamis or volcanic eruptions, they can prepare hazard maps, identifying possible regions affected and showing the evacuation ways and safety areas. For examples, most of local municipalities in Japan prepared hazard maps against tsunami and volcanic eruptions, which were distributed to all houses, schools and companies in their territories. The worst scenario about the hazard map is the case of eruption at Nevado del Ruiz Volcano, Colombia, in 1985. There, a volcanic hazard map already prepared was not used for evacuation due to failed communication between scientists and local governments, resulting in loss of 25,000 lives due to mudflows generated by glacier melt during the eruption. Utilization of hazard map by local community is important not only for people's evacuation but also for future planning of cities and communities.

ROLES OF GEOPARKS

Education for preventing disasters caused by geohazards is one of the elements to reduce the related risks. Many of the Japanese geoparks include active volcanoes and/or coastal terraces formed by repeated mega-earthquakes. Those are important geosites in their territories where hazard maps against volcanic eruptions or tsunami are commonly prepared. Education for disaster prevention is carried out for people living there in classes of school and town hall. It is also done for visitors through geopark guides; that is, earthquakes, tsunamis and volcanic eruptions may happen during their stay in the geoparks. Sign boards or signposts along roads leading to or in the geosites explain to them how and where they should escape from tsunami when they feel large vibration from earthquake, as well as cautions to falling rocks.

Some disasters resulted from failed communications among scientists, governments, bureaucrats and local people. Geopark activity can play a role to reduce the miscommunication among them before people will be faced with geohazards. As shown in the Osnabrüch and Shimabara Declarations, geoparks can provide very effective tools and opportunities to learn about geohazards and the associated disasters by looking at landscapes, touching the geological products and listening to their stories. Remains from those disasters and traditions by local people who experienced geohazards can be considered among the most useful tools. Stories talked by guides and local people who experienced disasters fascinate visitors and local young students, the latter of which may become city planners, leaders of communities/companies, and bureaucrats related to natural disasters.

However, thoughtlessly emphasizing natural hazards and disaster prevention may plunge them into fear. Natural hazard and disaster issue should be explained upon their understanding about natural dynamic movement and its benefit. Geopark is the entrance for visitors and local people to start considering the natural hazards and to prepare disaster prevention in their lives. In geoparks, we begin talking about the Earth's dynamics and blessings, and the story of natural hazards and disaster issues will follow.

ACKNOWLEDGMENTS

I thank Nicholas Zorous and the Organizing Committee of the Conference which gave me the opportunity to present this paper. I also thank Mahito Watanabe and members of the Japan Geopark Committee for usual discussion with me. Azusa Tonotani, Ueheyamamai Project (Yuka Murao) and Asia Air Survey Co. Ltd. kindly permitted usage of their photographs.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

European Geoparks: new challenges and innovative tools towards Earth heritage management and sustainable local development

Nickolas Zouros ([a])

([a]) Department of Geography, University of the Aegean - 81100 Mytilene Greece and Natural History Museum of the Lesvos Petrified Forest, nzour@aegean.gr)

ABSTRACT

The European Geoparks Network (EGN), 13 years after its foundation is facing a series of new challenges in front of the latest efforts towards the establishment of the UNESCO Global Geoparks Initiative. Since the beginning European Geoparks adopted a "bottom-up" approach for their management and operation, as community involvement is considered as a key-factor for the effective protection of the geological heritage sites laying within their territories. Based on the concrete results achieved in Earth heritage and geodiversity protection and promotion, in environmental education as well in sustainable economic development of geopark territories, the European Geoparks Network should continue to follow the same operational structure which reflects the open and democratic spirit that characterized it's creation and at the same time should adopt and develop new operational tools to improve its operation and networking.

KEY WORDS: European Geoparks Network, Earth heritage, sustainable development

INTRODUCTION

The European Geoparks Network (EGN), 13 years after its foundation by 4 territories in 2000 has been expanded to include, as of April 2013, 54 territories across 19 European countries. European Geoparks aim to protect geodiversity, to promote geological heritage to the general public, as well as to support sustainable economic development of geopark territories, primarily through the development of geo-tourism. Since the beginning European Geoparks adopted a "bottom-up" approach for their management and operation, as community involvement is considered as a key-factor for the effective protection of the geological heritage sites laying within their territories.

Through Geoparks operation important geological sites gain worldwide recognition and benefit from innovative preservation techniques through the exchange of knowledge, expertise, experience and staff among Geoparks.

The European Geoparks Network adopted a common logo which is registered in all European countries, contributing over time to creating a common image of quality, linking the enhancement of European Earth heritage with sustainable development.

Since 2004, the European Geoparks are part of the Global Geoparks Network formed under the auspices of UNESCO. Through a formal agreement with the UNESCO (former Division of Earth Sciences), the European Geoparks Network acts as the European sector of the Global Geoparks Network (GGN).

In order to achieve high quality standards in Geoparks operation and services provided to visitors, the EGN/GGN established an evaluation procedure for all new applicants for membership in the EGN/GGN. EGN/GGN membership is limited to a period of 4-years after which a revalidation procedure leads to the renewal or not of the membership. The revalidation follows similar procedures as the evaluation.

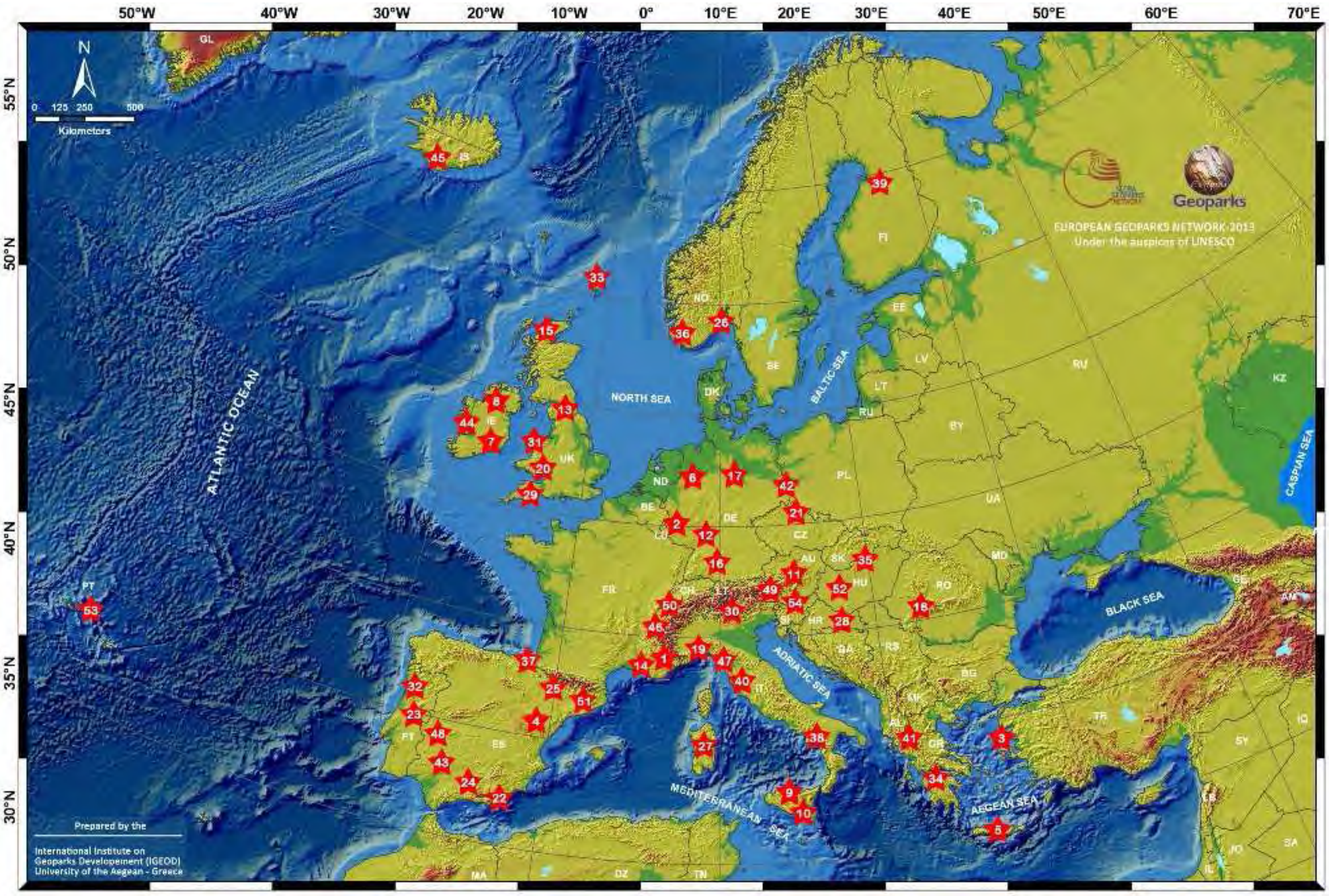
Thus the European Geoparks Network (EGN) represents today a growing European network of excellence, including territories that can present concrete results on geological heritage protection and promotion and contributing significantly to the economic and social local development.

After one decade of successful establishment and operation, the European Geoparks Network is facing a series of new challenges in front of the latest efforts towards the establishment of the UNESCO Global Geoparks Initiative.

The European Geoparks Network during the next decade should enhance the promotion of the Geopark concept in Europe and strengthen networking among EGN members in order to further expand and cover the total number of European countries and to include the most representative territories of the European geological history and evolution.

EGN networking will facilitate sharing of experience, organization of capacity building activities and formation of joint initiatives and projects.

The EGN operation will provide new innovative tools in territorial management, holistic heritage and nature conservation, raising public awareness on natural disasters and climate change, development of responsible tourism activities, environmental education, communication and promotion, contributing to the implementation of the E.U. strategy for a smart, sustainable and inclusive growth in Europe.



The European Geopark Network members (April 2013) : 1. Réserve Géologique de Haute Provence – France, 2. Vulkaneifel European Geopark – Germany, 3. Lesvos Geopark– Greece, 4. Maestrazgo Cultural Park – Aragon, Spain, 5. Psiloritis Nature Park – Greece, 6. Terra.Vita Nature Park – Germany, 7. Copper Coast Geopark– Ireland, 8. Marble Arch Caves European Geopark– N. Ireland and Republic of Ireland, 9. Madonie Geopark – Italy, 10. Rocca di Cerere – Italy, 11. Nature Park Steirische Eisenwurzen – Austria, 12. Nature Park Bergstrasse Odenwald – Germany, 13. North Pennines AONB – England, UK, 14. Park Naturel Régional du Luberon – France, 15. North West Highlands – Scotland, UK, 16. Geopark Swabian Albs – Germany, 17. Geopark Harz. Braunschweiger Land. Ostfalen – Germany, 18. Hateg Country Dinosaurs Geopark – Romania, 19. Beigua Geopark – Italy, 20. Fforest Fawr Geopark – Wales, UK, 21. Bohemian Paradise Geopark – Czech Republic, 22. Cabo de Gata – Nijar Nature Park – Andalusia, Spain, 23. Naturtejo Geopark – Portugal, 24. Sierras Subbeticas Nature Park – Andalusia, Spain, 25. Sobrarbe Geopark – Aragon, Spain, 26. Gea Norvegica – Norway, 27. Geological, Mining Park of Sardinia – Italy, 28. Papuk Geopark – Croatia, 29. English Riviera Geopark – England, UK, 30. Adamello – Brenta Nature Park – Italy, 31. Geo Mon – Wales, UK, 32. Arouca Geopark – Portugal, 33. Shetlands – Scotland, UK, 34. Chelmos Vouraikos – Greece, 35. Novohrad - Nograd Geopark - Hungary & Slovakia, 36. Magma Geopark – Norway, 37. Basque Coast Geopark, Pais Vasco – Spain, 38. Parco Nazionale del Cilento e Vallo di Diano, Campania – Italy, 39. Rokua Geopark – Finland, 40. Tuscan Mining Park – Italy, 41. Vikos – Aoos Geopark - Greece , 42. Muskau Arch Geopark – Germany & Poland, 43. Sierra Norte de Sevilla Natural Park, Andalucia - Spain , 44. Burren and Cliffs of Moher Geopark - Republic of Ireland, 45. Katla Geopark – Iceland, 46. Massif du Bauges Geopark – France, 47. Apuan Alps Geopark – Italy, 48. Villuercaas-Ibores-Jara Geopark – Spain, 49. Carnic Alps Geopark – Austria, 50. Chablais Geopark – France, 51. Central Catalunya Geopark – Spain, 52. Bakony-Balaton Geopark – Hungary, 53. Azores Geopark – Portugal, 54. Karavanke/Karawanken - Slovenia & Austria.

OPERATION AND NETWORKING

The structure of the European Geopark Network is relatively simple. EGN is governed democratically by the Coordination Committee, comprising of two representatives from each member and representatives of International Organizations which collaborate with the Network. EGN operates primarily by frequent Coordination meetings and Annual European Geopark Conferences. Decisions concerning the network are only made by the Coordination Committee. The Coordination

Committee meets twice a year in spring and autumn to discuss all issues regarding the strategic planning, collaboration with other International bodies and associations, operation and promotion of the Network. EGN members submit to the Coordination Committee their Progress Report which includes the main achievements of the previous period.

As part of the Co-ordination Committee the EGN Coordinator and the Vice Coordinator are elected every 2 years to represent the whole network. They co-ordinate contacts with other international bodies (E.U, UNESCO, IUGS, IUCN, Council of Europe etc.) and prepare the agenda of the meetings in partnership with the meeting host. An eleven member Advisory Committee (including the EGN coordinators and representatives of UNESCO, IUGS and IUCN) is elected every 2 years to elaborate proposals and advice the network on major issues, especially on strategy, external relations and the development and expansion of the Network within high quality standards.

European Geopark Conferences became the most important forum in Europe for the exchange of information on Geopark operation and activities. The 12 European Geopark conferences enable the Geopark staff especially from new aspiring Geoparks and Geopark collaborators to become acquainted with each other, exchange experiences, present new activities and common projects and define future common strategies on geoconservation, the enhancement of natural and cultural heritage, environmental education, geotourism and local development.

FUTURE PERSPECTIVES

In September 2012 the Coordination Committee of the European Geoparks Network in Arouca, having in mind the decision and the strong interest in the Global Geopark concept that was noted in the 36th General Conference of UNESCO in 2011, issued the so called “Arouca Declaration” in which describes the main issues for the future developement of Global Geoparks and the operation of the Geoparks Network in Europe.

The EGN welcomed the increasing levels of support for Global Geoparks within UNESCO and hoped that the present strong relationship between them would be strengthened even further in the near future. In particular, the Coordination Committee advocated that Global Geoparks should be totally and exclusively under the umbrella of UNESCO, with the Global Geoparks Network and UNESCO working together in tandem to continue the development of Global Geoparks around the World. At the same time, the Coordination Committee agreed that the core values and established practices that are fundamental to the success of Global Geoparks should be perpetuated and that it is important to retain the ‘bottom up’ approach to developing geoparks that has been fundamental to the successful establishment of Global Geoparks as a world-wide phenomenon that enjoys tremendous grass roots community support. The EGN wished to see the present well-tested and cost effective quality control measures and inspection/revalidation procedures retained for all existing or aspiring Global Geoparks. Lastly, the Coordination Committee members were anxious to ensure that future Global Geoparks should only be accepted on merit and not because of any political pressures or any other inappropriate considerations.

Having in mind the history and the development of the Geoparks during the last decade it is obvious that further development of Geoparks will be guaranteed by the effective operation of the European Geoparks Network, which represents not only the biggest group of the Global Geoparks but it has also proved that has the potential to accelerate initiatives and tools to contribute significantly for the promotion and spreading of the Geopark concept world wide .

Thus, in its second decade the European Geoparks Network will continue to follow the same operational structure which reflects the open and democratic spirit that characterized it’s creation and at the same time has already adopted and developed new operational tools to improve its functioning and operation such as the *National Geopark fora* (National Geopark Committees) and *Thematic networks - working groups*.

NATIONAL GEOPARK FORA

The establishment of Geoparks National Forum follows an EGN decision at the 23rd Meeting in Sardinia Mining Geopark. As Geoparks were established through “bottom-up” initiatives, the initial aim for the creation of the National Geopark Fora was a better coordination the Geoparks’ initiatives and activities at the national level and the improvement of the communication between Geoparks and National authorities.

A general proposal for the composition of National fora exists but each country should also take into account existing national priorities or special conditions. The proposed National Geoparks Forum composition is:

- a representative of the National Commission for UNESCO or the government body responsible for cooperation with UNESCO
- a representative of the national geological organization
- a representative of the national environmental/ protected area organization
- a representative of the national cultural organization
- a expert on tourism and economic development
- a representative of the Universities or Scientific association working on Geoparks
- representatives from each of the existing Global Geoparks

Thus the main aims of a National Geopark Forum defined as follows:

- to promote the development of new Geoparks;
- to promote new projects for the valorisation of the geological heritage at a national level;
- to provide information and popularize the International Network of Geoparks (EGN/GGN) through the various communication tools (website, specialized magazines, newsletters, newspapers, etc);
- to create new opportunity of integration between the many national activities direct to the growing of

geological heritage's policy and to the development of geotourism;
- to provide a technical and scientific support to the territories who want to submit to the EGN/GGN;
- to organize an annual workshops in order to exchange best practice and to popularize the various projects and activities of the Geoparks, the geological heritage conservation and the realization of virtuous actions for the sustainable development.

National Geopark fora or National Geopark Committees after the establishment of the UNESCO Geoparks Initiative will have another important duty, to approve all new Geopark applications at the national level before their submission to UNESCO secretariat.

Till now Geopark Fora in Europe exist in Czech Republic, Finland, France, Germany, Greece, Ireland, Italy, Portugal, Spain and UK. Similar structures need to be created in all European countries during the next year.

One of the most active ones is the Italian Geoparks Forum as it has already organized6 Forum meetings, 5 National Workshops on Geoparks, common publications, website and other promotional activities.

THEMATIC NETWORKS - WORKING GROUPS

Thematic networks within EGN have been formed in response to the need to strengthen collaboration between Geoparks on issues of common interest. EGN working groups may be set up to advance a working paper or project on a particular subject.

The themes of these networks initially were based on the geological characteristics of each Geopark, which can become a basis for the development of common activities of the group members based on the connection between the place (landscapes and geosites) and human activities (culture, local tradition, food, etc).

Later on other thematic networks were formed to elaborate specific issues which are crucial for the development and operation of Geoparks such as "Geoparks and intangible heritage", "Geoparks and tourism" etc. Every thematic network meets during EGN meetings and presents a report. For each thematic network one member of the Coordination Commission is nominated as Catalyst.

As the European Geoparks Network expands, Geoparks with common characteristics or interests may found the thematic networks as effective forums to work together and collaborate in order to improve sharing of experience and best practise among Geoparks.

CAPACITY BUILDING ACTIVITIES

The European Geoparks Network focuses on the development and transfer among its members of new methodologies and approaches to the management of European Geoparks. The exchange of experience and know how between Geoparks is achieved through high level workshops and seminars and the exchange of staff on study visits.

Since 2007 after a request from the GGN Bureau, the International Intensive Course on Geoparks is organized in Lesvos Geopark by the University of Aegean and the Natural History Museum of the Lesvos Petrified Forest, the management body of the Lesvos Geopark. The course is running under the auspices of UNESCO and with the support of GGN and EGN who provide the course contributors.

The main objective of the course is to provide the necessary information to new and aspiring Geopark teams and to support building capacity for individuals wishing to work for Geoparks development worldwide. The course focuses on geo-conservation, Geopark management and operation, geo-tourism development, educational activities in Geoparks, awareness rising on Earth heritage protection, as well as to the issue Geoparks and local development. Another objective of the course is to analyze the opportunities and challenges of safeguarding and developing the multiple contributions of Earth heritage sites and monuments to life and society and to present and explain the Geopark concept. Examples and good practices in geo-conservation and Earth heritage management in Geoparks are always presented as well as major mistakes in failed projects and successful strategies to overcome and to avoid common failures.

The content of the course provides:

a) methods and tools for understanding, managing and assessing Earth heritage sites and monuments;

b) a broad platform to study the impact of Geoparks and geo-tourism in human sustainable development and quality of life; and

c) critical and multidisciplinary approaches employed in comprehensive, participatory decision-making, governance and interventions in Geoparks.

The program includes lectures, workshops, in-course presentations, field work, group work and a final exam.

Exchange visits of Geopark staff have produced impressive results in building new links between Geopark management bodies and in sharing experience and know-how. This kind of exchange leads to improving understanding between partners, raising awareness of tourist behavior and needs, identifying sources of information for new geo-tourism and educational products, raising awareness among Geoparks for the creation of products and services in response to visitors expectations, providing a valuable human experience through the exchange of cultures, practices, and mutual understanding.

European Geoparks have used several opportunities to exchange thematic temporary exhibitions among partners. These exhibitions contribute significantly to promoting the values of European Earth heritage, improving recognition and understanding between Geoparks and creating a common image among partners.

GEOPARKS AND LOCAL DEVELOPMENT

As Europe is facing the worst economic and social crisis since the 1930s, Geoparks can present concrete results to gain broader recognition as development tools for rural European territories, implementing the main tasks of the EU strategy Europe 2020.

Geoparks contribute significantly to smart growth by investing in scientific knowledge and research and by developing educational activities for the typical and non typical education.

Geoparks are developing, experimenting and enhancing innovative methodologies for preserving the geological heritage and supporting research in the various disciplines of Earth Sciences. Scientific research in Geoparks led to the creation of new knowledge on geosite protection and management in Geoparks.

Geoparks became excellent environmental education destinations with efficient and well organized educational activities implemented in open air parks, thematic museums and interpretation centres in various disciplines of Earth sciences.

Geoparks are operating also as open air classrooms to improve public knowledge and raise public awareness on climate change and natural hazards (earthquakes, tsunamis, volcanic eruptions, landslides, liquefaction phenomena). Geoparks support communities living in volcanic or tectonic active areas or facing other geological hazards to improve public knowledge on earthquakes and volcanoes, to enhance preventive and preparedness measures and to improve the effectiveness of response on geohazards mainly through organizing educational programmes and educating relative groups (children, teachers, parents etc.) on the best practices and state of the art responses.

Geoparks support sustainable growth through the development of responsible tourism, which is based on the validation, utilisation and promotion of the territorial resources.

Geoparks develop a range of environmental friendly tourist infrastructures to provide access and interpretation to Earth heritage sites and quality services their visitors. A Geopark museum or interpretation centre is a necessity, to provide an holistic view of the territorial identity. Open air parks, interpreted geosites and a network of pathways linking the different sites of interest within the Geoparks are attracting thousands of visitors each year. Equipped with information panels and supported by maps, leaflets and field guides these footpaths link the interpreted geosites, visiting parks, wetlands, sites of natural beauty and ecological value, as well as cultural monuments and other sites of interest throughout the Geopark. Along the main roads leading to the Geopark area, informative panels and road signs direct visitors towards the Geopark and demarcate their borders. Geoparks also establish information centres to inform visitors about the geotouristic and educational activities.

Geo-tourism activities in Geoparks include guided tours, guided walks, outdoor and adventure activities, presentations and events. Geoparks also promote friendly accommodation and local gastronomy. Geoparks also collaborate closely with women's agrotouristic cooperatives and local organic food producers to offer their visitors the opportunity to taste and buy local food products (pasta, organic vegetables, wine, liquors, traditional sweets and marmalades etc). Geoparks promote quality local products, food and drinks bringing local producers and potential customers together. Several other local artisans, such as makers of handicrafts and ceramic fossil casts are permanent collaborators with the Geopark. In this way Geopark visitors experience not only the rich natural heritage of the area and sites of high ecological and aesthetic value, but also the culture, tradition, and local production of the region.

Geoparks replay also to the request of an inclusive growth by creating new jobs directly and indirectly.

Geoparks actively involve local communities as key stakeholders in the Geopark, and, in partnership with local communities, implement a management plan that meets the economic needs of the local population whilst protecting the landscape in which they live.

Geoparks are developing new economic activities for mining areas were the activities are ceased down and a second use to industrial infrastructures through the development of geotourism, creating new job opportunities for employees which were out of the job market.

Geoparks operation is based on the employment of local inhabitants that serve as administration officials, guides, guards, technicians and workers. But what is even more important for the employment in the area is the number of private job opportunities which are created in tourist enterprises, small hotels, guest houses, restaurants and outdoor activities related with the increase of tourist flow in the Geopark area.

CONCLUSION

European Geoparks provide as the most effective mechanism for the enhancement of the European geological history and the the value of the Earth heritage, its landscapes and geological formations, which are key witnesses to the history of life.

Geoparks through their activities and results are proving their potential to become development tools especially for rural areas hosting significant geological heritage in Europe.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

The contribution of the geo-scientific community to risk, resource and chance management, education and dissemination in the Cilento, Vallo Diano and Alburni - Geopark (Southern Italy).

Domenico Guida ([a])

([a]) Department of Civil Engineering , University of Salerno, Via Ponte Don Melillo, Fisciano, Italy. E-mail: dguida@unisa.it.

ABSTRACT

The paper, in general, deals with the role of the geo-scientific community to improve innovative approaches in raising public awareness and consciousness in geoparks about risk, resource and change management, education and dissemination. In particular, it discusses geo-scientific premises, ongoing experiences and future perspectives enhanced in the Cilento, Vallo Diano and Alburni European and Global Geopark in order to support local sustainable development linking geoheritage conservation, geodiversity preservation, geotourism promotion and fruition with biodiversity, ecosystem functioning and ecological services adopting trans-disciplinary approaches, integrate methods, adaptive modeling and participative process.

KEY WORDS: Cilento, Vallo Diano and Alburni European Geopark.

INTRODUCTION

The big issues in Anthropocene, the new era in Earth and Life evolution, are global: changes in climate, scarcity and pollution in geo-resources, transition in energy sources, increase and exodus in demography, new diseases in human health and new standards in people well-being, crisis and incertanties on the 3rd revolution in economy, directions of the nano- and digital technology, new scenarios in geo-politics, and so on. Without doubt, the solutions to the above big issues could be only global. But since times all the efforts of the international community in the several International Conference on Biodiversity, Climate, Food, Water and so on, don't have "globally" accepted and applied. Therefore, what is/are the best solution/s to face the above big issues? Certainly, no global solutions could be expected by this Conference. But, following the main topics of the Conference: could Earth Sciences assume an important role in global strategy development around the world? As quoted from introduction of the Conference Circular *"...geo-hazards and climate change hardly affect all human activities and can strongly condition the future of humanity. In fact, life, property, economic and financial losses due to natural hazards and the impact of disasters on society have both increased dramatically over the last couple of decades. Scientists - both physical and social-, policy makers, insurance companies, disaster managers, and the public themselves, have different ways for understanding natural geo-hazards and sustainable use of natural resources."* But this how can be performed with efficiency, effectiveness and share off the Earth Science Global Community? We need an international cultural umbrella: this is UNESCO; moreover, we need an international UNESCO-recognized Network: the European and Global Geopark Network and finally, we need local laboratories to incubate actual experiences on the subjects: the Geoparks. In this contest, quoting the 2nd Circular, *"This conference aims to: 1. verify how Geoparks can direct the scientific knowledge of the academic community on these items; 2. understand how the Geoparks address these issues in the educational system; 3. disseminate the role of Geoparks on the public awareness and sustainable use of natural resources."*

THE CVDA GEOPARK

Since 19th Century, the area broadly defined as Cilento attracted the attention of the Hearth scientists, both Italian and European. The same geographical place-names "Cilento", "Vallo Diano" and "Alburni" have its roots in Earth Sciences: the first from the latin Cis-Alentum as "on this side of Alento river" (Ancient Cilento), nowadays extended to a broader area; "Vallo" is not "Vallum" nor "Valley", but corresponds to an inter-mountain plain surrounded by mountainous reliefs; finally, "Alburni", means " *mountain built-up by white rocks*". The Cilento, Vallo Diano and Alburni European and Global Geopark, in the following only CVDA Geopark, is bounded by the Tyrrhenian sea, Policastro gulf to the South and Cilento coastland to the West, by the Sele and Tanagro rivers to the North and by the Maddalena mountains to the East. These boundaries corresponds roughly to the Cilento, Vallo Diano and Alburni National Park and their "Adiacent Areas"(fig. 1). Geologically, the CVDA Geopark represents the southernmost segment of the Tyrrhenian Borderland in the Southern Apennine chain. At Mediterranean scale, Southern Apennine constitutes a chain arch of the circum-mediterranean orogenic system and, more precisely, a segment of the Apennine-Magrebian chain system, related to the final stage of the Alpine Orogeny. Southern Apennine is an eastward fold-and-thrust chain, with the Bradanic Forethrough, Apulia Foreland and the Tyrrhenian back-arc area. The chain represent the orographic expression of an accretionary wedge due to a west-verging basement subduction, including overthrusted successions from several palaeo-geographic domains, developed from Mesozoic to Cenozoic and deformed eastward from Oligicene to Quaternary and migration of the orogenic front, creating several foredeep and piggy-back basins. As more widely illustrated on the 1st and 2nd Geopark Book and, concisely, on the Field Trip Guide-book, in the CVDA Geopark are represented from high: the Internal Units from oceanic-transitional ocean over-thrusted on Apennine carbonate Bahamian platform; the last two over-thrusted on the Lagonegro intermediate-crust basin Units and on the Apulia platform. Geomorphologically, the CVDA Geopark can be considered a morpho-structural province, well defined by main morphological systems: mountainous, carbonate and karst-influenced massifs to the Nord and NE; mountainous terrigenous ridges in the middle of the region, separated from the previous by a regional tectonic line, the so-called Paestum-Sapri Line. Hilly landscapes are located in the Calore, Mingardo and Bussento river valleys. , the isolated Bulgheria carbonate massif delimitates, on the South, Cilento from the Policastro gulf. Narrow and limited coastal and alluvial plain are present downvalley the main river basins. Low coastland are alternated with rocky coasts on terrigenous succession and carbonate, respectively. Ecologically, the CVDA Geopark results identified as "Cilento" Sub-section of the *"Latium-Campania" Section*, inside the *"Tyrrhenian Borderland" Province* of the *Mediterranean Division*. Orographically, the CVDA Geopark is represented as a distinctive 4th Order Orographic Group inside the Apennine Chain (6th Order), not included in the 5th Order South Apennine Orographic System. The same results gives the "*Oro-Hydrography Map of Europe*" in the Poster Exhibition, where are located as "*stars*" the European Geoparks. More information about the above subjects one can find on the 1st and 2nd Geopark Books and, more concisely on the geological Field Trip Guide-book.

RESEARCH, EDUCATION AND DISSEMINATION

Referring to the introductory notes, in the following the experiences on the Conference items are discussed:

1) how the CVDA Geopark have directed the up-to-date geo-scientific knowledge on these items?;

2) how the CVDA Geopark have addressed the up-to-date geo-scientific knowledge in the multi-level educational system?; and last, but no least;

3) how to disseminate the results of these experienced activities by CVDA Geopark and shared by European and Global Geopark Network?

Since the Cilento National Park institution and constitution, geological considerations have had primary attention in assessing, planning, programming and managing natural and cultural landscape. Prior the CVDA Geopark institution, in the 1997 Cilento National Park was recognized as Biosphere Reserves (Man and Biosphere - MAB - Program and successively included in the Cultural Heritage of the UNESCO. As MAB Reserve, Cilento National Park programmed initiatives on the Ecological Network and experienced the first Environmental Survey and Biodiversity Observatory in the Italian National Parks. In the 2000, during the multi-disciplinary analysis supporting the elaboration of the Park Plan, the Geosite Inventory and Classification was performed. Consequently, the Park Plan Accomplishment Rules acknowledged the geodiversity conservation instances in the Art. 12. " *The Plan localizes the areas comprising geosites of stratigraphical, palaeo-environmental, palaeo-biological, structural and geomorphological interest, both in the park and in the "adiacent Areas, where are prohibited new buildings or land use transformations…Are consented interventions addressed to conservation and rehabilitation of these areas and correct exploitation and fruition of the geosites*".

The first "*ante litteram*" directing of the geo-scientific knowledge from the academic community was the publication of the scientific paper on the Cilento Geosites, now revised and illustrated in the 1st Geopark Book provided as basic Conference documentation. In addition, the Park Plan Zoning and related Regulation Notes were based on the Environmental Systems and Subsystems, where an original ecological approach used climate, lithology and morphology, as the "*basic factors*" of the landscape physical structure, previously introduced as "*Reference Territorial Units*". The theoretical elaborations from the Cilento Park Plan will be the seeds for the definition of the "*Scientific Rules for Quality State of Italian National Park*" and, successively, for the above cited "*Eco-regionalization of Italy*", within the *National Program on Biodiversity promoted by the Ministry of Environment*. The Landscape Map of Italy constitutes the base map of the Italian Geopark Landscape, exposed in the last room of the Poster Exhibition. After the CVDA Geopark recognition by EGN in 2010 at Lesvos (Greece), Geopark management directs discussion with the geo-academic community from the Campania universities (Naples, Benevento and Salerno), forcing the traditional academic self-reference, sharing a step-by-step path to synthetizing the state-of-art of the scientific knowledge in Cilento geology, coordinating ongoing geo-research activities and addressing results in communication toward a non-academic communities for wider educational and dissemination targets. The initial slogan was "*Geopark: the House of Geoscientists*". Overcoming the initial difficulties, thanks to decisive dedication of the prof. Domenico Calcaterra, a synthesis of the Cilento hazards, risks and resources is now published as 2nd Geopark Book, available in the conference bag and successively useful for educational and dissemination purposes. The efforts lavished by CVDA Geopark in improvement more insights in geological researches on the conference topics have had confirmations in papers and posters submitted. The quality and number of the extended abstracts selected and published on the Rendiconti of the Italian Geological Society and on the Conference Proceedings give back in challenge derived from the EGN Coordination Committee decision taken in Aruka, Portugal.

In April 2012, the the CVDA Geopark supported the Pilot Experiments on "*Use artificial DNA as tracer in Mediterranean surficial and karst stream flow*", in cooperation with IHE-UNESCO Institute of water Education (Delft, The Netherlands). The Pilot Experiment above cited supports the Research Project on "*Karst and Water Resources in the Geopark*", regarding the karst-conditioned stability, functioning and ecological integrity of the riverine habitats, focusing on spring, sinkhole and resurgence geosites.

In the October 2012, CVDA Geopark supported the Workshop on "*Objective Geomorphological Mapping*", organized by the University of Salerno and the International Association of Geomorphologists. The successive Scientific

Field Trip taken place in one of the most fascinating and interesting Geosite Complex in the CVDA Geopark, verifying the reliability of the Salerno Methods in identifying, classifying and objectively delimiting landforms and, consequently, the geo-morphosites.

The CVDA Geopark have addressed the up-to-date geo-scientific knowledge in the multi-level educational system using as "tool", the Italian Geopark Week and, as "locations", the Educational Local Center Network. So, in the May 2011, CVDA Geopark organized, in collaboration of MIDA Foundation and Regional Geologist Association of Campania, the Official Public Presentation of the Geopark in the Focal Geosites of Angel Cave in Pertosa-Auletta towns and the Morigerati WWF Oasis, involving both emeritus professors in Cilento geology, undergraduate students in geology from Salerno University and professional geologists from Campania and Lucania regions. The 4th Field Trip participants will visit both the Angel Caves with geomorphologists, speleologists and expert guides and the MIDA Museum System dedicated to site promotion (i.e. a gastronomic uniqueness: *the Pertosa white artichok*), geo-tourism fruition (i.e. rafting) and environmental education (Spelaeologica Museum). In the May 2012, the CVDA Geopark organized the second educational geo-event, also in collaboration with Castelcivita Cave Management, Regional Geologist Association of Campania and Campania region, a seminar on the new geological mapping of the Cilento (CARG Project) in the fascinating underground landscape of Castelcivita caves, with the video-conference participation of Nicolaus Zouros, Patrick MacKeever and Maurizio Burlando, european geopark coordinator, european geopark vice-coordinator and Italian geopark coordinator, respectively. Students in geology from university courses enjoyed new geological knowledge on karst cave system in the perspective of their future involvement as professional or scientific operators and stakeholders. The 2nd Field trip participants will also enjoy the same interesting and fascinating underground world of the Castelcivita Caves with hydrologists, speleologists and palaeo-ethnic experts.

Finally, in the May 2013, the CVDA Geopark organized the third educational geo-event, called *Bussento Karst System Week End Field Trip*, also in collaboration with Caselle in Pittari, Morigerati, Casaletto Spartano and Tortorella municipalities, as the experimental program "Geopark-supporting Outside Educational System", involving students from the Department of Civil Engineering and Environmental Sciences of Salerno University and using the Bussento Educational Local Center Network: the MU.VI (Karst-Lab and Virtual Museum) and Bussento sinkhole path system in Caselle in Pittari, the "*Capillus Veneris*" Bio-Geo Laboratory in Casaletto Spartano, Otter WWF Oasis and Bussento Resurgence in Morigerati and Bussentino Little Canyon near Tortorella village. The 1st Field Trip participants will embrace in a few hours the main geopark "*experiment*" at basin scale, taking geo-conservation, geo-research, geo-promotion, geo-education and geo-dissemination into account, as occasion for a durable and sustainable local development.

The third item on "*how disseminate results of the above activities experienced by CVDA Geopark and shared by European and Global Geopark Network?*", is very hard to discuss here. In Italy, this subject is considered by most politicians as "*border line*" topic between so-called technical community and political community. "*For the times, they are a-changin'…*" said the famous Bob Dylan song. Therefore, I try to walk along the narrow road between geo-logists as "*useful idiots*" and geo-phile as "*useless phylosofers*".

The first question is: we can deal with the three topics of the conference separately. Certainly not! Most of the geo-science literature links together risks, resources and global changes. But the second question arises: how communicate these links for increase public awareness on these topics? Most of economics ideas, also based on strongest competitiveness theory, admits that "*development, either will be sustainable or will be not development*". Finally, the third question is: how to put into practice these ideas to effectively disseminate experienced results from Geopark activities for best practices, good governance and sustainable development?

The proposal of the scientific geopark management is the need for changes in the cultural approaches of the scientific community to improve conditions for transition from disciplinary to trans-disciplinary researches, from single real domain to system-based modeling, from one-way "hard" factual knowledge to "soft" participatory processes.

In the complexity of the risk, resource and change management, the institutional strategy, supported by objectives and results of the FP5, FP6 and successive European Community Research Programs, considers as the "*load-bearing columns*" of the scientific support to sustainable development by integrate knowledge approach improvement; adaptive management system application; participatory learning-based process implementation.

Therefore, the CVDA Geopark have addressed its support to above scientific efforts in:

- Geodiversity supporting Biodiversity, by creation of Bio-Geodiversity Center Network for research and education;
- Geoheritage management, by Monitoring Systems;
- Ecosystem functioning by Life Nature Projects
- Ecological Service by a Life+ Governance Project.

For each of these projects we need to spend a lot of time; we can continue more deeply discussion in thematic sessions.

CONCLUSIONS

In conclusion, as effectively expressed by Chris Woodley-Stewart, Geopark Manager, North Pennines AONB, United Kingdom: *"…Geoparks are not just about rocks - they are about people…"*. Therefore, beyond geoheritage, beyond geotourism, beyond geo-sustainable development, CVDA Geopark experiences, inside the EGN and GGN Network, can constitute occasion to discuss about the geology as basic factor for "*geo-identity, geo-diversity and geo-networking*" as potentials for the Cilento Geopark people and the same, I think, for the other geopark peoples.

Protected areas as essential tool for the maintenance of ecosystem services: the example of the National Park "Cilento, Vallo di Diano and Alburni"

Angelo De Vita ([a])

([a]) National Park of Cilento vallo di Diano and Alburni- Geopark –Via Montesani 84078 Vallo della Lucania (SA),direttore@cilentoediano.it

INTRODUCTION

The National Park “Cilento, Vallo di Diano e Alburni” is the largest protected area in Italy. It covers 181.000,00 hectares on land and 9.00,00 hectares on sea. In fact, in the 1991, the Italian Government, with the Law number 394, established the National Park of Cilento, Vallo di Diano and Alburni and, recently, in two thousand ten, the Minister of the Environment has established the two Marine Protected Areas "Santa Maria of Castellabate" and "Costa Infreschi and Masseta ".

The protected area preserves a priceless heritage, result of thousands of years old and harmonious interactions between natural environments and human works.

Located in the center of the Mediterranean, in Campania Region, the Park is a perfect combination in coexistence between nature and culture, a place of exchange and contamination. It is today a living landscape that maintains an active role in contemporary society, while retaining traditional characters: the organization of the territory, the plot of the paths, the structure of crops and the system of settlements. The exceptional biodiversity of natural habitats, the unique heritage of archaeological sites - from rock shelters inhabited since the Paleolithic period until the exceptional, well-preserved, settlements of Paestum and Velia , from the medieval urbanization of the landscape to the contemporary phenomena, they show, as in the Park, civilization has always identified in the nature, in the morphological, climatic, botanical and environmental specificities of the territory, an added value to be protected.

The harmonious integration between Man, Nature and Culture has transformed the territory of the Park in a complex bio-geographical system, a true living laboratory in which it possible to experiment some activities and initiatives in an attempt to combine the protection of nature and biodiversity with social, cultural and economic development of local communities.

As a result of this complex heritage, a perfect synthesis between culture and nature, the territory of the Park was, at first, in the 1997, included in the list of Biosphere Reserves of UNESCO MAB program, and later in the 1998, with the archaeological sites of Paestum and Velia and the Certosa di Padula, it was included in the UNESCO World Heritage List, in the category of "Sito Misto", just by virtue of Cultural Landscape and Natural Heritage, as enshrined in articles one and two of the Paris Convention in the 1972.

BIOSPHERE RESERVE

The advisory committee on the biosphere reserves of the program mab (man and biosphere) of the unesco, in the meeting that took place in paris between the 9th and the 10th june 1997, decided unanimously the inclusion of the area of the National Park “Cilento and Vallo di Diano” in the prestigious network of the biosphere reserves.

In the National Park there are, also, 28 Sites of Community Interest (SIC), according to Directive 92/43/CEE (Directive Habitat) and 8 Zones of Special Protection (ZPS), according to Directive 79/409/CEE (Directive Birds), all included in the Mediterranean Bio-geographic Region.

The Nature 2000 Network occupies a surface of 118.316 hectares, equal to the 65% of the whole Park and it will be managed through the relative Plans of Management.

The park contains a wide variety of different natural environments. A territory with environmental, botanical and cultural features: Nature and Culture express themselves in an indissoluble union.

Flora

Flora and vegetation show high diversity. The floristic population of the park is made up of about 2.200,00 different species of wild native plants, more than 30% of the national flora and about 60% of the regional flora. Of these species about 10% is of considerable importance, being endemic and/or rare.

The best known of these species, and perhaps even more important, is the Palinuro Primrose (Primula Palinuri), symbol of the park, especially the disclosure of which is localized to a few areas of the Cilento and Calabria.

The floristic diversity is favoured by climatic conditions, topography and soils very diverse.

The heart of the Park is a complex of carbonate mountains structured around Cervati Mount that, with its 1898 meters above sea level, is the highest mountain in the region of Campania.

Mountains, hills, valleys, rivers, streams, ravines, caves, many different natural environments make this place, from the point of view of flora and fauna, one of the richest in the Southern Italy.

The territory is characterized by large wooded areas that reach up to 1700 meters and by open glades that we find especially at high altitude.

Proceeding from the bottom to the top of the reliefs is possible to distinguish two main types of woods mesophilic:

- mixed forests characterized essentially by the presence of Cerri, hornbeam, ashes, maples (Acer Parsley, A. lobelii), Laburnum (Laburnum alpinum), Holly (Ilex aquifolium) and, sometimes, Sorb and Yew (Taxus baccata);
- and beech forest, almost as well, with regard to the tree layer, except for the sporadic presence of the mountainous Maple (Acer pseudoplatanus), of the Lobel Maple, of the Taxus and Holly.

Fauna

The variety of habitats in the area justifies the particular faunal diversity in the Park.

On the peaks, in the grasslands of altitude and mountainous cliffs, are frequent the Golden Eagle (Aquila chrysaetos) and its favourite prey: the Rock Partridge (Alectoris Graeca) and the Italic Hare (Lepus corsicanus). The presence of these two last species is very important, as they represent typically Apennine populations, now extinct in good part of the territory. The eagle divides this environment with other birds of prey, such as the Peregrine Falcon (Falco peregrinus), the Lanner (Lanner Falcon), the Common Raven (Corvus corax) and the Chough (Pyrrhocorax pyrrhocorax).

Among the pastures you can easily find the Savi Vole (Microtus savii), a small rodent preyed upon by the Fox (Vulpes vulpes), the Pine Marten (Martes martes), the Wolf (Canis lupus) and Wild Cat (Felis silvestris), whose presence is another treasure of the Park. It is also very rich the fauna of rivers, where dominates the population of Otter (Lutra lutra). In the rivers of the Park is present the most important population of otter in Italy.

MEDITERRANEAN DIET

In the territory there are unique natural and cultural emergencies, and a variety of endemic species: the presence of wolves and otters, archaeological sites (Paestum, Velia) and historical monuments (Certosa di Padula) of international importance, which have determined the inclusion of the National Park of Cilento and Vallo di Diano, with the archaeological sites of Paestum and Velia and the Certosa of Padula, in the list of UNESCO World Heritage, as Cultural Landscape.

Paestum

In the seventh century before Christ (BC), the Achaeans Sibariti found the city of Posidonia, in honour of the God of water.

In the fifth century BC political dominance of the city passed to the Lucan Gentiles that changed the name in Paistos or Paistom and after in Paestum, when in 273 BC the city became a Roman colony. Paestum is then abandoned in VIII century after Christ (AC) for fear of the Saracen invasions.

Today Paestum, famous tourist destination in the world, allows us to admire the most beautiful and best preserved monuments of Ancient Greece: the three Doric temples of Hera, Ceres and Neptune, the Forum with the agora, the Revenue, the tabernae and comitium, the pool, the amphitheater and the chapel ipogeico. A visit to the local National Archaeological Museum allows to admire, among other things, the famous Tomb of the Diver, one of the rarest paintings by Greek painting, handed down to the present day.

Elea-Velia

Elea was founded by Focei around the sixth century BC on a promontory stretching out into the sea, in the vicinity of a source dedicated to the nymph Yele. The city's reputation around the world is related to the classical school of philosophy, conceived by thinkers like Xenophanes, Zeno and Parmenides that radiated their knowledge from famous ancient Elea throughout all the Mediterranean. Very important was also the Medical School, whose doctrines and medical practices have been perpetuated in the Middle Ages up to the culture and tradition of the famous School of Medicine of Salerno.

The archaeological area allows us to admire The thermal complex, the Ionic temple, the theater, the agora, the Tower and the famous Porta Rosa, one of the oldest examples of Western architecture that uses the round arch.

Certosa of San Lorenzo

The Certosa of San Lorenzo in Padula is a real jewel of monastic prime example of the Baroque in the South, included among the International Monuments as far back as 1882.

The work of the Charterhouse began in 1306, at the behest of Thomas Sanseverino, nephew of St. Thomas Aquinas and Count of Marsico. Subsequent transformations and expansions, which lasted until the last century, were given its present appearance at the Certosa grand and suggestive.

The monastic complex, built on an area of more than fifty one thousand square meters, has a plant in the shape of a grid to commemorate the martyrdom of St. Lawrence. It encloses and concentrated in places distinct spaces intended for the enclosure and was used for its fervent work of the Carthusian rule.

GEOPARK

On 1st October 2010, in Lesvos, Greece, on the occasion of the 9th European Geoparks Conference, the National Park of Cilento and Vallo di Diano has been included in the European and Global Network of Geoparks.

The National Park of the Cilento and Vallo di Diano has provided itself with a very effective instrument of management of territory called the Plan of the Landscape.

The ambits pointed out by the Plan of the Landscape of the National Park have been defined comparing two different aspects, one physical-geologic-morphological-naturalistic and the other historical and about human settlements.

Homogeneous portions of territory have been individualized from the point of lithological, geomorphologic, stratigraphical and hydrographical view, correlated with important and well defined structural elements.

Subsequently the single geosites have been individualized, divided and encoded for landscape areas, to which has been attributed both the geologic interest and the "Importance."

136 geosites are included in the border of the park , while 24 are included in the neighbouring areas. These last ones have been individualized because they are strictly correlated with the first ones.

103 geosites are, also, included in the Nature 2000 Network area.

As it concerns the "Importance" parameter, four hierarchical levels have been defined:

- Principal: geosite of particular geologic interest, both as uniqueness/ representativeness at European level, and as didactic-scientific value;
- Focal: geosites to which is associated a real or potential fruition from the point of view of the geo-tourism. They are geosites already equipped with structures and explanatory paths or on the way of geo-touristic structuring.
- Complementary: geosites, to which it is associated the presence of an archaeological site or human settlements of great historical-architectural value.
- Secondary: geosites of geologic interest at national or regional level**.**

As it concerns the geological interest, we have:

- Stratigraphical and paleontological geosites
- Karstic geomorphosites
- Structural geomorphosites
- Hydrogeological geosites
- Coastal geomorphosites

THE ACTIVITIES OF THE PARK AUTHORITY

"POR Campania 2000-2006"

Furthermore, in the territory of the Park, beside the existence of a network of paths of about 1500 Km, mostly marked according to the modalities of the Italian Alpine Club, and partly equipped with didactic panels, system of signs, rest areas etc., there is a network of about 41 Museums (archaeological, geologic, paleontological, of the country civilization, of the sea, an Antiquarium etc).

Three are geological museums:

- Paleontological Museum in Magliano Vetere,
- Open Space Museum in Caselle in Pittari,
- the MIdA in Pertosa

The Park Authority was leader and beneficiary of some actions of the Integrated Project "The ecological network for the local sustainable development", financed with the funds of the POR Campania 2000 -2006. This Integrated Project has been the most important of the Region Campania both in terms of involved communes (95) and for the economic resources assigned to the Park (€ 112.814.368,59).

The main activities were:

- Strengthening of the structures for the safeguard and environmental exploitation through the realization of new structures and the recovery of existing buildings (Center of Studies and Researches on the biodiversity and geo-diversity; Center of Environmental Education, Center of Mediterranean Diet, Center of Visit "Otter");
- Improvement of the eco-systemic functionality and increase of the degree of Nature of the territory of the Park (network of the old-growth forests, interventions along the river bed of the principal rivers of the Park);
- Recovery and exploitation of the historical villages, restoration and exploitation of the archaeological sites, of the places of cult (for instance the Museum of Paleontology of Magliano Vetere, the archaeological area of Roccagloriosa, the paleontological site of Vallicelli, etc);
- Recovery and exploitation of historical-cultural-naturalistic itineraries that cross some principal geosites. Among these the "Via Istmica" must be remembered: retraining of the path (informative and popular sign system), the realization of rest areas and informative centers and the recovery of the whole abandoned rural suburb of Pietracupa (Roccadaspide);

"projects financed by the European Committee":

The Park authority has besides managed other projects financed by the European Committee, such as**:**

- Life Nature. "Management of the net of SIC / ZPS in the Park";
- Interreg III B Archimed. Project I TRACE (Integrated Tourism in Rural Areas valorising Cultures and Environment);
- Interreg III C Zone North 2005-2007. Project TOOLS (new strategies and tools for the development of the entrepreneurship in the marginal rural areas);
- Interreg III B Archimed. Project EAST_MEAD Net (East Mediterranean Network for the sustainable development of protected areas);

AREA BRANDS - PROMOTE AND SUSTAIN PRODUCTIONS, ACTIVITY AND SERVICES AIMING TO THE IMPROVEMENT OF ENVIRONMENTAL AND SOCIO-ECONOMIC QUALITY.

"STRATEGY OF BIODIVERSITY"

The loss of biodiversity is a major crisis that humanity is facing and in that regard, protected areas, such as places of refuge and protection of biodiversity, play a key role in ensuring the survival of the natural heritage of the Earth.

The main objectives of the commitments undertaken by the ratification of the Convention on Biological Diversity (CBD, Rio de Janeiro, 1992), which took place with the Law no. 124 of 14 February 1994, are:

- the conservation of biological diversity, considered at both the gene, that of species, community and ecosystem levels;
- sustainable use, or sustainable, its components;
- the fair and equitable sharing of benefits arising from the utilization of genetic resources and the transfer of technologies related to it.

In particular Art. 6 of the CBD states that "each Contracting Party shall, depending on your particular needs and conditions, will have to develop strategies, plans and national programs to ensure the conservation and sustainable use of biological diversity and will have to integrate as far as possible and appropriate conservation and sustainable use of biological diversity into relevant plans, programs and sectoral policies.

The new vision of the strategy "... biodiversity, our natural capital is preserved and restored to ensure the maintenance of ecosystem services and to contribute to human well-being in a changing world .." identifies a primary role in protected areas as "essential tool for the continuity of the flow of services and functions of ecosystems "

The experience gained by the Park Authority in the conservation and enhancement of biodiversity is attributable to the program guidelines and implementation identified by the National Strategy on Biodiversity. A very powerful tool, developed by the Park, is the definition of "Guidelines for the planning and rationalization of research, both basic and applied."

These Guidelines identify priorities for action, the strategic objectives and methods of practical application, directly or indirectly, on the issues of conservation and development of Natural Resources (fauna, flora) and Environment, Cultural Heritage and Landscape, Tourism, technical and scientific issues of the Food System and fishing in all its aspects and implications (food and wine, the Mediterranean diet, ..., etc.)., through the following areas:

L1. CENSUS AND MONITORING

- *L1.1 Presence, distribution and consistency in the Park of species and plant communities*
- *L1.2 Presence, distribution and consistency in the Park of animal populations*
- *L1.3 Monitoring of species considered as indicators of environmental quality*
- *L1.4. Implementation of basic geomorphological and hydrogeological knowledge*
- *L1.5. Census and enhancement of the geological specificities*
- *L1.6 Census and evaluation of the main phenomena of environmental and hydrogeological risk*

L2. BIOLOGY AND APPLIED ECOLOGY

- *L2.1 Long-term research on eco-ethology of priority wildlife species*
- *L2.2 Long-term research on the reproductive biology and ecology of species of priority flora*
- *L2.3 Modeling studies of population dynamics of protected species*
- *L2.4 Dynamics of phyto-and zoo-coenosis as a result of activities of traditional land use and / or disruptive*
- *L2.5 Analysis of the territorial expansion of the Boar and of its interaction, direct and indirect, on phyto-and zoo-coenosis;*
- *L2.6 Census, characterization and enhancement of local cultivars and wild species.*

L3. – EDUCATIONAL AND OUTREACH ACTIVITIES

Identification and selection of suitable and effective training, environmental education and promotion, which should include:

- *L3.1 specific advanced training courses nationally and internationally, with the establishment / collaboration of research doctorates, master's, specialist internships, scholarships, allowances research, "summer school", etc..;*
- *L3.2 scientific dissemination through publications, meetings, national and international conferences, development of activities and tools of dissemination and awareness raising on the issues of geo-biodiversity and the preservation and enhancement of Natural Resources and Environment, heritage cultural and Landscape, Tourism, scientific and technical issues of the Food System and fisheries;*
- *L3.4 theoretical and experimental research, laboratory and field for testing methodology for dissemination and education on the issues mentioned above, the development of methodologies for computing implementation, such as thematic maps; possible establishment of its scientific magazines / outreach.*

The National Biodiversity Strategy of 2010 identifies 13 areas of work, in order to integrate biodiversity needs with the development and implementation of national sectoral policies and identify policies for the conservation of biodiversity in the coming decade.

This new vision of the strategy "... biodiversity, our natural capital is preserved and restored to ensure the maintenance of ecosystem services and to contribute to human well-being in a changing world .." identifies a primary role in protected areas as "essential tool for the continuity of the flow of services and functions of ecosystems. "

The areas of work identified by the National Biodiversity Strategy, are*:*
1) Species, habitats and landscapes;
2) Genetic resources;
3) Agriculture;
4)Forests;
5)Inland Waters;
6) Marine Environment
7) Infrastructure and Transport
8) Urban Areas
9) Health
10) Energy
11) Tourism
12) Research and Innovation
13) Education and Outreach

RESEARC PROJECTS IN THE NATIONAL PARK "CILENTO, VALLO DI DIANBO AND ALBURNI"

projects divided by area of work
1) species, habitat and landscape

1. *Recognition of biological resources for the conservation and exploitation of Biodiversityin the National Park*
2. *Project for the study, the distribution and consistency of Minuartia moraldoi*
3. *Monitoring project of the wolf*
4. *Research project on otters*
5. *Research project on bats*
6. *Small Island - the study of migration of transahariani bird*
7. *project lepidopteran*
8. *Management Plan of the SIC "Rock of Mingardo Beach and Cala delCefalo"*
9. *Project agnates and freshwater shrimp*
10. *project Seagull "Corso"*
11. *Preservation of the Partridge*
12. *Conservation Italic Rabbit*
13. *Reintroduction of the Deer and the Roe*
14. *Defining a checklist of Bryophytes*
15. *Monitoring Royal Eagle*
16. *Checklist and census of Amphibians*
17. *Evaluation of the potentials of invasion of Nutria*
18. *Management Plan Nature "Phase IA and IIA"*
19. *Landscape Plan*
20. *The Application Dossier as Geopark*
21. *Identification and evaluation of conservations status of rare vascular plant species*

22. LIFE Nature Network Management of SCI and ZPS in the National Park "Cilento on the Net"
23. Distribution and habitat preferences of wild cat and marten in the SCI in the Park
24. Identification and description of the woody plants of landscape and environment interest, and their integration into the internal paths , descriptive theme aimed to promote the area
25. Check-list of macromycetes
26. Checklist of Lichens
27. Census and monitoring of Coleoptera and Heteroptera of Monti Alburni
Census and monitoring of terrestrial Mollusca from the Monti Alburni
28. Environmental monitoring of the microsites in which the Primula Palinuri grows - Pet. and study of the early stages of its life cycle
30. Analysis and characterization of riparian vegetation
31. Census and monitoring of the Agnati and Crayfish
32. Distribution and Monitoring of the Royal Eagle (Aquila chrysaetos)
33. Analysis and characterization of the briofitic coastal vegetation
34. Conservation Italic Rabbit (Lepus corsicanus)
35. Identification and evaluation of conservation status of rare vascular plants
36. Management of the Boar in the National Park

2) genetic resources, 3) agricolture; 9) healt

1. *Preservation of the biodiversity of traditional fruiting trees*
2. *Recovery maintenance and enhancement of Native Vines*
3. *The Mediterranean Diet*
4. *Genetic Park of Cilento and Vallo di Diano*

4) forests

1. *Monitoring Network of old-growth forests*
2. *Experimental application of prescribed fire in PNCVD*

5) inland waters

Master Plan for the defense of the soil and the safeguard of water

6) Marine environment

1. *Study for the establishment of Marine Protected Areas (MPAs) of Santa Maria di Castellabate and Costa Infreschi*
2. *Management Integrated Plan of Coastal Zone*

7) Infrastructure and transport

1. *Supervision system of transportation with minimal environmental impact of PNCVD*

10) energy

1. *Energetic Master Plan*
2. *The Reciprocity Agreement "Towards energy independence of the Park"*

11) tourism

1. *INTERREG III B– Archimed – Project I TRACE (Integrated Tourism*
in Rural Areas valorising Culture and Environment)
2. *Cilento. To discovery of National Park.*
Sport, Natur and Culture
3. *"RE-TIL Travel between the major Cultural attractors (UNESCO sites),*
the Excellence of Park and Contiguos Areas

3. *4. PIRAP: Rural Integrated Project of Protected Areas (PSR 2007 – 2013)*

12) research and innovation

1. *LIFE plus "Innovative technologies for the recycling of olive residues and vegetable water" (TIRSAV)*

13) education and dissemination

1. *Enviromental education programm " school in the Park"*
2. *Citizens of the Park- 1^ annuality – AS. 2007/2008*
3. *Giornata European day of Parks – 24° may 2008*
4. *The Parks of Repubblic – 02/06/2008*
5. *UNESCO Italian Commission – week of education to sustainable development – 10/16 novembre 2008 – Theme: reduction and Recycling of Waste*
6. *Citizens of the Park- 2^ annuality – AS. 2008/2009*
7. *Citizens of the Park- competition "Regoliamoci"*
8. *Open Schools - 2^ annuality – AS. 2008-2009*
9. *Citizens of the Park- 3^ annuality – AS. 2009/2010*
10. *"VIVIDARIA. Plants Friends: plant diversity for Wellbeing" - 3^ annuality – AS. 2009/2010*

CONCLUSION

The National Park "Cilento, Vallo di Diano e Alburni", and more generally the protected areas, have a natural capital, a capital of biodiversity, made of air and ground, of rivers and seas, of woods and forests, of animal and wisdom of man. A capital to be known and preserved in order to maintain the continuity of the flow of services and functions of ecosystems and ensure the survival of the natural heritage of the Earth.

The survival of humanity will depend by our degree of ecological expertise, from our ability to understand the principles of ecology and to live in accordance with them.

Short Paper

Nordic Geo Guideschool

Aarre G. ([a])

([a]) Project Manager, Magma Geopark, Sokendalsveien 23 4370 Egersund

ABSTRACT

The Nordic Geo Guide School is a Nordic project led by Magma Geopark in cooperation with Katla Geopark, (Iceland) and Saaremaa Omavalitsuste Liit (Estonia). The Nordic Geo Guide School 2 secured funding from the Northplus Adult Programme in 2012.The programme supports networking, collaboration and exchanges between actors from the Nordic and Baltic countries, whether in formal, non-formal or informal adult learning. The Nordic Geo Guideschool is a follow up project after a need analysis conducted by University of Stavanger.

KEYWORDS: Geopark, Geo tourism, Guide course, Regional development, Community development

NORDPLUS STRATEGY

The main objectives of the Nordplus adult programme are to strengthen adult's key competences in addition to recognize adult's informal and non-formal learning. The programme also supports adult continuing education. One of the objectives is to adapt the adult learning to meet the challenges of modern citizenship and to strengthen the link between adult learning and working life.

Fig. 1- Fieldtrip to Eigerøy Lighthose were all participants attending guided a short part of the hike

THE NORDIC GEO GUIDE SCHOOL

The project was initiated by Magma Geopark in 2010, as a result of a growing workload of geopark staff, especially in the tourist season. Magma Geopark experienced a growing need for quality guides, and there were few available in the area. Magma Geopark receives severeal bookings for guided tours weekly. Before the first Nordic Geoguide school course, there were 24 registered guides in the Magma Geopark database. However, the level of knowledge and quality of these guides is varied and inconsistent. This was unacceptable, since the service cannot be provided at the appropriate standard. It is a major goal of Magma Geopark that everyone willing to engage in guiding activities in the Magma Geopark area should be able to complete a guide-training program run by Magma Geopark.

Through contacts with other, most advanced geopark projects in Iceland and Estonia Magma Geopark discovered that the situation in the neighboring countries was similar to Magmas. Magma Geopark saw the value in developing a project that would benefit not only Magma Geopark, but other present and future geoparks in the Nordic countries. As a result an idea evolved to develop a common training program.

The goals of the Nordic Geo Guide School include the following:
- To offer an opportunity for members of local community to improve their knowledge and skills and strengthen their entrepreneurial potential through intensive study;
- To provide quality education to geopark guides;
- To encourage a pro-Nordic attitude through mobility opportunities for instructors and students in Nordic countries;
- To protect and promote respectful use of geological and cultural heritage;
- To better promote unique geology and cultural history of Norway, Iceland and Estonia;
- To provide help and serve as an example of best practice to

other organizations willing to develop guide training program.

The primary project target groups are members of local community and geopark staff. Most geoparks are located in rural and less developed areas often presenting negative demographic trends therefore, the project is aimed at the development of rural communities. The secondary target group is geopark visitors and other Nordic geopark projects and organizations, involved in promoting geological and cultural heritage.

The Nordic geo guide project offers the geoparks a unique arena to exchange experiences and best practice in a Nordic setting. The geoparks have started several other cooperation projects as a result of this initiative. This project will be important in that it enables Nordic geoparks deliver better services and become better visitor attractions.

THE COMPLETION OF THE COURSE

The project has been a success in all countries. A 36 hour course was successfully run once a week, with 35 participants in Magma Geopark (Norway) and with 41participants in Silurian Islands´ Geopark (Estonia) Katla Geopark arranged their first course as a pilot in 2012. The course participants were eager to learn more about the geoparks, that they all are a part of. Many of the participants were already working with tourism and new cooperation projects were formed among them after joining the course together.

Fig. 2- Treasure hunt games were introduced to the participants of the Nordic Geo Guideshool.

All in all the project has proven how interesting and fascinating it is to work across the national boundaries working towards an exciting common goal. Each geopark have the same need for rural development within their geopark, and each geopark suffer from increasing workload and not enough guides. The Nordic geo guide course capture a great need for the geoparks, as well as for the local communities that they are a part of!

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www.nordplus.eng
www.facebook.com/pages/Nordic-Geo-Guide-School

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

Building up a dinosaur identity in Miravete de la Sierra (Maestrazgo Cultural European & Global Geopark, Teruel, Spain)

Alcalá L.([a,b]), Santos-Cubedo A. ([c]), Mampel L. ([a,b]), Ferrer R.([c]), Espílez E. ([a]) & Hernández Á. ([b])

([a]) Fundación Conjunto Paleontológico de Teruel-Dinópolis (Museo Aragonés de Paleontología). Avda. Sagunto s/n, E-44002 Teruel, Spain. E-mail: alcala@fundaciondinopolis.org
([b]) Parque Cultural del Maestrazgo – Maestrazgo Cultural European & Global Geopark. Calle Pueyo 33, E-44556 Molinos (Teruel), Spain
([c]) Escuela Taller de Restauración Paleontológica IV. Gobierno de Aragón. Avda. Sagunto s/n, E-44002 Teruel, Spain.

ABSTRACT

Miravete de la Sierra is a very few inhabited municipality in the Maestrazgo Geopark (Teruel, Spain). Two dinosaur footprint sites from Miravete are catalogued in the main heritage list of Aragón (and, consequently, of Spain). Taking into account the regional development fostered in Teruel Province by means of its dinosaur heritage, an integral project of palaeontological research, dinosaur heritage conservation and dissemination of scientific results is on course in this village.

KEY WORDS: Conservation, Dinosaurs, Dissemination, Ichnites, Jurassic-Cretaceous, Maestrazgo Geopark, Research.

PEOPLE AND DINOSAURS IN MIRAVETE

Miravete de la Sierra is one of the 43 municipalities which constitute the Parque Cultural del Maestrazgo, i.e., the official institution that manages the Maestrazgo Cultural European & Global Geopark, according to the procedures of the Ley 12/1997, de 3 de diciembre, de Parques Culturales de Aragón (published in the Boletín Oficial de Aragón n. 143, dated 12th December 1997).

Miravete municipality is placed in the westernmost part of the Geopark, 67 km northeast away from the town of Teruel. Its 81 houses are inhabited only by 33 people (Spanish Instituto Nacional de Estadística, 2012) because 59 of them are secondary houses. As the total area of the municipality is 36.5 km^2, the average density of population is just 1 inhab./km^2.

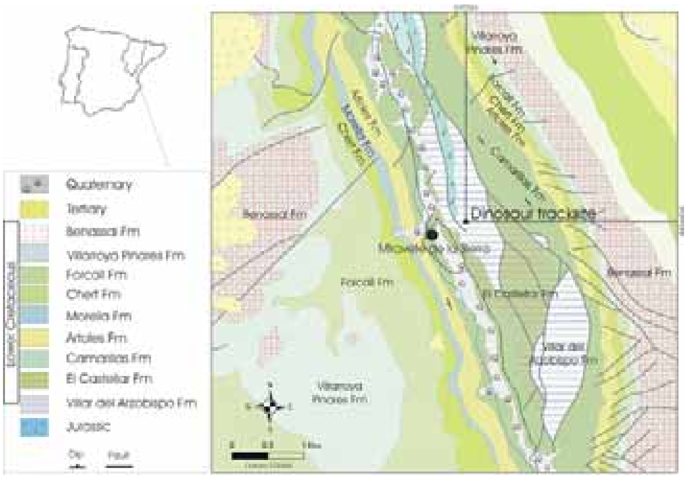

Fig. 1 - Geological map of Miravete de la Sierra (based on Gautier, 1974, and Liesa et al., 2006).

The landscape surrounding the village of Miravete is driven by the structure of an anticline composed by Late Jurassic-Early Cretaceous marine and continental sediments, deposited in the so-called Galve Sub-basin of Maestrazgo Basin (Salas et al. 2001; Liesa et al., 2006; fig. 1).

There are two dinosaur tracksites in the close vicinity of Miravete´s houses (fig. 2): Miravete 1 and Miravete 2. Footprints were attributed to sauropod and theropod (just a footprint) dinosaurs (Pérez-Lorente, 2004), and the limestone

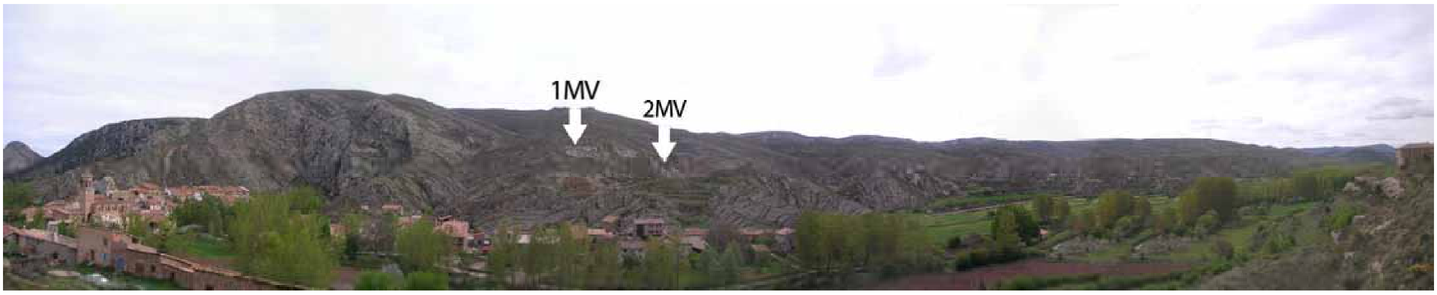

Fig. 2 - Miravete de la Sierra landscape including Miravete 1 (1MV) and Miravete 2 (2MV) dinosaur tracksites (left: north; right: south).

Both sites were listed as Bien de Interés Cultural, Zona Paleontológica, by Gobierno de Aragón (Decreto 20/2003 del Departamento de Cultura y Turismo del 28 de enero de 2003; BOA del 12 de febrero de 2003), the highest level of Heritage protection according to Spanish legislation.

AN INTEGRAL ACTION

In spite of including an interesting dinosaur heritage, Miravete municipality was not commonly tied with its palaeontological heritage but just to its popular architecture, being the medieval bridge the most popular sign of identity. Even more, some few years ago, in 2008, the village became renowned in all the country because a Spanish advertising agency chose Miravete for a national level publicity campaign with the motto "*el pueblo donde nunca pasa nada*" (the village were nothing ever happens). Realising that dinosaur heritage, in addition to its intrinsic palaeontological significance for researchers, could form part of the local identity, some activities in the municipality were fostered from Fundación Conjunto Paleontológico de Teruel-Dinópolis, an institutional member of the Scientific Committee of the Maestrazgo Geopark.

HERITAGE CONSERVATION

After overseeing the state of conservation of the two relevant dinosaur tracksites, some preservation issues arose. As a consequence, preparators and palaeontologists of the Escuela Taller de Restauración Paleontológica IV of Gobierno de Aragón, based in Dinópolis-Teruel, within its formative project, carried out a series of works in the Miravete 1 and 2 outcrops, which lasted for a period of almost three months. In Miravete 1, they began with the clearing of vegetation on the site and the application of herbicide to prevent regrowth of plants. Then, they cleaned the cracks and fissures, and adhered the broken fragments with mortar and epoxy resin. Once the cracks had been cleaned, they were filled with mortar and, in some cases, with epoxy resin (Ballano et al., 2008).

Finally, the preparators completed the cleanup of the site and its surroundings, highlighting the importance of the dinosaur footprints present on it (fig. 3, 4).

Alongside this conservation action a mold of a pair of dinosaur footprints (a hand and a foot that were part of a track made by a dinosaur) was made. To do this, they applied a layer of a release agent (polyvinyl alcohol), to prevent the silicone from adhering to the substrate. After that, they applied the first layer of silicone. Once this first layer dried, they applied a couple more layers of silicone to get a resistant mold. Later, a fiberglass and acrylic resin casing was made to give stiffness to the silicone mold (Aberasturi et al., 2008).

Fig. 3 - Miravete 1 dinosaur tracksite before the conservation action.

Fig. 4 - Miravete 1 dinosaur tracksite after the conservation action.

Back in the lab, a cast of the footprints with acrylic resin was made. Finally, the replicas were painted, giving them a realistic look.

In Miravete 2, restoration and conservation works have been different to Miravete 1. They consisted in the removal of a theropod footprint in danger of destruction. After that, a restoration process has been carried out, which includes the molding and casting of the original fossil in the laboratory.

RESEARCH

As a result of the preservation tasks, new dinosaur footprints were documented. In the lower layer of Miravete 1, the number of identified footprints has increased from 57 (Pérez-Lorente & Romero-Molina, 2001) to 66. All tracks are oval shaped or rounded. Additionally, 5 new footprints have been identified in the upper layer of Miravete 1 (1.2.MV), thus the number increased from 10 (Pérez-Lorente & Romero-Molina, 2001) to 15. Topographical detailed data of each footprint have been obtained for further studies with the help of a Trimble 5600 Total Station (fig. 5). These data, together with the use of

Fig. 5 - Footprints 3D data acquisition in Miravete 1.

photogrammetric techniques, have enabled the realization of a 3D surface, which reconstructs some parts of Miravete 1 site. Detailed palaeontological descriptions of the new data are still in progress.

In addition, as dinosaur bones had not previously been recorded, palaeontologists carefully surveyed in 2006 and 2007 the geological outcrops of the municipality with the objective of catalogue the palaeontological heritage of Miravete for its inclusion in the general urban planning (PGOU: *Plan General de Ordenación Urbana*, Luque & Espílez, 2007; Espílez & Mampel, 2008). The surveys were developed in the framework of the R&D projects FOCONTUR (Departamento de Industria e Inovación, Gobierno de Aragón) and VALDINOTUR (CGL2006-Spanish R&D National Plan; Alcalá et al., 2009; Mampel et al., 2009). The prospecting works were successful and several new dinosaur sites were located in the lowermost alluvial facies of the upper Hauterivian-lower Barremian El Castellar Fm. outcrops (Luque & Espílez, 2007; Espílez & Mampel, 2008; Alcalá et al., 2007, 2012a, 2012b). The recognized remains indicate the presence of iguanodonts showing anatomical differences compared to others previously found at the Galve Sub-basin (Luque et al., 2006-2007). Even other researchers initiated investigations in Miravete de la Sierra (Gasca et al., 2007a, 2007b, 2008) contributing to a better knowledge of its dinosaur heritage.

DISSEMINATION

Establishing a scientific-based tourist identity is not an easy task which would achieve immediate results. Therefore a plan to fulfil that goal is being developed; the plan includes different actions focused on different target audiences:

- informative talks to local people (fig. 6); target audience: quite limited; the talks were given by post-graduate students from Escuela Taller de Restauración Paleontológica and by palaeontologists.

Fig. 6 - Informative talk dealing with dinosaurs and local palaeontological sites directed to the people of Miravete de la Sierra.

Fig - 7. Exhibit of a theropod footprint from Miravete 2 in Dinópolis-Teruel.

- exhibition of the original theropod footprint –in danger of destruction in the outcrop- at Dinópolis-Teruel main Dinosaur Hall (fig. 7); target audience: hundreds of thousands of visitors;
- on-site information of the palaeontological features of Miravete 1 tracksite (fig. 8); target audience: to be monitored in the near future.

ACKNOWLEDGMENTS

This study was supported by the Departamento de Educación, Universidad, Cultura y Deporte from Gobierno de Aragón (and especially by its Dirección General de Patrimonio Cultural), IAF, and R&D project DINOSARAGÓN ("El Patrimonio Paleontológico como recurso para el desarrollo: los yacimientos de dinosaurios de Aragón", CGL2009-07792, Spanish Ministerio de Ciencia e Innovación and FEDER funds). We acknowledge the support of the Council and people of Miravete de la Sierra.

Fig - 8. Informative sign prepared by authors and placed in Miravete 1 dinosaur tracksite.

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12th European Geoparks Conference
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Italy, 4th-6th September 2013

Edu ation and s ienti i divulgation on t e anage ent o land related risks in agri ulture and livesto k ar ing in t e Cilento Geopark MIdA Integrated Environ ental Museu

Amato M. ([a, b]), Bove R. ([c]), & D'Orilia F. ([a])

([a]) MIdA Foundation – Musei Integrati dell'Ambiente, Contrada Muraglione, Salerno, Italia. E-mail: info@fondazionemida.it

([b]) Università della Basilicata – SAFE – viale dell'Ateneo Lucano 10. 85100. Potenza-, Italia. E-mail: mariana.amato@unibas.it

([c]) Dipartimento di Prevenzione, Servizi Veterinari, ASL Salerno, Via Nizza, 146, 84100, Salerno, Italia. E-mail: lellobove@libero.it

ABSTRACT

Land-related risks, ranging from earthquakes, landslides and flooding to soil degradation, affect agriculture and livestock farming. The Tanagro area, in southern Italy, hosts a series of activities related to early warning and management of such risks, as well as to education and scientific divulgation on related issues. Among such activities, the MIdA Integrated Environmental Museums, within the Cilento Geopark, has an ongoing collaboration with the National Authority for Public Health, and has set up a documentation center on land-related emergencies in agriculture and livestock farming, with materials donated by the late prof. Adriano Mantovani, the founder of veterinary medicine of disasters in Italy. Such a discipline was, in fact, born in a region affected by a devastating earthquake in 1980 which struck also the area of the MIdA museums.

An exhibit has been set up, with the aim of tracing 30 years of activities carried out by veterinary services in land-related disasters, and on procedure development and emergency management as related to food safety. The exhibit is available in several languages and has toured many countries; it can provide fundamentals for planning and managing best practices, public health and civil protection operations during disasters.

INTRODUCTON

Agriculture and livestock farming in Mediterranean regions are traditionally characterized by vulnerability to hydro-geological events. In recent times land degradation, due to the buildup of chemicals and radioactivity from industrial activities and waste disposal, is a rising concern. Geoparks may constitute a reference for best practices in geo-hazards awareness and management. Within this context the MIdA foundation has set up a series of activities related to education in land-related risks, but also to promoting strategies for rational territorial monitoring and management.

The MIdA foundation manages one of the focal geosites of the Cilento Geopark: the "Grotte di Pertosa ed Auletta", a karst system with about 3 km of underground trails open to the public, and other assets such as a geological and speleo-archeological museum, a museum on the vegetation and agriculture of the geopark, and a post-earthquake observatory to monitor social changes following tectonic activities in the area, as well as their consequences on local economy and land management. MIdA is an acronym which in Italian corresponds to "Integrated Museums of the Environment", and it is an agency founded by the regional government of Campania, the Province of Salerno, and the two municipalities of Pertosa and Auletta, where the geosite and museums are located. Both villages were severely damaged by a disruptive earthquake, involving a large part of the Cilento Geopark and a wider area, encompassing two regions (Campania and Basilicata), in 1980.

After such a major event the Health Ministry – General Directorate of Veterinary Services – appointed Adriano Mantovani, Professor at the Veterinary Medicine Faculty of the University of Bologna, as coordinator of veterinary activities in the area affected by the earthquake. The team of veterinarians, composed also of undergraduate and graduate students, was responsible for the reorganization of the veterinary services, the disposal of carcasses, the management of animal recovery and shelter, the re-establishment of meat production and milk collection and distribution. This was the first experience of systematic post-catastrophe veterinary medicine in Italy, from which veterinary medicine of disasters was born. A large body of experience has been collected since then, both in the national and international framework. At the end of his career prof. Mantovani donated part of his archives, including publications, photographs, films, documents and posters to the MIdA foundation, as foundation for a documentation center on the management of land-related emergency in agriculture and livestock management.

The general mission of the MIdA foundation is to promote local development, based on the geosite and on the natural, agricultural and cultural resources of the area. In addition, the mission encompasses also studying and divulgating the links between earth-related phenomena and anthropic activities, as well as the management of post-catastrophe issues. Materials from Prof. Mantovani were therefore integrated, through a collaboration with the National Authority for Public Health on fragile production chains in agriculture, and with further materials on geo-hazards emergencies in agriculture and livestock farming.

A museum exhibit has been set up by the MIdA foundation, with the collaboration of the Italian Society of Prevention Veterinary Medicine and of the Guild of Veterinary Doctors of Salerno, with the aim of tracing 30 years of activities carried out by veterinary services in land-related disasters, and on procedure development and emergency management as related to food safety. The exhibit also documents experiences in technological and environmental emergencies (Chernobyl nuclear accident 1986, Sacco Valley water pollution; dioxin

emergency in Campania), and many scientists contributed and continue to contribute to its development (Bove, 2011).
Veterinarians were also involved in the management of humanitarian emergencies during the war in Kosovo (1999). In that time the Kosovo population was forced, because of the conflict, to flee their homes and seek refuge abroad. Most of the refugees were housed in Albania and Macedonia. Italy formed a core control team for food hygiene, which was engaged primarily in kitchen and canteen management of the refugee camps set up by our country in Albania and Sicily.
Emergency management has been accompanied by a significant planning and participation in National Civil Protection drills: Vesuvius, Eastern Sicily (seismic risk), national protective measures against radiological and nuclear emergencies. Simulation of hurricanes in Nicaragua, emergency floods in Mozambique, veterinary interventions in refugee camps in Western Sahara were also featured.

The exhibit also documents events in the local territory linked to floods (figs. 1-2), such as the Tanagro flood of november 2010 following an exceptional 250 mm rainfall event (equal to one quarter of the total yearly average rainfall, with a return period of about 100 years; fig. 1), or the Sele plain buffalo farms flooded in the same year (fig 2).

Fig. 1 – Poster of the river Sele and Tanagro flood presented in the exhibit “1980-2010: Thirty years of veterinary medicine in disasters” (Bove, 2012).

Fig. 2 – Flooding of River Sele:buffalo farm.

Fig. 3 – Poster on waste management. “1980-2010: Thirty years of veterinary medicine in disasters” (Bove, 2012).

The exhibit aims to be a dynamic tool, and therefore subject to continuous updates and additions, such as that on waste disposal crises in Campania (fig. 3), which testify to the vitality of veterinary medicine in this area. A project on best practices in risk management is under development in the Diano Valley, involving weather forecast and flooding-landslide risk assessment, geo-referentiation of farms and early activation of livestock relocation; its methodology and outcome will be documented by the exhibit.

The exhibit is available in several languages and has toured many countries. The series of posters, illustrations, scientific and multimedia materials has been designed not only to document the activities carried out by veterinarians, but also as an aid for planning and managing, as well as to test the effectiveness of scientific divulgation through the exhibit as a basis for building best practices.

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Environmental education in the Cilento Geopark: ateliers and a book series at the "Grotte di Pertosa e Auletta" geosite

Amato M. ([a,b]), Di Tommaso T. ([b]), De Falco E. ([c]), Marena C. & Di Blasio P. ([a])

([a]) MIdA Foundation – Musei Integrati dell'Ambiente, Contrada Muraglione, Salerno, Italia. E-mail: info@fondazionemida.it

([b]) Università della Basilicata – SAFE – viale dell'Ateneo Lucano 10. 85100. Potenza-, Italia. E-mail: mariana.amato@unibas.it
([c]) Department of Pharmacy, University of Salerno, Fisciano Campus, 84100 Fisciano (SA), Italy.

ABSTRACT

An integrated project on environmental education has been set up in the Cilento Geopark, based on the focal geosite "Grotte di Pertosa e Auletta", through the development of ateliers and book series on the geosite and Karst systems, and on natural resources of the whole Geopark with their traditional uses.
The project targets geotourists visiting the geosite, school children and the local community.
The idea is to reinforce the identity of the local community, increasing awareness on the links between geo-heritage, natural resources and intangible heritage, and promote a more dynamic approach to understanding the whole ecosystem's functions not only as a part of conservation but also as a tool for developing new activities.
The local municipalities of Pertosa and Auletta were involved in the project and ateliers and publications developed include:
Carsism and Speleogenesis
Speleology
Botany
Dyeing with local plants
Basket weaving
Composting and soil organic matter
Freshwater biology
Experimental archeology

ENVIRONMENTAL EDUCATION AT THE GEOSITE

Increasing awareness of the complex functions and links between geo-heritage, natural resources and human activities is one of the keys to understanding and managing the whole system's behavior and therefore responses to driving forces such as changing climate and land-related hazards. Environmental education on such issues is therefore a focal objective of geoparks and a pivotal activity in building future generations of conscious citizens. The Cilento Geopark lies in southern Italy within the province of Salerno and extends from the Thyrrenian coast to the mountains of Lucania covering 181.048 hectares.

The territory is made of two geological units:

- the system of carbonatic massifs with their karstic activity and landforms, and with intense neo-tectonic activity.
- the top arenaceous conglomerate component of the "Cilento Flysch" and the basal marly clays, with their erosive phenomena.

Soils formed in situ especially on the conglomerates or on sediments transported by wind and by water in the other areas, host a wealth of ecosystems in reliefs and valleys. This Geodiversity is therefore matched by a remarkable diversity in landscapes and ecosystems, with unique features of naturalistic value, and emdemisms. The system of reliefs, valleys and waterways and their dynamics are also linked to an extreme diversity in history, culture and anthropic activities such as agriculture, industries and crafts.

One of the focal geosites of the park is the "Grotte di Pertosa and Auletta" complex: a karst area with various geo-morphological speleological, archeological and biological features (Fig. 1). The system of caves which are now open to the public extends for about 3 km and was inhabited since the Bronze Age, and perhaps earlier; palafitte have been found in the entrance, as well as stone, metal and biological specimens dating from at least the Middle Bronze age. The state of conservation of prehistoric plant and animal materials is particularly good because of submersion by an underground stream, which occupies the whole width of the cave system for the first few hundred meters.

The geosite is managed by the MIdA foundation ("Integrated Museums of the Environment"), along with other assets: a geological and speleo-archeological museum, a museum on the vegetation and agriculture of the geopark, and a post-earthquake observatory to monitor social changes following tectonic activities in the area, and their consequences on local economy and land management. Geo-tourists of the site amount to 75,000- 100,000 yearly, and include school fieldtrips (about half of the visitors), families, companies, speleologists and scientists. In 2009 the MIda foundation started a project on environmental education targeted to geotourists, local and regional schools and the local community.

The objective of the project was to reinforce the identity of the local community, and to increase awareness of the links between geo-heritage, natural resources and immaterial heritage. Also, traditional and innovative uses of local resources were used for environmental education with the aim to promote not only conservation but also creativity in the sustainable use of land-based local goods and as a tool for developing new activities.

The project involves the municipalities of Pertosa and Auletta and was partly funded by the MIda foundation and partly financed by a rural development funding program of Regione Campania based on European funds.

The main activities of the project were the development of ateliers on the geosite and local natural resources and the issue of book series on the geosite and Karst systems, and on natural resources of the whole Geopark with their traditional uses.

Ateliers were developed through the collaboration with the University of Basilicata, University of Salerno, IDIS Foundation – Città della Scienza, the speleoguides of the geosite, Association I colori del Mediterraneo and local teachers working with handicraft artisans.

Ateliers include:

Carsism and Speleogenesis
Speleology
Botany
Dyeing with local plants
Basket weaving
Composting and soil organic matter
Freshwater biology
Experimental archeology

A special section of the MIDA Integrated Environment Museums within the Cilento Geopark was set up for displaying the importance of geopark plants for the environment, for keeping the memory of its ethnic uses in the Cilento and Vallo di Diano area and for unraveling the biophysical and chemical bases of their properties. Ethnobotanic exhibitions display reproductions of traditional handicrafts, historical photographs and multimedia materials documenting the traditional techniques, and innovative uses of geopark plants.

Fig. 1 - An example of contents from the plant dye guide

A special activity is devoted to dyeing with plants, based on a local tradition of dyeing (documented by an industrial archeology site close to the geosite) and producing fabric (documented by the geosite archeological findings of weaving equipment from prehistoric times through to 20th century establishments). Ateliers are offered to schools and geopark visitors, a museum section and a guide display colors and procedures for the use of geopark plants.

Fig. 2 - Cover of the plant dye guide

Programs with local schools are being conducted in order to increase the awareness of local resources and their potential for environmental preservation and sustainable development.

Activities are supported by dedicated book series:

- MIdA Agriculture with publications on plant for dyeing, and a local artichoke variety
- MIdA unior with guides to plant dyes and a guide to the geosite written by children from the local school.
- MIdA Environmemt with guides to bats and to freshwater biology, and a multimedia production on composting of organic wastes and soil organic matter within the context of climate change mitigation.

Fig. 3 - An example of contents from the MIDA unior guide on the geosite

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

Developing knowledge and rising awareness on geoheritage and geotourism of Iran: A glance to the function of the Public Relations of the Geological Survey of Iran (GSI)

Badrikolalo N.([a]) & Jazani E. M. ([b])

([a]) Geological Heritage Department, Geological Survey of Iran (GSI). E-mail: Badri397@yahoo.com
([b]) Public Relation Group, Geological Survey of Iran (GSI)

ABSTRACT

One of the main purposes of geoheritage management in a region is to notify the host community and visitors from the value of heritage and necessity of its conservation. In fact, it seems necessary to promote cognition and knowledge as well as respect of the indigenous people to their heritage. As a result, they will be interested to conserve and protect geoheritage and receptive of developing tourism activities to raise visitors of the region.

Iran, which is named “paradise of geologists” and “1.5Km museum”, has diverse unique geological features. It has different potentials for introducing and registering national and international geoparks. Hence, it seems necessary to introduce geopark, advantages of registering geoparks and development of geotourism activities in rural regions through communication media and sources of general information.

It is in accordance with James Grunig theory namely situational theory of publics. This theory is in line with an applied theory on public thoughts. This theory discusses on the way of aligning public thoughts (i.e. geopark host community) and their responsibility and is applicable for determining the way of executing advertisement and cultural and media activities.

Based on Grunig’s theories and models on public relations, it is concluded that public relations of relevant organizations play key role in aligning public thoughts of the region to ensure them that the geoparks and indigenous people have common interests. In this respect, communication science plays important role as a major ring between earth scientists and societies. Public Relations of the GSI felt the necessity of informing people and rising culture in the field of geotourism and geopark. In this respect, it carried out several activities. In this study, strategies and activities of the GSI in the field of training and informing about geoheritage and its future plans are discussed.

KEY WORDS: Iran, GSI,Geoheritage, Geotourism

INTRODUCTION

Traditionally, Iran has been among the most attractive countries of the world from the culture and history points of view. Its natural characteristics and bio-diversity caused to have high ranking in natural tourism. Other type of its natural attractive, namely geological and geomorphological features and phenomena, have been considered during last decade and declared that Iran has an important geotourism situation in the world. Its geodiversity is weighty and valuable.

On this basis, it is important to inform and promote geotourism and geoheritage related concepts in Iran among the different levels of the community such as students, youth and kids making use of organizing different training courses for universities, schools, travel agencies, institutes which are responsible for holding ecotourism and natural tourism tours and finally indigenous people. Because, one of the most important perquisites for creating and preserving a prosperous geopark is training native people and host community on geotourism and geopark concepts as well as protecting geoheritage and their participation in training courses. Geopark activities should be in accordance with the local conditions, cultural and natural properties, and local customs.

During last decade (since 2004), Public Relations of the Geological Survey of Iran (GSI) started its activities on geotourism. It recognized and explored several geological phenomena and documented them through publishing books, articles, images and films to introduce these attractive features to the world. Nowadays, value and importance of Iran’s geoheritage is apparent for the experts and even people. It is obvious that continuation of informing and introducing these exquisite natural features will result to absorption of more interested groups that protect mentioned phenomana involuntarily.

STRATEGY OF PUBLIC RELATIONS OF THE GSI

Considering that the basis of each decision making process is information, it is obvious that if geopark host community have adequate information on importance and way of conserving its geoheritage, members of the community will have the necessary capabilities to accept geopark philosophy and participate in preserving geoheritage against threats. Therefore, public relations, making use of “situational theory in public relations”, can invite public participation to achieve this purpose. Developing analysis and studying public thoughts, they can understand causes of low awareness and disaffiliation as well as situation of the persons who could not received awareness. They use this information in revising function of the geopark managers. In such conditions, it is conceivable to attain some results of developing geotourism and geopark concepts in host community with the aid of public relations.

James Grunig provides four models for public relations:

1. "Publication, advertisement public relations" with the purpose of creating incentive
2. "Public information public relations" with the purpose of transmitting and reflecting information of the organizations to the people
3. "Two-lateral public relations" with the purpose of reconciling, solving discrepancies and catching agreement of social groups for organizations
4. "Two-lateral equivalent public relations" with the purpose of aiding to solve problems of organizations and related social groups in a way that provides equally benefits of two parties.

It is concluded from mentioned models that public relations of organizations such as Geological Survey of Iran, Cultural Heritage, Handicrafts and Tourism Organization of Iran, Agricultural Jihad of Iran and Environment Protection Organization of Iran play key role in aligning thoughts of geopark managers and host community to ensure them that have common interests, hence communication science plays important role as a major ring between earth scientists, managers, and host societies.

Employing geoheritage and information experts, main strategy of Public Relations of the GSI is as follows:

Developing knowledge and rising awareness on geoheritage

In this respect, role of public relations is creating knowledge-bases and knowledge dissemination and its resultant is developing awareness in host community. Public relations carry out this duty in different ways through usage of specific and general techniques.

For example, publishing earth sciences monthly journal, geoheritage newsletters, geotourism and geopark especial issue, compilation and translation of books, preparing reports on geotourism and geopark potential of Iran's different provinces, atlases, preparing CDs related to concepts and fundamentals of geotourism and geopark in Iran, are among several activities carried out in public relations to disseminate geotourism and geopark knowledge. Main outcome of mentioned activities is creating suitable mental and cultural platform for implementing programs, which are related to developing concepts and fundamentals of geotourism and geopark as well as preserving geoheritage.

1) Atlas of Iran's geopark and geotourism resources in Iran (published by the GSI)

First atlas of Atlas of Iran's geopark and geotourism resources in Iran prepared by Alireza AmriKazemi and published by the GSI. In this atlas (Fig1), the most important potential geoparks of Iran introduced by different images, maps and several data. In addition, 20 high priority zones are introduced that are suitable to be registered as the world's new geoparks.

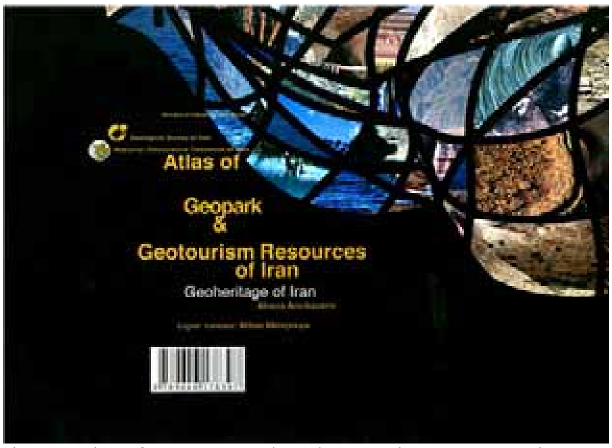

Fig. 1- Atlas of Iran's geopark and geotourism resources in Iran (GSI, AmriKazemi, Alireza, 2010)

2) Geoheritage atlas of Iran (published by the GSI)

Geoheritage atlas of Iran is the first step in widespread researches for introducing geological phenomena that nominates geological and geomorphological features of Iran (Fig2). It presents fantastic images from the geological features of Iran, which are described by simple and short phrases. Definitions, concepts and fundamentals of geotourism and geoparks are explained at the first parts of the atlas. It is a bilingual atlas designed in English and Persian and dedicated to researches and experts of geology, geography, natural and cultural heritage, environment, natural resources, artists and so on. It introduced near 150 prominent geosite from scientific, aesthetic, touristic points of view and provided general overview from the geoheritage of Iran. There are near 800 images in Geoheritage atlas of Iran and contains 500 pages. In addition to small location maps, which are related to each phenomenon, there is a 1:4000000 Iran map that indicates all introduced points in the book.

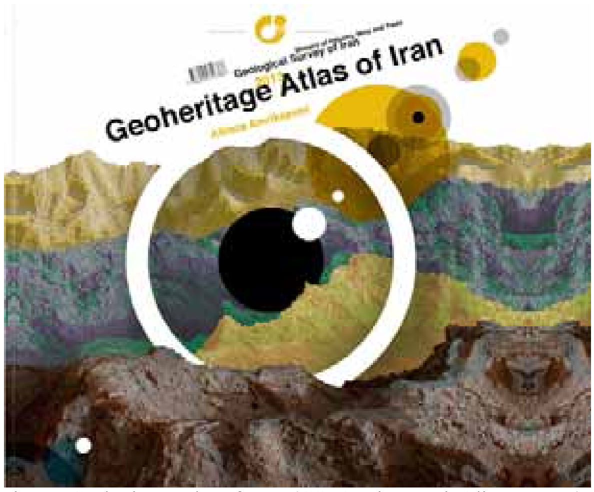

Fig. 2 - Geoheritage atlas of Iran (GSI,AmriKazemi, Alireza, 2013)

3) Iran's Geoheritage special Edition

Iran's Geoheritage special Edition is resultant of hard workings of the GSI's Public Relations, which was prepared and published in collaboration with a group of Iranian and foreign experts (Fig3). In this especial issue, fundamentals and concepts of geoheritage including geological and geomorphological features, geoparks, geotourism and geoconservation are studied. Furthermore, it included some interviews with famous experts that indicate their views. Main purpose of preparing and publishing this especial issue is disseminating related concepts, correcting and preventing wrong beliefs and methods in studying, introduction and beneficiation of geoheritage.

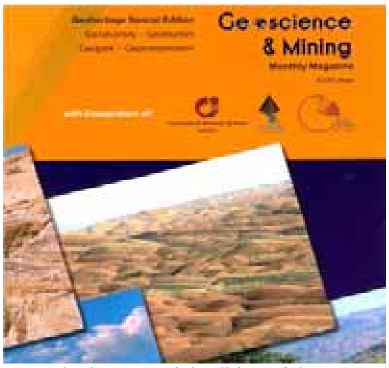

Fig. 3-Iran's Geoheritage special Edition of the GSI's Public Relations

4) Compiling a chapter of geotourism book (Geoheritage of Iran) and translating it to Persian

The World Geotourism book, compiling by Ross Dowling & David Newsome, is the first book that studies geotourism in the world directly. One chapter of this book is related to Iran and introduces Iran geoheritage. It was compiled by Alireza AmrI Kazemi, geoheritage expert of the GSI (Fig4). Precise and fluent translation of this book by the Public Relations of the GSI played an important role in conducting geotourism researchers.

Fig. 4 -Geotourism book (R. Dowling et al) Including a Chapter about Geoheritage of Iran (chapter5)

Inviting participation and decreasing information inequality

One of the secrets for success of developing policies in each community is public participation in developing process. One of the valuable capabilities of Public Relations is inviting public participation that is achieved through developing recognition, introducing participation methods, relating participation to individual and public interest of participants and conducting participants towards related information. In ideal case, public relations create "real participation" and prevent "false or selective participation".

Based on first model, one of the most important duties of public relations in development programs is informing all parts of the community (students, host and local community) to make suitable opportunity for their participation and involvement in developing earth sciences and geoheritage concepts.

1) Producing appropriate contents

Geoheritage group of the GSI's Public Relations, through preparing and producing films (Fig5), expertise brochures, journals, bulletins, books, maps, reports and advertisement stands on geoheritage of Iran, plays prominent role in inviting public participation in order to preserve geoheritage.

Fig. 5- A sample of Video about Geoheritage of Iran , GSI.

2) Translating and publishing earth sciences books for kids

Public relations of the GSI has compiled and translated some educational books for kids to make them familiar with the earth science and geoheritage concepts. "Stupendous fossils", "rocks and minerals" and "earth Facts" (Fig6) are among the scientific books in the field of earth sciences and geoheritage concepts (mineral, rocks and fossils) that have been translated by the geoheritage experts of the GSI and play significant role in promoting earth sciences concept and necessity of preserving geoheritage. Simple and comprehensive declaration of geology for different ages through these books together with holding workshops on scientific experiments to recognize rocks, minerals and fossils and making familiar with the earth forming processes, are among the valuable measures taken for disseminating earth sciences knowledge.

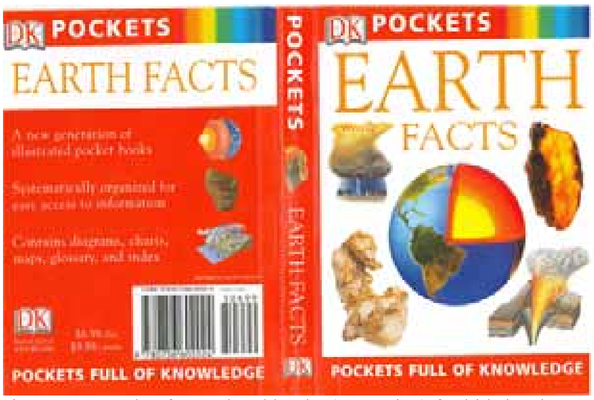

Fig. 6 - A sample of Translated books (to Persian) for kids in The GSI

3)Holding training workshops in different provinces

Making appropriate relationships with provincial responsibilities, Public Relations of the GSI took necessary measures to hold training courses and workshops on fundamentals and concepts of geotourism and geoparks and necessity of geoconservation in local communities, universities, schools, and organizations. Basis of this educational plan is holding training courses accompanying with one-day or several-days tours to have field visit from the theoretical educated knowledge.

4) Designing and establishing geotourism website

Another activity of the geoheritage experts of GSI in 2012 was registering and inserting geological features of different provinces and their images in geotourism section of the GSI website (http://geotourism.gsi.ir). They were categorized provincially. Easy access of users to the geoheritage information of Iran is very significant to conduct researchers, students and other users to be familiar with this valuable heritage and to be aware of its location on the map.

5) Holding the first Geoheritage Symposium of Iran

Holding the first Geoheritage Symposium of Iran, GSI tried to inform among expertise community including earth scientists, students, and other groups of tourism industry. The first Geoheritage Symposium of Iran held in Feburary 2013, aiming at introducing geoheritage potential of Iran. Several researchers, experts, and interested persons to the tourism attended at the symposium. Symposium held by experts of geoheritage and management of the GSI's Public Relations (Fig8). Main issues of the symposium were fundamentals, concepts, definitions, theoretical basics and history of geoheritage, geoheritage and geotourism, geoheritage and geoparks. Different scientists from universities, scientific and expertise associations related to the tourism and earth sciences participated at the symposium. Totally, 79 papers received, studied and refereed.

Fig. 8 - first Geoheritage Symposium,GSI

6) Implementing programs for kids and teenagers to visit earth sciences museum and holding geotourism and geopark training courses for them

Museums, information centers, especial visits for students, general publications, maps, CDs, educational displays, and holding seminars and conferences are among the tools that are used in geoparks for training of tourists and local community (Andrasanu, 2005). Training is widely considered as a main perquisite to realize sustainable development (Disano, 1995). Many students, geologists and others visit the earth sciences museum of the GSI annually. They are trained on geoheritage (Fossils, minerals, rocks) and necessity of geoconservation at the museum (Fig. 9).


Fig. 9 - Students Visiting the earth sciences museum of Iran (GSI)

CONCLUSIONS

Undoubtedly, it is not possible to live at the Information Age and ignored the role of public relations in informing and rising awareness. Public relations of each organization try to make suitable context and relationship with the internal and external audiences to realize organizational purposes. Regarding that results of scientific and expertise studies of geologists in the field of geoheritage and geotourism should be introduced to the Iranian and foreign audiences, informing and rising awareness will result in upraising public knowing on natural heritage. On the other hand, getting familiar and enjoying fantastic geological features, which are resultant of the Earth activities during million years, cause conservation from this valuable heritage. Hence, Public Relations of the GSI plays key role in effective communications for introducing geological heritage of Iran as a part of the world heritage. Compiling geology and communication art is an effective tool for disseminating knowledge and raising awareness on geoheritage.

ACKNOWLEDGMENTS

Here by, I would like to appreciate Mr.Korehie, deputy Minister & General Director of the GSI, Mr. Reza Jadidi, Head of The Public Relations of the GSI and finally Mr.Alireza Amrikazemi, Head of the Geoheritage Department, for their cooperation.

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esia al Grande Geopark

Candidate ember

Promoting Committee[a]

a) Tullio Bagnati Val Grande National Park; Attilio Boriani, University of Milan, Italy; Valeria Caironi, University of Milan, Italy;Edoardo Dellarole, GeoTouristic association Supervulcano Valsesia; Alice Freschi, GeoTouristic association Supervulcano Valsesia; Marco Giardino, University of Torino, Italy; Elena Mattasoglio, GeoTouristic association Supervulcano Valsesia; Marinella Merlo, GeoTouristic association Supervulcano Valsesia; Matteo Narcetti, GeoTouristic association Supervulcano Valsesia; ames uick , Southern Methodist University, Dallas, Texas, USA; Silvano Sinigoi, University of Trieste, Italy; Alba appone, Swiss Federal Institute of Technology, urich, Switzerland
direttore parcovalgrande it

ABSTRACT

Val Grande National Park and the Sesia Valley share the same geological heritage and the same desire to protect and increase the value of their natural and cultural heritage. The proposed Sesia-Val Grande Geopark is located in northwest Italy where it sits astride the Canavese segment of the Insubric Line, a 1-km-thick mylonite belt that is a major tectonic boundary in the Alps.

KE WORDS: Austro-Alpine domaine, Canavese Line, European and Global Geopark Network, Sesia Valley, Val Grande National Park.

E CA E A EA

The name of the area proposed for inclusion in the European and Global Network of Geoparks under the auspices of UNESCO is the SESIA - VAL GRANDE GEOPARK. The name represents the wish of two neighbouring territories, with cores in two Alpine valleys, the Val Grande, and the Sesia Valley to join into a single Geopark. The two territories share the same geological heritage and the same desire to protect and increase the value of their natural and cultural heritage.

The area proposed as a Geopark is located on the north-east of Piemonte Region, NW Italy, and encompasses areas of the Verbano Cusio Ossola (VCO), Biella, Novara and Vercelli Provinces (Figure 1).

The municipalities that make up the territory of the Geopark are 85, for a total surface of 191’141 hectares (1911 km^2) and a population of 152’813 inhabitants.

In the north, the proposed Geopark includes the entire territory of the Val Grande National Park plus surrounding territories for a total of 26 municipalities. In the south the proposed Geopark covers most of the mountain range of the Sesia Valley basin over an area of about 800 km^2, including the whole Sesia Valley and portions of neighbouring territories such as Valsessera, Prealpi Biellesi, Val Strona and Alte Colline Novaresi.

In the Sesia area, leaders of 59 municipalities have endorsed the establishment of the Geopark (Figure. 2) and consider its creation to be a significant component of their strategy for economic development of the valley, complementing the attractions provided by the natural environment of the valley and its rich cultural heritage, which spans thousands of years beginning with sites of Palaeolithic habitation at the regional park of Monte Fenera.

The upper part of the Sesia area is dominated by the Monte Rosa massif, (4634 m.) which provides one of the most appealing natural environments of the Western Alps. This part of the proposed Geopark contains at its highest altitudes the Parco Naturale dell Alta Valsesia, the highest natural park of Europe. Human settlement in this country dates to the 13th century Walser population, the heritage of which has been enshrined in the preservation of Walser traditional buildings and the celebration of their culture.

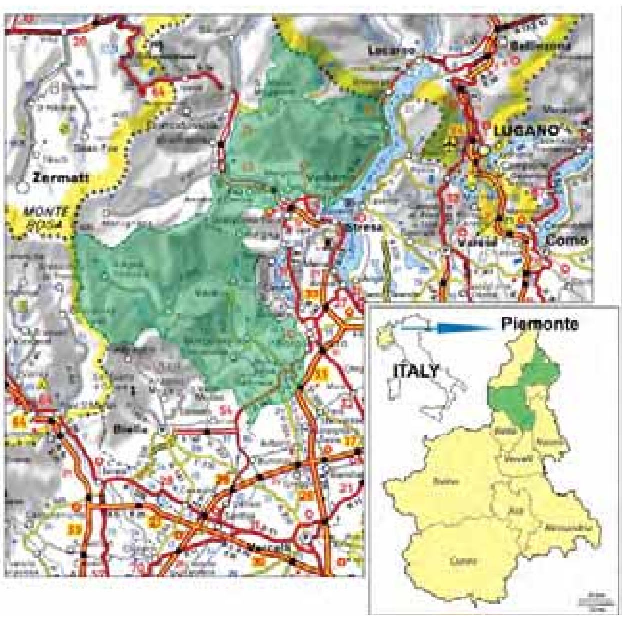

Fig. 1- Location of the proposed Sesia-Val Grande Geopark shown in green.

E G E A CE E P P E GE PA

The request for admission of the Sesia - Val Grande Geopark to the European and Global Geopark Network of Geoparks under the auspices of UNESCO is submitted jointly by the Val Grande National Park (Ente Parco Nazionale Val Grande) and the geo-touristic Association Supervulcano Valsesia (Associazione Geoturistica Supervulcano Valsesia ONLUS). This strong partnership have been established and formalized by a protocol of agreement approved by the two institutions and the Ministry of Environment.

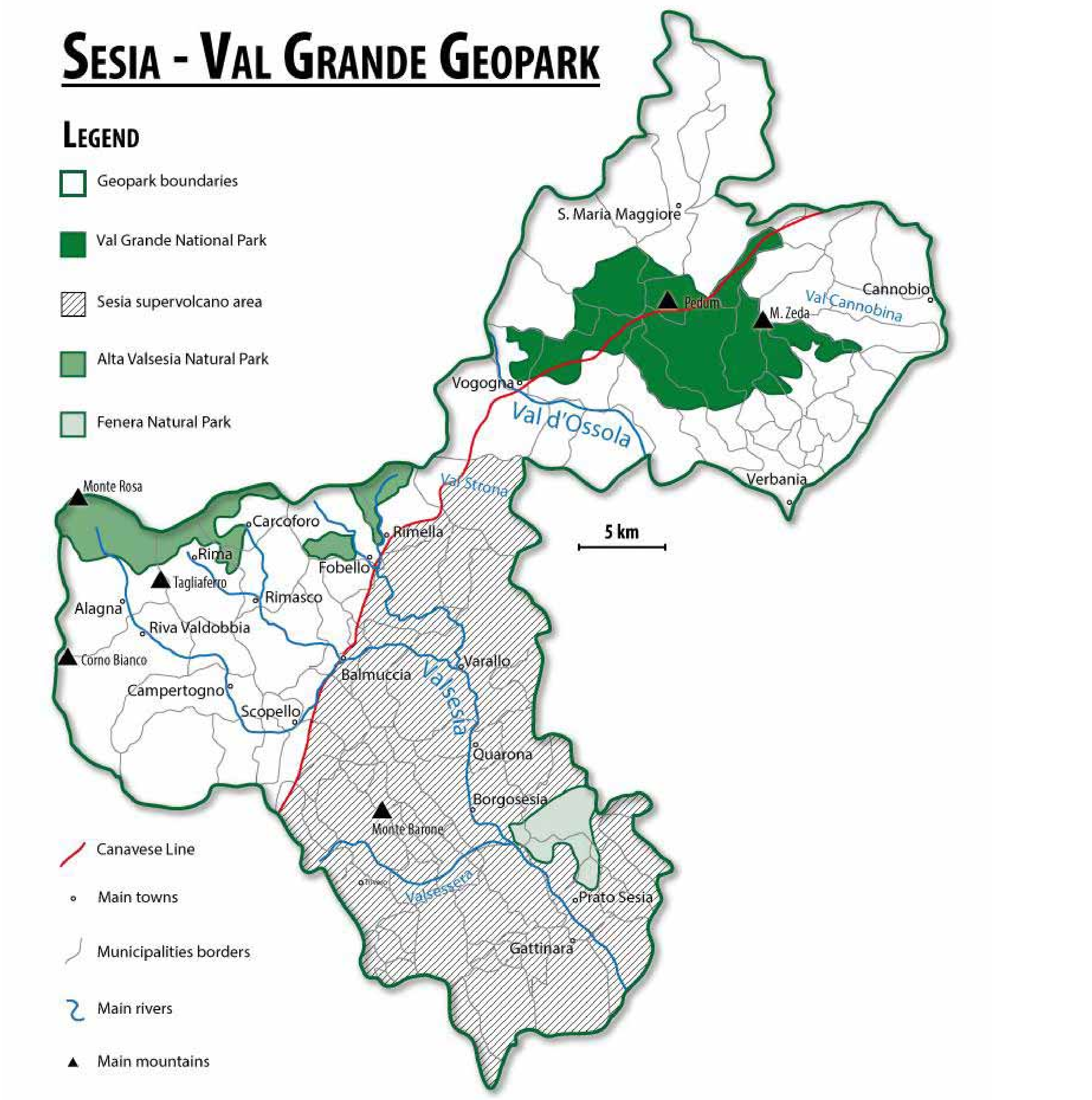

Fig. 2 – Map of the proposed Geopark showing the locations of the Canavese segment of the Insubric Line and proposed geo sites. National and regional parks within the proposed Geopark are shown in shades of green. The Sesia supervolcano and its plumbing system are shown with a grey pattern.

In order to define the management structure of the Geopark and coordinate their actions within the framework of this agreement, the parties agreed to establish with special and subsequent acts a Committee to manage the Geopark, which will operate at the headquarters of the Associazione.

The technical coordination of activities and the operational headquarters of the Geopark are entrusted, in the first four years, to the Val Grande National Park and its Director.

At the end of each four-year period the Parties will decide whether to alternate responsibility in the roles of Coordinator of the Committee and Technical Coordinator, and alternate offices.

The actions of the Plan will be conducted by the Association and Park Authority and other stakeholders as part of their management plans and in accordance with their respective budgetary availability.

The area that is proposed to the European and Global UNESCO network of the Geoparks includes, as above mentioned, 85 municipalities, three parks and the UNESCO World Heritage Sites of Sacromonte di Varallo and Ghiffa. The whole area proposed as part of the Sesia - Val Grande Geopark includes a total surface of 191.141 hectares (1911 km^2), for a total range of 152’813 inhabitants. The populated areas are quite completely external to the National Park, located on the valley floors or on the coastal urban centre.

GE G CA E AGE

The proposed Sesia-Val Grande Geopark is located in northwest Italy where it sits astride the Canavese segment of the Insubric Line, a 1-km-thick mylonite belt that is a major tectonic boundary in the Alps. North and west of the Insubric Line, the Austro-Alpine domain consists of piles of nappes, which were assembled and affected by a metamorphic overprint reaching amphibolite facies during the Alpine orogeny. South and east of the Insubric Line, rocks of the South-Alpine Domain were not affected by this metamorphic event and preserve an older history despite experiencing substantial Alpine tectonic deformation. These rocks originally belonged to the northern margin of the Adriatic plate, and within them an exceptional record of metamorphic and igneous events are preserved within a virtually intact section through the pre-Alpine crust that is the focus of the proposed Geopark.

Geologic relations in the proposed Sesia-Val Grande Geopark are internationally renowned and of world-class scientific significance. Accessible outcrops display the effects of dramatic geologic processes that shaped the continental crust through a wide range of crustal levels, from high-grade metamorphism, magmatism, anatexis and ductile deformation at depths as great as 25 to 30 km to the explosive eruption of a supervolcano at the surface of the earth 282 million years ago. For more than 40 years, this area has served scientists as an unprecedented crustal reference section in which geophysical observations and physical processes may be interpreted in the context of geology that is observable on the ground (Fountain, 1976, Kissling 2012, and references therein). As a Geopark, this area will be available to people of all backgrounds and ages to explore geologic processes that molded the evolving crust of a continent and produced the spectacular features that are preserved in accessible outcrops. For example, visitors may stand on fragments of the subcontinental mantle and trace clinopyroxene dikes that are the trails basaltic melts. They may visit the contact between an enormous gabbro intrusion in the deep crust to observe granitic segregations formed by partial melting of the adjacent crustal rocks. And they may visit the roots and the roof of a granitic pluton and marvel at the chaotic breccias produced by the explosive, caldera-forming super-eruption.

In addition to presenting to the public the world’s most accessible reference section for the continental crust, the proposed Geopark will introduce the public to processes that operate on a global scale. Outstanding examples of plate-boundary deformation and tectonics are found within the proposed Geopark because it encompasses the Canavese Line, that forms the westernmost segment of the Insubric Line, the major tectonic boundary separating the Austro-Alpine Domain to the north from the South-Alpine Domain (African Plate) to the south. Stacked European and African nappes (slices of rocks) which formed the Alpine belt during the collision of Europe and Africa are beautifully exposed along the lower Ossola Valley, and northwest of the Canavese Line, the public may visit exposures of high-pressure and ultra-high-pressure metamorphic rocks, and fragments of ophiolites derived from the Tethys Ocean and obducted during the Alpine event. And because it extends from the Po Plain to the high Alps, the proposed Geopark will provide visitors with opportunities to also observe a record of climate change as recorded by Pleistocene geomorphology, recent glacial retreat, and patterns of human habitation dating to the Paleolithic.

The most distinguished features of the proposed Geopark are outcrops within the South-Alpine Domain. Collectively these rocks form the Massiccio dei Laghi (Boriani et al., 1990a,b), which comprises two principal lithotectonic units, the Ivrea-Verbano one and the Serie dei Laghi, separated by the Cossato-Mergozzo-Brissago (CMB) and Pogallo lines. This terrane has been the object of intense and continuing scientific interest for decades because within it an association of accessible lower-, middle- and upper-crustal rocks constitutes an unprecedented model for interpreting the geophysics of the continental crust. Its scientific importance cannot be overstated, and the Massiccio dei Laghi has been the target of countless geologic fields from universities and professional societies. The number of scientific papers referencing the Ivrea-Verbano one alone has increased exponentially since 1970 and now exceeds 2,500. The following geologic description is focused on the Massiccio dei Laghi because collectively the relationships observable within it will provide geotourists with a unique exposure to processes that shaped the crust upon which they live.

THE MASSICCIO DEI LAGHI: A WINDOW TO DEPTH

The Massiccio dei Laghi presents a spectacular cross section through the continental crust, from the lower crustal

Ivrea–Verbano one to the middle– and upper-crustal Serie dei Laghi. This assembly of lower- and upper-crustal rocks can be observed over 50 km in a SW-NE direction, with an average width of about 25 km, and is considered worldwide as a model for a magmatically underplated and extended crustal section (Rutter et al., 1993; Schnetger, 1994; uick et al., 1994; Henk et al., 1997). Many authors have interpreted this terrane as a coherent Lower Paleozoic continental section that was tilted to the present subvertical position during the Alpine orogeny, while others favor a model of trans-tensional emplacement of the Ivrea-Verbano one, in which this lower crustal unit may be seen as the exposed roots of an early Permian pull-apart basin (Boriani & Giobbi, 2004). These differing interpretations notwithstanding, the rock association exposed in the Massiccio dei Laghi represents an unprecedented opportunity for visitors to "walk through" the earth's continental crust, observing the mineralogy, textures and structures formed at different depths.

The Ivrea-Verbano Zone

The Ivrea-Verbano one mainly consists of a metamorphosed volcano-sedimentary sequence, referred to as the Kinzigite Formation, and gabbroic to dioritic intrusive rocks, referred to as the Mafic Complex. The metamorphic rocks are mainly metamorphosed shales and graywacke (the so-called kinzigites and stronalites), with minor quartzites, thin meta-carbonate horizons and interlayered metabasites (Sills and Tarney, 1984). Mantle peridotite lenses, tectonically interfingered with the metasedimentary rocks (uick et al., 1995), occur in the northwestern part of the Ivrea-Verbano one, near the Canavese Line (e.g. Balmuccia in the Sesia valley and Finero in the Cannobina valley, among the proposed Geosites).

The Sesia Magmatic System

The Sesia Magmatic System, which cuts through this crustal section, constitutes a unique geologic reference section that not only allows scientists to interpret geophysical observations beneath active calderas in the context of geology observable on the ground, but also opens the door to people of all backgrounds and ages to explore geologic processes beneath a fossil supervolcano that is analogous to the famous active ellowstone and Campi Flegrei calderas. It is a bimodal suite of basic and silicic volcanic and plutonic rocks that are part of a large Late Carboniferous to Early Permian igneous province that developed across Europe from Spain to Scandinavia in association with an extensive crustal rifting (Wilson et al 2004). At upper- to mid-crustal levels, the Sesia Magmatic system includes the Sesia Supervolcano and relics of a bimodal volcanic field of basaltic andesite and rhyolite, the voluminous Valle Mosso granite with volumetrically less significant basaltic to andesitic dikes and sills within it, and small intrusions of gabbro to granite along the projection of the CMB Line. At the deepest crustal levels, the Sesia Magmatic System is represented by the Mafic Complex of the Ivrea-Verbano one and by anatectic granitic rocks produced by partial melting of the Kinzigite Formation.

The Sesia Supervolcano is one of the most significant and impressive components of the Sesia Magmatic System. Partially covered by younger sedimentary deposits of the Po plain, it is a huge rhyolitic caldera with a diameter exceeding 15 km. The estimated volume of ignimbrite erupted exceeded 300 km3, making the caldera-forming event a "super eruption" (uick et al., 2009). The Sesia Valley offers excellent exposures of volcanic megabreccia, a deposit characteristic of large calderas, in which blocks of pre-caldera volcanic and metamorphic country rocks are contained in the welded rhyolitic ignimbrite that fills the caldera. A portion of the caldera wall is preserved along which ignimbrite contains enormous landslide blocks of schist that have slid into the erupting caldera from the adjacent Serie di Laghi basement. Also preserved is the base of the caldera, which is intruded by coeval granitic rocks of the Valle Mosso Granite (ezza, 1984). Ages on volcanic rocks indicate that volcanism lasted approximately 6 million years, beginning about 288 Ma and culminating in the caldera-forming eruption at about 282 Ma (uick et al., 2009). Deposited on the caldera ignimbrite is the karstic Triassic marine carbonate of Monte Fenera, which hosts caverns utilized by Paleolithic inhabitants of the Sesia Valley.

The Serie dei Laghi

The Serie dei Laghi is composed of four main units (Boriani et al., 1990b), the Strona-Ceneri one, the Strona-Ceneri Border one, orthogneiss, and the Scisti dei Laghi. Remnants of the Permian volcano–sedimentary cover of the Serie dei Laghi occur near Arosio in Switzerland (Reinhard, 1964), where they lie horizontally over the Strona–Ceneri rocks.

The Strona-Ceneri one is an amphibolite-facies metapsammitic sequence which comprises fine-grained massive gneisses (Gneiss Minuti) as well as medium to coarse-grained gneisses (Cenerigneisses). The Gneiss Minuti (Hornfelsgneise in the Swiss literature due to their granoblastic texture) are finely layered metasandstones with abundant calc-silicate lenses (beautifully exposed along the Cadorna road. Near the orthogneiss bodies they contain thin meta-aplites and metapegmatites. The Cenerigneisses (proposed geosite) are coarse-grained to conglomeratic gneisses containing a diversity of clasts, and calc-silicate nodules similar to those occurring in the Gneiss Minuti. These nodules are zoned (with garnet, pyroxene, hornblende and biotite from core to rim; Boriani and Clerici Risari, 1970) and are interpreted as the metamorphic product of dolomite concretions, typical of many arenitic deposits

Petrography, geochemistry and field relations of the Strona-Ceneri metasediments support the interpretation of Gneiss Minuti and Cenerigneisses respectively as well sorted deposits from turbidity currents and as mass flow turbidites, deposited in an accretionary prism (Boriani et al., 1997; Caironi et al., 2004). Near the orthogneiss lenses, the Cenerigneisses acquire an augen texture due to the increasing presence of K-feldspar porphyroclasts; they could be the product of “melt infiltration and infiltration metasomatism” related to the Ordovician intrusions (Pinarelli et al., 2008).

The Strona-Ceneri Border one (Giobbi Origoni et al., 1997) forms a continuous horizon, one to several hundreds of meters thick, between the Strona-Ceneri one and the Scisti dei Laghi. It mainly consists of banded amphibolites, with lenses of ultramafites, metagabbros and garnet bearing amphibolites (retrogressed eclogites) and minor intercalations of paragneisses. The banded amphibolites (Giobbi Mancini et al., 2003) consist of cm-scale alternating dark (fine-grained amphibolites) and leucocratic layers (leptynites). They represent an example of LAG (Leptynite - Amphibolite Group), an association which is widespread throughout the Hercynian belt in Europe; it is formed by tuffites of alternate mafic and acidic composition deposited in a marine environment. Like the Cenerigneiss, the amphibolites grade into biotite-hornblende augengneiss towards the contacts with the Ordovician granitoids, suggesting the same infiltration mechanism (Pinarelli et al., 2008).

Banded and feldspar-bearing amphibolites are well exposed at Ponte Nivia and along the Cadorna road.

The orthogneisses form large lens-shaped bodies accompanied by meta-pegmatite, meta-aplite and augen gneisses, mainly located within or close to the SCB . They range in composition from tonalite to granite (Pezzotta and Pinarelli, 1994) and show a calcalkaline affinity and mainly metaluminous character (Caironi, 1994; Boriani et al., 1995 with references). They were emplaced in the Ordovician around 450 – 460 Ma (K ppel and Gr nenfelder, 1971; Boriani et al., 1982/83) and suffered the same Variscan regional metamorphism as their country rocks, recorded by mineral ages of 311 – 325 Ma (Boriani et al., 1995). The orthogneisses are well exposed along the Cadorna road at Ospedaletto and Mt Vadà.

The Scisti dei Laghi occur over a large area from Lago d’Orta to Lago Maggiore, near Verbania and, on the eastern shore of the lake, near Luino, were they are cut by the Val Colla-Cremosina fault. This unit corresponds to the Giumello gneise” in the Swiss literature (Reinhard, 1964). The Scisti dei Laghi consist of alternating micaschist and paragneisses, strongly foliated, with isoclinal folds. They contain typical quartz rods. A beautiful exposure of these micaschists is in the bed of the S.Bernardino river.

The CMB and Pogallo Lines

The contact between Ivrea-Verbano one and Serie dei Laghi occurs through an important subvertical tectonic lineament (Boriani et al., 1990a): the Cossato-Mergozzo-Brissago Line (CMB), characterised by the simultaneous occurrence of three distinctive features: high-T mylonites, basic-to acidic dykes and stocks (the Appinite Suite) and migmatites. The line is dissected by later discontinuities, among which the most important is the Pogallo Line. The Pogallo Line is characterised by amphibolite facies mylonites.

The Canavese Line

The Canavese Line is the westernmost stretch of the Insubric Line, a major alpine lineament that marks the boundary between the Central Alps, consisting of intricated refolded basement nappes (Milnes, 1974), and the Southern Alps with S-vergent thrusts (Laubscher, 1985). The Insubric Line accommodated a vertical uplift on the order of 10 to 20 km, since it juxtaposes the Alpine metamorphic rocks of the Central Alps with the pre-Alpine metamorphosed basement of the Southern Alps and its volcano - sedimentary cover (Niggli and wart, 1973; Frey et al., 1974).

In the area of the proposed Geopark, the Canavese Line consists of a 1 km thick greenschist facies mylonite belt. The mylonite sare derived (from S to N) from: a) Ivrea-Verbano rocks; b) Permo - Mesozoic cover rocks (Canavese one); and c) the Sesia one (Central Alps).

The progressive mylonitization of the Ivrea-Verbano rocks is well documented in Val Loana) the rocks are transformed into greenschist facies mylonites and phyllonites containing amphibolite-facies mineral relics (diopside and actinolite in the impure marble exposed at Lago del Marmo).

C C

The proposal for candidature to the European and World Network of Geoparks under the auspices of UNESCO has been enthusiastically welcomed by all local communities and the international scientific community. This is evidenced by the letters of official support signed by local authorities, universities, research centers and by various organizations working in the field of scientific research, tourism and natural conservation. These stakeholders universally endorse and wish to implement the goals of the GGN.

The scientific significance of the proposed Sesia-Val Grande Geopark is beyond dispute. As the world’s most accessible and complete exposed section through the continental crust, the Ivrea-Verbano one and Serie dei Laghi have been the focus of increasing international scientific attention for more than 40 years, and these terranes continue to be the targets of active research programs and the frequent destinations of fieldtrips by universities and professional societies. We believe that the widely recognized scientific significance of the proposed Sesia-Val Grande Geopark will make it a poster child for demonstrating to the scientific community at large that it is vital to engage the public and communicate to them the value and relevance of scientific research.

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T e ulti tou book version o t e Villuer as Ibores ara Geopark Geosites Guide as a touristi and edu ative tool

Barrera J. M. ([a]), Gil J.([b]) & López J. ([c])

(([a]) Biologist. Geopark director. Cáceres County Council Tourism Service. Palacio de Carvajal, Calle Amargura 1. 10003 Cáceres. Spain. jmbarrera@dip-caceres.es.
([b]) Geologist. Geopark Educative and Scientific Co-director. jugimo@gmail.com.
([c]) Geographer. University of Extremadura. javier@aprodervi.com.es

ABSTRACT

Villuercas-Ibores- ara Global Geopark (Spain) has decided to produce an electronic and interactive version of its Geosites' Guide. Reasons are to provide an easy and innovative tool for tourist and for the educative community. Also to enhance the Geopark promotion on the net. As only the multi-touch technology developed for the iPad devices can provide interactive tools for e-books, we have explored this possibility keeping other ones open in case new technologies for Android devices were made up.

This multi-touch book has the same chapters and contents that its paper version. But in advantage, it has more than forty photo galleries, some ten explanatory videos, interactive diagrams about the geological process involved in the geosites' formation and many other interactive capabilities using the glossary, the dictionary or the edition capacities. Furthermore, each chapter includes a quick test for the learning evaluation.

The new e-book guide appears on une 2013 in Spanish and English. Taking in account the tourists and students big immersion in technology, this initiative will represent an important asset to develop both geoturism and educative geopark strategies.

KE WORDS: Geosite, geoturism, guide, interpretation, multi-touch, Villuercas-Ibores- ara, tablet.

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The new Geosites' guide of the Villuercas-Ibores-Jara Geopark (Spain) appeared in early 2013. Written by JM Barrera and J Gil it has had the collaboration of the geologists and other professionals of the Geopark Educational and Scientific Committee. The paper edition, in Spanish and English, has been well received among geopark visitors which can purchase it on arrival at the Information and Interpretation Centers. The guide provides, beyond the presentation of the geological sites, chapters referred to the concept of geopark, the presentation of the European and Global Networks, some geological notes about this Geopark, their fossil record, some recommendations for geological itineraries, maps and other utilities. Its format is good as a pocket guide and has taken special care to geological interpretation of texts so that they can be understood by all people even if they have not initial training in these disciplines. It has included a glossary for more complex terms and diagrams that support the text and help people understanding what they are seeing on the field.

However, interpretation of the processes and the geological formations is sometimes a complex matter. Both in education and in its use in tourism, interpretation looks for moving people to an understanding of what is perceived, in order to gain their interest. In this way it is possible to create expectations of involvement, curiosity or new experiences, also from a tourism point of view, in its approach to the nature. Interpretation needs some support for it. The best is, certainly, having an expert to guide the visit. This is especially relevant in all forms of ecotourism, geotourism included here, unlike nature tourism (more ambiguous in its objectives either landscape enjoyment or natural sport practice). Differentiation is in tourism a key to success so increasing the quality of the interpretation is important to differentiate the geotourism. In an educational perspective both fieldwork and the quality of the interpretation tools allow greater capacity to absorb new concepts by students. These considerations led the authors to try to incorporate to the Geosites' guide some easy technology able to integrate animations, videos, photo galleries, interactive diagrams, glossaries, etc. The possibilities opened up by the new mobile devices, smartphone or tablet type, have allowed this development.

THE MULTI TOUCH TECHNOLOG

This technology, developed for touch screens, allows with the help of different gestures of one or more fingers, different features of easy understanding because of the intuitive of its action and the immediate visualization of their effects. It is so simple that it has quickly become popular in recent years for its application to smartphones or electronic games for children. Joined to other graph possibilities, animations, videos and web interaction has opened a path that has been followed by textbooks for students either elementary school or human anatomy in schools of medicine. The big publishers, owners of the best treatises have already made successful migrations between their traditional formats and these new electronic formats given its obvious educational advantages. This option, different from the epub or similar e-book format and also different to specific applications of tablets and smartphones, is called multi-touch textbook and so far, only applies to Apple s iPad tablet (fig.1).

Fig. 1 - The book is open from the iBooks app.

The textbook was developed with the iBooks Author app which allows the incorporation of text and layout design. Other elements, such as images and widgets dynamically connected with the text can also be added to the book. The possibility of incorporating widgets add interactivity, which in this case is used for the photo gallery, chapter index, interactive images, web links, videos, maps, evaluation tests, etc.

THE STRUCTURE O THE ELECTRONIC GUIDE

The electronic guide retains the chapter structure of the printed version. In summary, the guide begins with an introduction that brings the reader to the concept of geosite and explains how to use the publication. It continues with a chapter on what is a geopark with brief references to the EGN and GGN. From here on, the geological sites are divided into main sections: Crags, Hills and Sierras; Mining Activity; Rañas; Faults, Valleys; Synclines and Anticlines; Crags and Granite Boulders; Block Slopes; Caves and Other Geosites. The guide concludes with additional chapters on geological itineraries, general notes on the geology of Villuercas Ibores Jara, the geological map and the fossil record. In the wards of the print edition, some space is enabled to house the map of geological sites with their location.

The electronic book provides access to all chapters in a graphical and interactive way (fig. 2). All chapters are in the lower band of the screen and the user can choose any of them with a simple tap. Once inside, the contents of each chapter are also visible in the lower band in order to access the geosite of our choice right from the hypertext index chapter or from this lower band (fig.3). The text contents are the same and also the basic schemes of the print edition, but now they are dynamic. And this is the beginning of a whole set of new features that offers great utility to the user.

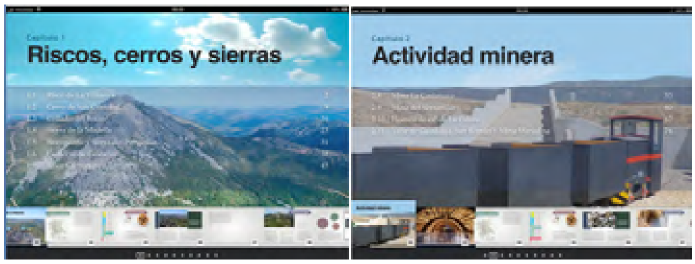

Fig. 3 - The content is visible in the lower band..

Fig. 2 - The chapters are accessible by an interactive gesture.

DICTIONARY AND GLOSSARY INCLUDED

The dictionary and the geological glossary are accessible from the text, so just tapping a word looking for a definition, a small window is displayed with the help requested.

POSSIBILITY OF EDITING AND NOTES

The text can be edited by the user allowing underlined, highlighted or notes.

INTERACTIVE DIAGRAMS AND ANIMATIONS

The basic schemes of the print edition are interactive in the electronic one. Incorporation of new animations like that lets us know the geological sites in which each geological period has representation and vice versa. It incorporates a new geological map of the Geopark that enables both complete viewing and scalable views allowing this expansion with a two-finger gesture (fig. 4). That gives access to the whole geological map or to the surrounding area of a single geosite. Geological sections are also incorporated of every great folding structure, batholiths and spheroidal weathering zones. Two new schemes explain the Ordovician fossil record and a figurative idea of the life position of *Cloudina carinata*, one of the Ediacaran first metazoans with carbonate exoskeleton that was described in this territory. All new drawings have been made by Antonio Grajera, draughtsman of great experience in nature issues.

PHOTO GALLERIES

What in the printed guide was a picture accompanying the text, is turned into galleries, which allows the textbook to have five times more images.

VIDEO

Fig. 4 - Scalable geological map.

Some chapters are complemented by videos that facilitate the understanding of the text or give a clearer idea of the importance of the geosites (fig.5). For example, in the Cancho Valdecastillo, the video provides the possibility to access inside this granite formation giving the chance to explain their use by the first settlers in the Chalcolithic period.

INTERACTIVE MAPS

Besides the already mentioned geological map, the map of geological sites also enables interactivity to facilitate direct access to the text or to guide the on-site access (fig.6).

EVALUATION TEST.

Each chapter incorporates a quiz in order to test simple achievements.

USE IN THE CLASSROOM OR ON GUIDED TOURS

The device can be used in the classroom with the support of a projector. Thanks to the schemes, glossaries and textual content, is easy to explain some of the geological concepts taught in primary and secondary education (fig. 7). It must be recalled that geosites themselves have already the function of field-explaining the geological processes affecting the territory. Teachers and students can interact with the guide to access to the content and prepare field trips. In the geotourism framework its use is important for the self-guiding, as an easy tool to use on the ground, and for the guided tourism so that the schemes can complement the explanations the guide offers to their customers.

CONCLUSION

The multi-touch textbook version of the Geosites' guide of the Villuercas-Ibores-Jara Geopark is an important technological contribution to the geotourism development and as an educational tool. Its wide graphics set and its interactivity adds obvious advantages over the printed edition. It avoids the concept of obsolescence because it can be corrected, enlarged and even enhanced with a simple job of updating that would come automatically and free of charge to all users who have already downloaded.

ACKNOWLEDGMENTS

The authors acknowledge the technical implication of the companies Laruinagráfica SL (print edition) and Imanguxara CB (electronic version) without whom special collaboration and advice, the publishing would not have been possible. The guides were realized thanks to the financial support from Plan to Promote the Tourism Product in Villuercas- Ibores-Jara involving Turespaña, Government of Extremadura, Villuercas Ibores Jara Municipalities and the County Council of Caceres.

Fig. 5 - Complementary videos are included in the geosite's chapters.

Fig. 6 - Dynamic schemas include maps and stratigraphic chart.

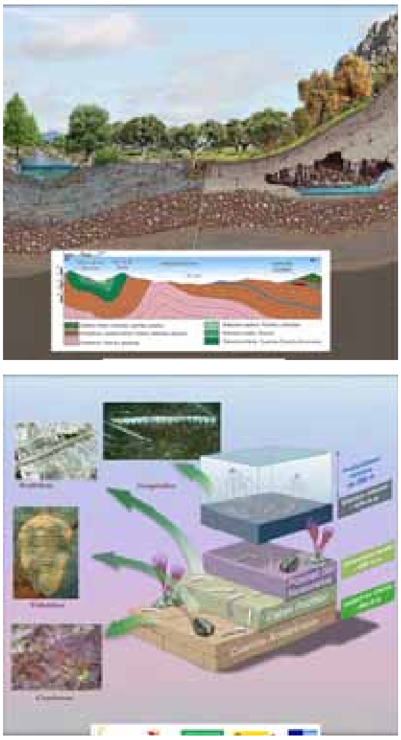

Fig. 7 - Grajera’s drawings explain fossil record or geological processes

he geoheritage o the Ca n del aipo Geopark Pro ect Chile

Benado, . ([a]), Brilha, . ([b]) & Schilling, M. ([c])

([a]) Earth Sciences Centre, University of Minho, Portugal. E-mail: josebw@gmail.com.
([b]) Earth Sciences Centre, University of Minho and Geology Centre of the University of Porto, Portugal. E-mail: jbrilha@dct.uminho.pt.
([c]) National Geology and Mining Service of Chile and Geological Society of Chile, Santiago, Chile. E-mail: manuel.schilling.d@gmail.com.

ABSTRACT

Caj n del Maipo Geopark is a project run under the auspices of the Geological Society of Chile in order to create a geopark in the San os de Maipo county. This area is located 50 km east of Santiago, the capital of Chile where more than 6 million people live (40% of Chile population). As a first step, an inventory of the geological heritage of the county was made as part of a thesis project of the Master’s in Geological Heritage and Geoconservation at the University of Minho, Portugal. This research selected and described 38 geosites representing the high geodiversity of the region of Central Andes in Chile.

KE WORDS: Caj n del Maipo, Chile, geopark, geoheritage.

INTRODUCTION

The geodiversity in Chile has international relevance due to a particular regional geological setting. The subduction of the Nazca Plate beneath the South American Plate generates intense volcanism and tectonic deformation originating a vast petrological diversity. These active processes are also responsible for an impressive geomorphology in association with high altitude volcanoes where glaciers shape the landscape. With such a geodiversity, the Chilean geoheritage must have worldwide significance. However, this geological heritage is not yet properly identified and no national geoconservation strategy is implemented so far. Nevertheless, some initiatives are already in place, such as the National Geosites Programme, driven by the Geological Society of Chile (www.sociedadgeologica.cl/geositios/) and the “Kutralcura Geopark Project” (Schilling, 2009), an initiative lead by the Geological Survey of Chile that expects to create the first geopark in the country.

This paper presents the Caj n del Maipo Geopark Project, another and still incipient endeavor for the creation of a geopark in Chile, under the auspices of the Geological Society of Chile. The selected area corresponds to the limits of San os county in the Central Andes region (Fig. 1) where extensive geological research has been carried out, particularly since 1957 when the development of geology in Chile started with the creation of the School of Geology at the University of Chile and of the Institute of Geological Research.

ABOUT THE PRO ECT

The aim of this study is to estimate the geoheritage potential of Caj n del Maipo area for an eventual creation of a geopark, located about 50 km east of Santiago, the capital city of Chile. As a first step, an inventory of the geological heritage of the county was made as part of a thesis project of the Master’s in Geological Heritage and Geoconservation at the University of Minho, Portugal.

Besides the outstanding geology of the Caj n del Maipo Geopark Project , the following conditions and attributes may justify its creation: i) There are more than 6 million people as potential visitors within a radius of 50 km; ii) The county has already a tradition of ecotourism, with activities like skiing, climbing, rafting, mountain biking, fishing, camping, hot springs and outdoor walks; iii) There are important conservation initiatives in the territory, especially dedicated to its biological component; iv) The National Tourism Service of Chile declared in 2001 San os de Maipo county as a National one of Tourism Interest (SERNATUR, 2009). This classification commits the government to promote the sustainable tourism development in the area, the stimulation of productive activities related to tourism, the protection of natural and cultural resources, among others; v) Due to the significant geological resources present in the county, there is a constant interest in implementing major water projects and mining in the territory. The local populations reject these initiatives arguing that they will not bring direct benefits to the development of the county, and also threaten their livelihoods and natural heritage of the area. The creation of a geopark in San os de Maipo could be an alternative of land-use according to the wishes of the local population, which seek a sustainable development and convivial with the natural environment of their territory; vi) Despite being a country influenced by its geological features (mineral deposits, volcanic and seismic activity, tsunamis, etc.), the level of Earth Sciences education in Chile is quite low.

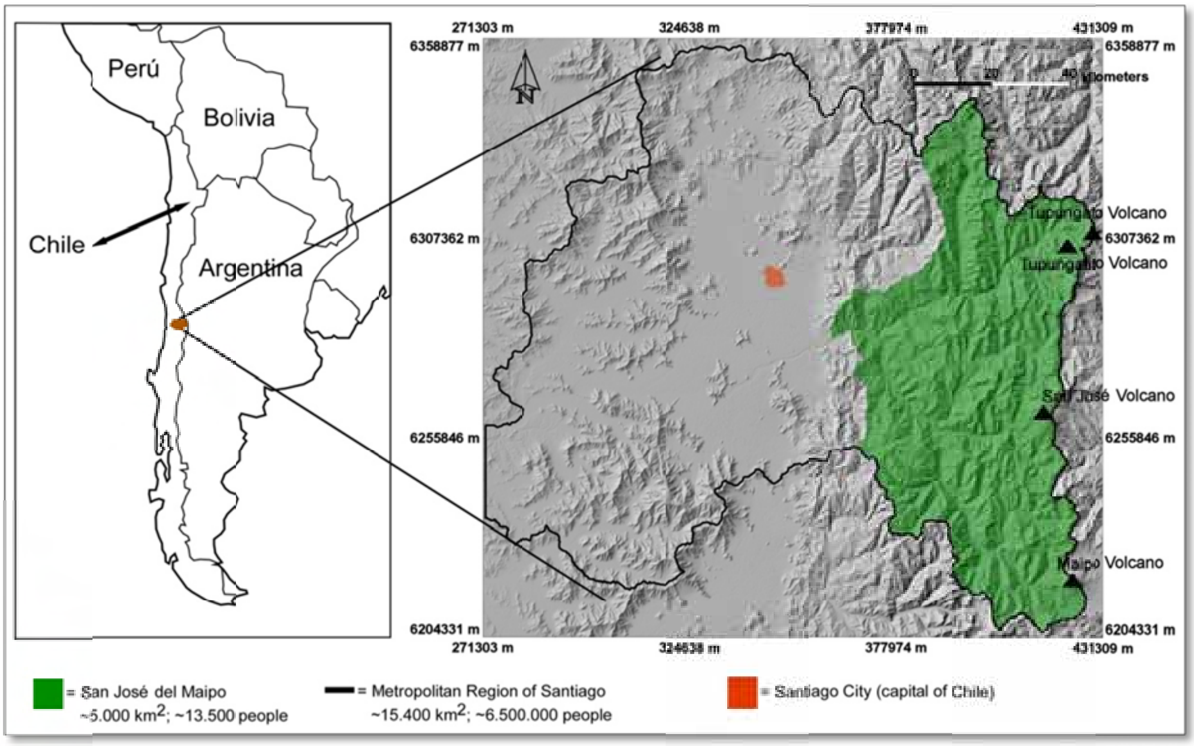

Fig. 1- Location of San os de Maipo county (Central Andes, Chile).

Thus, the establishment of a geopark near the capital, where about 40% of the Chilean population lives, could involve the community in educational activities related to the geosciences and encourage a more harmonious cohabitation with the environment.

NATURAL CHARACTERISTICS OF THE AREA

This county borders Argentina to the east with the boundary corresponding to the modern volcanic arc that includes active volcanoes such as Tupungatito, Marmolejo and San os . In this mountainous landscape there are peaks with altitudes ranging from 800 m (La Obra) to 6,570 m (Tupungato Volcano) and nine peaks rising over 5,000 m. The Caj n del Maipo is the name given to this valley, which has been formed by the action of the Maipo River. With a hydrographic basin with an area of about 5,000 km^2, the Maipo River is the main source of water for the capital. The rocks of this region record about 200 million years of geological history and a wide geodiversity including marine urassic rocks, volcanic and plutonic rocks of the Cenozoic, folds and faults that show intense tectonic activity, volcanoes, hot springs, glaciers, mineral deposits, and Holocene sedimentary deposits of fluvial, glacial, volcanic, and gravitational origin (Thiele, 1980).

In terms of climate, the city of San os de Maipo, which is the county's capital and most populous urban centre, is characterized by winter rains, temperatures that can range from 0-30 C depending on the season, and a dry season that lasts between 7-8 months. Above 3,000 m there is a mountain climate with precipitation in the form of rain and snow. Ecosystems in the area are known as Forest and Andean Mediterranean scrub and High Andean Steppe . Both are characteristic of the high mountains of the Andes in central Chile, and are now seriously threatened justifying present efforts made for their conservation. The public-private initiative called Santiago Andino" stands out as one of these conservation efforts covering 76% (3,779 km^2) of San os de Maipo county and aiming to conserve, restore and protect ecosystems. This territory was declared a hunting-forbidden area (CONAMA, 2005).

Fig. 2- El Plomo hot springs geosite. The water is sodium chloride type emerging with a temperature of 44 C (Bustamante et al., 2010). The water emerges from a rock wall with vertical layers of the fossiliferous Lo Valdes Formation.

There are three protected areas in the county: "Monumento Natural El Morado" (30 km^2); Santuario de la Naturaleza

Cascada de las Animas" (36 km^2) and "Santuario de la Naturaleza San Francisco de Lagunillas y uillayal" (134 km^2). To mention just two of them, Monumento Natural El Morado is a park under public administration located in altitudes of around 5,000 m. Its main attractions are the high peaks, the San Francisco Glacier and its moraines, the San Francisco Lagoon, the braided river Estero El Morado and its proximity to the Morales hot springs. The Santuario de la Naturaleza Cascada de las Animas" is an area under private management known for its steep gorges and waterfalls, where thick and intensely folded Miocene volcanic successions can be observed. Also, Santuario de la Naturaleza Cascada de las Animas" has a great diversity of flora and fauna, much of it native, and some endangered species.

Fig. 3- Nieves Negras glacier geosite. This glacier is 6.5 km long and is a mountain glacier in the higher parts (5,300 m asl) and a valley glacier in their lower parts (2,900 m asl).

CULTURAL CHARACTERISTICS OF THE AREA

The Caj n del Maipo is a well-known tourism destination located in Central Andes. This area is visited by national and foreign tourists and is part of the San os de Maipo county, which has an area of 4995 km^2 and about 13,500 inhabitants, contrasting with the nearly 6.5 million people living in the Metropolitan Region of Santiago. San os de Maipo is a semi-rural county with an unemployment rate of 9.7%. With 11.1% of its population living below the poverty line, San os de Maipo is economically depressed compared to the neighboring counties (BCN, 2012). The major economic activities of this area are mining, electrical energy production, livestock and agriculture. However, the Strategic Plan of the Province considers San os de Maipo a county with high potential for ecotourism, nature and environment and establishes tourism as the most promising development activity (PAC Consultores, 2010).

The county of San os de Maipo boasts great cultural and archaeological interest. To mention a few, we highlight two areas already included in the Tentative List for UNESCO's World Heritage. The first one is the hapaq Nan or Main Andean Road , an international initiative of Argentina, Bolivia, Chile, Colombia, Ecuador and Peru, which aims to preserve one of the most representative works of Incan culture: the road network. Part of this road network can be seen in San os de Maipo county, which ends at the Santuario de Altura del cerro El Plomo", the second area included in the list. This is the southernmost Incan ceremonial and religious site, located at 5,200 m high.

PRELIMINAR RESULTS OF THE GEOSITES INVENTOR

The inventory of geological heritage of the San os del Maipo county was based on the most recent methodological approaches (for instance, Lima et al., 2010). Every inventory must have a clear aim in order to justify the most appropriate criteria to support the geosites selection. The inventory aim must integrate the topic, the value, the scale, and the use. The topic is the subject or theme to be inventoried – for this work the geological heritage (as a whole). The value can be scientific, educational, touristic, cultural, among others, and is related closely to the use – the geosites were selected based on their scientific value. The scale refers to the geographical area where the inventorying occurs – the San os de Maipo county. Finally, the use is related to the purpose of the inventoried geosites – in this work, this inventory will be used to support the implementation of a geopark. The selection of geosites was based on 4 criteria: i) Representativeness (the ability of geosites to show the best characteristics of geological materials and processes); ii) Integrity (current status of conservation); iii) Rarity (number of occurrences of the same type in the studied area); iv) Scientific knowledge (number and relevance of scientific literature published and potential for future studies).

Fig. 4- Fault contact between the San Gabriel granodiorite pluton (on the left) and the Abanico Formation (red coloured) geosite. The San Gabriel pluton is ~11 Ma (Baeza, 1999).

The inventory started with a literature revision of the area including thesis, papers, abstracts and geological maps. Experts on the geology of this area were contacted in order to receive their opinion about potential geosites. After these 2 stages, 67 locations were included in a list of potential geosites. After fieldwork this list of potential geosites was reduced to 38 geosites. These 38 geosites represent different geological frameworks present in the Central Andes of Chile, such as: landslides, volcanoes and their materials, tectonic and neotectonic features, glaciers, mining heritage and hot springs.

Among the 38 selected geosites, 10 have geomorphological interest, 7 tectonic, 6 petrological, 3 hydrogeological, 3 volcanological, 3 stratigraphic, 2 palaeontological, 1 mining, 1 mineralogical, 1 pedological, and 1 geocultural.

Fig. 5- Landslide and hydrothermal alteration zone at Las Amarillas geosite. The fluid flow was facilitated by the occurrence of the El Diablo fault, an active tectonic structure (Charrier, 2005).

Fig, 6 - San os Volcano Complex geosite (5,856 m asl). Between 1822-1960 21 eruptive events have been recorded (Bustamante et al., 2010).

FUTURE STEPS

All geosites already selected will be assessed for their scientific, tourist and educational values, together with their vulnerability evaluation, in order to establish management priorities.

Finally, these results will be communicated to a wide public of this territory, including local and regional authorities, citizen groups devoted to the tourism industry, nature conservation, environmental education, and socio-economic development. We expect that this information, together with other experiences of national and international Geoparks, will stimulate the creation of the Caj n del Maipo Geopark.

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In Dar in s ootsteps bet een a s ienti i and naturalisti allenge t e Ba ia Busta ante oastal area (Patagonia Argentina)

Bini M., ([a]), Consoloni I. ([a]), Isola I. ([b]), Pappalardo M. ([a]), Ragaini L. ([a]), Ribolini A. ([a]) & Zanchetta G. ([a])

([a]) Dipartimento di Scienze della Terra University of Pisa, via Santa Maria, Pisa, Italy. E-mail: bini@dst.unipi.it
([b]) Instituto Nazionale di geofisica e Vulcanologia sez. Pisa Italy

ABSTRACT

Thanks to its geographic position, Patagonia , can be considered a strategic land for the studies of climate changes. In this work the main geomorphological features of the Bahia Bustamante coastal area are depicted. Moreover, the relevance of these features for the studies of palaeo sea level are stressed.

Finally, taking into account the high geological value of this area, the motivations for proposing it as a geosite are presented. The concomitance of a high geological, biological and hystorical interest make the study area particularly suitable for the promotion of a sustainable tourism.

KE WORDS: Climate change, Geosites, Patagonia, Sea level change, Sustainable tourism

C

The Patagonia is the only continental landmass emerging along the mid to low-latitudes in the south Hemisfere, and this makes it a unique region in the word. Charles Darwin was the first naturalist who documented the geological and geomorphological features of the Patagonian coast, explored during the famous travel of the Beagle ship (1831-1836). The Patagonia represents a key area for understanding the role of the southern hemisphere in regulating climate during the last hundred of thousand years. From the Andes to the Atlantic coast, Patagonia preserves an impressive geological record of the glacial events and sea-level oscillations. The uaternary coastal deposits, often organized in spectacular successions of raised-beach-ridges, contain an almost unexplored archives of past climate. These natural archives can offer precious information on local relative sea-level changes, tectonic and glacial isostatic component, fundamental information on past surface ocean conditions and, through the study of the continental deposit related to beach-ridge systems, information also on terrestrial climate. In this context several sectors of the Gulf of S. Jorge have been studied in order to identify geomorphological /geoarchaeological markers of past sea level (Ribolini et al 2011; Zanchetta et al., 2012, Schellmann & Radtke, 2010)). This work is aimed to highlight the geological heritage of Bahia Bustamante area (Fig.1) and its relevant scientific interest for the studies of palaeo seal level and climate changes.

Fig. 1 – Study area location

SCIENTI IC VALUE O THE STUD AREA

A geomorphological survey carried out in the area of Bahia Bustamante allowed the reconstruction of the main geomorphological features, suggesting the landscape evolution of this territory. The study area extends over more than 1,000 km^2 between the mouth of Cañadon del Linyera and the Caleta Horno (66 50’W – 65 47’W longitude and 44 54’S – 44 51’S latitude; Fig. 1). Here, an outstanding succession of raised beach deposits is exposed for a total area of more than 500 km^2, extending up to 10 km landward and reaching 100 m of elevation (a.s.l.). Past landforms and deposits are particularly well preserved because weathering processes are very limited. The oldest rocky substrate, Complejo Marifil, consists of Jurassic rhyolites, ignimbrites and volcanoclastic conglomerates. It is often covered by thin to very thick debris deposits and crops out basically in current and paleo rocky shore lines, islands and cliffs. Subordinate outcrops are represented by the Paleocene marine deposits of the Formación Salamanca and the Paleocene continental deposits of the Formación Río Chico (Cionchi, 1984 Lema et al., 2001). The landward part of the area is characterized by the outcrop of a pediment surface covered by rounded volcanic pebbles and gravels in a sandy matrix, occasionally strongly cemented by carbonate. Wave action is the most important geomorphologic agent responsible for the past and present landscape. The coast is characterized by a high-energy system with intense storms and a macrotidal regime. Unfortunately, tidal data are not available, but a tidal range 4 m can be reasonably assumed for most of the Patagonian coast. The landscape is dominated by outcrops of marine deposits, predominantly organized as series of sandy to gravelly beach ridges, extending several kilometers inland (Fig.2), rising to more than one hundred meters above current sea level (Isola et al 2012). A large number of depressed areas lying in a back-beach ridge position are one of the characteristic elements of this region. They are remnants of old coastal lagoons locally known as “salitrales” (Figure 3a) formed in dry evaporative environments by sandy silt and clay deposits including mineral deposits, such as gypsum, that locally form crusts (Fig. 3b). This area is particularly relevant for geological evidences of sea level oscillations, especially for the great number and the dimensions of beach ridges. Preliminary data suggest that there is a record comprising at least MIS 9 (Shellmann & Rudke, 2000, 2010), but probably MIS 11 and older beach ridges could be preserved here. In addition to the beach ridges commonly used as sea level markers also in other sector of the Patagonian coast, in the study area have been identified also notches carved in volcanic rock (Fig. 4). Even if studies on this topic are still in progress, their localization seem to be related to the High tide level providing additional information on palaeo sea level.

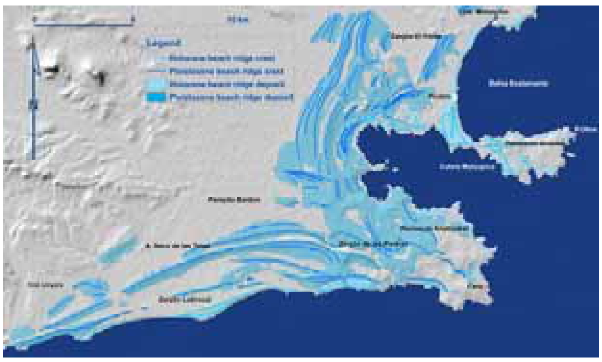

Fig. 2 – Beach ridge deposits in Caleta Malaspina - Peninsula Aristizabal area

Fig. 3 – a) salitral in Bahia Bustamante, b) gypsum crust

REASONS TO CONSIDER BAHIA BUSTAMANTE A GEOSITE

This sector of coast preserves impressive traces of sea level oscillations represented by marine deposits and erosional forms of high scientific value for understating climatic changes and tectonic uplift history in this area. In particular the Bahia Bustamante area, due to the great number and the excellent state of preservation of its landforms, represents one of the areas where the uaternary period is best represented in all the Argentinean coast. Past landforms and deposits are in fact, particularly well preserved because weathering processes and infrastructures are very limited. The landscape is dominated by the outcrops of marine deposits, prevalently organized in impressive series of sandy

Fig. 4 – Active notch at the Canadon Restinga mouth

to gravelly beach ridges. Beach ridges are considered sedimentary structures formed during the progradation of the coastal system. It occurs during periods of sea-level fall which results in marine regression. The shoreline has been built seaward by accumulation of sand and pebbles stranded by storms waves. The waves activity rips benthic animals from the seafloor and accumulates them within beach ridges. From the fossilized shells preserved until nowadays, is possible to determinate the deposit age. Thanks to the great geomorphological paleoclimatic and naturalistic values the area of Bahia Bustamante is worthy of particular attentions, having all the characters to be a geosite. This area provides a direct and friendly interface which reveals the knowledge of Earth history to a public without specific geological background. It enables them to understand the events that have produced the current landforms and those phenomena that will modify and generate the future landscapes. This sector of coast is an environment of high natural values (however, it is threatened by oil exploitation, mining and increasing tourism) and represents a natural heritage that need to be preserved for future generations as reserve of marine and terrestrial biodiversity. Moreover in addition to the significant geological heritage this area preserve a relevant biological and historical heritage. From the biological point of view, the coastal area is one of the most important seabird nest-building zone of the Atlantic Patagonia. The islands and islets whose habitat is characterized by a combination of different substrates and vegetation, seabirds provide suitable environments to reproduce. The bird-watchers come to Bahia Bustamante to watch principally the two endemic species that inhabit these shores: the Orlog Gull (or Olrog) and Steam Duck, which are no-flying birds. From a historical point of view, a small village of fishermen of algae (Pueblo Algueros) took place in this area in 1947, hosting a company dedicated to the collection and processing of seaweed. Today a modern alguera industry is active in Bahia Bustamante village, with various products in the areas of nutrition and biomedicine. Moreover, the village which hosted up to 400 people has been recently converted into a sustainable village opened up to tourism, promoting natural resource trough the philosophy and ethic of reduce, reuse and recycle. Biological and historical heritage combined with geological heritage are key elements to support a geological tourism (Poli 1999). In this regard the area of Bahia Bustamante is suitable to promote a geological tourism and more in general knowledge on Earth Science.

ACKNOWLEDGMENTS

This work was made possible thanks to the funding of the University of Pisa (Progetto Ateneo 2007, Leader G. Zanchetta) and MIUR (PRIN2008, Leader G. Zanchetta).

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Geomorphological ha ard and tourist use o rock coasts in uscan tal

Bini M. ([a]), Mascioli F. ([b]) & Pranzini E. ([b])

([a]) Department of Earth Sciences University of Pisa, Via S. Maria 53, 56126, Pisa, Italy. E-mail: bini@dst.unipi.it
([b]) Department of Earth Sciences University of Florence, Borgo Albizi 28, 50122, Firenze, Italy

ABSTRACT

Most of the world's coastline (80%) is formed by rocky coasts. In spite of that, rocky coasts are not thoroughly studied.

In this study we introduce a new approach for the study of geological hazards in rocky coast and present preliminary results from 5 selected areas in Tuscany.

Criteria for a safe tourist use of coastal areas are suggested and the need for the development of knowledge on geological heritage is indicated.

KE WORDS: geological hazard, geological heritage, geosite, rocky coast, Tuscany.

C

Rocky coasts are the 80% of the world's coastlines (Emery & Khnun, 1982). The Tuscan coast is 450 km long, characterised by over 240 km of high and rocky coasts, in accordance to the Mediterranean and Italian percentage of about 55% of cliff or rocky sloping coasts (AA.VV., 2006).

The morphology and geomorphological evolution of high coasts is strongly related to a very complex interaction between rocks features, a large number of natural morphogenic factors and human activities. All these factors together induce irreversible erosional processes (Sunamura, 1992; Trenhaile, 2002; Finkl, 2004; Pranzini, 2004; Naylor et al., 2010).

The extent of this coastal type, including areas with intense anthropization and tourism use, and the coastal hazard strongly related to the typical geomorphological evolution outline the need for specific research programs (Violante, 2009).

The aim of this work is to define general criteria for geomorphological hazard evaluation, both at regional and local scale. The regional study has been performed on the entire rocky coastline of Tuscany, islands included. It proposes a method to quantify, rank and map the distribution of coastal hazards. The local study has been developed on 5 areas, characterised by different geological settings and high levels of human presence. For each area, criteria have been defined for safe human use. They include information signs that use coded and iconographic language. Moreover, we propose an improvement in geo-tourist fruition of rocky and cliffed coasts, being these landforms natural laboratories for the understanding of evolutionary landscape processes.

GE G CA E G

The 5 selected areas from north to south are: Calafuria, Punta Miglio, Poggio San Leonardo, Baratti e Punta Rocchette (Fig.1).

Calafuria, Punta del Miglio and Poggio San Leonardo are characterised by foredeep sandstones (non metamorphic succession of Tuscan Domain, Chattian – Aquitanian in age) while Baratti area is characterised by sand to gravel deposits of Pleistocene and Holocene ages. The area of Punta Rocchetta is characterised by quartz rich conglometares calcarenites, marls and calcilutites (Late Triassic – Malm in ages; Carmignani e Lazzarotto 2004.

E

The regional study (at scale 1:25,000) has used geological and geomorphological data from Tuscany Region, and geological photo-interpretation. The information has been processed using a Geographical Information System (GIS), which allowed: control of data quality, coherence between data collected and project objectives, standardisation and normalisation of information, realization of metadata and digitalisation of maps.

The local study, at scale 1:2,000, is based on detailed field geological, geomorphological and geomechanical surveys (Spring-Summer 2011). The geological and geomorphological surveys have been performed following the guidelines from Geological Survey of Italy (SGN, 1992, 1994; SGI, 2009), improved and upscaled for detailed investigations and applying the methods suggested by the Italian working group on rocky coasts (Valente et al., 2009).

Fig. 1 – Location map of the study area. 1: Internal stones flysh, sandstones, siltstones with olistostromes; 2: uartz rich conglomerates calcarenites, marls and calcilutites; 3: Conglomerates sandstones silts stones of fluvio lacustrine environment; 4: Ophiolites; 5 studied areas

Geological surveys aimed at defining lithologies along the whole cliff, whereas geomorphological surveys aimed at characterising landforms along the cliffs, mostly related to marine and gravitational processes (Emery & Khun, 1982). Lithotecnical surveys aimed at defining the setting of discontinuities and the uniaxial strength values (Barton and Choubey, 1977; ISRM, 1978; Bieniawski, 1993, 1979; Budetta et al., 2000). The interpretation of lithotecnical data led to the evaluation of the SRM index (Romana, 1992). Data collected in regional and local studies were analysed considering the phenomena responsible for coastal processes both separately and mutually, with the aid of an interaction matrix, already applied for the Italian rocky coast hazard (De Pippo et al., 2008, 2009). This allowed an objective formulation, minimizing the personal interpretation, of relationships between all geological, geomechanical and geomorphological parameters in the considered rocky coastal system.Two different interaction matrixes have been used for the regional and local studies. They differ in details of the analysis, related to the number of parameters *P* considered in the system (Tab. 1).

The *Interacti e Intensity* value (causes effect) results from the interaction of all involved parameters and is an indicator of the equilibrium condition of the entire system. Moreover,

egional tud	ocal tud
Morphology	Cliff height
	Cliff slope
Cliff strike	Cliff exposure
	Lithology
Lithology	Uniaxial strength
	SMR
Lithotecnic	Vegetation
	Expected rain rate
Discontinuities setting	Wave condition
	Previous landslides/rockfall
Previous landslides/rockfall	Anthropic features
	Potential instability

Table 1 - Parameters *P* considered in the interaction matrixes for regional and local study

the matrix coding allowed the calculation of Regional Instability Index (IS_r) and Local Instability Index (IS_l), given by:

$$IS_{r,l} \quad \sum_t I_t \; V_{k,t}$$

where:

- I_t is the value of the interactive intensities of the *Pn* parameter, as percentage of the total interactions (causes effects), and summarises the role (subordinate or dominant) of the parameter in the system;
- $V_{P,k}$ is the value given to each parameter *P*, for each site *k*.

$IS_{r,l}$ is the Regional Instability Index (IS_r) and Local Instability Index (IS_l). This value allowed to define 3 classes of instability. The boundaries of classes, which are different at regional and local scales, have been calculated using weighted sum, appropriately adapted to the Tuscan coast. Class boundary values are strongly related to the variation of Interactive Intensity (I_t), considering that increasing values give more instable systems, and to $V_{P,k}$ values given to parameters.

E

REGIONAL STUD

The regional geological cartography outlines the outcrop of very heterogeneous lithologies along the Tuscan coast. In order to relate different lithologies to numerical parameters, they have been grouped into three different categories: (i) intrusive and volcanic rocks, (ii) limestone and metamorphic rocks, (iii) clay lithologies.

From a lithotecnical point of view, the Tuscany rocky coasts are made of (i) mono-lithologic rocks, massive in aspect, fractured; (ii) mono- and poly-lithologic rocks, with stratification, fractured; (iii) over-consolidated cohesive clay, heterogeneous chaotic terrains. The tectonic setting is classified as dip-slop, anti dip-slop and oblique strata. Previous instability characterises most of the investigated coasts. It is characterised by localised rockfall deposits or widespread landslides with erosive and deposition forms. Cliff exposure is mainly western and southwestern; short coastal sectors, localised near major promontories, are characterised by northern and northeastern exposure.

Morphology and previous instability parameters are subordinated to the system and are strongly subjected to the other parameters, with reduces values of "causes" and increases values of "effects". The most dominant parameters are lithology and lithotecnic features (Fig. 2).

The Interactive Intensities values (%) show that "previous instabilities" is the main parameter for determination of landslide hazard, followed by lithotecnic, morphology and discontinuity settings, whereas exposition has a secondary role.

LOCAL STUD

- The Calafuria area is characterized by a rocky coast gently dipping seaward (about 20), made of strongly cemented sandstones. The structural setting is mostly characterized by seaward dipping strata, mainly parallel to the coastal slope. The interpretation of geomechanical data gives a value of SMR 65,66, class 2, with good stability and a low attitude to rockfall. Evolutionary processes are closely related to lithological and tectonic features, highly conditioned by strata dipping. Rockfalls are mainly related to processes of slope dynamics.
- Punta del Miglio area is characterised by a sub-vertical cliff, circa 30 m high, also made of strongly cemented sandstones. The tectonic setting is characterised by weakly dip-slip strata. Geomechanical data interpretation gives a value of SMR 26,55, class 5, meaning low stability given by the detachment of metric polyhedral blocks. Lithology and geomechanical features induce mainly rockfall processes, strongly conditioned by discontinuity system settings.
- Poggio San Leonardo area is characterised by a rocky cliff, 40 m high, made of strongly cemented sandstones. The strata setting is counter-slope. Geomechanical data interpretation gives a value of SMR 37,99, class 4, meaning very low stability, with the detachment of metric polyhedral blocks. Geomorphological evolution is induced by sea-wave erosion and slope processes, strongly controlled by lithological and discontinuity features.
- Baratti Gulf is characterised by a sub-vertical cliff, 10 m high, made of sandy sediments at the base, and gravelly sands strongly cemented in the middle and upper parts. The cliff aspect is mainly massive, without stratification; main discontinuities are open fractures and tension cracks, vertical and sub-parallel to the cliff, localised in cemented sandstone deposits. The geomorphological evolution is characterised by intensive erosional processes, mainly triggered by marine erosion at the cliff base. Moreover, gravitational processes dynamics are strongly related to lithological changes between the base and the top of the cliff, inducing landslides that

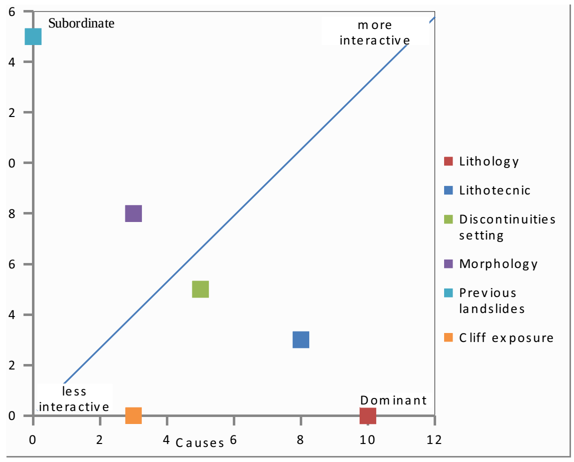

Fig. 2 – Interactions of regional parameters

involve great volumes of material.
- Punta delle Rocchette is characterised by a rocky cliff, 30 m high, made of strongly cemented quartz gravel. Strata thickness is between 0,10 and 1 m, increasing towards the cliff top; the general dip is orthogonal to the cliff. Geomechanical data show SMR 36,83, class 4, suggesting low stability, given by the detachment of metric and decametric blocks. Geomorphological evolution is strongly related to marine erosion and slope processes, driven by the intense fracturing of the rocky mass.

Results of the field survey show as lithology and SMR parameter (including uniaxial strength and discontinuity setting) are dominant on the system. Geomorphological parameters are strongly subordinated and affected by the system, resulting from morphogenetic features made of prevailing parameters.

Wave action is characterised by a high value of interactive intensity, with a role that is simultaneously prevailing (erosion of the cliff base, alteration in rock and discontinuities) and subordinate (cliff morphology, lithology, exposure, geomechanical features, landslide deposits at the cliff base). Less interactive parameters are exposure, expected rain rate and anthropic features. Cliff slope and previous instability are the most interactive parameters; they interact with all parameters in terms of cause and effect, pointing out their importance in geomorphological evolution.

TOURIST USE OF ROCK COASTS

All coastal sectors analyzed are characterized by a high flow of tourists in summer. Nevertheless there is no on-site information in these areas explaining the hazard level of the site. The few existing panels are usually incomprehensible for foreigners. In fact the language used is usually Italian. Moreover, symbols used are not internationally recognised (Fig. 3). In these context we propose the use of ISO 20712 Water safety signs and beach safety flags symbols that can be internationally recognised and that is easy to understand showing the main hazards of the coastal area, as well as the characteristics and hazards of the access paths (Fig.4). Paths from the upper part of a cliff to the sea are usually very dangerous, but tourists are often unaware and unequipped to cross them, differently from what happens in mountain trails. It seems clear that the mere placing of bans is not an adequate form of managing coastal areas. A good management of the territory must inform tourists and local communities the reasons for the prohibition. This allows greater awareness of the danger inherent to the territory, leading to more appropriate use of coastal areas.

Cliffs are often a friendly interface for reading the geological history of an area, and represent an unique opportunity for the promotion of geological heritage.

Among the studied areas an example of panel showing the turbites formation, fossil contents and ancient quarries the (Calafuria cliff) is presented to increase the awareness of the geological value and developing tourism. (Fig. 5)

C C

The Instability Index allows the classification of coastal sectors into three different hazard levels, at regional and local scales.:

- P1, low rockfall propensity, characterising coasts with moderate slope angle, strong lithotypes lithologies, weakly

Fig.3 – The sentence Pericolo - Area in frana (Danger –area exposed to hydrologic risk and landslides) should warn beach users at Baratti on the risk of falling blocks. No symbols or foreign languages text are used in this beach where visitors come from various countries.

fractured;
- P2, high rockfall propensity, typical of cliffed coasts, with high slope angle, fractured rocks and widespread previous landslides;
- P3, very high rockfall propensity, characterising cliffed coasts, with sub-vertical slope angle, rocky lythotypes strongly fractured and stratified, or sandy and clay deposits, with widespread previous landslides.
- The index analysis for the local studies shows that the Calafuria coast is characteriszed by the lowest value of

Fig.4 – A proposed panel for Calafuria coast where ISO 20712 Water safety signs and beach safety flags symbols have been used.

interactive intensity and parameter features, with moderate propensity to rockfall and hazard rate (IS_l 2134).

Punta del Miglio and Poggio San Leonardo areas are characteriszed by the same values of interactive intensity. Nevertheless, they are characterised by a different propensity to rockfall, with very high hazard rate in Punta del Miglio (IS_l 4474) and high in Poggio San Leonardo (IS_l 3744). This difference is given by parameter features, mostly inducing rockfall in Punta del Miglio area.

Baratti area is characteriszed by very high values of interactive intensity and parameter features strongly inducing landslides processes, with the highest hazard rate (IS_l 4785).

Punta Rocchette area is characteriszed by values of interactive intensity and parameter features strongly inducing instability processes, with . The area is characterised by high rockfall hazard (IS_l 4139).

In order to improve awareness on hazard and geological heritage, a panel explain site hazards using an internationally recognizable language (symbols).and a panel revealing the geological heritage of the area have been realized.

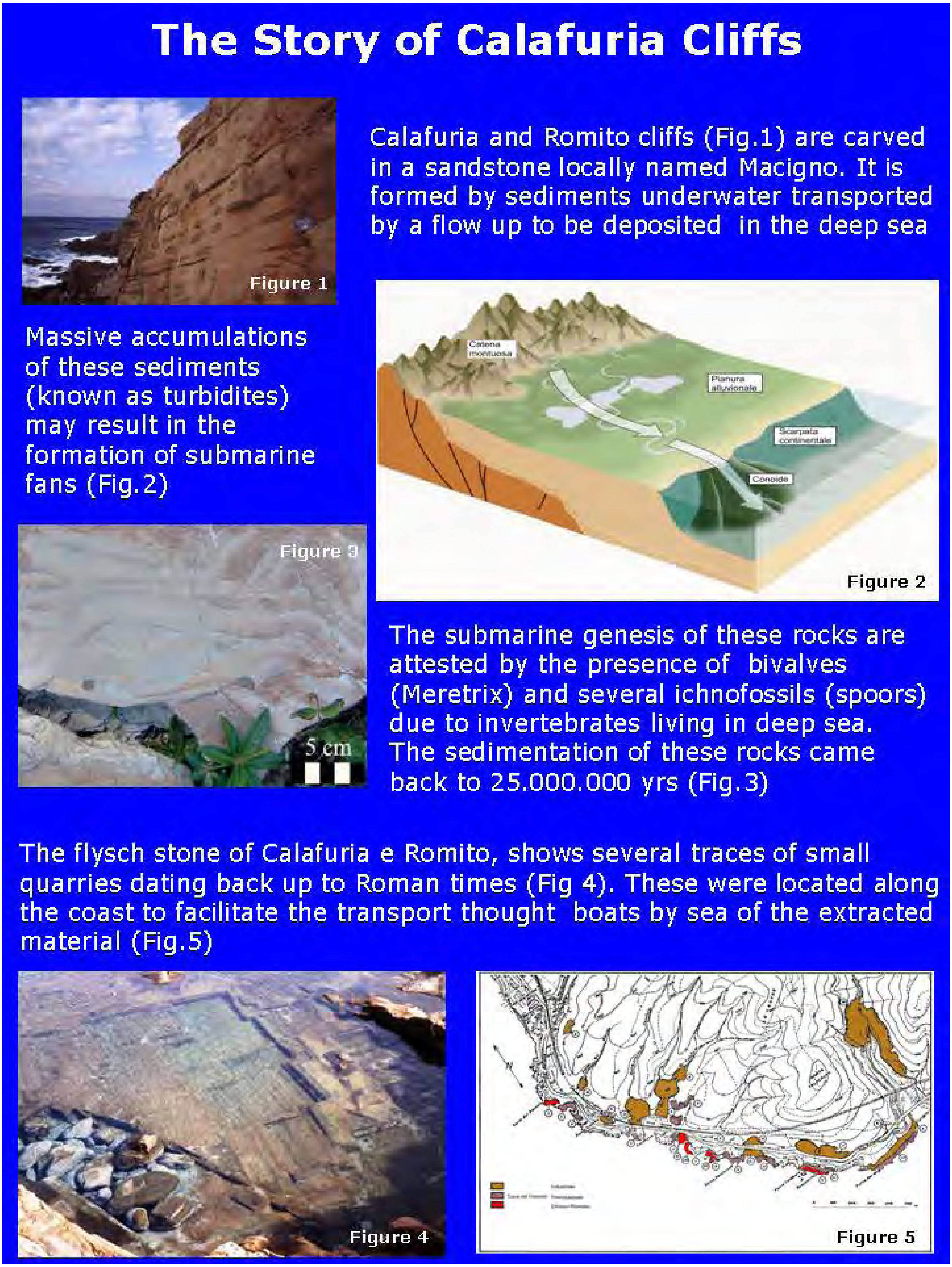

Fig.5 – Example of panel showing the history of Calafuria Cliff.

ACKNOWLEDGMENTS

Research carried out within the Program P.E.R.L.A. (ProgEtto peR L Accessibiltà, la Fruibilità e la Sicurezza della fascia costiera delle Regioni Transfrontaliere) Programma Operativo "Italia – Francia Marittimo 2007-2013" and PRIN 2008 - Le pocket beach delle coste italiane: dinamica, bilancio sedimentario e modelli evolutivi .

The authors would like to thank Alessandro Ciampalini for the images used in the panel of Calafuria.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

he main geological and geomorphological values o the Pollino ational Park: Protection and Enhancement

Bloise L. ([a])

([a]) The Pollino National Park, of Rotonda (P), Complesso Monumentale S.M. della Consolazione 85048,. E-mail: luigi.bloise@parcopollino.it

ABSTRACT

The area of the Pollino is characterized by the superposition of the Pollino tectonics, land of the allochthonous complex Liguride resting on carbonate successions of Mesozoic-Tertiary age. At the geological complexity has been superimposed a geomorphological modeling of the entire area where the morphotypes are related to different types of erosion: fluvial erosion, glacial, karst and criocarsica, and related forms of accumulation.

In short, the territory of the Pollino National Park appears to be characterized by a particularly weak due on the one hand to its complex structure and other characteristics of highly differentiated lithologies that compose it.

Accentuated fragility hydrogeology of the land correspond numerous testimonies of labor geological and morphodynamic that led to the configuration of geological and geomorphological characteristics peculiar and extraordinary beauty, representing areas of interest or particular emergencies, that require different degrees of protection.

The Pollino National Park protects one of the most extraordinary natural Italian heritage; characterized by a great diversity of landscapes and the presence of interesting historical and cultural reality.In the management of the protected area must be taken into full account also the initiatives of preservation and enhancement of geodiversity, foundation integrity of ecosystems and biodiversity of the area (Piacente, Poli, 2003). The environment of the Pollino has in fact as the main distinguishing feature just the geo-diversity, the variety of geological phenomena and processes occurring in this area, is one of the determining factors in the allocation of a high nature value to the landscape of the border Calabria and Lucania ..

KE WORDS: the Pollino national park, protection and enhancement of geological sites.

C

The Pollino National Park has an area of 192.565 ha, it spreads between two regions of Calabria and Basilicata and three provinces (Cosenza Potenza Matera) (fig.0). The Park includes not only the Pollino Massif, but the Mont “Alpi” and the Mont “Orsomarso”.

The highest peak of the massif of Pollino is Serra Dolce dorme with 2267 m. height s.l.m. and it represents the highest point of the Southern Apennines and it is the only Italian massive from which are visible three seas: the Ionian, the Tyrrhenian and the Adriatic.

The Park s landscape varies considerably: in the north slops gently towards rivers Sinni Mercure-Lao, the south looks rough and bumpy.

The territory is a vast space but with strong physical and human presence, it has a succession of mountains, plateaus, timpe, rocks of magmatic origin of dolomite, glacial cirques of moraine accumulations, sinkholes, boulders, caves, gorges.

Some rivers are surrounded by lush forest vegetation, such as the Peschiera, others are imprisoned inside deep canyons such as the Raganello, Argentino and Lao, if the limestone is the dominant rock in the area of National Park there are also formation like the “Timpa della Murgia” with its pillow lava .

Fig 0: Geographic localization

A GE G CA GE P G CA C A AC E C

The border of Calabria and Lucania is of particular interest in the geology of southern Italy, representing the complex band connection between the structural domains of the calcareous and the covers crystalline-sedimentary-metamorphic Calabrian Arc-Peloritano.

In this context, the Pollino chain is configured as one of the major geological structures, constituting, in its classical extensive monoclonal, with average direction WNW-ESE and NE dipping general, Mesozoic-Tertiary carbonate platform. The geological and structural characteristics of the units Calabro-Lucano Apennines constitute one of the elements that allow us to reconstruct the main stages of evolution of this orogen. In particular, the unit ofiolitifere provide information on the processes of accretion that developed between the Upper Cretaceous-Eocene and Oligocene, following the closure of the ocean Tethys.

Today the southern Apennines is recognized, consists essentially of the tectonic superposition of two structural elements, separated by an overthrust of regional importance.

This interpretation shows the carbonate units as belonging to the Pollino, a limestone substrate raised, in the form of wedges, by a tectonics Pleistocene. Currently are recognized different strata, belonging to different depositional environments and whose emplacement corresponds to the various tectonic phases or stages of formation of the Apennines of Calabria and Lucania:

- **nit Carbonate**, constituent parts of the Apulian platform according to more recent interpretations. These units occupy the western sectors of the Park area (Massif of Pollino and Orsomarso Mountains) (fig.1), these units are the basis of regional stratigraphic succession;
- **nit l sch icilide**, essentially represented, in the area studied by the Numidian Flysch and Variegated clays;
- **nit illing Plio Pleistocene**, present mainly in the north (Sinni valley) and the basin of the Mercure, in this unit also includes the deposits of recent and current modeling: floods and debris, the latter well represented along the southern edge Pollino.
- **etamorphic unit**, consist of schists, phyllites and probably belonging to the garnet-gneiss complex Calabride.

The area of the Pollino is then essentially characterized by the overlapping tectonics, land of the allochthonous complex Liguride resting on carbonate successions of Mesozoic-Tertiary age (fig.2).

At the geological complexity has been superimposed a geomorphological modeling of the entire area where the morphotypes are related to different types of erosion: fluvial erosion, glacial, karst and criocarsica, and related forms of accumulation.

In short, the territory of the Pollino National Park appears to be characterized by a particularly weak due on the one hand to its complex structure and other characteristics of highly differentiated lithologies that compose it.

Accentuated fragility hydrogeological of the land correspond numerous testimonies of labor geological and morphodynamic that led to the configuration of geological and geomorphological characteristics peculiar and extraordinary beauty, representing areas of interest or particular emergencies, require different degrees of protection.

In general, the geological and geomorphological characters, representing areas of interest or particular emergencies, require different degrees of protection are:

- **pe o sur ace** (outcrop areas of particular formations such as rocks carbonate; areas of geomorphological modeling (fig.3): such as those due to the action or glacial river; seat surfaces of erosion in particular forms: reasons, such as gullies or subcalanchivo (fig.4); areas of outcrop formations witnesses to particular states of the environment in which the rocks were generated: the pillow lavas (fig.5) or the ophiolites; witnesses areas of the forms subterranean related to the water cycle: the doline (fig.6), areas home to gravitational movements)
- **inear t pe**, mostly coincident with ridges or particular traits of fluvial (fig.7-8-9)
- **punctual t pe**, such as walls and slopes that allow you to read easily the geological history of the area (fig.7-8).

P EC A E A CE E GE E

The safeguarding requirements and environmental protection have become increasingly insightful and overwhelming enough to also affect the powers of town and country planning regions and public organizations. This was also confirmed by some judgments of the Constitutional Court occurred after the Constitutional Act no. 3 of the 2001 reform of Title V of Part Two of the Constitution.

A passage legislative instrument in this regard has been had with the new rules laid down by D.lgs. . 42 /.2004 it is expressed in the implementation of the new constitutional powers of the federal, state and local set out in the Articles 117 and 118 of the Constitution, as amended in lc18.10.2001 n. 3.

It is consequential that in protected, areas the safeguarding requirements and environmental protection, are even more priority than in any other part of the national territory More specifically, A National Park meets the two founding missions closely related:

- on the one hand the protection, conservation, knowledge, values, natural, historical, cultural, landscape of the area;
- the identification of other forms of social and economic development (environmentally friendly), of settled communities in the territories of the park and adjacent areas of the territory protected.

The two missions foundational environmental conservation and landscape and local economic and social development programs should help to identify the correct project management of complex territorial and social development.

The Pollino National Park protects one of the most extraordinary natural heritage Italian; characterized by a great diversity of landscapes and the presence of interesting cultural-historical reality, it is still relatively little known to the tourist flow.

In the management of the protected area must be taken into full account also the initiatives of preservation and enhancement of geodiversity, foundation integrity of ecosystems and biodiversity of the area (Piacente, Poli, 2003). The environment of the Pollino has in fact as the main distinguishing feature just the geo-diversity, the variety of geological phenomena and processes occurring in this area, is one of the determining factors in the allocation of a high nature value to the landscape of the border Calabria and Lucania .

These geomorphological emergencies**:**

- will be properly recorded and promoted through specific actions: survey of the most important features landscaped environment of the park, activation of the procedure for the nomination of the whole territory of the PNP Geopark etc.;
- are currently protected through the application of specific relevant legislation (Law 394/91, safeguards contained in the DPR 11.15.93, Legislative Decree 42/04, D.lgs.152/06, etc.). and through the medium of Planning: Plan for the Park (pending approval).

To integrate all these levels of environmental protection should also be considered as required by European Union directives on the SIC and PS set up under the Directive 92/43CEE and Directive 79/409/EEC as the entire territory of the Park Pollino is entirely included inside two large PS (Pollino and Orsomarso-Pollino-M. Alpi) and includes numerous SIC.These Directives have been transposed by the state and regional regulations regulating all activities and / or work compatible in the Natura 2000 network (SIC and PS), basically going to specify that all plans or projects likely to have significant effect on sites and that they are not directly related and necessary to their management must be subject to the environmental impact assessment procedure. It is the tool to ensure the achievement of a satisfactory balance between conservation of habitats, species and land use.

Fig. 1 - Mountain Pollino

Fig. 2 – Mountain Alpi. From the geological point of view is a key area for understanding southern apennines. The massif is formed by lithological units carbonate platform, while the mountain is surrounded by land allochthonous series liguride. At an elevation of about 980 m. Above sea level, on a large stone slab of a limestone marl gray, was found the fossil of a fish. It measures 23.5 cm. From the rostrum to the caudal fins, 95 cm. From the ventral to dorsal fin. The rostrum is 30 cm. The fossil dates back to 30 million years ago and is a valuable record of miocene marine environment particularly

Fig. 3 "Due dita" di S. Sosti

Fig. 4 - Sub forms calanchiformi in gravels

Fig. 5 - Pillow lava of Mountain Cerviero

Fig 6 - Doline of Masistro

Fig. 7 - "Timpa" del Demanio

Fig. 8 - Creek Raganello

Fig.9 - Gorges of Garavina

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Valle del Cro io Aspiring Geopark (Calabria Italy)

Colosimo F. ([a]), Scarciglia F. ([b]) & Infelise E. ([c])

([a]) G.A.L. Valle del Crocchio, Cropani (C), Italy info@vallecrocchio.it
([b]) Department of Earth Sciences , Calabria University, Arcavacata di Rende, Rende, Italy.
([c]) Geologist-Consultant G.A.L. Valle del Crocchio, Taverna (C)

ABSTRACT

The area candidated to the European Net and UNESCO Global of the Geoparks is called “Valle Crocchio Geopark”. It includes the whole territory of the Presila Catanzarese, where it falls a part of the protected area of Sila National Park, the whole area of Valle del Crocchio L.A.G., and the Municipalities of Catanzaro, Gimigliano, Tiriolo and Marcellinara. “Valle del Crocchio Geopark” concerns an area made up of 23 Municipalities, included in the Medium Ionian area of the Province of Catanzaro up to the territory of Sila National Park, bordering the provinces of Crotone as for the coastal side and of Cosenza as for the internal one.

KE WORDS: Valle del Crocchio Geopark, Calabria, Sila

INTRODUCTION

The territory of “Valle del Crocchio Geopark” embraces a huge naturalistic patrimony which, beginning from the coast, reaches Sila’s upland.

The territory’s extension so shaped includes a series of altitude gradients allowing to move from a sea landscape, in proximity of a coastal tract, to a mountain landscape through hills, valleys, furrowed by water streams and intersected by very suggestive rocky ridges.

Different altitudes and, as a consequence, different territorial climate features, have consented the settlement of various vegetative associations providing valid habitats to a fairly good number of species of undiscussed naturalistic value.

The area has an extention of about 905 kmq and presents a strong hilly mountaneous connotation, constituted by the Massif of Sila Piccola, with the highest height by Mount Gariglione (1.765 a.s.l.) and the hilly piedmont area, where they’re concentrated the majority of the inhabited places constituting the Geopark’s area.

The remaining part of the territory is made up of the coastal level areas (from Botricello to Marina of Catanzaro) and the fluvial ones (Marcellinara – Tiriolo) where they’re concentrated the most important communication lines which cross the area of interest and the tourist and commercial ones.

The area is passed through by 4 important water streams with a sub-parallel course flowing into the Ionian Sea. Starting from the West we find Corace, Alli, Simeri and Crocchio Rivers. From a geological point of view, it is necessary to subdivide the area of the future Valle del Crocchio Geopark into two lithological complexes: the igneous-metamorphic complex and the sedimentary one.

They belong to the first one those lithostratigraphic units corresponding to Calabride and Liguride Complex: Unit of Sila, Unit of Castagna, Unit of Bagni, Unit of Gimigliano. They belong to the second one the sedimentary formations which crop out along the edges of the Sila’s Massif (onic Coast and Stretta of Catanzaro).

GEOLOGICAL SETTING

The territory of Valle del Crocchio L.A.G. is included in the northern sector of the Calabrian Peloritan Arc, along the southern edge of the Sila Massif. The following will describe the various geological units that characterize the whole, by including a few that fall outside, but are of great importance for the geological history of Calabria.

The northern sector of the Calabrian - Peloritan Arc - is characterized by the presence of two mountain ranges: the Sila and the Coast Range. These are separated by the valley of the crater that occupies a tectonic depression formed from the late Pleistocene and limited by normal faults with a NS trend.

Sila and the Coast Mountains consist of a building in layers formed by Mesozoic ophiolitic sequences, crystalline basement rocks.

The structure at slopes of northern Calabria was divided into three main elements tettonostratigrafic in which different units have been distinguished tectonic-metamorphic

The three elements tectonic-stratigraphic are, from top to bottom:

1. *Complesso Calabride*
2. *Complesso i uride*
3. *Complesso delle Unit Appenniniche*.

LIST OF GEOLOGICAL SITES

The geological sites in the area of the Valle del Crocchio L.A.G. are located, in greater numbers, in units of the complex crystal calabride formed, as previously reported from igneous-metamorphic lithologies while the remainder falls within sedimentary formations that emerge, especially, on the eastern edge of the Sila. The geological sites mentioned in the territory are:

1. VALLI CUPE
2. SORGENTE MINERARIA - SELLIA
3. ALTOPIANO SILANO - Valle del Tacina
4. INTRUSIONI SULFUREE NEGLI SCISTI BIANCHI
5. FIUMI (ALLI - SIMERI - CROCCHIO)
6. MINIERE DI FELDSPATO (Sorbo San Basile)
7. AREA DI GIMIGLIANO - TIRIOLO
8. MINIERA DI BARITE - Catanzaro
9. AREA FOSSILIFERA DI BELCASTRO E MARCEDUSA
10. AREA DI MARCELLINARA (CALANCHI E GROTTE)

REASONS OF THE TERRITOR 'S APPL ING AS EUROPEAN AND UNESCO GLOBAL GEOPARK

The territory of the future "Valle del Crocchio Geopark" represents an area of extraordinary interest and geologic-environmental-historic-archaelogical-cultural value, inside which a lot of the geological phenomenologies find a spectacular expression.

The numerous sites with a high geological value, considered in its wider meaning, that is together with its scientific value, the didactic exemplariness and the historic importance, represent the most meaningful emergencies of a patrimony of great worth the Geopark intends to value and safeguard through the development of suitable and sustainable forms of geotourism.

The initiatives of protection and valorization of the geological and geomorphological patrimony of the future "Valle del Crocchio Geopark" become part of a wider and complex strategy of safeguard of the natural - historical-cultural – archaelogical patrimony of the territory, to be reached through measures of planning and management aimed at achieving an active keeping of the environmental resources.

An active keeping which is achieved in concomitance with an appropriate and compatible socio-economical development. With the approval of the Plan of Local Development "Rural Tourism of uality" the L.A.G. has shown the intention of being willing to promote the valorization of the territory and the goods present in it also in the field of the geology and the geomorphology, underlining the importance of the census of geosites and geomorphosites, pointed out as "natural monuments", and, above all, of the spreading of such studies.

Under this profile it is important to underline the strong sharing by Valle del Crocchio L.A.G. of the purposes of the European Net of the Geoparks, like:

- the cooperation to safeguard the geological patrimony;
- the incentive of the sustainable development at a local level through the valorization of a general image linked to the geological patrimony;
- the promotion of initiatives of geotourism to increase the environmental education, the development and the spreading of the scientific research in the various disciplines of the Sciences of the Earth.

The action of applying to the European and Worldwide UNESCO Net of the Geoparks carried out by Valle del Crocchio L.A.G. has been embraced with goodwill by the local realities, as shown by the official letters of support undersigned by the local and Provincial public authorities and by the different boards working in the field of the scientific research, tourism and trekking.

Valle del Crocchio L.A.G. has already been carrying out actions of valorization of the natural patrimony, often dealing with geological-geomorphological items. The possible aknowledgement of the area as European and UNESCO Global Geopark offers an important opportunity and incentive to give value and spread the knowledges in the specific field of the geology, conceiving also new projects of environmental education so to stimulate in the teenagers the interest in a so complex as fascinating subject.

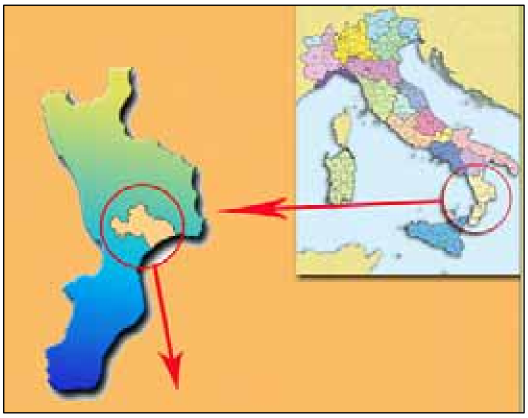

Fig 1- Territorial frame work of the "Valle del Crocchio Geopark"

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

Orographic barrier in the climate change prespective at regional and sub- regional scale: Campania region and Cilento Geopark

Cuomo A. ([a]), Guida D. ([a]), Palmieri V. ([b]) & Rossi F. ([a])

([a]) Department of Civil Engineer , University of Salerno, Via Ponte Don Melillo, Fisciano, Italy. E-mail: acuomo@unisa.it
([b]) ARCADIS, Soil Conservation Campania Region Agency, Via Marchese Campodisola, 21 - 80133 Naples

ABSTRACT

The aim of this paper is to identify, delimitate and classify the orographic relief in the Campania – Lucanian Apennine (Southern Italy) to investigate the effects of large-scale orographic and small-scale windward-leeward phenomena on distribution, frequency and duration of rainfall.. The approach used is based on a GIS procedure applied on Digital Elevation Model (DEM) 20×20 meters cell size and derived from Regional Technical Map (CTR) of Campania region (1:5000) preliminary smoothed from data spikes and pits. The procedure consists on: a) Identifying the three basic landforms of the relief (summit, hillslope and plain and by simplifying the established rules of the differential geometry on topographic surface; b) Delimitating the mountain relief by modifying the method proposed by O. Z. Chaudhry and W. A. Mackaness. It is based on three concepts: prominence , morphological variability and parent-child relationship. Graphical results have shown a good spatial correspondence between the digital definition of mountains and their morpho-tectonic structure derived from tectonic geomorphological studies; c) Classifying, by using a set rules of spatial statistics (Cluster analysis) on geomorphometric parameters (elevation, curvature, slope, aspect, relative relief and form factor).

Finally, we have recognized three prototypal orographic barriers shapes: cone, tableland and ridge, which are fundamental to improve the models of orographic rainfall in the southern Apennines and other circum mediterranean chains

KEY WORDS: orography, geomorphology, multiscale- hierarchical approach, orographic signature (style: key words).

INTRODUCTION

In the recent years a growing attention arises about the link between geomorphology, atmospheric sciences and other disciplines, as hydrology and ecology (Galewsky et al. 2008).

The workshop held in Boulder (Col. USA) in the October 2007, has focused especially on the need of interaction between the orographic precipitations and regional and global dynamics. Geomorphologists, atmosphere scientists and hydrologists give a great importance in the integrated studies concerning land/atmosphere interactions as wind dynamics, precipitation distributions and evaporation (Pielke, 2001).

The presence of mountainous relief on the land plays a definitive role for studying landforms processes and landscape evolution (Bush et al., 2004).

Orogenesis affects deeply the long-term weather and climate of a landscape. Landscape topography and its evolution depend by the complex interactions between hillslope and channel processes, controlled by rainfall- runoff trasformation (Horton,1945; Montgomery and Dietrich, 1989).

The topographic relief is the best first-order meso-scale rainfall predictor and the relief changing along an orocline can alter rainfall distribution (Bookhagen and Strecker 2008).

Over short-term, orographic barriers influence the annual, monthly and daily distribution, intensity and frequency of precipitations (Roe 2005). In fact, on a smaller scale, a mountain basins with prevailing wind enhance precipitation along the windward side of mountains and much reduced on the lee side (Jiang 2003).

The orography induces effects on atmospheric flows and produces precipitating clouds by orographic lifting, triggering of convection, indirect effects of flow splitting or blocking, and induced waves (Figure 5.1). The common mechanism of orographic precipitation is the “stable upslope ascent” (figure 5.1 a). This mechanism occurs when forced mechanical lifting of air impinging on the windward flanks leads to cooling of the air column, resulting in condensation and precipitation. Descent in the lee side leads to warming and drying and precipitation is suppressed. If the atmospheric conditions are stable the air mass flow may get diverted around the mountain or it may stagnate (fig. 5.1 b). The blocked air can cause ascent further windward of the range and can also enhance the lifting and hence the precipitation that does occur.

Basics aspect of orographic precipitation have been recently reviewed by Roe (2005) and Smith (2006), highlighting influences of aspect and shape of the orographic barriers in order to predict flash floods, landslides, avalanches (Roe 2005) all triggered by precipitation intensity in mountainous regions (e. g., Caracena et al. 1979, Caine 1980, Conway and Raymond 1993).

In order to give a contribution to the research study on the climate change at a regional and local scale, the present paper deals with the identification and classification of the orographic barrier of the Campania Region. In particular, following the recent research, focused on the influences of the mountain shape on the precipitation dynamics, we have performed a

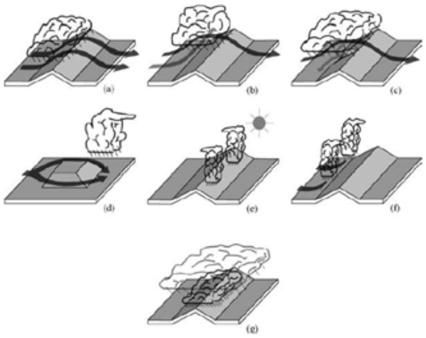

Fig. 1 – Mechanisms of orographic precipitation: (a) Seeder-feeder mechanism; (b) upslope condensation; (c) upslope triggering of convection; (d) upstream triggering of convection; (e) thermal triggering of convection; (f) leeside triggering of convection; (g) leeside enhancement of convection. Slanted lines below cloud base indicate precipitation. (from Roe 2005).

analyses on some mountains of the Cilento, Vallo Diano and Alburni Geopark classified as orographic barriers.

METHOD AND DIGITAL SOURCE DATA

The methodology adopted to define the orographic barrier follows two procedure, summarized in the fig. 2.

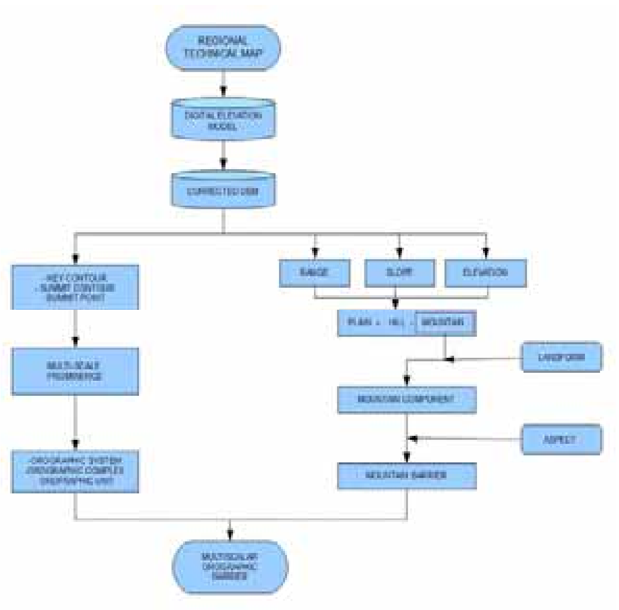

Fig. 2 – Flow chart on the multiscale identification of the orographic barriers

The first one provides (on the right) the definition of orographic barriers on geomorphometric base; the second one (on the left) allows to define the hierarchy orography based on multiscale prominence approach. The original procedure, here proposed, was implemented on a DEM of Campania region, derived from a Technical Regional map.

The DEM was, firstly, corrected by removing spikes and pits using a traditional pit removal tool, implemented in a free Gis software.

MULTISCALE OROGRAPHIC PROCEDURE

The effects of interaction between atmospheric phenomena and land orography are connected to the study phenomena scale (macroscale, mesoscale or microscale). For take into account all a possible scale effects of the atmospheric phenomena, we have used a multiscal – hierarchical approach identify the orographic setting (Dramis et al., 2011).

The advantage of adopted multiscale approach, is a nested description of the orographic region which acts as framework for the model generalization and spatial query. The orographic procedure, is based on the "prominence" concept that deals with the multiscale approach. The prominence is usefully adopted to measuring the independent stature of a summit or simply the amount by which a hill rises above the local area.

Between the different method for calculating prominence on a contour map we adopted the elevation difference between "summit point" and the lowest closed contour that encircles that summit (key contour) (Chaudhry & Mackaness, 2008).

$$P = H_{SUMMIT\ POINT} - H_{SUMMIT\ CONTOUR}$$

In order to identify the summit point encircled by the key contour, we first delimitate multiscale-hierarchical key contours (fig.3).

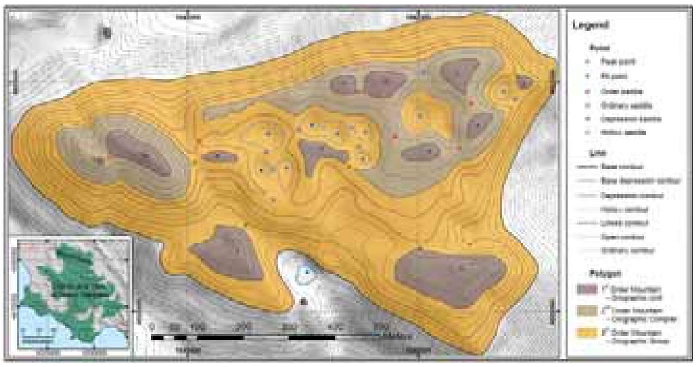

Fig. 3 – Orographic entity identification in a typical karst landscape (Alburni Mts – Cilento Geopark, Southern Italy) (Cuomo et al 2011).

For each scale, we found saddles point of highest hierarchy level (level zero), that divide two key contour of the same level. All closed contour of first level are named "group key contour". For each group key contour, we found, within it, the saddle points of the higher level (2nd level). So, we identified the "complex key contour", containing the highest level key contour named "unit key contour" (3rd level).

After that, within each key contour were identified the summit points associated to the cell, from the DTM ,with the maximum elevation. Using multiscale key contours and the respective summit points we calculated prominence (fig. 4 e 5).

UNIT NAME	COD_UNIT	ELEVATION POINT (m)	PROMINENCE (m)
SOPRANO	SPR	1210	310
CHIANIELLO	CNL	1319	419

Fig. 5 –Chianiello orographic unit in the Soprano- Chianiello compex

COMPLEX_NAME	COD_COMPLEX	MAX ELEVATION POINT (m)	PROMINENCE (m)
SOPRANO_CHIANIELLO	SPR_CNL	1319	644
STELLA	STL	1131	506
BULGHERIA	BLG	1225	575
ALBURNI	ALB	1742	792
CERVATI	CRV	1743	693
GELBISON	GLB	1703	653

Fig. 4 – The Orographic Complexes of the Cilento Orographic Groups

GEOMORPHOMETRIC PROCEDURE

The definition of mountain relief on geomorphometric approach is based on a combination of a set of maps which shown the spatial distribution of the primary topographic attributes .

The first step leat to identification of the three essential element (plain, hill, mountain) for defining the extension of a mountain . The map of mountain extension is carried out by combining the range, slope and elevation maps. Their value are classified in three classes to distinguish between the three essential elements. Necessary condition to defining mountain extension (Landscape map) was the contemporary of following conditions:

Slope > 50 %
Range > 200 m/m
Elevation > 600 m

Areas with plain relief above 600 m in elevation correspond to the tableland or karst uplands.
From the Landscapes map, is selected the Mountain-scape only. Then, each Mountain- scape was characterized by three orographic components:
1.The summit or crest as the highest area of the mountain;
2.The hillslope as the sloped flank of the mountain;
3.The flood-plain or Plain dividing two or more mountain areas.
In order to identify the basic components of the mountain, named lanforms, was used the original tool of Fels and Zobel (1995), Weiss (2001) and Tagil and Jenness (2008). So, combining the Landscape with the Landform map of Campania Region we performed the Mountain Landforms Component map of Campania Region.In order to define mountain barriers, we have considered the prevalent direction of wet air mass which could be provide heavy rainfall. For mediterranean climate, typically of Campania region, the south-west is the prevalent wind direction. So, with rispect to the south-west direction of the aspect map, we defined the wind-leeward side

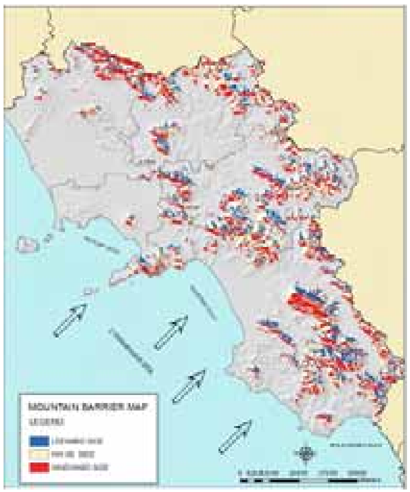

Fig. 6 – The mountain barrier map of the Campania region

of mountain by combining the mountain component map and the aspect map.

OROGRAPHIC BARRIER CHARACTERIZATION

Considering the atmospheric dynamics, it seems to be important the classification of the mountains against their shape. In order to do this was calculate the Fractal dimension. Generally, object can lie either in Euclidean space, with an integer number of dimensions (0 for points, 1 for lines, 2 for surface, 3 for volumes) or in a fractal dimension, introducing a new way of characterizing the occupancy of the space by the objects (between 0 and 1 for clusters points, 1 and 2 for curves, 2 and 3 for surfaces and 3 and 4 for volumes) (Fortin and Dale, 2005). In order to give an idea on the characterization of the orographic barrier by using the Fractal Dimension (D) was used the prominence maps, performed with a cell size of 5x5 m, of the Stella and Chianiello Mounts, defined as orographic units in this study (fig. 5). Using continuous data the literature suggests to computed D as the slope of a log variogram assuming that the variogram is isotropic, linear and without a sill (Fortin and Dale, 2005).

$$2\gamma(h) = h^{4-2D}$$

Where the slope is (4-2D).
Therefore, firstly the geostatistic analysis was made on the prominence grid map of the two units considering two directions: the south-west and the north-west.

Units	D (SW)	D (NW)
Stella	2.8	2.9
Chianiello	2.5	2

Tab.1- The fractal dimension D of Chianiello and Stella units

Then, for each direction was build up the log variogram and the slope of that computed. In the table 1 are reported the fractal dimension calculated for the two units in the SW and NW directions.

The Stella mountain has the same D value in the two directions, so its features is similar to the circular one, whilst for the Chianiello mountain were obtained D=2 in the NW direction, similar to a linear shape, and D = 2.5 in the SW direction that is the central value between the elongate and circular shape.

The results are more closed on the realty. In fact the Chianiello Mount has an elongate shape and in the cluster analysis was classified as a Ridge, whilst the Stella mountain is more compacted and to this aim were proposed the following two methods of characterizations:

CONCLUSIONS

In order to give a contribution to the researchers in the climate change study and on the interaction between the atmospheric circulation and the shape of the mountains, a quantitative characterization of the orographic barrier (orographic signature) is proposed. In particular the orographic signature is operated for the Southern part of the Campania Region, the Cilento, Vallo di Diano and Alburni Geopark. This area is very important for the high presence of flora and fauna and for the spectacular landscapes due to a perfect interaction between all the environmentals dynamics. In order to preserve all the environmental components such as animals and vegetables species or the landscapes it is important to study how the climate change could influence this landforms and vice versa.

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he irst geotrail in the oukkala Abda aspiring geopark orocco : a tool or local sustainable socio economic development

Errami E., Ennih N., Choukri A., Enniouar A. & Lagnaoui A.

Department of Earth Sciences, Choua b Doukkali University of El adida, BP. 20, 24000,El adida, Morocco. E.mail; errami.e@ucd.ac.ma

ABSTRACT

The first geotouristic trail in the Doukkala-Abda aspiring geopark was launched during the celebration of the first edition of the Day of Earth Sciences in Africa and Middle East. This geotrail aims to promote Doukkala-Abda hinterland as a geotouristic destination instead of predominated-seaside tourism in the region and also to shed the light on the need to develop its touristic and socio-economic infrastructures.

KE WORDS: Aspiring geopark, Doukkala-Abda, geotourism, geotrail.

C

Doukkala-Abda aspiring geopark belongs to the Moroccan Coastal Block of the western Meseta (Fig. 1). Geologically, it is characterized by subtabular Mesozoic and Cenozoic formations overlying folded Paleozoic formations. Geomorphologically, the region consists of two main zones: the coastal zone and the hinterland. The region consists of four provinces, an area of 13,285 km and 2 millions of inhabitants 64% of which are living in the rural areas. Furthermore, the region has a privileged geostrategic position with an Atlantic coast of almost 350 km making it a popular destination for its seaside tourism. The ongoing geoheritage inventory within our research group shows that the region is composed of various natural systems that are individualized by their geomorphology and geology (lagoons, rivers, caves, escarpments, volcanic rocks etc.). In this paper, we describe the first Geotrail in Doukkala-Abda organized by the African Geoparks Network and the African Association of Women in Geosciences during the celebration of the first edition of the Day of Earth Sciences in Africa and Middle East (DESAME) proclaimed by both organizations on the 20th March of each year. The day aims to promote Earth Sciences for Society and to increase the awareness about the role that earth scientists could play to help to build a peaceful, healthier and wealthier continent.

E C P E GE A

This one-day geotrail is 182 km long. It starts from the Portuguese City of Mazagan (El adida) settled in 1502 by the Portuguese explorers in West Africa, after it had been a Portuguese protectorate since 1486. The city is situated on the Atlantic coast and has been designated a world heritage site in 2004.

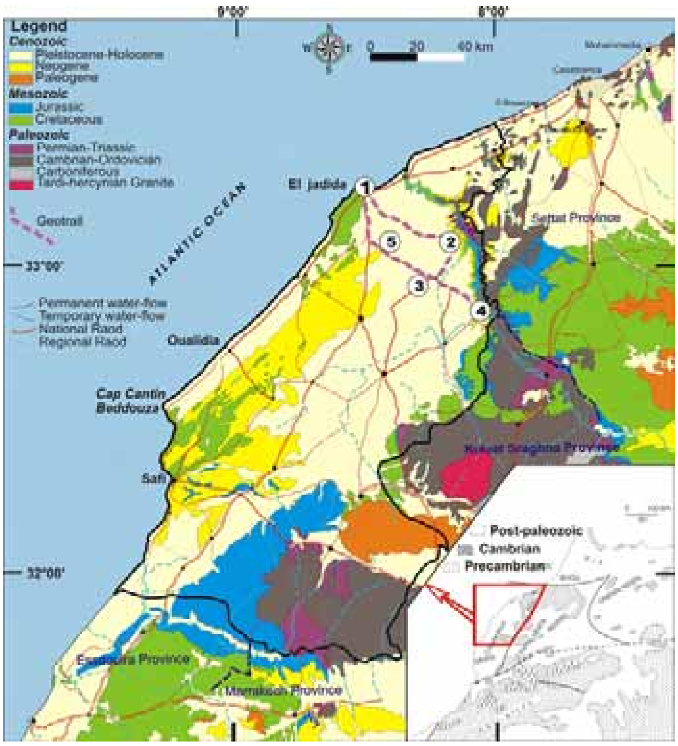

Fig. 1 - Simplified geological map of Doukkala-Abda aspiring geopark with the proposed geotrail (pink dashed line; (1) Mazagan city; (2) Sidi Sa d M achou basin; (3) Falconry of Lakouassem; (4) Kasbah Boulaouane geosite; and (5) Tazotas.

The second stop is Sidi Sa d M achou Basin whose geological outcrops quality and geomorphological landscapes along Oum Er-Rbia River, the longest river in Morocco, make it a popular destination near scientists and students of the University of the Region (Fig. 2). The basin covers an area of ca 24 km^2 and consists of 10 geosites of educational and scientific importance and one-day walking geotrail. Geologically, the basin consists of three main formations: middle Cambrian dominated shales, unconformably covered by continental Triassic formations and marine Plio- uaternary formations (El Attari, 2001; Hminna, 2005) providing two didactic angular discordances. The volcanic complex of Sidi Sa d M achou consists of two main events, the dolerites lavas flows synchronous with the sedimentation of the Middle Cambrian Paradoxides schists, and the Late Triassic event marked by several intercalated flows of tholeiitic basalts, linked to the rifting of the Central Atlantic. The Triassic formations correspond to sedimentation in a playa-like, fluvio-lacustrine system under semi-arid conditions where fossils have been found such as plant impressions, rhizoliths, fish scales, and invertebrate and vertebrate traces (Hminna et al., 2012). The tetrapod footprints recorded in this area are assigned to *Brachychirotherium parvum*, which is considered as the first record of Triassic tetrapod footprints in Morocco outside of the High Atlas and the first record of this species on the African continent (Hminna et al., 2012).

It is important to note that there is no touristic infrastructure and almost no socio-economic activities generating revenues for local population in Sidi Sa d M achou village whose name was given to the first dam built on the Moroccan territory and entered into service in 1929.

The third stop is Lakouassem village, one of the latest bastions of falconry in Morocco (Fig. 3). Falconry is considered as a social tradition respectful of nature and environment. This tradition is playing an important role for human development of local population and for the touristic marketing of the Region. It is considered as a living human heritage that has been classified as Intangible Cultural heritage for humanity. In order to promote and protect this tradition, the first Festival of falconry was launched on 19 April 2013. This special event aims to shed light on other aspects of falconry such as the hunting equipment, the traditional clothing, the music, the singing, the cooking and, above all, the horse, which has always been an important element in the art of hunting with falcons (Chahid, 2010).

The fourth stop is the Kasbah Boulaouane geosite which is a site of cultural and geoscientific interest (Fig. 4a). The Kasbah, built in 1710 by Sultan Moulay Ismail, the second ruler of the Moroccan Alaouite dynasty, on a promontory overlooking didactic meanders on Oum-Er-Rbia River (Fig. 4b) (Camara et al., 2011), is classified as a National Historic Monument since 1925. Two geological units, well differentiated around the monument, are composed of Middle Cambrian Paradoxides schist and sandstone, unconformably overlain by Plio- uaternary fossiliferous marine conglomerates (El Attari, 2001).

Boulaouane is well known by its wine due of its red soils ("*Terra Rossa*", in Italian). This type of soil has been known since ancient times to be very suitable for agriculture, especially wine production (Fig. 5).

Fig. 2 - Panoramic view of the southern side of Sidi Sa d M achou Basin (a); Didactic angular unconformity between the red continental Triassic formation and marine Plio- uaternary formations (b); Fossil Pecten from the Plio- uaternary formations (c) ; Sidi Sa d M achou dam (d).

Fig. 3 - Falconer from Lakouassem.

The last stop before returning back to El adida city is dedicated to Tazotas, a geosite of cultural value (Fig. 6). Tazotas are dry constructions with a specific architecture. This type of architecture, in Morocco, is restricted to Doukkala-Abda region and its origin is still controversial. Some authors considered them as an evidence of a former existence of Berber tribes in the region. Tazotas consist of one piece and are of spherical or trapezoidal shape with a lateral entrance. They are self-conditioned construction. Their use is diverse (living spaces for men, shelter for animals, storage, cattle).

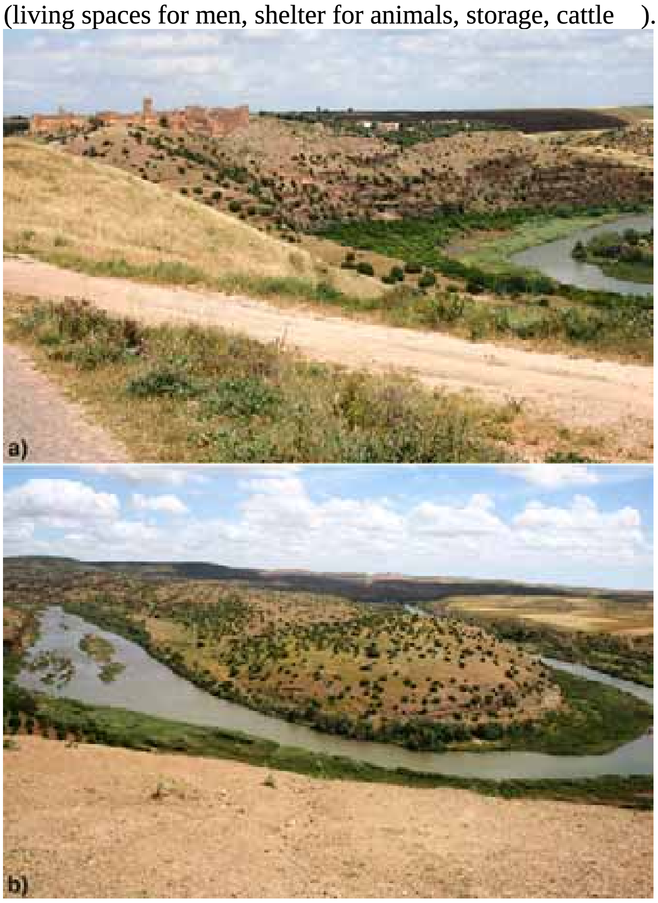

Fig. 4 - Kasbah Boulaouane geosite (a) with its didactic meanders (b).

Fig. 5 - An old wine cave in Boulaouane.

C A C C

The first geotouristic trail in Doukkala-Abda aspiring geopark launched during the celebration of the first edition of the Day of Earth Sciences in Africa and Middle East, attracted more than 40 participants (2/3 of them were women) (Fig. 7). Most of them lived in the region since years but it was the first time that they discovered its geotouristic and cultural richness; a survey is in progress in order to evaluate that first experience. This geotrail aims to promote Doukkala-Abda hinterland as a geotouristic destination instead of predominated-seaside tourism in the region and also to shed the light on the need to develop its touristic and socio-economic infrastructures (roads improvement, creation of guest houses, generalised access to drinking water and electricity).

Fig. 6 - Tazotas, dry construction characteristic of Doukkala

To attract national and international tourists, such geotrail needs to be valorised and promoted through indicative and interpretative panels, organisation of onsite cultural events (Conferences, competition, photography, painting, festivals,), flyers, guide books, NTIC (websites, facebook, blogs) and its promotion during cultural and scientific events held in the main cities in and around the region. Training of local population to act as guides will help to create jobs for people living in that area and to increase the awareness about the importance on the preservation and valorization of their geosites. Boulaouane kasbah, an attractive monument, needs to be excavated and restored respecting its integrity and authencity. Moreover, the creation of an information and interpretative center is needed.

The valorization of Doukkala-Abda geoheritage associated with its ecological, cultural, historical heritage, through the promotion of similar geotrails linking coastal geosites to hinterland geosites, will help to develop a sustainable tourism respectful of its environment in rural areas. Four other thematic geotrails are in progress. In order to evaluate the knowledge of local population, to involve them since the beginning of the geopark project and to increase their awareness, a survey of 18 questions is in progress.

Fig. 7 - Photo of some participants to the launch of the first geotrail in Doukala-Abda region aspiring geoparks.

ACKNOWLEDGMENTS

We would like to thank the local organizing committee of the celebration, in Morocco, of the first edition of the "Day of Earth Sciences in Africa and Middle East". Special thanks go to the association of falconers for their hospitality during the launch of the geotrail.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

Earth Sciences divulgation, geoheritage and landscape approach: the project of the Geologiro d'Italia

Farabollini P. ([a,b]), Graziano G. V. ([a]), Lugeri F. ([c]), Lugeri M. ([d,e]) & Lugeri N. ([d])

([a]) Geological National Council , via Vittoria Colonna, 06100, Rome
([b]) Department of Earth Sciences, University of Camerino, via Gentile III da Varano, 62032, Italy. E-mail: piero.farabollini@unicam.it
([c]) ISPRA, Geological Survey of Italy, 06100, Rome
([c]) ISPRA, Department of Nature Protection, 06100, Rome
([c]) www.Bikenews.it

ABSTRACT

Landscape is an expression of geology and, at the same time, is the object of human perceptions, therefore it could become a "medium" to communicate Earth Sciences to society. By integrating different information about the geo-morphological arrangement of a region, it is possible to reach a complete knowledge of the territory: a multi-scale Landscape approach is adopted in modern geological applied research. Modern technology offers new powerful tools: GIS are able to synthesize, manage and represent a large amount of data; thanks to GIS it's not difficult to reach an evaluation of the state of the studied landscapes, referring to the dual risk/resource which characterizes Italy. Territorial and environmental problems require the constant presence of geologists, in all contexts. Knowledge is the key tool: diffusion of scientific heritage, using topics that are accessible to the public, may represent one of the new goals for geologists. The popularization of the geo-environmental heritage walks on the same paths of tourism. Special attention should be devoted to an original link between landscapes, geology and sports, such as road cycling events (e. g. the "Giro d'Italia"); each "GeoloGiro" stage can be described in terms of geo-morphological arrangement, starting from a landscape analysis: the landscape components represent, at the same time, the elements characterizing the competition trough the territory. The described approach offers new fields for new actions, in order to reach the common aim of territorial safety and a shared well-being.

KEY WORDS: Earth Sciences, Landscape, Geoheritage, Cycling Tour of Italy, Italy.

INTRODUCTION

Landscape plays a key role in the processes of knowledge: it is the result of endogenous and exogenous activities that build and shape the Earth's surface and at the same time, it can be considered the result of the interaction of many components of natural and cultural ??? (Troll, 1950; Forman & Godron, 1986; Naveh & Lieberman, 1994), and therefore represent an excellent vehicle to communicate Earth Sciences (Lugeri, 2011; Lugeri et al., 2012). Therefore, awareness regarding Geosciences as a a powerful tool to reach out and share a "sense of natural identity" resulting from the awareness of being part of an ecosystem, is achieved through the knowledge and experience of the environment (Amadio, 2003; Lugeri, 2011).

Geological features of landscape, in particular, are in every place, but they need to be understood and recognized as heritage, and at the same time they need to be protected, in order to become a resource (APAT, 2005): the key role that this plays is in terms of perceptive and symbolic power: it is what people perceive, from the first contact with the environment, as a source of resource, risk, and especially of emotions (Farabollini, 2008; Farabollini et al., 2013).

Geosciences seek to understand the history of our planet and the changes it has undergone. They allow, through special geological and geomorphological situations, to know the places where these geological situations are manifested more clearly, emphasizing that what is commonly called "Geotourism" just means traveling to discover the wonders of the geological landscape (geological sites and geomorphosites) in the place where they are located.

Divulgation of Geosciences, then, through a simple but rigorous language, is an objective of primary importance for the development of a given area, its culture and its products. Knowledge is then the starting point to initiate effective prevention against the risks.

GEOTURISM AND DIVULGATION OF GEOSCIENCES

Landscape study must be addressed as a complex process, through the integration of all components of the studied system: through its geomorphological and ecological landscape, as well as its cultural aspects, it is possible to achieve a complete understanding of the landscape itself.

In recent years, a new theoretical approach is developing, that integrates Geosciences and culture, making it possible to offer new powerful teaching and educational tools, and implement a new dialogue between researchers and local managers (Castaldini et al., 2009; Lugeri, 2011; Tozzi, 2012, Farabollini et al., 2013).

This approach is essential to realize a new type of dissemination of geo-naturalistic heritage, in order to involve the whole society in a common action towards a sustainable land management (Aringoli et al., 2009; Angelini et al., 2012): the link between Earth Sciences, geological Landscape and historical-cultural-economic heritage (such as the food and wine heritage, the geo-cultural heritage in fiction *sensu* Lugeri et al., 2012), is an excellent example of a connection between nature and culture (Lugeri et al., 2011; Farabollini et al., 2013).

In this context, a journey through the geological landscapes is like a journey through the Geosciences: the integration of the complex aspects of the landscape and the historical development of certain areas of particular interest, with the main purpose of public involvement, is achieved through the use of special media, where nature, culture and sports may represent useful tools for the modern geologist.

The need to talk about landscape, its forms and its origin through a language that is understandable, and to devise schemes that facilitate understanding, would allow us to see how many "geological" places of great scenic beauty have been created: the knowledge about these beauties (the geosites) must be made public, protected and valued (Larwood & Prosser, 1998; Principles, 2008; Farabollini et al., 2013). To this regard, there are examples in European and National legislations (e.g., Law 22 January 2004, n. 42, "Code of Cultural Heritage and Landscape").

Landscape is the strategic element of the project: it is necessary to acquire a new point of view, to interpret landscape as the result of all natural and human processes that occur in a complex system. The cognitive process is the identification, description, interpretation and classification of the areas of the territory that can be considered homogeneous. The combination of morphological components allows the recognition of physiographic units, through models based on a multi-scale system, which integrates a wide range of information about the physical, abiotic, biotic and anthropic aspects, considered both individually and in their mutual interactions.

The geographic information systems and representations of thematic maps allow a scan of the landscape at different scales of analysis and reveal, especially when integrated with other themes, interesting diagnostic potential in cognitive and evaluative processes of the territory. A holistic and systemic (non-systematic) approach to the study of the territory, is the basis of Landscape Approach, italics by its nature very close to the methods of study of Geosciences own but, unfortunately, almost always left to other professionals.

DATA BASE, GIS, GEOSCIENCES AND DIVULGATION

Geographic Informatics Systems can be considered as a tool that is well suited to the creation of geo-naturalistic databases, to support the dissemination of Geosciences, and especially

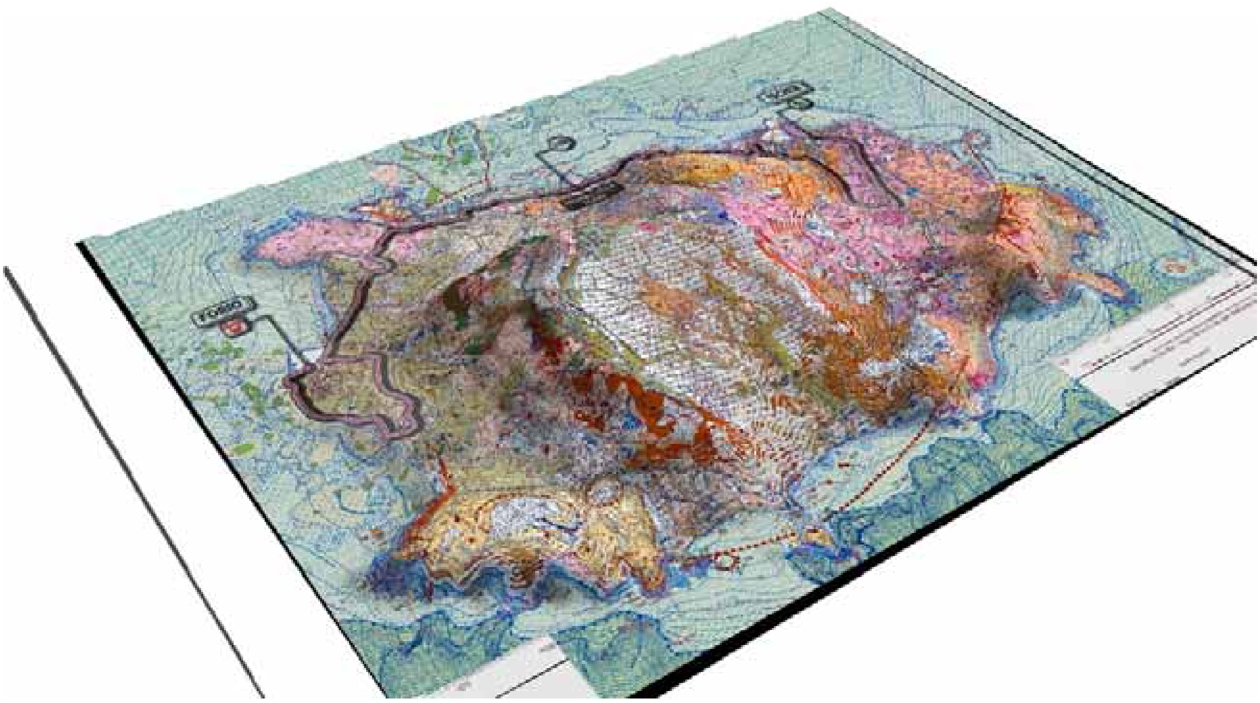

Fig. 1 – The 3D geological map of Ischia island. The second stage of the Tour of Italy 2013, which will take place precisely on the island of Ischia, emphasizes the continuity of a path (real and ideal) through the beauty and fragility of our country: Ischia, a metaphor of the earthquake and the difficulties that ensue, the disruption, the hydro-thermal resources, the scenic beauty: opposite poles of the continuum from risk to the resource, the combination of an equation that can be solved with constructive outcome through knowledge and awareness.

through the geological sites, geotourism and geoheritage (and therefore with the ability to create routes that are as representative as possible for a conscious knowledge of the abiotic aspects of an area, *sensu* Angelini et al., 2012)..

In this context, GIS allow to reach, in a rather immediate and complete fashion, some goals that would facilitate the dissemination and awareness of the role played by the Geosciences: 1) increase the geological knowledge of the area to enhance the sites in terms of scientific and geo-naturalistic heritage; 2) provide specific knowledge about geodiversity, identifying and delimiting areas characterized by richness and variety of geological sites and/or geomorphosites, so that they can be proposed as Geoparks; 3) geo-naturalistic dissemination of a territory's features, through implementation of guides, brochures and itineraries, both in geological and naturalistic terms; 4) illustrate the possible elements of the territory that can be valued and promoted in terms of tourist use; 5) increase awareness of the fragile nature of the natural beauty of the area, in order to respect the environment and natural beauty at the same time; 6) use the geo-naturalistic paths to facilitate the integration of geological component with the traditional ones for tourism (culture, arts,, history, archaeology, food and wine, etc.); 7) develop educational courses in the geosciences; 8) use the power of representation of GIS to involve stakeholders participating in decision making, showing results, scenarios, alternatives, and providing them with an interpretive tool that is very useful to build a shared project of territory.

These objectives then allow the full use of methodologies such as those communicative for presenting and examining the elements of the geotouristic territory (cards, pictures, charts, maps, panels, audiovisual, etc..) Arising from the identification of a pattern of timely elements ("geo-sites") that emerge for their rarity, representative or exemplary teaching and testifying, with a physicality accompanied by strong elements of scientific knowledge, the stages in the geological evolution of the area.

A further implementation of GIS, for the purpose of a more complete divulgation and communication of Geosciences through a holistic approach (developed by the landscape approach), is the superposition, on the basis of geological small-medium scale, even better if in 3D of information under the Charter of Nature and the Charter of the Landscape Units (APAT, 2003; Angelini et al., 2008; Graci et al., 2009; Bozzato, 2010).

THE PROJECT "GEOLOGIRO D'ITALIA"

Cycling, popular sport for excellence, represent the spatio-temporal relationship between individuals, communities and societies. The Tour of Italy (defined as "the toughest race in the world in the most beautiful country in the world") is one of the most popular events and well-known and is the most popular race in our country, representing then great potential as a means of communication and multifunctional.

The chance to show the general public (and, to a lesser extent, and when possible, even for athletes) the geological and geomorphological components of the places visited by the various stages of the race, describing the main characteristics and peculiar geological sl, natural and environmental assets of the same , can be a great vehicle for the knowledge that the Geosciences may represent a new way of reading on their own territory, knowing and valuing, its cultural components and perceiving the potential socio-economic conditions.

The characteristics elevations of the various stages (such as running up and down), are essentially linked to the morphology which depends on the geological characteristics of the territory, linked to endogenous processes, and subsequent exogenous agents and morpho-dynamic processes that have changed. 3D GIS processing (Fig. 1) and images can help to show the situations "geo-environmental" path, making it easier for the public to recognize the landscape (Angelini et al., 2012; Lugeri et al., 2012; Farabollini et al., 2013).

The idea of GeoloGiro was born a year ago, as part of a methodological proposal for the study of the morphology of the territory, according to the "Landscape approach" (Lugeri, 2011). Now it is becoming a concrete project, thanks to the synergy established between CNG, ISPRA-Geological Survey of Italy and the Gazzetta dello Sport, the legendary newspaper for decades organizes the race. The goal, strategically shared, is the enhancement of the landscape, unique in the world, of our country, through the analysis of the stages of the "Giro d'Italia".

Fig. 2 – Cortina- Lastoi de Formin – 17° stage of the Giro d'Italia 2012 (from RCS sport). In the background you can recognize slopes consist of limestone intensely folded and deformed by alpine tectonic.

The proposal is to insert a communicative space dedicated to the description of the places paths, in terms of geological, geomorphological, natural and territorial. An insert designed to highlight the most significant places of our country and analyze the constitution and origin, with special attention to situations of high landscape value and / or particularly fragile area.

The morphology of the territory, which the sporting event is configured as a plot of racing uphill, downhill and flat, is explained by the geologist (perhaps cycling), to offer the public a scientific record of the places, linking the landscape analysis and the sports , on route sections particularly significant both for their geological nature that for the valence agonistic under the stage. Even you can groped a geo-prediction, depending on the origins of the athletes and the characteristics of their usual area of training, in comparison with that of the race.

In just a few minutes, in plain language, panoramic images, watch catalyzed by natural link between structure and competitive context: this can, in a simple and spectacular, facilitating a deeper useful for the promotion of the territory. The communication part of the landscape, keyword of this project: the shape and position of the "boot" mean that a wide variety of types of landscape, natural and man-made, are concentrated in a long, narrow space, and therefore represent a special feature that should be to make the best, thanks to a scan, on scientific grounds, places known for their beauty.
The proposal is flexible and can be formulated in various solutions in the framework, for example, of television services planned for reconnaissance of the stages, or as part of the transmissions that accompany the stage.
The information is accompanied by video animations with the representation of three-dimensional model on the geology of the land and representative images of the most interesting phenomena that characterize the geological structure of the area crossed by the stage: to associate with the description of landscape elements, news and curiosity can attract the attention of the public.
The presence of UNESCO WHS sites and / or protected areas (in addition to cities, archaeological sites, etc.)., gives an opportunity to deepen the relationship between geology, nature of the land and culture that has developed in the area. To scientific news can therefore are associated with cultural news (eg., the link between the monuments and the rocks used to build them), to tradition, to the typical products (especially the wine, still deeply tied to geology), emphasizing the close connection with the geological structure and morphology of the territory.
The 2012 Giro welcomed the presence of the geologist (fig. 3). The press-room, contact with journalists from all over the world, interested in the connections between the current issues with the more purely sport, dialogue with the organizers of a sporting event so important and complex, the meeting with the athletes and the public: all new experiences, but natural and exciting for a professional figure that now-more than ever-must claim a greater role in the field of forces that determines the dynamics of land management, its development, prevention.
It is clear need to expand the scope of action of the geologist to that effect, with particular reference to skills in the landscape, the study of which, so deeply tied to the geology and geomorphology of the systemic own needs of Earth Sciences. The experience has opened the door to a structured collaboration and constant, wide-ranging and international in scope. New codes, systems dialogic agile, flexible rhythms and operational autonomy: these are the characteristics of the professional world of communications.
The great potential represented by a sporting event of extensive media coverage, thus articulated in space and time, so popular and culturally significant as the Tour of Italy, it soon came out, so striking, in the stages experienced in the experimental stage in the Giro 2012 (Fig. 3).
In particular, even if accidentally, and interestingly, the common denominator of the 3 stages of 2012 (Civitavecchia to Assisi; Limone sul Garda-Falzes; Falzes-Cortina), proposals on an experimental basis to the Official, was the pink, the emblem of the Giro and the shirt worn by his winner. This common thread (indeed fil rosé, nda) is represented by its geological elements: from light shades of pink stone, the more intense tones of porphyry from Alto Adige, Dolomites enrosadira to changing phenomenon.
The stage of Civitavecchia to Assisi, came right in the heart of Assisi, passing through the most impressive monuments of our country, a symbol of art, culture and spirituality of a universal, more linked to the harmony between man and landscape of Mount Subasio (on the slopes of which Assisi is built, using its limestone cliffs, both for flooring and for the monuments themselves) more than the clichés canons. And 'the geology that configures the beauty of places and architecture that gives the special light that makes the city of San Francesco UNESCO World Heritage Site: the pink stone.
The stage Limone sul Garda-Falzes, instead went through the geological alpine domains that tell a fascinating evolutionary history, up to the pink porphyry of Val Pusteria.

Fig. 3 – Image of the Tv studio of “Anteprima Tappa” at the stage “Falzes – Cortina” of 23 may 2012.

The third stage, which is defined by the Gazzetta dello Sport, "the great stage dolomite", from Falzes to Cortina, the so-called "Pearl of the Dolomites", proposed an extremely interesting, that Enrosadira, an interference effect between the oblique light the sun and the rocky walls consist of dolomite that are tinged with pink, shimmering in shades. The popular tradition Ladin attributes this phenomenon to a charming legend, that of King Laurin, who launched a curse at the rose garden in which he was hiding in vain to escape the enemy, either by day or by night no human eye could admire more . But he forgot the sunset, and it is the moment when the Dolomites reappears "Rosengarten" of the king.
One of the crucial steps of the stage was the stretch between Forcella Staulanza and the Passo Giau, on the slopes of Mount Pelmetto. On the surface of a rock detached from the walls of the Mount, were discovered about 10 years ago, dinosaur footprints, attributed to specimens of ornithischians and saurischians, who lived in an environment of intertidal flat.
Even for the Tour of Italy in 2013 is expected to stage (May 25, 2013 - Silandro / Schlanders – Tre Cime di Lavaredo) that goes to the Tre Cime di Lavaredo (UNESCO World Heritage Site), as defined by the journalist Marco Pastonesi (Gazzetta

dello Sport) "paradise mineral". The Dolomites then, taking advantage of an invitation to speak of geology for the value of the land, for its geological beauty and aesthetics, unique, will be further discussed by the geological point of view.

Further opportunity to enhance the role of popular Geosciences, in this case even in a perspective of prevention of natural hazards, is also represented by the stage of the May 15, 2013 "Tarvisio (Cave of Predil) - Vajont (Erto and Casso)" which will arrive on places the greatest tragedy Italian 50 years

Fig. 4 – Tv studio of “Anteprima Tappa” at the stage “Tarvisio-Vajont” on 15 may 2013.

after the event (fig.4).

On October 9, 1963, at 22.45, in the valley of the Vajont huge landslide was activated. The rock mass, with a volume of nearly 250 million cubic meters, slid from the northern slope of Mount Toc, along a front of 1,800 yards and rushed into the underlying artificial lake caused a huge wave, assessed in 25-30 million meters gallons of water. The mixture of water and rock fragments climbed over the dam placed in the Vajont ravine, crashing into the valley of the Piave. The dead were 1,909, the Longarone town was almost completely destroyed and the village municipalities of Erto and Casso suffered considerable damage.

At 50 years after the tragedy, the Tour of Italy, paying tribute to the victims, remembers and reflects and gives rise to the National Council of Geologists, invited to broadcast on the site of the tragedy, to point out the necessity of knowledge of the area that would assume its space-time evolution, intervening in a preventive, thus avoiding recourse to the emergency. The tragedy of Vajont also represents the event from which were launched studies that are now considered the basis of modern geology.

CONCLUSIONS

The enhancement of the natural heritage must be based on the awareness that the knowledge and understanding of the geological heritage, the environment and landscape, and the development of systems of nature conservation, is a key contribution to the social, economic and aesthetic, the possibility to look for opportunities for study and research of the same natural goods and, not least, to create conditions for new jobs. The enhancement of the natural heritage becomes social services, contributing to the civil, economic and cultural development of the local communities.

Divulgation and the understanding of Geosciences, through a simple, but rigorous language, it is an objective of priority importance for the development of the territory and of its culture and its products. In addition, knowledge is the starting point to launch an effective policy to promote a culture of prevention against natural and anthropogenic risks. In fact, the prevention, must necessarily be based on cognitive processes that activate in society conscious knowledge that activate those virtuous practices that reduce emergency situations.

The National Council of Geologists has activated this year, a series of projects and activities aimed at enhancing the profession, training and information, opening up a broad spectrum fruitful dialogues with institutions, the world of research and the society. With the start of the new activities that they see the renewal of themes and codes, in the service of effective communication of geology, have opened important professional openings which are based on communication and dissemination of Earth Sciences, on geotourism and geo-escursionism, on planning of landscape resources, strategic objectives and to secure social and economic impact..

Is it in this direction that the project Geologiro of Italy, born of a shared intentions and objectives, based on the awareness that the disclosure of Geosciences, through various forms of communication, can be an excellent vehicle for the perception of the real values the Italian territory, it is proposed to launch a promotion of the geo-nature itself as a tourist attraction: the anti-crisis landscape as a resource.

ACKNOWLEDGMENTS

We want to remember Fabrizio Galluzzo (ISPRA) and the colleagues of CNG for their support and expertize and for their helpful advice. We thank also the organizing committee of the meeting.

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Stone constructions in Geoparks and their relations to Intagible Heritage: A preliminary study

Fassoulas C.([a]) & Martini G. ([b])

([a]) Psiloritis Natural Park, Natural History Museum of Crete, Heraklion, 71409, Crete, Greece. E-mail: fassoulas@nhmc.uoc.gr
([b]) Reserve Geologique de Haute-Provence, F-04005 Digne Les Bains, France. E-mail : guy.martini@hotmail.com

ABSTRACT

Many decades ago international organizations like UNESCO, identified the importance of the intangible cultural heritage as a mainspring of cultural diversity and a guarantee of sustainable development (UNESCO 2003). During the UNESCO's General Conference of 2003 the Convention for the Safeguarding of Intangible Cultural Heritage was developed, which up to now it is signed by 152 member states all over the globe.

In this convention, the Intangible Cultural Heritage is described as a concept that includes "the practices, presentations, expressions, knowledge, skills – as well as the instruments, objects, artifacts and cultural spaces associated therewith – that communities, groups and, in some cases, individuals recognize as part of their cultural heritage" (UNESCO 2003). It was also recognized and clearly stated that this intangible cultural heritage is transmitted from generation to generation, it is constantly recreated by communities and groups in response to their environment, their interaction with nature and their history, and it provides them with a sense of identity and continuity, promoting thus respect for cultural diversity and human creativity.

Since their early steps on the Earth, humans found refuge at the natural shelters the natural processes and rocks offer. By developing agriculture and organized societies they had to leave these shelters and create their own with natural materials, timber, clay and stone. Very early however it was recognized that stone constructions are those that are stable, secure and most important, durable. Thus, initially they used nearby stone, but with increased technology and wealth they developed skills and techniques that enabled them to use the most suitable and resistant rocks types, even if they had to transfer them from long distances (Fassoulas & Panagiotakis 2004).

In most European territories, dry stone constructions (without usage of any connecting material) are widespread, dated from to Neolithic to modern times. These constructions are today indications and testimonies of social practices, special skills, and transfer of knowledge through generations and eras. They represent thus a human treasure and a valuable heritage related to abiotic environment that have to be recognized and promoted.

In order to identify stone constructions existing at the European Geoparks that may be related to the intangible heritage of each territory we have circulated to all EGN a template to collect basic information. Each geopark hosting such important constructions had to report up to two such structures providing information on the local name, the building stone, their age, present usage by humans, recognition or protection, and related images.

At this first phase we received 13 responses from Azores (Figure 1), Massif des Bauges, Bergstrasse-Odenwald, Burren, Geomon, Maestrazgo, Parque Cultural del Maestrazgo, North Pennines, Psiloritis Natural Park, Rocca Di Cerrere and Shetlands geoparks. Data collected were first analysed in order to arrange recorded structures into several categories. These categories are related to the intangible heritage domains of "social practices", and "knowledge and practices concerning nature and the universe" (UNESCO 2003). Thus we identified

Fig. 1 – Black walls of basalt stone, forming a square-structures network "currais" that would help protecting the vines from the strong winds and from the sea spray, Azores geopark.

No	Geopark	Name	Rock	Category	Age	Protection
1	**Azores**	"Currais"	Basalt	AU	XV C.	WHS
2	**Azores**	Celar and Water wells	basalt	HSR		
3	**Massif des Bauges**	Palets de l'Arclusaz	Limestone	LLB	1200 AD	
4	**Massif des Bauges**	Murets de vignes	Limestone	AU		
5	**Bergstrasse-Odenwald**	Dry-stone walls -terraces	Sandstone	AU	17th C	
6	**Burren and Cliffs of Moher**	Penitential Stations	Carboniferous limestone	BSS	17th C	
7	**Burren and Cliffs of Moher**	Poulnabrone Dolmen	Carboniferous limestone	BSS	Neolithic	Yes
8	**Geomon**	Standing stones near Porth Dafarch	Mica schist	BSS	Neolithic	Scheduled Ancient Monument
9	**Geomon**	Ichthys Stone	Glacial erratic	BSS	440 AD	RIGS
10	**Maestrazgo C.P.**	Arquitectura de Piedra Seca	Limestone	AU	18 C.	Higher level
11	**Magma**	Glerhaug Jakthytter JanOve	Magmatic	AU	1800 AD	
12	**Magma**	Stone circle at Stoplesteinane - Eigersun	Magmatic	BSS	850 AD	
13	**Naturtejo**	Antas	granite	BSS	Neolithic	National Monument
14	**Naturtejo**	Furda	granite	HSR	Decades ago	
15	**North Pennines**	Limekilns	Carboniferous sandstone	HSR	Roman times	Listed buildings
16	**Psiloritis N.P.**	Mitato	Platy marble	AU	1500 AD	Regional
17	**Psiloritis N.P.**	Limekilns	limestone and sandstone	HSR	1800 AD	
18	**Rocca Di Cerrere**	pyramid of Cerumbelle	limestone(?)	BSS	Prehistoric (?)	
19	**Shetlands**	Barn		HSR		
20	**Shetlands**	Sheepfold		AU		

Table 1- Analysis of stone Constructions in Geoparks

structures that can be designated as Human Shelters and Residence (HSR), Landmarks and Landscape Boundaries (LLB), Burial and Spiritual Sites (BSS), and Agricultural Use (AU). From the various reports we received we have analyzed under this study up to 20 structures (Table 1).

For the needs of this early study we analyzed up to two structures per geopark. The majority of the structures analyzed are falling into the domain of Burial and Spiritual sites (7 of them), seven also are for agricultural and stock rising needs, five are Human Shelter and Residence and one is a Landmark and Landscape boundary. The most characteristic sites for Agricultural Use are the "currais", low stone walls made by basalt in Azores to protect vine trees from the weather conditions (Figure 1), and the shepherds' houses.

The later occur at Maestrazgo, Magma (Figure 2), Psiloritis and Shetlands geoparks, having in most cases a circular structure and made by the local stone (marble, igneous, limestone etc.). The age of these structures comes from the Minoan times in Psiloritis geopark till our days in most cases.

The most outstanding structures according to their style and age at the category of Burial and Spiritual Sites are the 'Antas" the circular burial dolmens made by granite at Naturtejio geopark, the "Poulnabrone Dolmen" made by carboniferous limestone at Burren-Cliffs of Moher Geopark (Figure 3), and the "Standing stones near Porth Dafarch", possibly a sun ritual or site related with human sacrifice rituals, made by mica schist at Geomon geopark, all of Neolithic age.

Impressive sites characterized as Human Shelter and Residence are the "Funtas" and "Barns" at Naturtejio and

Shetlands geoparks respectively, the later dated back to Viking times (Dockrill et al. 2010), which are made either by granite or limestone. Limekilns are to be found at North Pennines and Psiloritis geopark, but we suppose that it should be the case for other geoparks too.

A characteristic Landmark and Landscape boundary is the “Palets de l'Arclusa”, the Stones to bound landscape and properties at Bauges Geopark made by limestone.

This first study revealed that impressive stone constructions exist in many European geoparks, in most cases closely related to the culture and history of each territory, to the sustainable use of existing resources for agricultural and stock rising needs, as well as to utilitarian structures of human societies. It is well known that many other geoparks who, for many reasons were not able to respond at this time, host very important stone constructions, famous worldwide, like the small circular building in Luberon geopark that occur at their logo, and the stone, multi-arch, bridges at Vikos-Aoos geopark, that are also part of their Intangible Cultural Heritage. We believe that this activity, developed under the “Intangible Heritage thematic group” of EGN, can be the base for a holistic, and scientific inventory, study and analysis of these peculiar, rock constructions existing in geoparks.

KEY WORDS: Cultural heritage, geoparks, intangible heritage, stone constructions.

ACKNOWLEDGMENTS

We would like to thank all those who have contributed to the collection of these data, i.e. Manuel Paulino Costa, Jérôme Daviet, Claudia Eckhardt, Jochen Babist, Eamon Doyle, Margaret Wood, Luis Alcala, Pål Thjømøe, Carlos Neto de Carvalho, Elizabeth Pickett, Valentina Di Natale and Alan Blain.

Fig. 2 – Shephard shelters “Glerhaug” from Magma geopark,

Fig. 3 – Neolithic tomb from Burren and cliffs of Moher Geopark

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Developing a geopark at the eastermost end of Crete: Sitia Nature Park

Fassoulas C. ([a]), Staridas S. ([a]), Perakis V. ([b]) & Mavrokosta C. ([b])

([a]) Natural History Museum of Crete, University of Crete, Heraklion 71409, Crete, Greece. E-mail: fassoulas@nhmc.uoc.gr
([b]) Social & Cultural Development Organization of Sitia Municipality, Sitia 72300, Crete, Greece

ABSTRACT

The easternmost end of the island of Crete is covered by the Sitia Municipality. It is a mainly mountainous area, however with long coastline, peculiar geology and varying landscape. It has a very wealthy environment with unique and peculiar ecosystems, endemic species and a large area protected under Nature 2000 network. Additionally, history and culture are outstanding too, with Minoan and younger archaeological sites, excellent cuisine and best quality agricultural and livestock products. Being far away from the main big cities of the island and having a very bad road system, it is suffering from underdevelopment and lack of financial opportunities. This has led to the development of controversial investments in past without real benefit for local communities, as well as minor but very crucial eco-touristic activities. Recently, local communities decided to adapt the geoparks' initiative in order to protect their environment and support local sustainable development, by the development of an aspiring European Geopark. This manuscript summarizes the main steps, methodologies and actions that were developed in order to create from the beginning, a geopark in a rural and remote area.

KEY WORDS: Geopark, geotopes, geotourism, responsible tourism, Sitia.

INTRODUCTION

During the last decades conservation and management of nature had to combine development activities together with conservation actions, so that the one can support the other. This need became more prominent in our days due to the economic crisis in Europe which magnifies all other existing problems. The need to discover resources for study and conservation has been covered in many cases by the adaptation of sustainable development actions (Croall, 1995). Only sustainable development can ensure the prosperity of the present generation and the wellbeing of future ones (Smith & Rees, 1998). Thus many international organisations have focused their efforts in identifying actions and means that can support such development activities adapted to the needs of sustainability.

The same has been started in geoheritage management by initiatives aiming, either to identify and promote geological and geomporpological features, or trying to conserve and study their value (Martini & Pages, 1994; Brilha, 2002). The most successful among the others can be considered the initiative of geoparks (Patzak & Eder, 1998). A term that has been present in literature for several decades became active serving the needs for modern nature management in the form of European Geoparks (Zouros & Martini, 2003).

The European geoparks not only combine geoconservation and sustainable development as fundamental constituents of their existence, but work and collaborate together at a European scale to maximise the benefits of their actions. The geoparks thus aim to protect and conserve geological heritage simultaneously with the development of various actitivities that serve the needs of education and information of visitors, attract tourism through geotouristic and eco-touristic activities and support in various ways local economy and production (Zouros & Martini, 2003). By a sufficient and central management both geopark and local economy receive benefits to continue implementing actions and ensure the necessary economical resources.

Eastern Crete presents some very peculiar geological features that can be regarded as unique among Cretan geoheritage, including peculiar rocks, fossils, and other geotopes. The extended presence of carbonate rocks at the mountainous areas shapes landscape and forms a large variety of geomorphologcal features. The variety of geological environment is associated with unique ecosystems and rich flora and fauna leading a large part of the area to be member of the NATURE 2000 network. Human environment is similarly wealthy, including many archaeological sites, traditional settlements and monasteries, whereas some fantastic cretan products come out from the land of Sitia.

Being far away from the main cities of the island, with poor transportation infrastructures and lack of other significant natural resources, the area of Sitia is suffering of under development. Various controversial investments have been implemented in the area, with renewable energy projects to be more extensive. However, several years ago local communities decided to adapt the philosophy of geoparks as a development strategy.

This document presents the basic steps that had been followed in order to create the necessary infrastructure, the facilities and the procedures to develop a geopark at the far eastern part of Crete, the Itanos and Zakros areas of Sitia

Fig. 1 – The geomorphologic and geoheritage map of Sitia Nature Park.

Municipality, to reveal the aesthetic and scientific value not only of geological but nature environment in general and to demonstrate the beauty of this part aiming to submit an application for a European Geopark membership.

GEOSITE INVENTORY

GEOLOGICAL SETTING

The area for the proposed geopark is located at the easternmost part of Crete and at the municipality of Sitia (Fig.1). It is characterized by very rich geological heritage which includes impressive rocks and geo-formations from both the alpine and post-alpine units (Fassoulas et al., 2013). The alpine units comprise the "Platy Marbles or Plattenkalk unit", the "Phylites – Quartzites Unit", the "Tripolitsa unit" and the "Mangassa unit". Additionally, the geopark includes large series of post-alpine rocks and especially units from the Miocene, Pliocene and Pleistocene eras.

The oldest dated rocks of the island crop out around Sitia area; violet schist in Zakros and Palaikastro areas form very fascinating landscapes; coastal caves host a variety of Pleistocene mammal fossils, whereas the Miocene rocks reveal the largest mammal ever lived on Crete and probably in Greece, the *Deinotherium giganteum* of Sitia. Intense Neogene and Quaternary tectonism has fragmented landscape resulting in depressions and ridges, whereas Pleistocene crustal uplift shaped eastern coastline in successive marine terraces (Fassoulas, 2001). The extended presence of carbonate rocks at the mountainous areas gave birth to various karstic features like sinkholes, dolines, plateaus and gorges, as well as to elongated cave systems, exceeding in places more than 6kms in length, that in many cases give birth to numerous springs like Zakros and Flega.

GEOTOPE ASSESEMENT

Inventory of geotopes identified more than 88 sites of geological importance that have been recorded using a template produced for the field inspection based on pre-existing studies (Fassoulas et al., 2012; Fassoulas & Skoula, 2006). According to the prevailing geological features the geotopes were after attributed into several categories, like geomorphologic (analysed further into landforms, coastal, karstic, gorges and caves), geological (that are distributed in petrological and stratigraphical), tectonic (categorised further in tectonic, folds, and microtectonic), hydorgeological, fossiliferous, geocultural and geohistorical.

From the 88 geotopes that have been identified 75 of them were then assessed using the methodology developed by Fassoulas et al. (2012), in order to recognise the touristic, educational, and conservation values. According to this evaluation (Fassoulas et al., 2013) the highest *educational value* share two gorges the Kato Zakros and Moni Toploy, mainly due to their proximity to tourist and other landmark points, followed by the spring of Pano Zakros, the Voila Venetian settlement and the Pindos Tectonic nappe at Krioneri. Regarding the *touristic value* the geo archaeological site of kastri near Palekastro delivered the highest rank, followed by the Kato Zakros gorge, the tectonic nappe at Krioneri, the Voila Venetian settlement and the Moni Toplou gorge. Due to theses two results it becomes apparent that Kato Zakro and Moni Toplou gorges, Voila Venetian castle and settlement as well as the Teconic nappe at Krioneri appear the most important geosites of the area in respect to geotourism and education.

Regarding the *conservation value* the majority of the geotopes received values below 5 meaning that quite a few need protection measures and special conservation strategy. The most vulnerable appears the *Deinotherium giganteum* excavation site at Ag. Fotia. The next most vulnerable sites are the stone tiled trail of Magassa area, followed by the spring of Epano Zakros and Maridati beach.

GEOTOURISTIC – EDUCATIONAL ACTIVITIES

Following the geotope assessment as well as the existing archaeological, touristic and natural wonders of the area an action plan was prepared as part of the General Master Plan of the area. The plan had set the basis for the development of certain geotouristic and educational activities in the area under study.

INTERPRETATION AND GEOTOURISM

Interpretation of the area was been shared into insitu interpretation, and in printed material. ***Insitu interpretation*** was mainly achieved by the designation and interpretation of certain geo-trails that run over the whole territory and the development of outdoor panels that refer either to the established trails or to a specific geosite. According to the study and the assessment of geosites 15 trails were developed, connecting geological, archaeological and touristic places of the area. From these trails four are car or bicycle trails and eleven of them are trekking or hiking trails.

Static, ***insitu*** interpretation refers to the development of certain information panels or signposts. *Panels* are used mainly for the introduction of trails and have been set up at the most important attractions of the area and the places that a big concentration of visitors happens. Their dimensions vary in size depending on the number of trails illustrated. Each

Fig. 2 – Interpretation panel for the trails of Sitanos – Skalia area

Fig. 3 – The Zakros local Natural History Museum.

contains a geomorphologic map of the area under consideration with the existing trails, as well as the nearby geotopes and other important sites, and also the necessary explanation in Greek and English language (Fig.2). The *geotopes' signposts* are simpler displays located at the area of the most important geotopes exposing a picture of the most prominent feature of the geotope, as well as a short explanation of its importance.

Printed material on the other hand was designed for the various needs of visitors, as well as the educational processes. The most important item is the *Geotouristic field guide* that has been produced including general and popularised information on the landscape and geology of the area, the natural and cultural environment as well as the main cultural assets. The general information is followed by extended presentation of the most important geotopes as well as the trails, and this was produced both in Greek and English language. In addition a series of five *leaflets* has been produced for the interpretation of the trails distributed in the various geomorphological and geographical areas of the geoparks. Leaflets are again bi-lingual containing the map of the area as well as its interpretation, together with necessary information for the visitors.

In addition to these leaflets and the field guide a big *geomorphological and geotouristic map* of a scale of 1:15000 has been produced which is compatible with most common geographical coordination systems. The map at its back-side includes again bi-lingual information on the geology of the area as well as on the various geosites and the developed trails.

Geotouristic infrastructure has also been established through various activities that are dedicated to support tourism in the area based on the principles of sustainable and responsible tourism development (Smith & Rees, 1998). Issues of sustainability in tourism have long ago been established aiming to environmental integrity, social justice and maximizing local economic benefit (Croall, J. 1995).

The main tourist actions developed so far refer to the development of two information centers that will act as contact and dissemination points. These have been established at the villages of Pano Zakros in the form of a Local Natural History museum and at the karidi as a speleological centre. *Local Natural History Musuem of Zakros* hosts information on the natural environment of the territory, explaining the local geology and geological heritage in the form of thirteen small dioramas of ecosystems and three displays with representative samples of rocks minerals and fossils of the area (Fig. 3).

The *Karidi Speleological center* serves the needs of speleological research and dissemination. It provides all necessary infrastructure for accommodation and hosting of speleological groups and expeditions. It also will serves the needs for visitors information and welcome and will also provide all printed material and the educational projects for visiting schools.

In addition to the developed infrastructure a *video* has been produced to present the values of landscape, geology, environment and culture of the area, whereas a *website* (www.sitia-geopark.gr) has already been established that will act as the entrance gate to all geopark's visitors, providing in two languages the activities that are developed, the opportunities existing in the area as well as any other tourist and visitor data.

EDUCATION

Two *educational projects* have been developed for the area of Sitia that both are fit into the special geological, geomorphological and ecological features of the area. One is dedicated to cave and karstic environment whereas the second explores and interprets the endemic animal and plant species.

The educational projects have been designed in the form of museum kits that occur as a suitcase which can be transferred and implemented in many places and not only indoors. Both projects have been designed in the form of educational pathways and are based on the concepts of inquiry and experiential based learning (Endelson et al. 1999). They include theory and instructions booklets, a number of educational activities that can be performed indoor and outdoor, constructions and games, as well as small models and exhibits. The educational projects are indented to be used at the facilities of the two information centres in Zakros and Karidi villages, as no other official educational center exists at the area. Both projects include experiential activities along two of the trails around Karidi and Zakros, urging children to experience the nature and geology of geopark.

LET THE GEOPARK START

It is well known thorough the life of European Geoparks that geology, infrastructure and existing resources are not always the necessary tools to establish a successful geopark. Experience has shown that it is the willingness of local people and the operation of an effective management structure that can develop a strong and long lasting European Geopark.

The local community support for the development of the Sitia Geopark is prominent in the area, as for many years long efforts have been undertaken to create geo- and eco-touristic activities at their territory. Setting things in place was the first step that has been already achieved, but in order to make them work together with the local support, an efficient Management plan and public consultation were also necessary.

The developed *Management plan* is analysed in three parts. The first refers to the inventory and recording of all special features of the natural, cultural and economical environment putting emphasis on the geological heritage of the area. It includes also the evaluation of the geotopes and identify the value and the strength of the main sites, resulting in a SWOT analysis. The second part deals with the development of a Strategic plan for territory development presenting the vision for the operation as a geopark. This strategic plan is based on the provisions and consideration of responsible development, putting emphasis on education, development of geotourism and conservation. Based on the evaluation of former part, it also sets the priorities for the actions and the measures that have to be developed and recognises the means to achieve them. The third part presents the detailed action plan which summarises the goals and the actions to be undertaken, identifies the organisations, stakeholders, economical and human resources to be used for their achievement and sets the time table for their implementation.

The *public consultation* is one of the most important aspects of any development activity and has already started with discussions with the local authorities, the Foundation Panagia Akrotiriani that owns large properties in the area, as well as local trading and tourism associations, organisations dedicated to conservation of nature and local communities. For these reasons special meetings, public talks and informative events have been developed. The interest of all engaged contributors appeared considerably high especially due to other development activities that are planned for the area and have caused very serious arguments and objections. This may be identified as the reason that no management structure has been set yet, although the discussion in ongoing.

DISCUSSION

One of the most important prerequisites of a territory to be accepted as EGN member is to act already as a real geopark. It should thus have emplaced all infrastructure and processes on action, should receive visitors and provide information and services to them and manage all activities and materials in a common and sustainable way. Development of Sitia aspiring geopark in an area that no former protection or management structure occurs can be regarded as a model for development of a geopark in rural and remote areas.

Using existing and gain experience within the European geoparks Network, available and requested resources (like the support by INTERREG initiative) and following methodologies and formulas that exist in global literature a series of actions and infrastructure have been developed to set the basis for the responsible and sustainable management of Sitia territory. The inventory and assessment of geotopes phase was followed by the development of certain geotouristic and educational activities and infrastructures to interpret the abiotic, living and human environment of the area, to inform and educate visitors on the value of their environment and to offer qualitative services to the tourists. The conducted Management plan has finally identified future actions and activities, necessary resources and means, as well as the time space for their achievement.

The established Sitia Nature Park has a great potential to act as a real European geopark because the area has at present, a high tourism capability due to its distance from the big cities of the island and the difficulties in transportation that have resulted in a low tourism profile, with minor for the moment infrastructures, and mainly the development of eco-and cultural tourism. The model proposed under this geopark project is regarded by many individuals and organisations of the area as an alternative proposal to the extreme investments that are in progress in the area of easternmost Crete. These investments although most of them are related to renewable energy projects, which from a first view appear environmental friendly, if considered under the provision of sustainability and responsible development, one may find significant contrasts especially on the issues that deal with the reduction of negative economic, environmental, and social impacts, the creation of greater economic benefits for local people and enhancement of the well-being of host communities, and their positive contribution to the conservation of natural and cultural heritage.

The reasons for these arguments depend on several facts like their incredible size, the feature of these investments that either are water consuming or waste producing and that are actually implemented in most cases without the positive opinion and acceptance of local communities. Furthermore, these investments due to occupation of large areas, actually lead into fragmentation of natural environment, landscape modification and increase of threats to species and ecosystems.

The only solution to this debate may come from the implementation and the real operation of the geopark that will make obvious the benefits for local communities and environment.

ACKNOWLEDGMENTS

This project, GEOTOPIA, has been co-financed under the INTERREG IIIC Greece – Cyprus 2007 – 2013 program.

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Facing children's psychological burden in case of an earthquake or volcanic disaster through training and knowledge: RACCE project

Fassoulas C. ([a]), ZourosN. ([b]), Boldrini F. ([c]), Kourou A. ([d]), Tzvetanski T. ([e]), Nave R. ([f]) & Martini G. ([g])

([a]) Natural History Museum of Crete, University of Crete, Heraklion 71409, Crete, Greece. E-mail: fassoulas@nhmc.uoc.gr
([b]) Natural History Museum of Lesvos Petrified Forest, Lesvos, Greece
([c]) Villa Montesca, Cita di Castelo, Italy
([d]) Earthquake Protection and Planning Organisation, Athens, Greece
([e]) Center for Educational Initiatives, Sofia, Bulgaria
([f]) Vesuvius Observatory – INGV, Naples, Italy
([g]) Reserve Geologique Haute Provence, France

ABSTRACT

Natural disasters appear in our days the most serious threat for modern societies. Among them, earthquakes and subsequent volcanic eruptions are those that result in severe human losses, destruction of structural elements and engagement of huge financial resources for recovery. These hazards are those that mainly disrupt social cohesion because they are sudden, unpredictable (quakes) and their consequences last for long, affecting mainly women, children and disabled people. The lessons learned from past earthquake disasters have shown that children are among those civilians that are more psychologically depressed, either due to lack of experience, of knowledge and/or psychological support by the adults around them. **RACCE** project was supported by EU Civil Protection financial instrument in order to raise awareness and cope with children emotions in case of a serious earthquake or volcanic disaster. The project was implemented for two years in four countries; Greece, Italy, France and Bulgaria by seven partners and was coordinated by Natural History Museum of University of Crete. Various activities and deliverables were tested and implemented with schools, teachers and volunteers, and are available for use at project's website.

KEY WORDS: Disaster prevention, earthquake, eruption, awareness, education, RACCE

INTRODUCTION

According to United Nations and World Bank reports, disasters cause more than 3.6 million deaths and US$2.3 trillion in damage (in 2008 US dollars) between 1970 and 2010 (World Bank, 2010). The same study reveals that by increasing population and cities' size, meaning urbanization, increasingly more people are exposed to risks and thus to extreme damages caused by disasters without considering possible climate change effects. The expected cost is considered to be tripled up to 185 billion $ annually. Among the most disastrous appear the natural disasters, which in our days are more often than in past, although the natural phenomena that cause them, without considering climate change, do not present any significant changes at their development or even their recurrence periods (UN/ISDR, 2004). The reason has to be found in urbanization and modern societies' structure that support concentration of large number of people is small areas.

The geophysical disasters i.e. earthquakes, tsunamis and volcanic eruptions, are those natural phenomena resulting from internal earth processes, that may cause loss of life or injury, property damage, social and economic disruption or environmental degradation (Alcantara-Ayala, 2002; Gomez, 2006). These geophysical disasters, especially earthquakes result in severe human losses, destruction of structural elements and engagement of huge financial resources for recovery (World Bank, 2010; Danniel et al., 2011). These hazards are those that mainly disrupt social cohesion because they are sudden, unpredictable (quakes) and their consequences last for long. It is also concluded that although natural disasters can potentially affect everybody, it is the poorest and most disabled people (including women and children) who are more severe hurt.

The Hyogo framework for action developed by UN/ISDR in 2005 identified as a great priority the need to enhance international and regional cooperation and assistance in the field of disaster risk reduction through, transfer of knowledge, technology and expertise to enhance capacity; building capacities for disaster risk reduction; sharing of research findings, lessons learned and best practices; compilation of information on disaster risk and impact for all scales of disasters in a way that can inform sustainable development and disaster risk reduction; and through appropriate support in order to enhance governance for disaster risk reduction, for awareness-raising initiatives.

According to UN/ISDR (2005) report "Disasters can be substantially reduced if people are well informed and motivated towards a culture of disaster prevention and resilience, which in turn requires the collection, compilation and dissemination of relevant knowledge and information on hazards, vulnerabilities and capacities". Earthquake injuries and damages can be mitigated or prevented if appropriate measures are taken (Ehrenreich, 2001).

Thus the only tool that humanity has to protect itself is to be as better as possible prepared for a future earthquake. This document presents the results of an awareness project, titled RACCE that was supported by the Civil Protection financial instrument of EU aiming to educate and train children and adults on how to cope with children emotions in case of an earthquake or volcanic disaster.

MATERIALS AND METHODS

AIMS AND PARTNERSHIP

The project titled "Raising earthquake Awareness and Coping Children's Emotions - RACCE" was aiming at palliating the emotional burden and helping children cope in case of a serious natural hazard (primarily seismic and secondary volcanic), including those with movement disabilities. It focuses on raising awareness, improving knowledge on earthquakes and simultaneously, educating relative groups (teachers, parents, volunteers and civil protection operators) on the best practices and state of the art responses.

The Project was contracted on the 1st of January 2011 with a total duration of 26th months and its main objectives were:

- to identify, share and implement best practices and methodologies gained from previous EU projects and partners activities,
- to study and analyse the needs in each participating country,
- to develop and realise innovative initiatives and actions aiming to raise awareness and increase knowledge of pupils on earthquake and volcanic hazards, including those with movement disorders,
- to train teachers, parents or other relative groups to be able to contribute to children palliation in case of seismic hazard,
- to disseminate and share project's results and outcomes to potential beneficiaries and broader audience on a constant base.

In order to support a culture of prevention, focusing on a project in the Mediterranean area, European Research and Educational Institutions and Museums proposed a new approach of intervention in case of an earthquake or volcanic eruption to inform, protect and prevent, when possible, any psychological effect on children. Three Partners from Greece, the Natural History Museum of Crete (NHMC) which is the coordinator, Lesvos Petrified Forest (Lesvos PF) and the Greek National Earthquake Planning and Protection Organization (EPPO), as well as, four partners from Europe, the Villa Montesca Educational center and the Vesuvius Observatory/INGV from Italy, Center for Education Initiatives (CEI) from Bulgaria and Reserve Geologique de Haute Provence from France (Reserve GHP), met together to implement RACCE project.

NEEDS ANALYSIS

Education and training were the main objectives of RACCE however prior to their development it was necessary to identify the needs in every participating country. This was achieved by conducting Needs Analyses under which best practices and results of similar initiatives mainly for seismic, but also for volcanic hazard prevention and raise of awareness in younger ages were studied, evaluated and adapted to the needs of participating countries. This was achieved by the creation of project and local expert groups, the development of desk analyses by all partners on the formal school curriculums and best practices in raising children awareness on natural disasters and palliation of their emotions, the realisation, use and analysis of questionnaires in all countries; and, development of video-interviews with experts and specialists on the topic.

The main deliverable is a technical report summarizing information, assessment and conclusions of this analysis and is sited at the project webpage (http://racce.nhmc.uoc.gr/files/items/8/887/compiled_needs_analysis.pdf). Video interviews were shot with professors, experts in civil protection, specialists and educators in order to have a personal opinion and knowledge from people well experienced in the topics of civil protection, awareness raising, prevention of risks and education on natural disasters. Three were delivered from Greece, four from Italy, two from Bulgaria and one from France. Among the specialists were Prof E. Lekkas, Specialist on Natural Disasters, Dr Dr. Romano Camassi, seismologist from INGV, Dr. Alexander Dimitrov, specialist in first aids on disaster cases, Prof Olivier Bellier, and seismic hazard expert.

The most interesting results of Needs Analyis were delivered from questionnaires that indicated in a direct way situation in each participating country. Questionnaires were addressed by all partners to children aged between 6 and 13, including disabled children and adults (parents, educators and civil protection operators). Questions referred to earthquakes for all countries and volcanoes for Greece and Italy and were

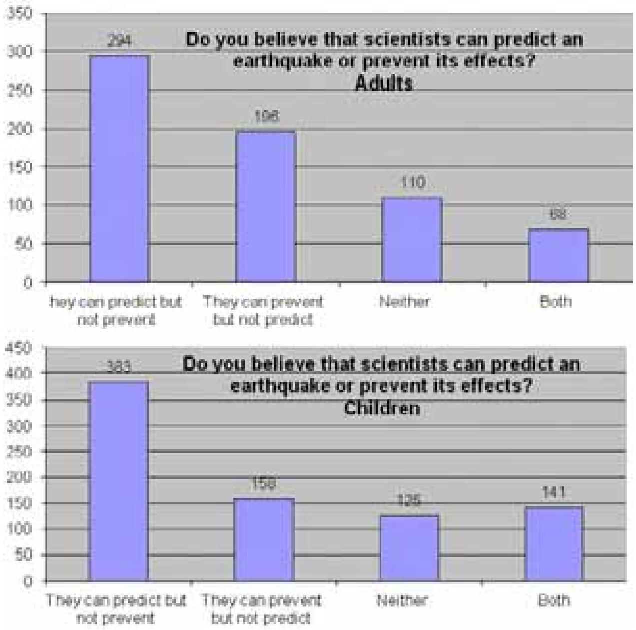

Fig. 1 – Adults and children response on the question about prediction and prevention of earthquakes and their effects depicts the great lack in knowledge.

settled in three groups: the technical and academic knowledge, the behaviours and the psychology.

In total we gathered 1449 responses, 567 from adults and 882 from children including two from disabled children. Analysis of results indicated that knowledge on these natural disasters is aged and country dependent with children to be proved more educated on earthquakes and volcanoes than adults and the state of knowledge to be higher in Greece and Italy compared to those in France and Bulgaria. It was proved however that the higher state of knowledge in Greece and Italy was achieved mainly through complementary education and not through formal school curriculums.

For comparison, knowledge on earthquakes at the fifth grade curriculum in Greece is restricted in 4 pages under geography lessons, describing generally volcanoes and earthquakes, while at the State of Californian similar aged children learn about earth's internal and plate tectonics theory, even discussing mantle convection. An interesting result appeared from the question that was addressed to adults and children about prediction and prevention in case of earthquakes. It is surprising to see that most adults and children believe that scientists can predict but not prevent the effects of an earthquake, than the opposite situation (Fig. 1). It is thus apparent that basic knowledge is missing even in countries with better awareness response.

The same conclusions came for preparedness that is more developed in Greece and Italy than in the other two countries, but even in these countries families do not have or discuss on an emergency plan. Additionally, at these countries the frequent exposure of people in minor events force them to ignore or at the better situation, to underestimate the earthquake and the volcanic threat.

Furthermore, volcanic preparedness is not at the same level as with earthquake risks. Finally, most people seem to be aware that experiencing a natural disaster can cause great psychological impact on children, but they lack both the knowledge and the experience of coping with seismic or volcanic emergencies. At this stage the responses of adults and children proved that the opinions of these groups on which are children's fears regarding an earthquake or volcanic hazard do not coincide. Adults believe that general panic and family disorder are things that children are afraid of, whereas children are actually afraid that some relative might be hurt or that house will be damaged.

The analysis of the questionnaires and the main conclusions are listed at the Annex accompanying Needs Analysis Study that can be found at project's webpage.

EDUCATIONAL PRODUCTS

Two main educational products have been designed following the results of Needs Analysis: a Travelling Exhibition and a mobile Educational Product.

The **travelling exhibition** was developed in the form of twenty roll-up poster of 200 cms high and 80 cms in width. The posters were first developed in English language and then were translated and realized in all partners' languages. Each poster covers a special scientific and conceptual topic like Natural phenomena and disasters, Myths and reality, earthquake and Volcanic phenomena in Mediterranean, Prevention and Preparedness measures, Psychological Effects in Children and Guidelines to Cope with Children emotions. The travelling exhibition has been used by all partners during project duration, and afterwards, for various needs and occasions like the implementation and training activities, civil protection meetings, school activities and public events.

The **mobile educational project** is the main deliverable of RACCE as it synthesizes the basic information, the good practices and experiences as well as the activities to train and educate children (FEMA, 1999; ELCNSTA, 2007). It was developed in the form of an educational pathway based on the scientific and research involvement of students and teachers through the experiential and inquiry-based learning processes (Edelson et al., 1999). The whole project was included in the form of a museum kit, a suitcase that can be shared and lent to schools and other educational centers for their needs (Fig. 2). The suitcase was prepared in English language and then it was translated and realized in all partners' languages. Each partner had to realize at least one suitcase and use under the implementation phase.

The museum kit contains three booklets for theory, instructions for educators and presentation of activities, models of earth and volcano interior, and a tsunami simulator, DVD-Rom with presentations and videos for constructions in class related with earthquakes and volcanoes, a table game, fourteen activities ranging according to children's age and two evaluation forms.

Following project's provisions efforts were undertaken to develop an additional project addressed to disabled children in collaboration with School for disabled children of Rethimno Crete, who were interested to develop and implement an earthquake awareness project. In close collaboration with the teachers the project was implemented at school and at Natural History Museum facilities and was then illustrated as a proposal in the form of a brochure inside the educational suitcase (Goudromichou, 2008).

Both mobile Educational project, and the Travelling exhibition were evaluated, tested and revised repeatedly, mainly by the EPPO and INGV, but also by external evaluators, for their scientific accuracy and their adaptation to children's age and knowledge. It was a cyclic evaluation, revision and testing process that lasted more than originally considered.

For educational needs a textbook with **Guidelines to Cope with Children Emotions** was prepared in collaboration with Dr A. Koumoula expert in child psychiatry and with experience from Athens earthquake, as well as by Mr Mauro Luciani, Psychologist, Prof of social psychology of University of Perugia, Italy. Palliation of children's emotions, especially in the case of a serious earthquake, or volcanic disaster is a very complex problem and international studies have shown that normally can take many years or even decades for their achievement (Ehrenreich, 2001). Moreover, undesirable emotions or/and behaviors can take a long time to appear on the surface making the effort much more difficult for the operators.

The aim of this deliverable was to develop of a tool to be used by various target groups to help palliate and cope undesirable emotions and behaviors of children and to cover the needs on that issue in each partner area. The guidelines however, can contribute in the early recognition of symptoms and behaviors, can offer a first aid psychological support, and can equip certain actors (parents, teachers, volunteers, others) with skills and methodologies to help coping undesired results the crucial period after the disaster.

IMPLEMENTATION AND TESTING

Implementation and testing of products developed during the early project phase was the main goal of final project implementation. It was thus indenting to recognize and improve miss functions, omissions or adaptation problems through training, testing and implementation of educational products. This was necessary for the non-formal and formal educational activities prepared for children that should be continuously implemented in preferably, an experiential manner. Implementation was also considered as necessary for groups not skilled in the relative topics, such the emotional burden of children due to natural hazards. All these prerequisites have been considered seriously and checked during the pilot implementation phase which resulted in various actions, all under an implementation plan.

Implementation of educational project was a necessary action for the finalization of deliverables, offering the opportunity to test products and methods proposed according to their applicability, relevance to the knowledge status of pupils, accuracy and admission of scientific information, functionality of proposed activities and materials, and identification of miss-functions and inconsistencies (Fig. 3). It can thus be considered that this action was real time and natural condition evaluation of products by external contributors and the end users. Each partner implemented thus the project either at its facilities or/and at school classrooms.

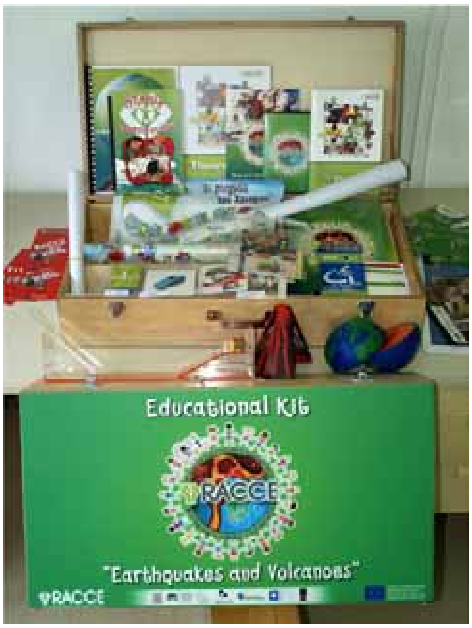

Fig. 2 – RACCE Educational Kit.

NHMC implemented products in all major towns of Crete: in close collaboration with the Regional Education Advisors for school Activities of Heraklion tested the educational project with two schools, the 20^{th} and 56^{th} Primary school of Heraklion; developed and tested a project for disabled children with the 1^{st} primary school for disabled children of Rethimno; and also developed and tested the educational project for preschool age in collaboration with the Regional Education Advisors for school Activities of Chania at the 11^{th} and 26^{th} Kinder School of Chania. EPPO also implemented the educational project for Primary School directors at Thessaloniki, Northern Greece. CEI implemented project in collaboration with the National Polytechnic Museum of Sofia, the 6^{th} Primary School in Sofia, the primary and secondary school "Hristo Smirnenski and the primary school "Peyo Yavorov", in the town Burgas. Vesuvius Observatory implemented educational project with the developed Local Network of Stakeholders, whereas Reserve GHP with the collaboration of the regional PACA office implemented project for students, parents and volunteers at Digne les Bains.

Training activities were developed by all partners in various forms of informative presentations, experiential workshops and drills at museums, national or local workshops, implementation of educational project at school classrooms and demonstration of Travelling exhibition, laboratories for construction of models proposed at the Mobile Educational suitcase, public talks and, participation in events and activities organized by Project stakeholders and external collaborators. Activities were addressed to various target groups like children, teachers, parents associations, civil protection staff, volunteers and broader public.

The final action of this task was related with the establishment of local voluntary groups. This was achieved in most cases during the implementation and training activities where various voluntary groups related with civil protection like Red Cross in Bulgaria, the Hellenic Rescue Team and the Heraklion Municipality Volunteer group "Protecta" in Crete. Lesvos established also collaborations with the local Department of Hellenic Rescue Team; Villa Montesca collaborated with four local voluntary associations and Reserve GHP with local civil protection volunteers during the SEISMOTOUR event. These groups were informed on the RACCE products, were educated on how to cope with children emotions and have implemented educational project and other experiential activities.

Various dissemination actions were scheduled and were fully undertaken according to work plan, whereas, various opportunities that appeared (like International days for Disaster Risk reduction or the Dinosaur exhibition at NHMC) were additionally used to share project activities and outcomes. The majority of dissemination actions and deliverables are hosted at project webpage (http://racce.nhmc.uoc.gr/) and at Facebook.

DISCUSSION

RACCE project was designed to offer basic knowledge, transfer of knowhow and best practices and train various target groups as pupils, teachers, parents, civil protection volunteers and operators, and to support children cope with unexpected emotions in case of an earthquake or volcanic disaster. During the large number of training and implementation activities project staff came in close collaboration with many educators, teachers, civil protection professionals, children, civil protection volunteers and other citizens, who expressed their enthusiasm and appreciation on the delivered actions and products. Projects' activities were also presented under various occasions, like the International days for Disaster Reduction, International Congresses, as well as activities under International organizations like UNESCO and Global and European Geoparks.

The Regional Education Office of Crete, various educational offices in Athens as well as many schools across Greece and Italy, have expressed their interest to use the educational projects and the Travelling exhibition, with some of them already having benefited from their use. Evaluation sheets, as well very positive comments were received especially on the high quality graphics, contents, innovation and tools, putting the necessity to reproduce educational project in more kits than originally planned. Similarly, internal evaluation process attested the quality and achievement of all goals and standards set initially.

For these reasons NHMC has managed to save money and reproduce four more Educational kits for the regional education offices of Crete, and develop an extra kit in five pieces, for the needs of the pre-school and early primary school ages, that have been offered to the Regional Education office of Crete.

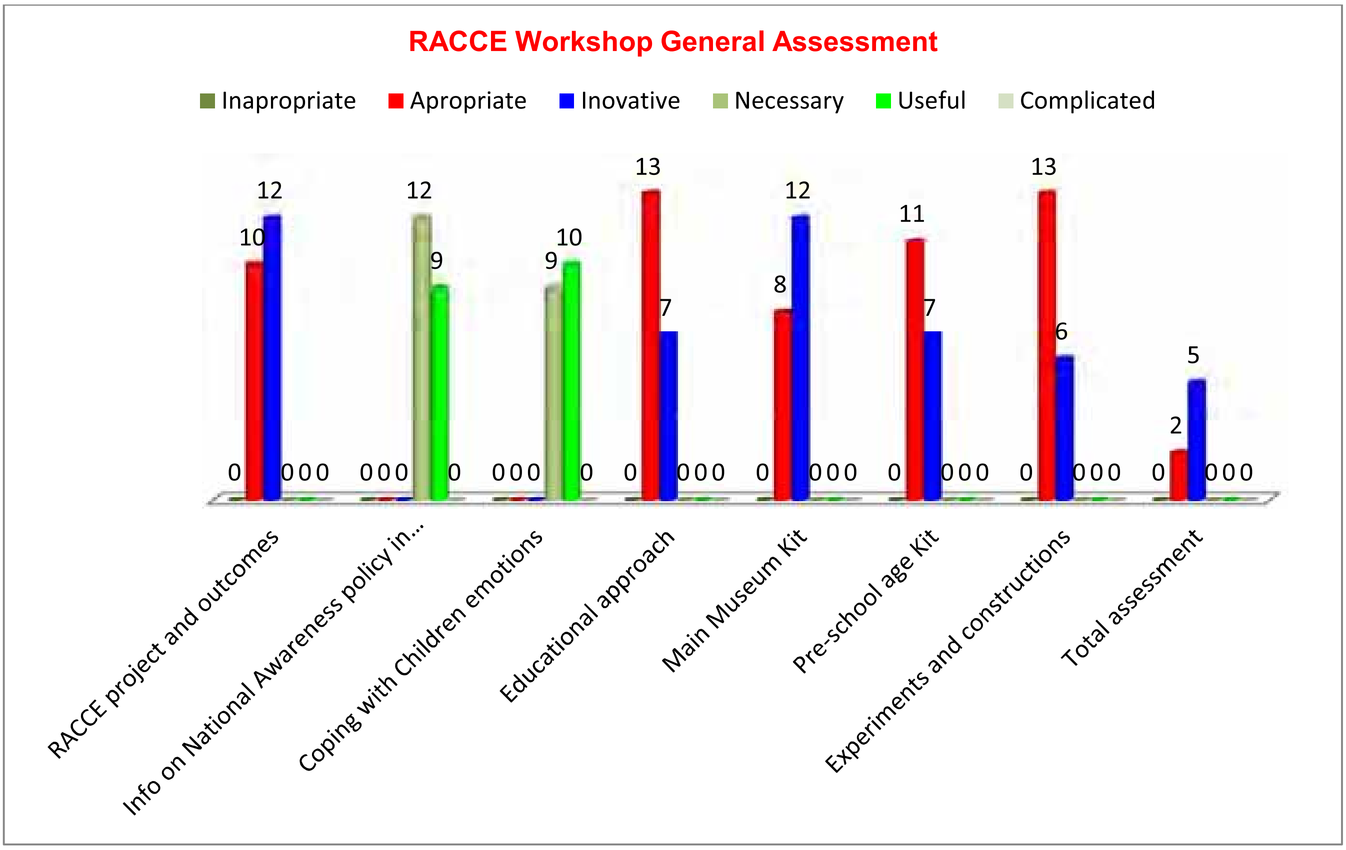

Fig. 3 – Example of a training seminar evaluation addressed to teachers of primary education hosted in NHMC on 26/11/2011. Participants were asked to evaluate various activities of meeting, so values present the number of participants favouring each answer. In some activities only some of the teachers gave answer (like the last one for Total Assessment of meeting).

A long list of activities for the forthcoming school year (2013-2014) have already been prepared to disseminate and present RACCE deliverables and train teachers, schools and individuals.

All the above testify that RACCE deliverables not only have fully covered initial goals and standards but in many cases extended their effectiveness and application as well as their implementation to as many beneficiaries as possible. Pilot implementation actions, internal evaluation process and collaboration with educational experts offered the opportunity to make necessary improvements and modifications of deliverables where it was necessary.

The general comments we have received so far lead to a very important ascertainment that applies to the whole extent of Civil Protection operation: "Although we have improved and developed high technology products to serve civil protection, still necessary and basic issues like simple knowledge transfer and training are missing in many countries and procedures throughout Europe".

The case of the kid who understood the danger from the retreated sea at the beginning of the Sumatra tsunami and managed thus to save his family by escaping, quite early, from the coast, is very characteristic for the effects that knowledge of basic information on civil protection can have!

ACKNOWLEDGMENTS

RACCE project has been co-financed by the EU, Civil Protection Financial Instrument, Grant Agreement No.070401/2010/579066/SUB/C4. Project staff, external collaborators, associated experts, collaborating teachers, volunteers and schools are deeply thanked for their support in project implementation.

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Monitoring and valuing the European geological heritage: operational uses of satellite applications

Grazia M. Fiore ([a])

([a]) Research and Project Coordinator, Eurisy, 94bis avenue de Suffren, 75015, Paris, France. E-mail: Grazia.fiore@eurisy.org

ABSTRACT

Geological and landscape diversity is an essential part of the European culture. It characterises our rural and urban environments and offers the resources needed to sustain human communities.

To monitor and protect geological heritage, back in 2003 the European Parliament stressed the importance of harmonising analytical methods to obtain comparable soil data and of increasing the exchange of information among Member States on soil, topography, structure and natural form of the land in Europe (European Parliament, 2003).

Today, satellites offer the opportunity to collect and access geological and biological information covering large areas, including urban, rural and natural environments at the micro and macro regional levels. On their own initiative, or within European and national schemes, local and regional managers are already using satellite services to monitor, protect and promote geological, landscape and biological diversity.

To disseminate the results of these initiatives is fundamental to capitalise on experience to develop new services adapted to local needs, and to set the basis for the establishment of an integrated coherent system to manage geodiversity in Europe. Eurisy, a non-profit association of space agencies, works to foster awareness of operational uses of satellite applications in this and other sectors.

KEY WORDS: Satellite services, Earth Observation, Satellite navigation, Soil protection.

INTRODUCTION

Designing and implementing management policies regarding cross-border issues such as natural and man-made hazards, landscape monitoring, and conservation of geological and biological diversity, among others, require the involvement of all the stakeholders acting on a specific territory, who are connected by an immediate interest in its welfare.

This paper aims at informing such public managers and stakeholders about some satellite solutions already available and used by European local managers to map and monitor geological and landscape changes, to improve territorial planning and to raise awareness and enhance education on earth heritage.

Such experiences will be presented from the end-user perspective, with the intention of focusing on the results of the satellite solutions adopted rather than on the technology per se, in line with the Eurisy mission of connecting space to society.

THE EUROPEAN GEOLOGICAL HERITAGE: CONSERVATION THREATS

Geological heritage includes geo-morphological, geological, hydrological, pedological, special archaeological values originated throughout the long history of the evaluation of the Earth's crust (Ilic, 2006).

This heritage is vulnerable to global phenomena, like climate change, and to human activities, such as inappropriate agricultural and forestry practices, industrial activities, tourism or urban development carried out at local and global scales. Indeed, the EC policy report of February 2012 on the implementation of the Soil Thematic Strategy stresses an increase in soil erosion, sealing, desertification, contamination, landslides and flooding, among others, in Europe (European Commission, 2012). At the same time, recent natural catastrophes, like the earthquakes which occurred in Italy in the last few years, revealed gaps in the information available for policy makers and emergency managers when facing geo-hazards.

TOWARDS A EUROPEAN MANAGEMENT FRAMEWORK FOR EARTH HERITAGE

Geological heritage is clearly an issue of transnational relevance, and its monitoring and conservation has been the object of concern and discussion among European governmental and non-governmental institutions at various levels. Although this interest has not yet led to the establishment of a coherent strategy for geological heritage monitoring and conservation in Europe, different intergovernmental and non governmental institutions expressed the need to improve management of geological heritage through the use of better inventorying techniques, wide dissemination of scientific information on nature and improved cooperation among decision-makers working in complementary sectors (Council of Europe, Committee of Ministers, 2004).

Also the EU Biodiversity Strategy for 2020, often protecting sites having also a geological interest, emphasises the need for "*digitised, accessible maps containing accurate information about the principal natural resources, protected* *areas, land uses, water bodies and areas at risk*". Moreover, the Strategy recommends that scientific data on biodiversity and examples of best practices are made "*widely known and shared among policy-makers and key stakeholders, and that the relevant ICTs play a crucial role in delivering new opportunities and tools*" (European Commission, 2011).

The EU has been also working, since 2002, to a "Thematic Strategy for Soil Protection", complemented in 2006 by a Soil Framework Directive that has been rejected by a minority of Member States (March 2010, Environment Council) on grounds of subsidiarity, excessive cost and administrative burden (European Commission, 2012). The proposed Framework Directive–asked for an integrated framework of actions, implemented by each country according to the characteristics of the soil.

In 2004, the European geoscience community and the voluntary sector–published a Manifesto on Earth Heritage and Geodiversity, urging the EU to "*incorporate Earth Heritage and Geodiversity in policy, planning and related procedures*".

SATELLITE SERVICES AS A VALUABLE TOOL IN ENHANCING GEOLOGICAL KNOWLEDGE AND MANAGEMENT

The EC policy report of February 2012 on the implementation of the Soil Thematic Strategy envisages the establishment of mechanisms for harmonised European monitoring of soil parameters for a whole range of statistical, research and policy purposes, and specifies that "To consolidate harmonised soil monitoring for a variety of purposes [...] the Commission is considering repeating soil investigations at regular intervals (five-ten years), also by using new remote-sensing techniques. [...] The Global Monitoring for Environment and Security (GMES) programme will also be a source of information, particularly on soil sealing" (European Commission, 2012).

Indeed, European engagement in space activities, and in particular the two flagship initiatives Galileo and Copernicus (formerly GMES) will provide European managers with consistent and comparable EU-wide information products across administrative boundaries that will enable an integrated approach towards efficient soil use.

Satellites in fact make it possible to have a comprehensive overview of regional ecosystems, and offer valuable information on changes on the Earth's surface, like soil sealing and vegetation coverage, that can be used by public managers to improve soil management and spatial planning and to evaluate processes influenced by the state of the soil, such as floods (GMES, 2013). Furthermore, mobile services based on satellite navigation allow for new interactive ways to inform the general public on geological and biological issues and to raise awareness on environmental concerns.

LOCAL AND REGIONAL AUTHORITIES AS INNOVATION LEADERS

Many actors intervene on territorial management and conservation, including urban and rural planners, civil protection officers, environmental managers and policy makers at local, regional and national levels, but also national geological surveys, industrial associations, trade, farmer and land owner organisations, science and research institutes, as well as several associations and NGOs. In the absence of a coherent European policy on geological monitoring and conservation, soil management remains mainly an issue of national concern, often entrusted to local and regional public managers.

On their own initiative, or within national and European frameworks, local and regional managers are indeed experimenting new solutions for geological monitoring and conservation. Satellite-based information, in particular, is used to identify sites of geological or geomorphological interest, to monitor geological trends and changes, to raise awareness and to educate the public on the value of these sites.

The examples provided below are only a few among the numerous initiatives undertaken by European local and regional authorities to harness the benefits of satellite applications for improved territorial management. A wide dissemination of these experiences is essential to ensure capitalisation of results and to foster the development of better solutions, adapted to local needs and to the variety of European landscapes.

ENHANCING MAPPING AND SURVEYING TO PROTECT HEARTH HERITAGE

Mapping land cover: the experience of the Dorset County, United Kingdom

The Dorset County includes a variety of habitats and land covers such as woods, agricultural cultures, urban conglomerates, and coastal zones on which a number of private and public entities intervene. As from 2005, the Dorset County Council adopted a Local Geodiversity Action Plan, which fosters the creation of a Geographic Information System (GIS) with a layer for geodiversity data (Dorset County Council, 2005).

Geoconservation is complementary to biological conservation, and indeed land cover and vegetation management have a key role in protecting geodiversity processes. In order to acquire reliable data on land cover and vegetation, the South West Protected Landscapes Forum -the umbrella body for the most prized places of natural beauty in Cornwall, Devon, Dorset, Gloucestershire, the Isles of Scilly, Somerset and Wiltshire- uses a combination of aerial and satellite imagery to produce landscape maps of the territory. Although information on land cover existed also prior to the use of satellite imagery, it had never been combined into one map, leaving the potential for overlap and duplication (Dorset AONB Partnership, 2013).

Remote sensing techniques used since 2010 within the framework of the Cordiale project (www.cordialeproject.eu), allowed for land cover classification (woodland, grassland, heathland and wetland) over a large area (884.8 km^2) in a homogeneous way, and for the identification of core habitat sites and a 'functioning ecological network' (with regards to species movement).

The land cover and habitat maps have been made available to different public and private entities operating on the territory. In fact, these maps provide guidance not only to environmental managers and urban and rural planners, who can better target actions where the restoration effort will yield the fastest and most robust ecological benefit, but also to land owners and farmers, who are encouraged to use the maps when considering a new application for Environmental Stewardship and/or Forestry Commission grant aid (Eurisy Website, Nov. 2012).

The use of remote sensing reduces the need for labour intensive, time consuming site Surveys and inventories (Environment Systems, 2012), and helps to easily detect land cover and habitat changes by comparing images taken at different moments in time.

Managing land use conflicts to protect geological and archaeological heritage: the experience of the Vestfold County Council, Norway

Vestfold, in Norway, is also a county in which urban, rural and natural environments coexist. The Vestfold County is in fact relatively close to the capital, Oslo, and is characterised by large areas of arable land with patches of forests, interspersed with exposed bedrock. The county has a unique natural environment, botany and geology, including the Vestfold "Ra", a gigantic, visible but mostly covered ground moraine from the ice age. Moreover, the area hosts some impressive ship burials from the later Iron Age. The Vestfold County Council is responsible for protecting such geological heritage from infrastructure development and agriculture exploitation.

Although many archaeological sites were known thanks to field surveys and excavation works, recent surveys showed that many sites are still hidden under cultivated land. This discovery was made possible with the combined use of aerial photos and satellite imagery. The latter has been analysed with a new software, CultSearcher, developed and tested through a collaboration among the Vestfold County Administration, the Norwegian Computer Center, the Norwegian Institute for Cultural Heritage Research, and the Norwegian Directorate for Cultural Heritage (Rune Solberg at al., 2009). The use of satellite-based information allowed for the discovery of over 30 new ring ditches surrounding a grave mound in the last three years and will enable territorial planners to take better informed decisions on new infrastructure. On the basis of the Vestfold experience, the Norwegian Directorate for Cultural Heritage envisages the establishment of a system using the same software on a national level (Eurisy, 2012).

RAISING AWARENESS ON GEOLOGICAL HERITAGE TO PROMOTE CONSERVATION AND LOCAL DEVELOPMENT

Educating on Earth heritage: the example of the Swiss National Park

Article 15 of Chapter IV of the proposed Framework Directive on Soil "Awareness raising and public participation" invites Member States to "take appropriate measures to raise awareness about the importance of soil for human and ecosystem survival" (European Commission, 2006).

The Swiss National Park has a long experience in using remote sensing and satellite navigation to update its geographic information system (GIS), which is used for research and management purposes. Moreover the Park, which is a category 1 strict nature reserve and wilderness area, where no human can leave the established paths, has used since 1998 GPS to track mammals and reptiles to better understand their behaviour. The area has a particular interest both in terms of biodiversity and geology, since over 200 fossilised dinosaur footprints were discovered in the eastern part of the park. In order to allow visitors to witness the unique landscape without a park guide while remaining on the established visiting perimeter, "IWebPark", a multimedia guide has been created by geolocating images, audio tracks and texts covering a wide range of information, such as the user's position, the animals and plants in the park and geological and historical facts, among others. The multimedia guide can be rented in the Park or it can be downloaded directly on smartphones. This initiative aims both at making young visitors interested into the biological and geological heritage of the area and at promoting a dynamic image of the National Park (Eurisy Website, May 2013).

Valuing Earth heritage to promote local sustainable tourism: the experience of the Swiss Region of Mendrisiotto and Basso Ceresio, Switzerland

The previous is an example of how satellite-based services can support environment managers in their educational mission. Similar mobile applications can also be used to foster ecotourism, which is an important example of how economy can be oriented towards activities which are respectful of the territory and its inhabitants.

That is the case for the Swiss region of Mendrisiotto and Basso Ceresio. The region, relatively unknown to people visiting the country, is covered by 60% with forests, including areas of outstanding natural beauty, as the Parco della Breggia and the UNESCO World Heritage site of Monte San Giorgio, where fossils can account for the geological history of the area over the last 240 million years. In addition, the region hosts some endangered habitats and species, included in the Emerald list of protected areas. To foster tourism in the region while valorising its natural and cultural heritage, the regional Tourist Board created a series of thematic itineraries over a range of about 300 km and made available the GPS tracks to follow them autonomously, walking or biking. Some of the itineraries have been designed in collaboration with other tourist offices, or other environmental organisations. The collaboration with the World Wide Fund for Nature (WWF), for example, led to the creation of nine geolocated itineraries to discover the

"Emerald" zones in the territory, including a geo-paleontologic itinerary on Monte San Giorgio.

To involve local business, e-bike itineraries have been created involving hotels renting electric bikes, while other tracks guide visitors through vineyards and cheese factories, thus promoting not only the beauty of the landscape, but also local products (Eurisy Website, Apr. 2013).

MONITORING SOIL CHANGES TO MANAGE GEO-HAZARDS

Slope hazard detection to reduce impacts on human settlements: the initiative of the Campania Region, Italy

Geological heritage needs to be monitored not only to protect its diversity and beauty, but also to observe, prevent and manage hydrogeological movements that can seriously damage the landscape and human settlements. Satellite services proved to be extremely effective in supporting local managers to monitor soil changes and cope with geo-hazards, as exemplified by the Campania Region and the Arno River Basin Authority in Italy.

The varied landscape of Southern Italian region of **Campania** includes hills, plains, a part of the Apennine Mountains and six important volcanic sites, which have determined the morphology of the area throughout the centuries. The Region has a medium-high seismic hazard and a high exposure and vulnerability to this risk (due to the fragility of the buildings and infrastructure and to the population density). Seismic and hydrogeological movements make the region also affected by bradyseism, the gradual uplift or descent of the Earth's surface.

The **Sector for Soil Protection of the Campania Region** uses a permanent satellite monitoring system of slow-moving landslides to detect slope hazards in urban areas. Within the framework of the Tellus project (2005-2009), a local GPS network was built on the regional territory (Regione Campania, 2007). The information provided by the fixed and mobile GPS stations is combined with aerial and satellite imagery and with geological surveys to control the impact of soil deformation, soil erosion and slow-moving landslides on urban settlements particularly exposed to hydro-geological risks.

Data collected by the local GPS stations are automatically sent to the Soil Protection Sector and the Civil Protection Office of the Campania Region. Moreover, all the geological and geomorphological data obtained through aerial imagery, satellite imagery, the GPS stations and the field surveys have been collected into a cartographic and thematic GIS web portal, which enables different public entities to access and share such information. This allows for an integrated analysis on the whole regional territory of some of the slow-movements of the soil caused by seismotectonic, volcanic, gravitational and human activity. Furthermore, the system enables a detailed analysis of the single landslides and deformations with an impact on residential areas, transport infrastructure and productive areas (Carlo Terranova et al., 2009).

Flood and landslide monitoring: the experience of the Arno River Basin, Italy

Similarly to the example of the Campania Region, satellite imagery is used, in combination with other sensors and surveying tools to integrate the Landslide Geographic Database used by the **Arno River Basin Authority**, in the Italian Tuscany Region, to map and monitor old and new unstable areas (Filippo Catani et al., 2006).

The Arno River Basin covers about 9 131 km2, and it is particularly affected by landslides. In fact, there are more than 300 areas within Italy's Arno Basin at high risk of landslides (European Space Agency Website, 2005) and more than 600 landslides have been mapped between March and April 2013 (Autorità di Bacino del Fiume Arno Website, 2013).

To build its Hydro-geological Structure Plan, as required by Italian law, the Arno National Basin Authority profited from the ESA-funded project SLAM (Service for Landslide Monitoring). Within the project, more than 350 satellite images of the region were combined with ground information to identify and assess slope instability and risk across 8 830 km2 of territory (European Space Agency Website, 2005). This procedure has been coupled with an intense geological interpretation phase characterized by the analysis of traditional in situ monitoring data, ancillary data and the performing of field surveys (P. Farina et al., 2004). The data collected permit to characterize and monitor temporal changes of existing and new unstable areas, like the modification of boundaries, and to forecast slope behavior and future landslides, hence supporting local managers in focusing monitoring and prevention in the areas where landslides are most likely to happen.

The Hydro-geological Structure Plan is constantly updated in cooperation with Municipalities and is the main planning and programming tool for risk reduction in the Arno Basin.

CONCLUSIONS

The previous examples demonstrate that satellite services do have the potential to support environmental managers in acquiring information essential to monitor and protect Earth heritage. Moreover, the information collected with satellite applications is objective enough to be used by a number of stakeholders in complementary sectors, like water and forest managers and land owners. Finally, it can also support the design and implementation of local development strategies focusing on the protection and valorisation of natural heritage.

The experiences presented here exemplify only a few of the satellite applications available for public managers to collect information, monitor and valorise geological heritage in Europe. The wide dissemination of these and other operational initiatives of use of satellite information and services is essential to capitalize on experience, to identify replicable good practices and to develop new services adapted to the specific needs of European landscapes.

The greatest advantage of satellites is to offer precise, comparable and sharable information on large portions of territory. In order for this information to be fully exploited by land planners, researchers and stakeholders working on geological monitoring and conservation, it is desirable the creation of a common platform to share harmonized data at the European level. Some platforms already exist to provide public managers and stakeholders with satellite-derived information of geological characteristics and changes. For example, the **INSPIRE Geoportal** (http://inspire-geoportal.ec.europa.eu/) permits to search for spatial data sets and spatial data services and, subject to access restrictions, to view spatial data sets from the EU Member States within the framework of the INSPIRE Directive. Also the **European Soil Data Centre –ESDAC** (http://esdac.jrc.ec.europa.eu/), hosted by the Joint Research Centre (JRC) of the European Commission aims at collecting all relevant soil data and information at European level. The ESDAC Map Viewer allows to access information on several geological characteristics of the European soil, such as land use, primary, chemical, hydrological and mechanical properties, water management systems and others. The EC **PanGeo project** (http://www.pangeoproject.eu/) instead, provides free access to ground instability geohazard information for many of Europe's largest cities, combining satellite measurements of ground and building movement and geological information already held by National Geological Surveys. Such data can be viewed in Google Earth or via the portal integrated into the PanGeo website. Moreover, a **Digital Observatory for Protected Areas** (http://dopa.jrc.ec.europa.eu/index.html), also hosted by the JRC, provides park managers, decision-makers and researchers, among others, with satellite-based information and tools to assess, monitor and forecast the state and pressure of protected areas at the global scale.

As an example of a portal collecting information at the global scale instead, the **International Charter Space and Major Disaster** (http://www.disasterscharter.org) offers a platform to access information on major natural disasters, such as earthquakes, landslides, floods and volcanic eruptions. Authorised users (and soon any national disaster management authority) can request support from the Charter for emergencies in their own country, or in a country with which they cooperate for disaster relief and obtain satellite data on a disaster occurrence.

These initiatives clearly aim at giving the widest dissemination to geological information collected through satellites and other means, and are to be welcomed as the starting point for the establishment of integrated regional and global monitoring systems for Earth heritage.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

From cave to land:a model of local development

Gay V. ([a]) & De Mauro A. ([b])

([a]) General Manager Fondazione MIdA-Musei Integrati dell'Ambiente, loc. Muraglione, 84030, Pertosa (SA), Italy E-mail: direttoremida@yahoo.it
([b]) Marketing Assistant Fondazione MIdA-Musei Integrati dell'Ambiente, loc. Muraglione, 84030, Pertosa (SA), Italy E-mail: marketing@fondazionemida.it

ABSTRACT

Every territory is characterized for its particular characteristic, all deserving of attention and valorization. For this reason the discriminating factor between development and decline consists in the ability in acquiring awareness of its own possibilities, in order to make such awareness patrimony of the reference community and to start in the meantime a process of rediscovery of its own identities, making itself "product" to offer to the market.

It is then necessary implement consequential innovations of management from intuitions reflecting on commercial activity successful in other different sectors. Therefore it results opportune a managerial contamination able to overcome the normal self-referentiality that express when is pursued only a vertical development of competences and management experiences.

KEY WORDS: caves, innovation, museum, sustainability.

INTRODUCTION

MIdA is an acronym that is for Integrated Museum of the Environment. MIdA Foundation is born for creating a model of development grounded on the touristic exploitation of environmental assets often defined "minor".

The reference territory is characterized by the presence of karst phenomena that find their own peak in a cave open to tourists since 1932, known as Cave of Pertosa, then as Cave of the Angel and today named Caves of Pertosa-Auletta.

Its motto is "not only caves". Declining the term to the plural, it wants to affirm the opportunity to enjoy the cave in different manner, besides that to promote the surrounding territory, for its all characteristics.

The replicability of the model finds its ground in the peculiarity that every territory has, all deserving attention and improvement. So the discriminating factor between development and decline consists in the ability of acquiring awareness of own possibilities. Making such awareness reference patrimony of community and starting, in the meantime, a rediscovery process of its own identities, it could be a mere "products" to offer to the market. in this perspective have been grounded the integrated museums of the environment, recognized of regional interest. With the museum have started involvement activities of the local schools in different projects candidate to the annual announcement, of the local stakeholders with the employment of the Campania Region Plan of Rural Development.

A SHORT ACCOUNT

About the different manner of caves fruition, there were two tourist trips and two speleological trips. The caves owes its particular success to the initial stretch crossed by boat on a pond, that picks up the water of the Negro river for hydroelectric uses. This specificity induced a private theatrical production, Tappeto Volante S.r.l., and MIdA Foundation to conceive a representation of "Dante's Inferno in the Caves in Pertosa There are not wings and the scenery is offered by the constant work of nature with its marvellous concretions. Public, divided in groups and accompanied by an actor that plays Dante Alighieri, make a tour across the ten circles describe in the first cantica of the Divine Comedy and interacts with its principal characters: devils like Caronte and damned like Paolo and Francesca, Cavalcante Cavalanti, Pier delle Vigne and Count Ugolino, up to experience absolute evil, Satan. In this way is born the speleo-theatre. In fact, this model of show has been after rerun in Castelcivita with the performance of "Orfeo and Euridice" and in Castellana with the show "Hells in the cave".

To defeat the vegetable pollution caused by the phenomenon of chlorophyll photosynthesis has been realized a technologically advanced plant of scenographic illumination. So, to avoid the graft of the photosynthesis, caused by a particular frequency of white light, are used led, managed by a software that filters and reduces the particular bright with a different combination of colours that gives place to suggestive sets of light; this cold lamps have also served for avoiding the development of the process, facilitate by the heat of old lamps; while the time of light and heat exposure has been reduced sectioning the cave in 17 accesses point, managed by the tour guide with a palm top, so today the illuminated section is only indeed that visited and not all the cave, as it was in past. The palm top allows also to reach a greatest safety, because it is possible to communicate with outside, through VOIP technology and because it is possible to follow the dynamic location of the groups of visitors.

The territory is crossed by the Tanagro river. Therefore the Foundation started at first some sporting activities of canoe, ending up also organizing a valid competition for the national Championship. Then it has given hospitality to the Campobase association that today offers activities of rafting, canyoning, trekking, paint-ball and tree-climbing. The whole offer of adventurous experiences, together to the European novelty of speleoraft and the speleological tours characterize the territory as a real and natural playground of adventure. Among this the very adventure is the "Journey to the Centre of the Earth " with the up of an underground river to the spring in the bowel of Gea mother, All with services of locker room and showers.

Few away from the entry of the caves there is a disuse railroad. The Foundation has summoned the neighboring Communes interested by the railroad, their Mountain Communities and the National Park of Cilento, Vallo di Diano and Alburni in order to ask its assignment to the Italian Railway Net (Rete Ferroviaria Italiana, RFI) like a loan for use. In the next spring it will be so founded the first national line of Velorail: the fruition in bike on rails of an abandoned railway stretch. Pedaling on the experimental route, from Pertosa to Auletta, it can be enjoyed of a tour in the luxuriant nature of the Alburni Mountains, with unusual perspectives and particular suggestions offered by crossing an ancient building bridge to three arcades and two galleries.

The integrated museums of the environment have a geo-speleo-archaeological section and a botanical section. The museum scientific direction is submitted to professor of Agricultural science. This choice was born from the demand to qualify the museum as laboratory to the service of the local agriculture. So the presence of a gastronomic excellence, such is the white artichoke of Pertosa, has offered the opportunity for two separate projects. The Novorod project, grounded on the milk-cheese chain, and the project on the artichoke as dyeing plant. Novorod foresees the production of stretched cheeses with vegetable curdle of white artichoke of Pertosa, milk naturally enriched, particularly of omega3 after feeding the cattle with flax seeds, reusing of the buttermilk with wild berries for the realization of other creamy and spreadable cheeses and energy's production from biomasses. Currently in pending realization, it is studying the opportunity of the creation of a consortium among the partners of the project: University of Basilicata Region, two southern foundations that are MIdA and Medes, the centre of researches CRA ZOE - Ministry of Agricultural, Food and Forestry Policies and 17 local dairies. The project of artichoke as dyeing plant is inserted in an ampler project of the Faculty of Pharmacy of the Salerno University. In this project are reused the rests of the workmanship of the artichokes, through their atomization in dust that, through a process of staining and extraction of the dyes, it has produced three new colours: a yellow called Gold MIdA, a particular green named Green Pertosa and a brown denominated Soils of Auletta. Financed by the Campania Region Department of Agricultural Policies, currently it is appraising the opportunity of a spin-off with the participation of a private entrepreneur for the production of plasters and colours for the market of the sustainable architecture.

The Foundation has recorded then two brand name: Terre di grotte (Soils of caves) and ma-integrated museums of the environment. With the first one it would to commercialize local products that will go on the market with a local specialty certification and with the respect of a sustainable and biological disciplinary able to increase the intrinsic value of the traditional productions. The second one allows the capitalization of Foundation brand gathering the opportunity offered by the name and the job of research. In the name of the foundation stand out two great “valours”: the words museum, index of authoritativeness, and environment, synonym of ecology. In this way it would be possible to reach a commercial remuneration of “added value" created with the laboratory research and the expository and communicative ability, proper of a museum. To achieve a suitable distribution of such products the foundation, besides, has undersigned an agreement with the society Art'em, that manages the archaeological areas of Paestum, Velia, Capua, etc.

With the purpose to oversee the tourist chain in its strategic heart of promotion and distribution the foundation has been among the promoters of the constitution of the tour operator Cilento incoming SCaRL. While to realize activity of fund-raising has been founder member of the Salernitana Community Foundation.

Currently, the foundation intends to give importance and value to the archaeological emergency of the cave, offered by the existence of a unique complex of pile-dwelling in cave and in altitude. It has already been realized recognitions and cataloguing of the finds emerged with the nine hundred excavations and it is now trying to take back them, with modern technologies, in the intent however of making spectacular the results of such researches and to found on them a system that produces real productive economy.

MANAGERIAL INNOVATION

Extension of the offer: the previous tourist offer was based on two tariffs of entry to caves: the basic tour and that long one with a facilitation for the children from 6 to 15 years old and for the over 65 years old. The offer has been widened with the introduction of an intermediary tour. The enlargement of the offer has allowed an increase of the earnings without meaningful increases of price. For the simple statistic positioning on the intermediary offer it is achieved a 13,45% increase in the first year to which is added the 14,71% increase in the following year.

Process innovation and formation: in the past visits were effectuated according a pre-arranged timetable, with indication of tours and waiting times that were of around 1 hour and with tour-guide service also for few people. The abolition of the timetable for the visits, with consequent sell and management of the itineraries by the box-office, formed with specific courses, it has reduced the waiting times to a maximum of 30 minutes and the creation of groups without entrance of individuals. Besides this has contributed to a further raising of the middle earning from tickets with a great positioning of the offer thanks to the “sell” of the tours. All this has also increased the productivity of the tour guide (raising the relationship visitors/tour guide and increasing the real times of employment of the tour guide) and therefore the general profitability of the management.

Emilia Romagna Apennine Geopark Project-(ERAGP)

Gentilini S.([a]) & Panizza M.([b])

([a]) BolognAppennino Local Action Group, Viale Silvani 6, 40120 Bologna, Italy. E-mail: sara.gentilini5@gmail.com; info@bolognappennino.it
([b]) Earth Sciences Department, University of Modena and Reggio Emilia, Largo S. Eufemia 19,Modena Italy. E-mail: mario.panizza@unimore.it

ABSTRACT

This contribution aims to communicate how the Emilia Romagna Apennine Geopark application has been produced by Gal BolognAppennino supported by the Earth Science Department of the University of Modena and Reggio Emilia.
The article introduces the main characteristics of the project, it analyzes the role of the partners and how they contribute to the development of the Geopark d through educational programmes and geo-tourism activities.
The second part of this article is focuses on the valorization of the geodiversity: this is a new scientific-didactic approach to the Apennine geological heritage, following the methodology suggested by Professor M.Panizza.

KEY WORDS: Geopark, Geodiversity, Geo Hazard, Geo Tourism.

THE PROJECT

The Emilia Romagna Apennine Geopark Project (ERAGP) represents a unique initiative in Italy. The project aims to develop a new identity that conforms with the values of the European and Global Geoparks Networks . The Geopark project is located in the North-Centre of Italy, in the Emilia Romagna Region. The Gal Appennino Bolognese introduced the ERAGP as an important action of the Local Action Plan, since 2009 following the Leader Programmes´s goals for the sustainable development of rural areas.

In October 2012, Gal Appennino Bolognese, together with several local Institutions, presented its application to become a member of the EGN-GGN under the auspices of UNESCO. The application was the result of several years of valorization and educational activities in the area carried out by Gal, by the six Natural Parks active in the area with the support of the Geological Survey of Emilia Romagna Region, the Regional Speleological Federation and the Geological Museum in Bologna. These Institutions have established several common practices to improve the awareness of geo-hazards and respect for the geological and speleological heritage. These experiences have been catalyzed within the project and contribute to attaining the EGN-GGN standard.

For the promotion of the provision of geotourism, the project benefits from the experience of the Emilia Romagna Destination Company (http://www.travelemiliaromagna.com). The Destination Company (APT Emilia Romagna) will support the ERAGP in developing a new thematic offer focused on geotourism in collaboration with Natural Parks and Associations (CAI and others). The new initiative will be part of the promotional activities already delivered by APT over a long period of time and will contribute to implement sustainable tourism practices in the ERAGP area.

In March 2013, the EGN-GGN Committee decided to proceed with the evaluation visit in the ERAGP in August 2013.

If the evaluation mission is successful the ERAGP could be nominated as a European and global Geopark during the EGN-GGN Conference in Cilento next September.

Fig.1- Project area (dark orange)

THE PARTNERSHIP

The partnership of the ERAGP includes public and private

Institutions, the Gal Appennino Bolognese and the Gal Altra Romagna signed a special agreement concerning the project, established inside their common Leader program the ERAGP "Cooperation Project", with a total budget of 193.000 Euro. The area of the ERAGP is included in the jurisdiction of both Gal (it includes all the Gal Appennino Bolognese area and part of the Gal Altra Romagna corresponding to the Gypsum Vein Park), allowing them to invest Leader money in the project.

Both Gal have understood the common and local actions required in order to reach the EGN-GGN goals in education, tourism, supporting the local communities and the development of new Geopark products.

Other partners are the Agricultural and Tourism Department of the Emilia Romagna Region, the Bologna and Ravenna Provinces and the municipalities involved.

The scientific partners are: the University of Modena and Reggio Emilia, the geological Museum in Bologna and the Regional Speleological Federation. The project is fully supported also by the Geological survey of the Emilia Romagna Region.

DATA ON THE MANAGEMENT AND MAINTENANCE OF THE GEOLOGICAL SITES IN THE ERAGP

There are several Institutions and associations involved in the management of the ERAG geosites: the Emilia-Romagna Region with the Geological and Soil Survey Service of the Emilia Romagna Region, the Regional Speleological Federation, the CAI (Italian Alpine Club), the Emilia-Romagna Region, etc.

The general management responsible for the geosites in the Region is provided by the Geological and Soil Survey Service of the Emilia Romagna Region supported by the Regional Speleological Federation (official partner of the ERAGP): this collaboration aims to conserve and appraise geological heritage both at and below the earth's surface. Several other Institutions and associations are involved in the management, depending on the geosites' positions in relation to natural areas. The geological trails alrady established within the area are extremely and contain. These trails are used annually by hundreds of students from national and international schools.

The project aims to increase the valorization and protection of the geological heritage through specific planned actions concerning the support of the didactic paths and the use of new technologies.

THE NON-GEOLOGICAL HERITAGE AND ITS INTEGRATION INTO THE ERAGP

The ERAGP is characterized by several natural and cultural heritage localities. From the naturalistic point of view, the ERAGP is located in in the southernmost part of the Central European region and is adjacent to the Mediterranean region: its location has a particular significance in European biogeography. All the Apennine four vegetation and bioclimatic belts can be found in the Geopark area and the project will contribute to their conservation and promotion. The project aims to implement the educational activities already delivered by the Natural Parks within the in order to make nature more attractive for younger generations. The Treasure Hunt project aims to make the ERAGP localities more attractive for children and adults and can be downloaded free from the website. The Treasure Hunt has its origin in 2011 with the cooperation of the Locatify Company in Iceland and Magma Geopark in Norway. In order to adapt the original platform to the ERAGP context, the expertise acquired by the Icelandic and Norwegian companies will be applied.

The ERAGP will provide the Natural Parks' headquarters with a specific space dedicated to the Geopark project, the EGN and GGN, local tourism offers among others. In this way it will be possible to have Geopark corners across the territory, sharing initiatives with the Natural Park staff and the local authorities, with a small economic contribution. In the same context the project aims to improve educational activities and events directed to the discovery of the geological heritage

The ERAGP area is also very important from the cultural and historical point of view: due to the geomorphology of its landscape., From ancient times the ERAGP area has been characterized by strong reciprocal influences between human activities and the landscape. Several sites have been detected in the area, from the prehistory to the Middle Ages: statement of the importance of the area since long time ago.

THE ECONOMIC ACTIVITIES IN THE ERAGP

The area is characterized mainly by rural and manufacturing activities. The agricultural activities are very important and produce several local products identified as DOP-Protected Designation of Origin (salamino italiano alla cacciatora, parmigiano-reggiano, grana padano and aceto balsamico) and the eight IGP-Typical Geographical Indication Products (mortadella, cotechino, zampone, vitellone bianco, marrone di Castel del Rio, scalogno di Romagna, pesca nettarina di Romagna) which testify to the quality of local produce. High quality products are represented by the rare white truffle and the "porcini" mushrooms that grow in the area close to Savigno. The ERAGP could provide a great opportunity to develop these products as Geoparks product, increasing their market sector.

THE ERAGP GEODIVERSITY APPROACH

The ERAGP dossier hasprovided an opportunity to "read" the geological heritage of the area following the same approach that allows the Dolomites to be includrd in the UNESCO WHL in June 2009. Prof. Mario Panizza, chief of the ERAGP scientific committee, established this approach for the area under consideration.

Starting from the definition of Landscape (European Landscape Convention, 2000) and of Geoheritage (European Manifesto, 2004), Geodiversity is defined (Panizza, 2009) as the critical and specific assessment of the geological features of a territory, by comparing them in an extrinsic way (with other territories) and in an intrinsic way (within the territory itself), taking into account the scale of investigation, the purpose of the research and the level of scientific quality (Fig. 2). It should be noted that some authors consider the number and variability of geological elements to be the basic parameters on which the quantitative and qualitative assessment of geodiversity should be founded; they also use mathematical indices and formulas. This procedure can be considered as a mere statistical elaboration of geological data which, in most cases, had been previously collected: it seems an unfruitful exercise, simple spatial statistics that add nothing either from a conceptual viewpoint or regarding content.

The physical characteristics of the territory reflect those of the mountain chain (Panizza & Piacente, 2008). In particular, they are strictly controlled by geological-structural factors, such as the outcrops of the Tuscan Units (Oligo-Miocene arenaceous Flysch), overlying the mostly clayey Ligurian Formations. A vast area is characterized by landform homogeneity and corresponds to the zone where the so-called «Argille Scagliose» (historical name) crop out: the prevalence of pelitic formations has favoured erosional processes along the valley floors and on the slopes, with widespread mass wasting processes and «calanchi» (badlands). A lower geomorphological unit corresponds to the outcrop area of the Plio-Pleistocene sands and silty clays, showing badland erosion landforms between sandy-arenaceous bluffs. Along the eastern border of territory the Messinian «Vena del Gesso» crops out, with its spectacular epigean and hypogean gypsum karst morphology (Fig. 3).

In the case of extrinsic geodiversity, the ERAGP area can be considered as an exemplary case in the Apennines owing to its typical geological features: it is in fact an educational example for illustrating structural-tectonic evolution and stratigraphic sedimentological sequences in this chain, compared with other mountains in the world. Other characteristics of the extrinsic geodiversity are related to epigean and hypogean karst landforms: the Labante and Spipola-Acquafredda caves should be quoted; the former is in travertine whilst the latter is in gypsum and they both are among the most important and studied caves in the World.

On the other hand, intrinsic geodiversity concerns first of all the complexity and variety of geomorphological features: LGM glacial and periglacial landforms, landslides, badlands, cuestas, tafoni, waterfalls, meanders, mud volcanoes etc. In particular, the spectacular badlands and the high frequency of landslides are also a sort of open-air laboratory for investigations on their evolution and, in some cases, on their hazards. This is mainly due to the prevalent clayey nature of the rocks as well as their jointing, tectonic setting and climate characteristics, with intense precipitation in the springtime and autumn. Finally, human intervention should not be ignored since various anthropogenic activities in the past have created slope instability on a vast scale, resulting from deforestation or slope cuts for engineering works. Owing to all these characteristics and processes, the Emilia Apennine can be counted among the most landslide-prone regions in the world.

Other characteristics of intrinsic geodiversity are related to mineralogy or petrography, such as the ophiolites or paleontology, including some specific types of vertebrate and invertebrate fossils.

It can be observed that, considered from the standpoint of geodiversity, the ERAGP territory shows a multifaceted and complex image, depending on the various points of view of scientific observation. In order to carry out a thorough territorial analysis, it is therefore of paramount importance to first chose the goals of our investigations and, consequently, the most appropriate conceptual and methodological approach to the project.

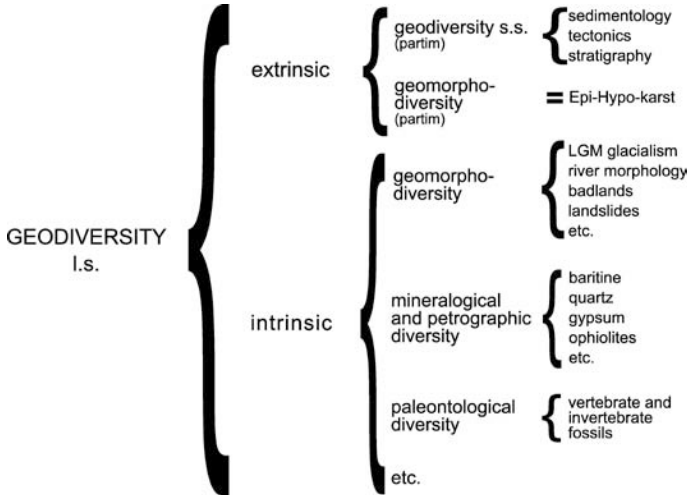

Fig.2 - Geodiversity schema

Fig.3 - Zola Predosa gypsum (photo by Paolo Forti). The intra-Messinian karst morphology discovered in quarry tunnels is the best example of gypsum karst system of this geological period in Europe. The level of interest is undoubtedly international. The high extrinsic geo(morpho)diversity of the site is offered by the importance of the hypokarst.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

GEO2NOR- Northern Georoutes

Gentilini S.([a]), Barton R. ([b]) & Thjømøe P. ([c])

([a]) Sara Gentilini, Project Manager, Magma Geopark, Sokndalsveien 26 4370 Egersund.

([b]) Robina Barton, Geology Project Officer, Geopark Shetland, Shetland Amenity Trust, Garthspool, Lerwick, ZE10NY

([c]) Pål Thjømøe, Magma Geopark, Magma Geopark Manager, Sokndalsveien 26 4370 Egersund.

ABSTRACT

The GEO2NOR project secured funding from the NORA (Nordic Atlantic Cooperation Program) programme in June 2012. It is a transnational project led by Magma Geopark (MGP) in Norway in cooperation with Geopark Shetland, Katla Geopark, Stonehammer Geopark and ICT experts Locatify. There are two Associated Partners: the Norwegian Centre of Expertise (Fjord Norway) and Ilulissat Kangia Isfjord UNESCO World Heritage Site in Greenland.

KEY WORDS: Geoparks, Geo tourism, NORA, Tourism offer,

NORA STRATEGY

"The NORA Region includes the Faroe Islands, Greenland, Iceland, and coastal Norway (the 9 coastal counties of Norway, from Finnmark in the north to Rogaland in the south). Although the region covers an area of land and sea that is larger than the continent of Europe, it is sparsely populated. The distances between the four territories are vast and so is the distance between the NORA countries and the rest of the world. Despite the vast distances, shared characteristics, common challenges, and historical, institutional and cultural links bind the NORA countries together. Furthermore, the NORA Region is situated between Europe and North America as an entryway to the Arctic. This gives the region a strategically important position. The NORA region and the region's neighbours, especially Canada and Scotland, have many characteristics in common, including high dependence on the sea, a resource-based economy, fragile marine environments, long distances, sparsely populated areas, out-migration, relocation from rural to urban areas, high cost for the provision of services, poor regional accessibility, a narrow export range and limited regional trade.

According to the OECD, all North Atlantic communities face similar demographic, environmental, economic and social challenges; therefore, an increased exchange between the NORA region and neighbouring countries may benefit all parties"

Fig.1- NORA Geographical area

GEO2NOR

The GEO2NOR project aims to develop a high quality tourist offer and booking system for Geoparks in the NORA Region. The areas involved are Iceland, Norway, Scotland (Shetland), Canada, and Greenland. The lead Partner is Magma Geopark with the Norwegian Centre of Expertise (NCE) - the tourism department of Fjord Norway - as a facilitator and tourism advisor. NCE tourism is the longest-running and most successful regional tourism cooperation in Western Norway.

The project will benefit a range of stakeholders, particularly small businesses such as restaurants, accommodation providers and local tour companies, through the development of tourism packages and a common promotional platform.

The project is divided into two phases. The first phase is underway. A common promotional website has been set up to market the chosen localities in the NORA countries as tourist destinations and help them appeal to key audiences around the world.

The purpose of the project is to capitalize on tourism experiences in four areas of the NORA Region to promote geo-tourism in Norway, Iceland, Scotland and Canada through the Global Geoparks Network that is supported by UNESCO.

The GEO2NOR strategy will provide the four Geoparks involved with:

- Tools to support tourism development in the NORA Region and Geoparks
- Innovative new tourism products.

The main outputs will be:

- 3-day tourist packages, developed by the Geoparks with support from the Norwegian Centre of Expertise.
- A promotional website
- A browser offering multi-Geopark tour packages from a server containing all the information from the Geoparks.
- Geopark online SmartGuide and TurfHunt apps

The main outcomes will be:

- Promotion of the NORA Region as the 'destination of choice' for a niche tourist market.
- Support for local businesses in the NORA Region through coordination of tourism activities.
- Reduction in the cost to the tourist.
- Increased recognition of the NORA tourist brand.

The project will consider the tourist needs of each region.

Results will be achieved by working in partnership with tourism businesses and specialized local agencies, improving cooperation and coordinating efforts to develop a common strategy for the NORA Region. The NORA Region will benefit from the creation of tourist packages that include Geopark destinations, as this will guarantee interest from, and continuous advertising through, EGN and GGN channels and the Geoparks North Association.

These outcomes will help the NORA region to address weak points identified in the "OECD Territorial Review of the NORA Region, 2011" by increasing the economic value of nature based tourism, addressing the lack of brand recognition and reducing the cost of tourist packages.

PROJECT PROGRESS

Project progress was detailed in a report to NORA in April 2013, highlighting the following key achievements:

- Needs analysis of stakeholders completed
- Website programming completed: www.northerngeoroutes.com
- Facebook Page at: www.facebook.com/NorthernGeoroutes
- Communication and Quality Assurance strategies completed.

Since May 2013 the project consortium has worked to develop tourist packages that will be added to the website in autumn 2013. In March 2013 a request for further funding was submitted to NORA in order to implement the second phase of the project.

Fig.2 - Guide course in MGP – March 2013, Jøssingfjord

ACKNOWLEDGMENTS

Authors thank the organizing committee of the European and Global Geopark Conference 2013.

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Recovery and enhancement of the historic route "*Camino Real del Azogue*" (Royal Trail of Mercury) in the Geopark Sierra Norte de Sevilla (Spain)

Gil Toja, A. ([a]), Pérez de Guzmán Puya, R. ([a]), & Mellado Jiménez, S. ([b])

([a] ([a]) Sierra Norte de Sevilla Geopark (Tragsatec)
([b]) Regional Ministry of Agriculture, Fisheries and Environment (Junta de Andalucia)

ABSTRACT

The historic route "Camino Real del Azogue" was a transcontinental route between Europe and Central America and the most important path of communication in the Iberian Peninsula during the sixteenth, seventeenth and eighteenth centuries.
The essential merchandise that was transported in this way was the "*azogue*" (the old name for mercury, Hg), produced in the mines of Almaden (Ciudad Real). The mercury was used, among other applications, for the amalgamation of silver ores.
The supply of mercury to the silver mines of South America becomes a necessity to achieve: the supply of silver for the Spanish crown, the financing of American colonization, and financing of the interests of Spain in Europe.

KEY WORDS: mercury, historic route, intangible heritage.

THE CAMINO REAL DEL AZOGUE

The *Camino Real del Azogue* was the most important way of communication in the Iberian Peninsula, and by extension in America, between the 16th and 18th centuries.

The essential merchandise that was transported in this way was the "*azogue*" (the old name for mercury, Hg), produced in the mines of Almaden (Ciudad Real).

Mercury is a high density metal (13.7 g./Cm^3), liquid at ambient temperatures and in silver color. The mercury is mainly generated by decomposition of the cinnabar (the most important ore of mercury (HgS). Mercury is used, among other applications, for the amalgamation of gold (from years 54-68 BC), and the amalgamation of silver ores from the sixteenth century.

El *Camino Real del Azogue* was a transcontinental route between Europe and Central America.

It came between Almaden and Seville by land (by rail from the late nineteenth century), between Seville and Cadiz by the Guadalquivir River, between Cadiz and Veracruz by ocean transport (by Indian fleet), and by land from Veracruz to the various silver mines in Central and South America.

Fig. 1 – Map showing the mercury path between the villages of Almaden (producer) and Seville (boat load).

It was from the discovery of the process of the amalgamation of silver with mercury (the first application to the mining industry is from Bartolome de Medina, in 1555, Pachuca, Mexico), when established routes to America (from 1555 to New Spain, from 1570 to Peru). The supply of mercury to the silver mines of South America becomes a imperative need to achieve: the supply of silver for the Spanish Crown, the financing of the American colonization, and the payment of the interests of the Crown in Europe.

The mercury was packed in bags of high quality leather that stored between 1 and 4 Castilian arrobas (11.5 to 46 kg) later were used metal bottles (from late eighteenth century).

The transports were performed using two systems: by ox carts, with 10 bags per cart (around 460 kg), from April (when the roads were no longer muddy) until June (due the requirement of fresh pastures) in groups of 30 wagons, with a journey time of about 40 days; and by mules in the summer, with a journey time of about 10-15 days.

These two different systems imposed the establishment of two types of different routes to the difficult step of Sierra Morena (between the towns of Azuaga, in Extremadura and Seville):

Fig. 2 – The two routes of the *Camino Real of Azogue* that passed through Sierra Norte de Sevilla Geopark: right, the eastern wagon path (yellow); left, the *arriero* path (brown).

routes for wagons, with two paths, the western and the eastern trail; and the arriero path, for transport by mules.

Through the Sierra Norte de Sevilla Geopark (Andalusia, Spain) passed two routes for the pass of Sierra Morena: the eastern wagon path and the arriero path. The Geopark intends to complete the survey, study, restoration, dissemination and promotion of the sections of this historic route within the limits of the geopark. This work is being carried out mainly by the Environmental Volunteer Network of Sierra Norte, and in close collaboration with the municipalities of the Geopark. From the two routes of the Camino Real of Azogue that passed through Sierra Norte Geopark, its well-know the eastern wagon route because have been kept mostly paths and cattle trails that formed it. But the *arriero* path is currently largely unknown, possibly due to several causes: lack of current use, neglect, occupation, existence of several alternative routes, etc. It should be in consideration the different needs of ox carts and mules transport. The ox carts carried heavy load, and need paths with small slope, of a certain width and easy steps to rivers and streams.

The transport by mules had some minor requirements, given the lower cargo being transported and the ease of mules to pass through stretches with steep slopes or crossing streams.

Because of this we are working primarily recovering the arriero path doing the following tasks:

- Compilation of historical information in various documentary archives: Provincial Archives of Seville, Indian Archive and municipal archives. Special attention is given to any of the documents that can refer to geographic data showing the position of the path.

Recognition in field of the data retrieved in the historical documentation.

- Evaluation of the possible recovery of the path for public use, or study of possible alternatives.

- Recognition of the elements related to the route: fountains, troughs, bridges, fords, resting place, etc.

A very important part of the study on the Camino Real of Azogue in Sierra Norte de Sevilla Geopark, is the recovery of intangible heritage linked to this path: stories and legends, information about events, old workings, customs, etc.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

Maps and guide of Geo-Environmental and Geo-Cultural fieldtrips in Ischia island (Italy)

Giulivo I. ([a]) & Monti L- ([a])

([a]) Regione Campania-Settore Difesa del Suolo. Via De Gasperi,28 Napoli (Italy) . E-mail carg.campania@regione.campania.it

ABSTRACT

The multidisciplinary approach used in the geological survey of Ischia Sheet (CARG Project), encompassing underwater geological surveys and marine geology surveys in the marine areas around the island, allowed an improvement of knowledge of the Ischia complex geological and volcanological structure.
The island of Ischia is the emerged part of a large volcanic field that extends from Procida to the western off-shore Ischia submarine volcanoes. The volcanic activity of Ischia last from about 150 ka up to 1302 a.D..
The island contains a significant geological heritage. In the regional cadastre of the geological sites of Campania (L.R. n.13 del 13/10/2008), 36 geological sites have been inventored in Ischia.
The geological sites of the areas above and below sea level have been included in 8 geo-environmental and 3 geo-cultural fieldtrips that illustrate the interaction of the geo-volcanological component with aspects of the natural and anthropogenic environment.
The maps and guide of geo-environmental and geo-cultural fieldtrips in ischia island describe the island in its globality and show it as a set of past and present, of the geological heritage and culture, tradition and resources.
The island of Ischia has all the characteristics necessary to be nominated for inclusion in the European Geoparks Network.

KEY WORDS: geodiversity, geological sites, geo-tourism, geo-environmental guide, Ischia Island, geo-environmental fieldtrips, geo-cultural fieldtrips.

INTRODUCTION

The "Regione Campania - Settore Difesa del Suolo" takes part with ISPRA to the production of new geological map of Italy (CARG project) at 1:50,000 scale.
In the CARG Project, the "Regione Campania" realized the geological mapping of the emerged and submerged areas of Island of Ischia, at 1:10,000 scale, with explanatory notes.
For the realization of the Island of Ischia geological map have been carried out geological surveys (scale 1:2,000/1:5,000) and analysis of emerged areas, submerged coastal areas (0 to -30 m) and seabed (up to - 200 m).
The multidisciplinary approach allowed to:
- to correlate many volcanic deposits cropping out in the emerged areas to mostly explosive activity of submarine or coastal volcanoes;
- to identify below the seabed extensive ignimbrite units,
- to correlate the large debris avalanches that are present in marine sequences around the island of Ischia with extensive and similar deposits outcropping on land,
- to know extent and evolutionary dynamics of Ischia volcanic field between land and sea.

GEOLOGICAL FEATURES

The island of Ischia is the emerged part of a large volcanic field that extends for about 300 sq. km from Procida to the western off-shore Ischia submarine volcanoes. The volcanic activity of Ischia last from about 150 ka up to 1302 a.D. Arso eruption, with dozens of eruptive vents and resurgent caldera structures (Sbrana et al., 2011).
The evolutionary history of the volcanic field was mainly influenced by the volcano-tectonic processes related to the volcanic feeding system (laccolith type) that induced accelerated constructive and destructive phases in the emerged and submerged sectors of the volcanic field with strong interactions between volcanism and sedimentation.
The volcano-tectonic phases that produced the up-lift of the Mount Epomeo block, which is formed by a characteristic ignimbrite sequence (Pizzone Tuff, Frassitelli Tuff and Mount Epomeo Green Tuff), have generated the collapse of entire sectors of the central part of the island causing the deposition of large debris avalanches both in the emerged and submerged areas (Fig. 1).

Fig. 1- Geological map of Ischia Island. Derived by Ischia geological map, scale 1:10.000; CARG Project - Regione Campania

Ischia represents a rare example, perhaps the only, for an exhumation of a geothermal field in an active caldera.

GEODIVERSITY AND GEOLOGICAL SITES

The work carried out for the realization of geological mapping has shown that the island holds a significant geological heritage, characterized by places with landscapes that preserve important evidence of the geological history and evolution of the area and also a unique bond with the biological world and human activities.
Each significant element of the geological landscape has been selected as geological site. 36 geological sites were inventored, 26 point type and 10 areas, which belong to the regional cadastre of geological sites of Campania - L.R. n.13 of13/10/2008 (Fig.2).

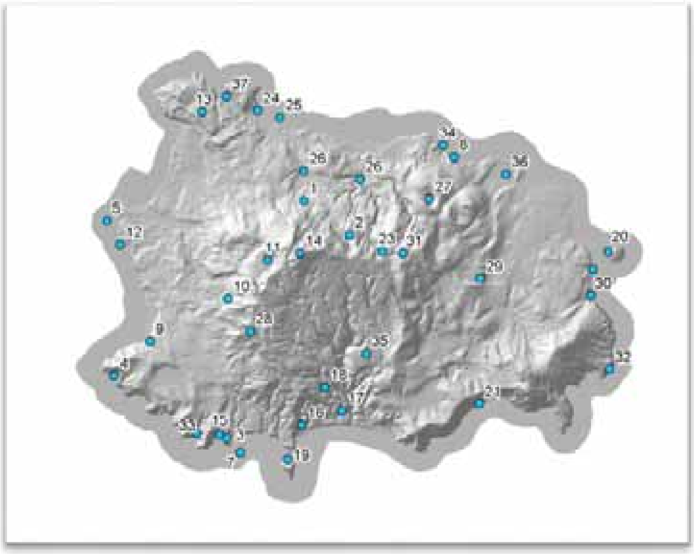

Fig. 2 - Map with the location of geological sites of the island of Ischia

The geological sites of the areas above and below sea level have been included in 8 geo-environmental and 3 geo-cultural fieldtrips, that well illustrate the interaction of the geo-volcanological component with other fundamental aspects of the natural and anthropogenic environment.

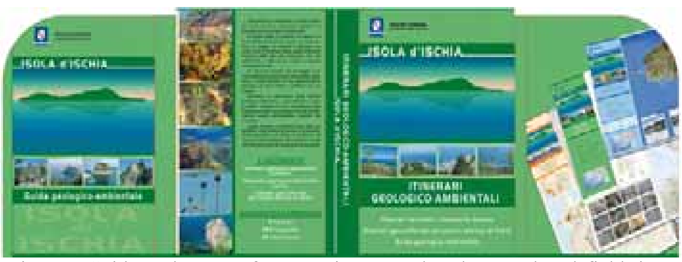

Fig. 3 - Guide and maps of geo-environmental and geo-cultural fieldtrips of Ischia island

The Campania Region has realized the maps and the guide of geo-environmental and geo-cultural fieldtrips of Ischia island (Fig.3) with the aim to facilitate the knowledge of the geological, natural, historical and identitarian heritage of the island, to increase the offer in eco-tourism (geotourism) but also to enhance the awareness of the population to belong to a active volcanic area, whose sustainable management must necessarily be based on compliance with the physical and ecological limits and conditions.

GEOLOGICAL-ENVIRONMENTAL GUIDE

The guide describes the island in its globality and show it as a set of past and present, of the geological heritage and culture, tradition and resources (Monti et al.,2011). The geological concepts have been "translated" into a language accessible to all; the geology of the places was valorized within its environmental context, and the environmental specificities have been described with reference to the relationship between man, resources and territory affected by volcano-tectonic events of the island.
The guide is divided into two sections. In the first part it describes the main characteristics of the island, such as location and physical configuration, geology, hydrography, hydrothermal system, climate, vegetation and fauna, archeology and history, human resources and environment, wine geology and landscape, dialects, geology and coastal marine submerged landscape. The second part is dedicated to the detailed description of 8 fieldtrips: 6 overland fieldtrips, one trip by sea and 1 exploratory tour of the coastal submerged landscape.

MAPS OF GEO-ENVIRONMENTAL AND GEO-CULTURAL FIELDTRIPS

The geological-environmental guide is supplied with 3 maps of the itineraries.

The *"terrestrial geo-environmental fieldtrips Map"* (1:20,000 scale) is a simplified geological map showing geological sites, CAI (Club Alpino Italiano) footpath tracks, the geo-touristic stops and the links to the island's roads.
The paper provides on the back side a summary description of the 6 fieldtrips stops and travel times.

- CAI 501 Fieldtrip - *Mount Epomeo Green Tuff*

Fig. 4 - The peak of Mont Epomeo

The fieldtrip is dedicated to the most distinctive geological formation of the island and to the peasant story of the area, which is in close relationship to the local geology. The origin of the green tuff is related to large explosive eruptions that occurred about 56,000 years ago. During these eruptions large thicknesses of ash and pumice were deposited within a submarine caldera structure. The subsequent circulation of hydrothermal fluids in these deposits has transformed them into the green tuffs that we see today. Following the tuffs have been raised from the seabed to form the present relief of the of Mount Epomeo (Fig.4).

- CAI 502 Fieldtrip - *Alum and fumaroles*

The fieldtrip is dedicated to the discovery of the sites linked to the manufacture of alum that was extracted in ancient times at the fumarole fields (Fig 5).

Fig. 5 - Hydrothermal Alteration of the fumarolic field of Monte Cito with the characteristic Cyperus polystachius flora

- CAI 503 Fieldtrip - *Between land and sea*

The fieldtrip runs through the oldest area of the Ischia volcanic field, along the characteristic streets of the wine that run on the steep terraced slopes of the eastern coast of the island (Fig.6).

Fig. 6 - Terraced vineyards in the pyroclastics

- CAI 504 Fieldtrip - *Geology of the ancient Ischia*

The fieldtrip goes along a steep path cut into the southern cliffs of the island (Scarrupata of Barano), and crosses the products of the numerous volcanic eruptions which took place between 150,000 and 5,000 years ago (Fig. 7).

Fig. 7 - Scarrupata of Barano cliff.

- CAI 505 Fieldtrip - *The "Pizzi Bianchi"*

The fieldtrip allows to observe the erosive forms that develop in the stratified pyroclastic deposits produced by a local eruptive center, which were subsequently transformed into clays due to the circulation of hydrothermal fluids (Fig. 8).

Fig. 8- Pizzi Bianchi: pinnacle erosive forms

- CAI 506 Fieldtrip - *Along the ring road*

The field trip follows the coastal road circuit of the island and describes the geological-environmental and historical-cultural particularities of the territory.

In the "*marine geo-environmental fieldtrip Map*", the island is represented by means of an orthophoto base reporting the toponymy of the main localities and the footpath network. Along the coast is traced the path of the geological trip by sea with its significant observation points and diving spots. At each observation point is linked a photograph with its descriptive sheet reporting the main geological, historical and environmental aspects (Fig.9).

Fig. 9 - CO_2 gas emissions out of Posidonia oceanica submerged in front of the Aragonese Castle

The *"geo-cultural map of the historical center of Forio"* shows three pathways representative of the geological, historical, environmental and architectural treasures of the town of Forio, built on a debris avalanche unit, consisting of green tuff blocks and megablocks. The main feature of the urban landscape of Forio is the lithic element and the adaptation of buildings to geological local resource. The local stone was used in the past as a building block in the buildings, such as foundations or architectural element of houses, towers and churches (Fig.10).

Fig. 10 - Green tuff Tower, Torrione, Forio

The urban center of Forio proposes a symbiosis with the environmental context, typical of local rural culture, which is layered over the centuries, challenging the historical and geological events of the island. This symbiosis emerges today in the landscape between the heights of Monte Epomeo and the coastal village, testifying to the identity of Ischia.

CONCLUSIONS

The island of Ischia has all the characteristics necessary to be nominated for inclusion in the European Geoparks.
Recognition as a geopark could constitute a new opportunity to give worth to the geological, natural and historical heritage of the island, through a strategy that combines conservation, enhancement, protection and sustainable development.

ACKNOWLEDGMENTS

We thank all those who contributed to the realization of the guide and maps of the itineraries related geo-environmental and geo-cultural island of Ischia.

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"Geology for all": a map-guide for observing geological resources in nature (Sierras Subbéticas Geopark)

González L. G. ([a]) & Barquero A.S. ([b])

([a]) Directora Conservadora del Parque Natural Sierras Subbéticas/ C/Tomás de Aquino s/n. Edificio Serv. Múltiples, pl 7ª. 14071, Córdoba (Spain). E-mail: lourdes.guerra@juntadeandalucia.es
([b]) Parque Natural Sierras Subbéticas/ C/Tomás de Aquino s/n. Edificio Serv. Múltiples, pl 7ª. 14071, Córdoba (Spain).

ABSTRACT

At times like the present, with the current general economic situation and where funding is a challenging issue, Geoparks tend to maximize their available resources. In this context, and in order to continue promoting its geological heritage, Sierras Subbéticas has designed a simple but efficient map-guide that contributes to the spreading of geological heritage through the Geopark.

KEY WORDS: Enter key words in alphabetical order separated by comma (style: key words).

INTRODUCTION (STYLE: CHAPTER – FIRST ORDER HEADING)

Sierras Subbéticas Geopark & Natural Park is located in the central area of the Betic Cordillera (South of the Iberian Peninsula, Spain).

The External Zones of the Betic Cordillera are composed of the materials deposited in the South Iberian Margin during Mesozoic and Cenozoic, until Upper Miocene.

Sierras Subbéticas Geopark is noteworthy for its widely outcropping Jurassic and Cretaceous marine sedimentary series, with abundant invertebrate fossil fauna, being ammonites one of the most outstanding groups. In higher areas of the territory, a spectacular karstic landscape has developed on calcareous Jurassic rocks, with great scenic elements such as the Polje of La Nava, the Karren of Los Lanchares or the giant Dolines of Los Hoyones. Beneath the surface, a huge abundance of cavities includes some of special interest, like the Bats Cave and the Cabra Abyss. At the foot of the calcareous mountains numerous sources flow. The presence of permanent streams has conditioned the main human settlements in the area. Some of the fountains associated to natural sources present great architectonic interest. The sparse vegetation favours the observation of geological elements in landscape, mainly tectonic features.

Sierras Subbéticas Geopark has an important infrastructure regarding the promotion of its Geological Heritage and Geotourism: The two visitor centers, Santa Rita and the Eco-museum of the Bats Cave, are provided with innovative and updated information about the geological origin of the region. Among the 8 official trails for hiking, biking and riding, two of them are mainly focused on the geological elements: "The Bailon River" and "La Tiñosa". These trails are the most visited of the geopark and include successions of interpretive eye-catching panels, understandable to the non-specialists, with information on the geosites. In addition, there are other isolated panels, not related to existing paths, which are scattered through the park and include on-site interpretation of geological features as well. These panels and sites are underpromoted in relation to the panels situated in the geological paths. Taking this issue into account, the Geopark's management body has developed a very simple tool in order to derive the visits to other parts of the area, and to promote geological heritage in general.

THE MAP-GUIDE

Usually, the most requested information in the visitor centers are printed maps, especially for hiking and for moving around the territory. Besides, more and more visitors ask for information about geological elements in the park.

Fig. 1 - The folded maps fit in a small pocket

Taking into account the necessities of the area, a very simple map-guide has been designed to meet the principal visitors' requirements: A map of Sierras Subbéticas area, where the Geopark panels are included, i.e., with information on the geosites that can be visited and have on-site geological interpretation.

Fig. 2 - Obverse map of the region with paths and geosites

The main characteristics of the map are the following:

-It is formated to print on A3, comfortable and manageable size. When folded it fits in any pocket.

-In this map are included only the geosites that can be visited (excluded dangerous or private sites) that are explained in the field through interpretative panels (Geopark Panels).

-The list of geological sites has the UTM coordinates, a photograph of each site, and a short and attractive phrase which incites their visit.

-The map includes information like the 8 official trails of the park, the greenway (ancient railway, now adapted as a natural path), major roads and towns, visitor centers, etc.

When a visitor requests a map of the natural park, this map-guide called "Geology for everyone." is given free of charge. This information is used to draw attention to the presence of a Geopark in the area. While visitors use the map to explore the territory, they are encouraged to visit the sites of geological interest.

Since it has begun shipping the map with information panels, has been spotted a growing number of people reading the interpretive panels.

This map-guide is a very useful tool not only for visitors, but also for teachers in the area, who use it to plan their field trips with the students.

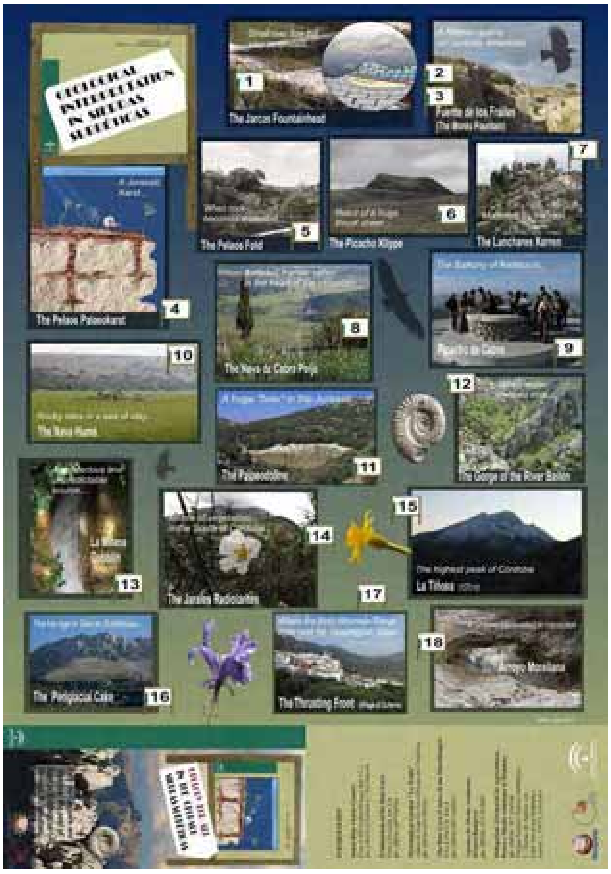

Fig. 3 - Reverse: photographs of the geosites with an attractive motto

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

Occurrence of *Sphagnum* in the Apuan Alps (Tuscany, Italy)

Guazzi E. ([a]) & Amadei L. ([b])

([a]) Apuan Alps Geopark, "Research and conservation" Service – via Simon Musico, 8, 54100 Massa, Italy. E-mail: eguazzi@parcapuane.it
([b]) Botanic Museum, University of Pisa – via Luca Ghini 13, 56126 Pisa, Italy

ABSTRACT

This paper reports the final results of an investigation into the presence of *Sphagnum* in the Apuan Alps. *Sphagnum* species were found in 18 sites in this area; 8 of these are confirmation of published results and herbarium reports, while 10 are new. The *Sphagnum* entities found in the area are 8, including 6 species and 2 varieties; this is the first time that *Sphagnum squarrosum* Crome has been found in the Apuan Alps. Finally, our results lead to the hypothesis of a relationship between the occurrence of *Sphagnum,* and the lower phyllites ("Autochtonous" Auct.) and sericitic phyllites (Massa Unit) .

KEY WORDS: Apuan Alps, *Bryophyta*, *Sphagnum*, Tuscany.

INTRODUCTION

The genus *Sphagnum* (bog or peat moss) (Fig. 1, 3) is usually found in wetland habitats. The anatomy and growth form of *Sphagnum* plants show adaptations to retain large quantities of water and some species are able to survive short periods of complete drying out. *Sphagnum* species have a pronounced capacity to exchange hydrogen ions for mineral cations, a feature of particular advantage in environements where minerals needed for nutrition are in short supply.

The *Sphagnum* genus contains a large number of species and its members are very widespread, being found from the Arctic to the sub-Antarctic. Although widely distributed, the more detailed patterns of distribution are dependent upon local climatic, hydrological and chemical conditions.

An important factor influencing the distribution of *Sphagnum* species is the chemical status of peat and the water contained within it, particularly the degree of acidity and the quantities of dissolved ions. These two aspects are largely complementary, as an increase in acidity is normally accompanied by decreased concentration of mineral nutrients, particularly calcium, available to plants (Daniels et al., 1985).

In Tuscany *Sphagnum* is limited to few areas, mainly located in its northern and north-western sectors (Bottini, 1915, 1919; Bonini et al., 1998; Raffaelli, 1976; Saveri et al., 2009; Tomei et al., 2002); here these bryophytes were be able to survive after climate change, just because they found their preferred environmental conditions, i.e. riverbanks, swamps and valleys with a constant supply of basically acid *ph* water.

In the Apuan Alps *Sphagnum* represents an example of glacial relic, reflecting the periods when the north-western Tuscan climate was colder and wetter than today and *Sphagnum* certainly was very frequent in the whole territory (Tomei et al., 1995); just like other microthermic species, they progressively restricted their distribution areas in the post-glacial period, becoming more rare in the lower elevations and surviving only in specific sites equipped with suitable micro-climatic conditions, soil and water availability.

The occurrence of these conditions rarely happens in the Apuan Alps, mainly because of the considerable slopes steepness, which does not allow water presence, and the frequent calcareous soil, which makes water unsuitable by *Sphagnum* communities.

So, in the Apuan Alps only small and highly fragmented areas of hills and foothills now have the right conditions for *Sphagnum* life; today *Sphagnum* survives only in these places, just like other relict species such as *Hymenophyllum tunbrigense* (Ferrarini et al., 1983; Guazzi et al., 2002).

Fig. 1 – *Sphagnum palustre* L.

Fig. 2 – A typical *Sphagnum* site in the Apuan Alps

In the Apuan Alps *Sphagnum* is generally found on north and north-west exposed slopes (Fig. 2), mainly in good lighting conditions, not fearing the cold but direct exposition to sunlight; the substrate is strictly acid, not only in the site area but also along the whole side of the related relief, up to the ridge.

As it has just been said, the specific studies about the presence of *Sphagnum* in the Apuan alps are few and rather dated so the aim of our work has been to clarify and update, as much as possible, the distribution of *Sphagnum* species which live in the Park area and to try to find possible relationships between their presence and the geological formations over which they live.

WORKING METHOD

We started our research using the list of Apuan Alps bryophytes published by Cortini Pedrotti (Cortini Pedrotti et al., 1991) as the main bibliographic data source, together with Apuan *herbarium* samples coming from different *herbaria* [Herbarium Bottini (PI-BOTT) Herbarium Horti Pisani - Bryophyta (PI), Herbarium Pellegrini (PI-PELL), Herbaria Ferrarini (SI, Carrara)].

First, each of the sites identified in the bibliographic sources was geo-referenced by a geographical information system (GIS), then, we continued our work with several inspections of the plotted areas, in order to confirm the presence - or absence - of the species that was mentioned in the data sources and describe the main features of the related habitat.

The obtained species distribution was then superimposed on the geological map of the Park (Carmignani et al., 2000) in order to investigate possible associations between Sphagnum presence and geological formations. A considerable *Sphagnum* presence was found within the lower phyllites ("Autochthonous" Auct.) and sericitic phyllites (Massa Unit).

We therefore built a specific GIS query in order to try to identify some new never investigated areas which might be able to host *Sphagnum* based on geology. First we asked the software to select the desired geological formations, originating largely acid soils, and theoretically capable of accommodating *Sphagnum* sites; then, helping us with a DEM (digital elevation model) we proceeded to elaborate the database queries that would intersect geological, altitudinal and exposure data; basically GIS was asked to show all park areas featuring selected geological formations, a N to NE exposure and a relatively soft slope; note that the altitude has not been considered as significant parameter because in Tuscany *Sphagnum* lives in a wide altitudinal range, so we didn't want to exclude its presence on the Apuan Alps outside its typical known altitude range.

The areas identified by GIS queries have been investigated by focused exploration which often gave negative results; the reasons for these failures could probably be related to different causes, such as very steep hillsides, complete lack of water, presence of weed in woods or high *ph* values in water. However, we had good results in several cases, and were able to find 10 sphagnum sites which had not previously been identified.

RESULTS AND CONCLUSIONS

Our investigations confirm 8 entities (tab. 1) living on the Apuan Alps area, relating to 6 species and 2 varieties; one of these, *Sphagnum squarrosum* Crome, was found in the Apuan Alps for the first time.

	Species	***Sites***
1	*Sphagnum capillifolium* (Ehrh.) Hedw. (= *S. acutifolium* Ehrh. ex Schrad)	Canale del Grotticino.
2	*Sphagnum compactum* DC. ex Lam. & DC.	Botro di Rimone e Canale di Riomagno.
3	*Sphagnum palustre* L.	Canale del Serrone, Canale della Rocca, Canale del Baccatoio e Canale della Borra.
4	*Sphagnum subnitens* Russow & Warnst.	Monte della Canala, Altagnana loc. i "Tecchioni", Canale di Gallena, Canale del Serrone, Canaletto della Ciortèllora, Canale di Basati, Canale del Bottino, Colle del Cipollaio, Canale del Piastrone e Canale del Grotticino.
5	*Sphagnum squarrosum* Crome	Vallata di Cardoso.
6	*Sphagnum subsecundum* Nees ex Sturm	Rio Moneta.
7	*Sphagnum subsecundum* Nees ex Sturm var. *contortum* (Schultz) Huebener (= *S. contortum* Schultz)	Monte della Canala.
8	*Sphagnum subsecundum* Nees ex Sturm var. *rufescens* (Nees & Hornsch.) Huebener (= *S. lescurii* Sull. in Gray; *S. auriculatum* Schimp.)	Monte della Canala, Valle di Betigna e Rio Moneta.

Tab. 1 – *Sphagnum* entities living in the Apuan Alps, according to Cortini Pedrotti et al., 2001.

	SITE NAME	GEOLOGY	OUTCOME	DATA SOURCE
1	Baccatoio (Canale del)	lower phyllites ("Autochthonous" Auct.)	**new site**	GIS
2	Basati (Canale di)	lower phyllites ("Autochthonous" Auct.)	**new site**	GIS
3	Betigna (Valle di)	lower phyllites ("Autochthonous" Auct.)	**new site**	GIS
4	Borra (Canale della)	lower phyllites ("Autochthonous" Auct.)	confirmed	published / *herbarium*
5	Bottino (Canale del)	lower phyllites ("Autochthonous" Auct.)	confirmed	published / *herbarium*
6	Canala (Monte della)	lower phyllites ("Autochthonous" Auct.)	confirmed	published / *herbarium*
7	Cardoso (Valle di)	lower phyllites ("Autochthonous" Auct.)	**new site**	GIS
8	Ciortèllora (Canale della)	lower phyllites ("Autochthonous" Auct.)	**new site**	GIS
9	Cipollaio (Colle del)	lower phyllites ("Autochthonous" Auct.)	confirmed	published / *herbarium*
10	Colletto (Il)	black phyllites (Massa Unit)	not confirmed	published / *herbarium*
11	Fornovolasco	lower phyllites ("Autochthonous" Auct.)	not confirmed	published / *herbarium*
12	Fragolito (Monte)	sericitic phyllites (Massa Unit)	not confirmed	published / *herbarium*
13	Frigido (Canale del)	lower phyllites ("Autochthonous" Auct.)	not confirmed	published / *herbarium*
14	Gallena (Canale di)	lower phyllites ("Autochthonous" Auct.)	confirmed	published / *herbarium*
15	Grotticino (Canale del)	lower phyllites ("Autochthonous" Auct.)	**new site**	GIS
16	Inferno (Valle dell')	black phyllites (Massa Unit)	not confirmed	published / *herbarium*
17	Moneta (Rio)	sericitic phyllites (Massa Unit)	**new site**	GIS
18	Montignoso (Canale di)	lower phyllites (Massa Unit)	not confirmed	published / *herbarium*
19	Piastrone (Canale del)	lower phyllites ("Autochthonous" Auct.)	**new site**	GIS
20	Renara (Canale di)	lower phyllites ("Autochthonous" Auct.)	not confirmed	published / *herbarium*
21	Rimone (Botro di)	lower phyllites ("Autochthonous" Auct.)	**new site**	GIS
22	Riomagno (Canale di)	lower phyllites ("Autochthonous" Auct.)	confirmed	published / *herbarium*
23	Rocca (Canale della)	sericitic phyllites (Massa Unit)	confirmed	published / *herbarium*
24	Serrone (Canale del)	lower phyllites ("Autochthonous" Auct.)	**new site**	GIS
25	Tecchioni (I)	lower phyllites ("Autochthonous" Auct.)	confirmed	published / *herbarium*

Tab. 2 – *Sphagnum* sites in the Apuan Alps.

Tab. 2 shows all considered *Sphagnum* sites, that is the known ones by literature, confirmed - or not - by field inspections, and the new ones, as identified through the intersection of geological and geographical data. The total amount of the sites reaches to 25 units, 18 currently found in the Apuan territory, the remaining not confirmed by our inspections. 8 sites represent a confirmation of literature and *herbarium* data, while 10 are new stations; for every station the table also shows the geological formations, the inspection outcome and the used data source.

In the Apuan Alps *Sphagnum* sites are located in an altitudinal range from 30 to 1050 m above sea level; 15 sites are located in the west side of the Apuan Alps and 3 in the inner side.

The overlapping of the new *Sphagnum* sites distribution map (pic. 4), obtained with the results of our research, lead to the hypothesis of a correspondence between the distribution of *Sphagnum* and some peculiar geological formations that originate largely acid substrates, lower phyllites ("Autochthonous" Auct.), and sericitic phyllites (Massa Unit); obviously, considering the large extent of the investigated area and the difficulties in reaching all the areas shown by the GIS device, we cannot leave out the possibility of the occurrence of this species somewhere else, nevertheless, the results of our studies and that of past centuries botanical investigations in the Apuan Alps, never marked the presence of *Sphagnum* on geological substrates different from these. This observation encourages us to think that lower phyllites ("Autochthonous" Auct.) and sericitic phyllites (Massa Unit) are the main formations which house *Sphagnum* in the Apuan Alps.

The 18 *Sphagnum* sites currently detected in the Apuan Alps have to be considered as a starting point for further investigations; here we suggest a possible method, the geographic databases querying nevertheless.

A specific knowledge of the distribution of *Sphagnum* genus in the area, combined with a correct understanding of their survival issues will allow the Park to act properly in order to protect the plants and manage habitat in peculiar situations where these species could be threatened (or endangered), as already tested in the "Valle del Giardino" site (Amadei et al., 2006).

ACKNOWLEDGMENTS

We wish to thank all those who, in different ways, have supported us during the steps of the investigation: Gianni Genovesi, Alessandro Mandorli, Tullio Pierotti and Park Rangers for giving us the necessary logistic support; Dino Marchetti, Maria Vittoria Olivi and Jürgen Waizel for indicating us some sites needing to be investigated; Simonetta Maccioni for constant collaboration; Viviano Mazzoncini for samples revision.

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Fig. 3 – An ancient Sphagnum drawing

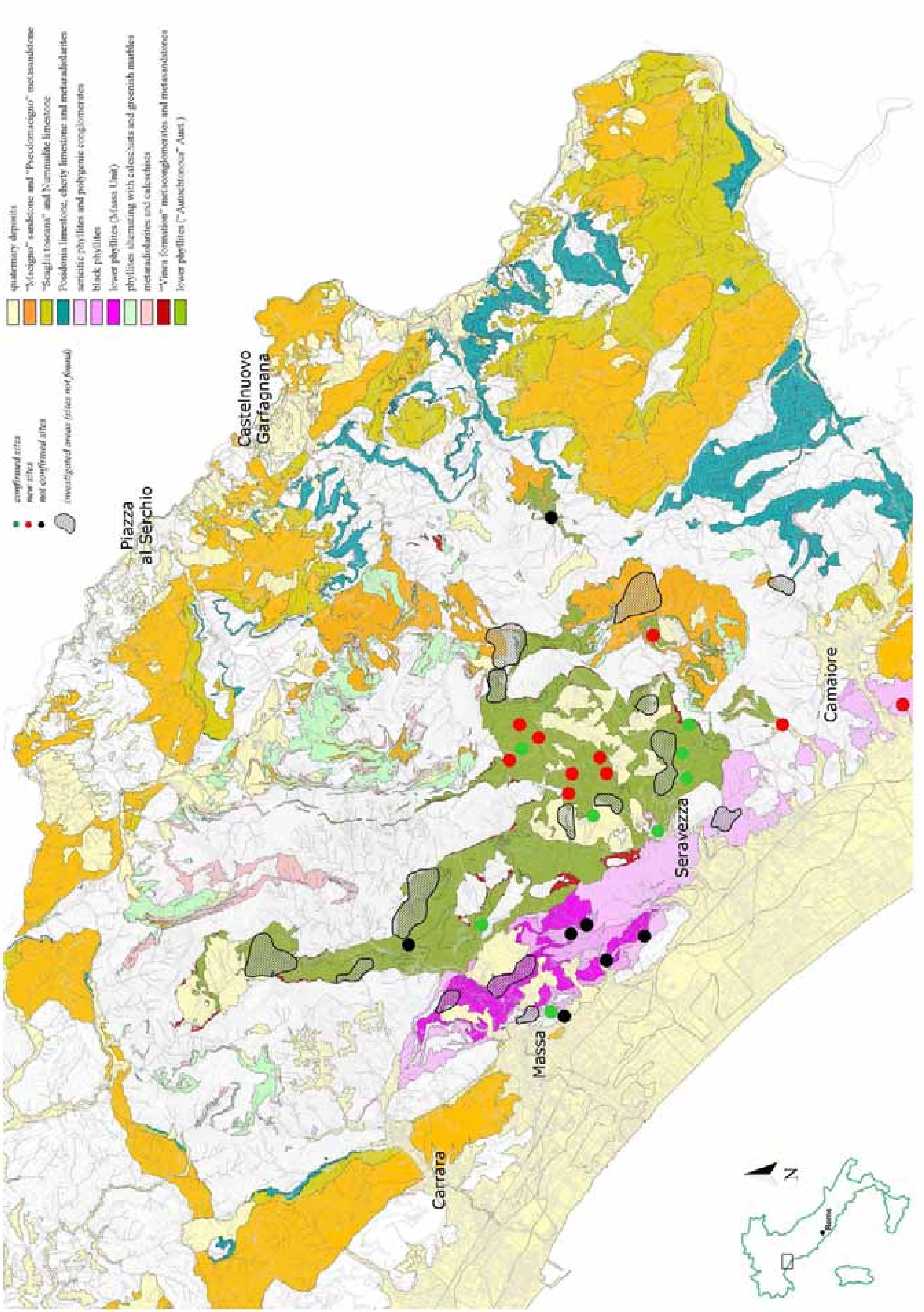

Fig. 4 – Apuan Alps Sphagnum sites overlapped with the map of geological formations (Carmignani et al., 2000)

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Italy, 4th-6th September 2013

Using Radon-222 as a Naturally Occurring Tracer to investigate the streamflow-groundwater interactions in typical Mediterranean fluvial-karst landscapes: interdisciplinary studies in the Campania region (southern Italy).

Guida D.([b,c]), Guida M. ([a,c,d]), Guadagnuolo D. ([a,c]), Cuomo A.([b,c]) & Siervo V.([c])

([a]) Department of Physics, University of Salerno, via Ponte Don Melillo, 84084, Fisciano (SA), ITALY; dguadagnuolo@unisa.it
([b]) Department of Civil Engineering, University of Salerno, via Ponte Don Melillo, 84084, Fisciano (SA), ITALY;
([c]) C.U.G.RI., interUniversity Centre for Applied Research on the Prediction and Prevention of Major Hazards, University of Salerno, 84084 Fisciano (SA), Italy;
([d]) I.N.F.N., National Institute for Nuclear and Subnuclear Research, Salerno Branch, University of Salerno, Via Ponte don Melillo, 84084 Fisciano (SA), Italy.

ABSTRACT

Karst aquifers provide 25% of the overall drinking water resources to the world's population and sustain aquatic life in most fluvial systems, providing several ecological services to human beings, although, because of their complex links between surface and groundwater, turn out to be very vulnerable to contamination and pollution. This paper describes the preliminary findings from Radon-222 activity concentration measurement data collected in streamflow and instream springs during monthly field campaigns in a typical Mediterranean karst river: the Bussento river (Campania region, Southern Italy). The general aim is to investigate the complex interactions and exchanges between streamflow and groundwater, at scales that are imperceptible to standard hydrological and hydraulic analyses. Experimental data about 222Rn activity concentrations in streamflow and inflow spring waters, from selected sampling stations, have been acquired and managed by means of the Radon-in-Air analyzer, RAD7, together with the Radon-in-water accessories, Radon Water Probe and RADH2O (DURRIDGE Co. Inc.), for continuous and batch sampling measurements, respectively. In addition, data about physical-chemical and streamflow rate have been, also, collected in-situ. During preliminary surveys, appropriate sampling procedures and measurement protocols have been tested, taking into account the different local hydrogeological and hydrological situations occurring along the Bussento river basin.

KEY WORDS: Fluvial Karst Landscape, Groundwater, Hydro-geomorphology, Radon, River Drainage Basin

INTRODUCTION

Surface and groundwater resources assessment represents one of the main issues in socioeconomic planning and management and requires more and more interdisciplinary-based scientific researches, particularly in hydrogeology, hydro-geomorphology and hydrology.

It is worldwide recognized that global fresh-water resources, stored in rivers, lakes, and aquifers, constitute less than 0.5 % of all the water on the Earth, and therefore, their uses have to be, necessarily, sustainable.

Karst aquifers provide the 25% of the global drinking water resources to the world's population and sustain aquatic life in most fluvial systems, providing several ecological services to humans. Being characterized by complex links between surface and groundwater, they turn out to be very vulnerable to contamination and pollution (Smith, 2004).

In Mediterranean environments, karst aquifer groundwater represents more than 98% of the available fresh-water supply and, during summer seasons, feeds perennial streamflow through the aquifer-derived base flow, thus contributing to the total streamflow in a measure of 30% to 70% (Tulipano et al., 2005).

An understanding of a given aquifer flow characteristics and its interaction with adjacent surface water resources, turns out to be critical if the total water resource is to be managed sustainably (Simonovic, 1998).

In order to assess and manage water resources, the European Water Framework Directive 2000/60/EC (EWFD, 2000) suggests an integrated approach, taking hydro-geological, hydro-geo-morphological, hydrological, hydro-geochemical, physical and biological contributions into account, in particular for groundwater-streamflow interaction assessment and monitoring. Especially in karst Mediterranean landscapes, the interdisciplinarity turns out be fundamental (Ford, 1989). In fact there are very complex recharge processes and groundwater circulation mechanisms (Vogel, 1992; Barbieri, 2005).

Determination of the interaction between groundwater and surface water in karst landscape is particularly difficult.

In the last decades, a substantial help in providing an answer to the questions of interest in karst hydro-geomorphology and hydrology has been provided by the use of isotopes (stable and unstable) like tracers, both in field investigations as in laboratory analysis (Goldscheider, 2007). One of the most interesting and promising approach to assess quantitatively the groundwater contributions to streamwaters and seawaters in natural environments, consists in measuring Radon-in-water activity concentrations [Andrews, 1972; Shapiro, 1984].

Therefore, it has been proved that Radon-222 can be an useful natural tracer, because its activity concentrations in groundwater turn out to be typically one order of magnitude or bigger than those ones occurring in surface waters (Rogers,1958).

RESEARCH ACTIVITY

Radon-222 (for sake of simplicity called simply 'Radon' in the following) is a volatile gas with a half-life of 3.8 days, moderately soluble in water and atmosphere.

It is released to groundwater from Radium-226 alpha decay, by means of permanent alpha recoil in micro-pore or fracture walls (Rama, 1984) and progressive dissolution of the aquifer-forming material that supplies more and more soluble Radium-226, subsequently decaying to Radon (Ellins, 1990).

Due to its volatility, Radon gas quickly dissipates when exposed to the atmosphere producing a significant disequilibrium between concentrations in surface and groundwater.

From the seminal work of A. Rogers (Rogers, 1958), the assessment of spatial-temporal variations in Radon activity concentrations between surface and groundwater (Ellins, 1990; Lee, 1987) have provided insights in:

1) testing soil infiltration-filtration models (Genereaux, 1990),
2) performing hydrograph separation (Hooper, 1986),
3) calculating residence times,
4) interpreting the role of "old water" in non-linear hydrological response of catchments,
5) estimating shallow and deep water mixing (Hoehn, 1989),
6) calculating flow velocities in homogeneous aquifers (Kafri, 2001).

In addition, the use of Radon enables the researchers to trace groundwater migration pathways (Hoehener, 2001), and to assess the time dependence of groundwater migration processes.

Infiltration of surface waters from a river to groundwater, as well as flow dynamics in a karst system (Eisenlohr, 1995), are just few examples of applications, where Radon-based methodology has been successfully used to gain additional information on environmental functioning.

This potential for using Radon, as a suitable aqueous tracer, is due to its main characteristics:

i) it occurs naturally in the environment in an ubiquitous way; ii) it behaves like an inert substance; iii) it has a half-life of 3.8 days, differently from other aqueous environmental tracers, like stable isotopes; iv) it is easy to manage, fast to monitor and its measurements inexpensive to be performed.

STUDY AREA: BUSSENTO RIVER BASIN

The Bussento river drainage basin is one of the major and more complex drainage river systems of the southern sector of Campania region, in Southern Italy. This complexity is due to the highly hydro-geomorphological conditioning induced by the karst landforms and processes.

In fact, it is characterized by widely and deeply karst features, like summit karst highlands with dolines and poljes, lowlands with blind valleys, streams disappearing into sinkholes, cave systems, karst-induced groundwater aquifers and gravitational karst-induced "sackungs" (D'Elia, 1987).

The hydro-geo-morphological setting induces a very complex surface-groundwater interaction and exchanges. Therefore, groundwater inflows from outside of the hydrological watershed and groundwater outflows towards surrounding drainage systems, frequently occur, influencing the basin water budget and streamflow regime.

The Bussento river regime is also affected by a very complex hydropower plant system. In order to provide a physical scheme of the complex recharge, storage and routing system of the Middle Bussento karst area, a preliminary, physically-based, conceptual model has been built-up, accounting for an interconnected sequence of geologic substrates, structural discontinuities, type and rate in permeability distribution, recharge areas and discharge points, that collectively attempt a conceptualization of the karst aquifers-river interactions (White, 1969; 1977; 1988; 2003) focusing on the variety of hydro-geomorphologic settings and their influences on the streamflow regime. With reference to the work done by G. Iaccarino et al. (Iaccarino 1987, 1988) and by D. Guida et al. (Guida, 2006) , the conceptual hydro-geomorphological model of the MBKS, contains three nested hydrological domains (Fig. 1):

i) a hydrogeologic domain;
ii) a hydro-geo-morphological domain and
iii) an aquifer-river domain.

The hydrogeological domain represents the 3-D structure of aquifer, aquitard and aquiclude, conditioning the groundwater circulation and storage, vertically differentiated in the classic subdivision of karst hydro-structures (Bakalowicz, 1995): epikarst, vadose, percolation and saturated or phreatic zones. The last one is hydrodynamically subdivided in cave, conduit and fracture routing system.

The hydro-geomorphological domain comprises karst and fluvial landforms and processes, conditioning groundwater recharge ("karst input control" (Ford, 2007)), by means of the infiltration and runoff processes, including: a) allogenic recharge from surrounding impervious drainage basins into deep and shallow sinking stream infiltration points, and fractured bedrock stream infiltration; b) autogenic recharge, including sub-soil and bare diffuse epikarst infiltration, endorheic runoff infiltration in dolines and poljes; c) groundwater discharge (“karst ouput control” (Ford, 2007)), differentiated in the groundwater-river interactions within the aquifer-river domain. This last comprises the complex interactions between the streambed-springs system, which generally results in a downstream river discharge increase, occurring generally in typical bedrock streams, flowing in gorge and canyons carved in enlarged fractured limestone sequences. Following the routing karst system, the springs inflowing into streamlow can be characterized in: i) upper epikarst springs, ii) intermediate cave resurgence springs, iii) lower conduit springs and iv) basal fracture springs.

MATERIALS AND METHODS

According to the types of stations to be monitored, different measurement techniques, from discrete sampling to continuous measurements, have been tested, both in-situ as in the laboratory, during the preliminary phase of experimentation and testing, aimed to optimize sampling and measurement protocols. In fact, usually, the sampling method is adopted for water samples collected especially from spring locations, where the Radon activity concentrations turn out to be high, while for measurements in surface waters along the river, where lower values can be reasonably expected, a continuous monitoring experimental setup is usually used (Surbeck, 2005). The experimental tests have demonstrated a best comparison between data from discrete sampling and continuous monitoring procedures, within the experimental errors.

Therefore, in order to optimize the monitoring campaigns, the sampling measurement approach has been chosen for all type of stations.

The following data acquisition procedure and measurement protocol, consisting of the following steps, have been adopted: sample collection protocol; experimental measurements of the Radon-in-water activity concentrations; evaluation of the effective Radon-in-water activity concentration at the collection time; assessment of the experimental errors. During the different campaigns, water samples for discrete measurements have been collected, either at some stations along the main course of the river or at some lateral spring inflows. These water samples have been stored in two different types of glass vials: W250 (calibrated volume of 250 ml) and W40 vials (calibrated volume of 40 ml), depending on the value of the Radon activity concentration presumably expected for that location. More specifically, W40 vials have been used for stations with expected high values (about the order of tens of Bq/l), like those characterizing the springs, and W250 vials for much lower values (from few Bq/l down to tenth or hundredth of them), like the ones typically occurring, instead, in the waters along the streamflow.

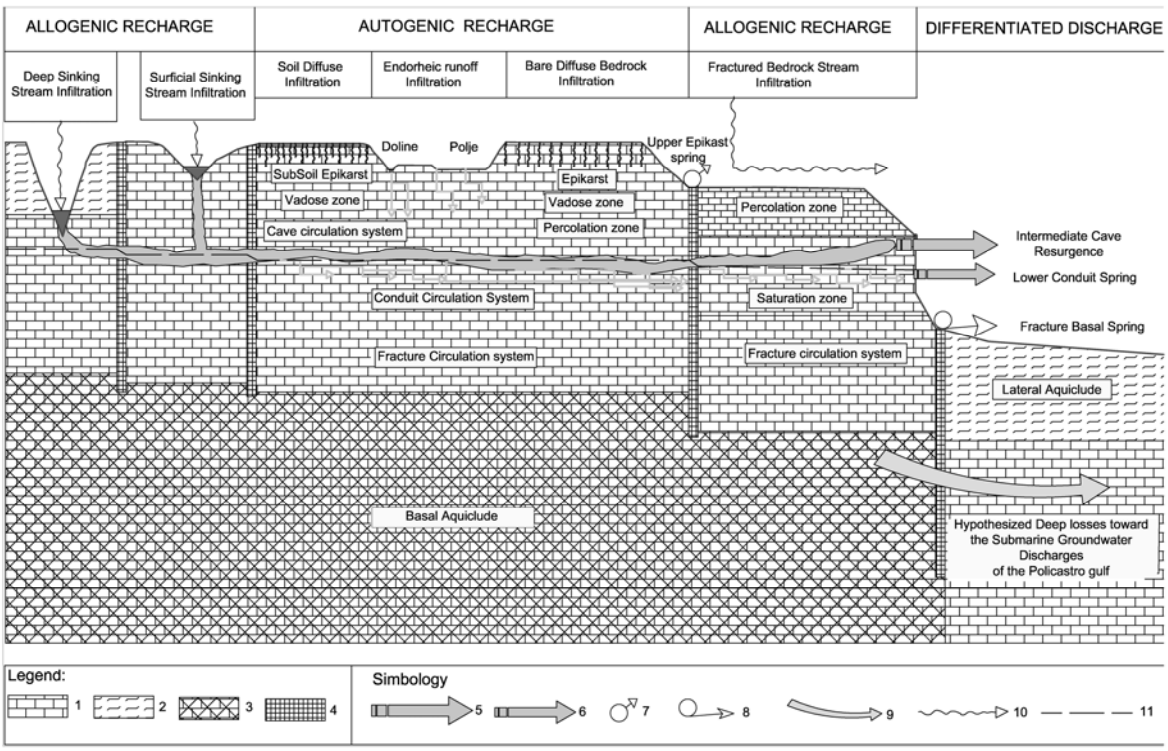

Fig. 1 – Conceptual hydro-geomorphological model of the Middle Bussento river Karst System (MBKS); Legend: 1) Limestone aquifer; 2) Marly shale aquiclude; 3) Basal highly fractured limestone aquitard; Lateral fractured fault-induced aquitard; 5) Intermediate cave resurgence; 6) lower conduit spring; 7) Upper epikarst spring; 8) Basal fracture spring; 9) Probable groundwater losses toward marine spring; 10) Infiltration of streamwater along the river bed; 11) Water table.

The water samples have been analysed as soon as possible after the collection on the field, in the laboratory, using as equipment, the Radon-in-air analyzer RAD7 (DURRIDGE Company, Inc. - Bedford, MA, U.S.A.), capable to perform Radon short-lived progenies‘ (Polonium-218 and Polonium-214) alpha spectrometry from the air stream maintained through the system with an internal pump. For these measurements, the RAD7 has been equipped with the accessory kit for sampling measurements in water, RADH20, enabling it to measure radon-in-water, over a wide activity concentration range, from less than about 1 Bq/l up to much greater (orders of magnitude) values than 3 kBq/l (DURRIDGE, 2012), with an accurate reading achieved in 30 minutes acquisition data runs.

Exploiting the law of Radon exponential decay, backward-in-time, the data obtained are re-evaluated at the time when the water samples have been collected in situ.

RESULTS AND DISCUSSION

The Radon activity concentration data have been arranged in relation to the fluvial level hierarchy and scale analysis: firstly, at segment scale, managing the data collected only from the main stations; secondly, at reach scale, including also the data from the complementary stations.

Some significant portions of the river have been identified. They have turned out to be ideal for our analysis. More precisely, the data were collected along two fluvial segments: the former, the Middle Bussento segment, from the Old Mill Spring to the Bussentino creek confluence, and, then, the latter, the Middle-Lower Bussento segment, stretching from this last confluence to the Bussento Hydropower Plant.

The rate of spatial in-stream groundwater influx results differentiated for the two segments of interest, in relation to groundwater hydro-chemical type, discharge magnitude, and hydraulic river constraints, related to hydro-geomorphological typology of stream. In order to understand this differentiation, due to a different degassing rate in Radon from free surface of streamflow, an analysis at reach level and more detailed scale has been performed along the Sicilì Bridge reference reach and WWF Oasis reference reach. In the following, the results and data discussion for each reach are explained. Their hydro-geomorphological characteristic, based on standardized geomorphic measurements, allow to classify the first reach in the category “plane bed”, sensu Montgomery & Buffington (Montgomery, 1998), defined as an alluvial channel bed morphology type “C”, and the second, in the “step-pool” category with a channel bed morphology type “B”.

SICILÌ BRIDGE REFERENCE REACH

This reference reach is located uppermost the Middle-lower Bussento river segment, identified by the reference main station BS13 (Sicilì Bridge).

The station BS13-US has been chosen as an upstream monitoring station. It is placed upstream the Cillito springs group, emerging along the right bank, from enlarged fractures into Miocene calcarenites, overlaid by the marly-clayey formation regional aquiclude. Downstream, the first spring outlet of the Cillito group, four monitoring secondary stations (BS13-03, BS13-02, BS13-01, BS1300 - have been established in the river at a relative distance of 50 m, one from the other. Downstream the main station BS13, other two monitoring stations have been established: BS13- DS, and BS13-DS-Jundra-DS, this one downstream the superficial inflow from Jundra creek.

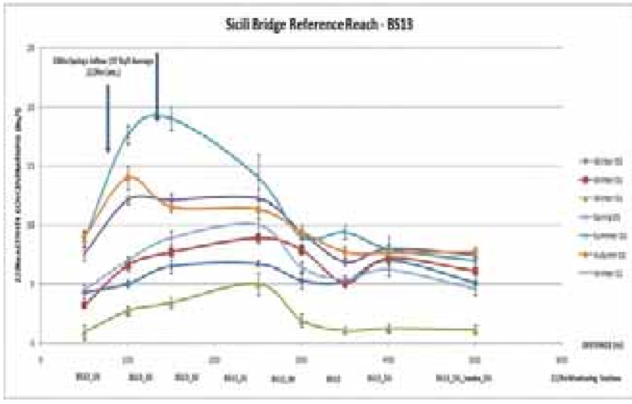

Fig. 2 –Radon activity concentration values measured (seasonally) at the Sicilì Bridge reference reach

The results of the measurement campaigns are plotted in Fig. 2. Here, the data from all the stations established along this reach are summarized in the context of the segment to which they belong, and have been classified according to the seasonal period (recharge, discharge) of the measurement campaign, in order to highlight the time variability of the results.

These results show, as expected, that concentration measured at the group of 4 stations from BS13_03 to BS13_00 increases because of the inflow of the lateral springs, whose water is richer in Radon. At the following stations there is a downstream decrease of Radon concentration due to Radon losses to the atmosphere, with the exception of the station BS13_DS, which shows a certain increase of concentration for almost all the measurement campaign.

The plots from Fig. 2 also show

• homogeneity in the general trend of the curves: there is, in fact, an increase in Radon activity concentration values starting from the station BS13_03 and then a decrease from the station BS13 which is not influenced by the springs;

• seasonality of radon relative concentrations, confirming in general that the measures made during the aquifer recharge period provide values of concentrations that are lower than the ones of the discharge period. There is also an intermediate stripe of values corresponding to the first part of the new recharge period with a decrease in the Radon activity concentration.

There is an anomalous increase in Radon concentration, for all the three periods considered, between the stations BS13 and BS13_DS, that is at the moment subject of further investigations in order to determine whether it can be attributed just to statistical fluctuations or not.

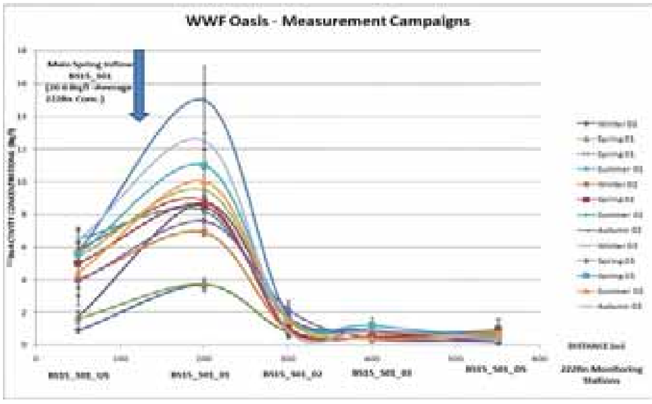

Fig. 3 – Radon activity concentration values measured (seasonally) at the WWF Oasis reference reach

WWF OASIS REFERENCE REACH

This reference reach is located uppermost the Middle-lower Bussento river segment, identified by the reference main station BS13 (Sicilì Bridge).

This second case study concerns another reference reach of the Bussento river, located inside a World Wildlife Fund (WWF) oasis, in which there is a main spring (BS15_S01 – Old Watermill Spring), where an average radon activity concentration of 36.5 Bq/l has been measured.

As in the previous case, a monitoring station (BS15_S01_US – Old Watermill Upstream) has been established above the inflow of the water coming from the spring, which, through a little cascade, falls into the river. Below the cascade and down the course of the river other 4 monitoring stations have been established. This part of the river is characterized by high turbulence, according to the step and pool stream typology, which surely can affects the Radon losses, increasing its degassing to the atmosphere. The results of the measurement campaigns are plotted in Fig.3. It can be inferred a great increase in the Radon activity concentration in correspondence of the stations below the spring inflow, and then a quick decrease.

KARST SPRINGS GROUNDWATER ANALYSIS

This reference reach is located uppermost the Middle-lower Bussento river segment, identified by the reference main station BS13 (Sicilì Bridge).

This Some karst springs along the Bussento river basin have been, also, monitored. Their importance is due to their content in Radon, which is responsible of the Radon activity concentration increase in the surface water. According to the results in Radon activity concentration, three “families”, corresponding to the typologies of karst springs assumed in the conceptual model, have been identified :

1) Fracture basal springs (i.e., B13_S01 and BS13_S02), with high values of Radon activity concentration (32.4 Bq/l (mean value) from the first one and 35.8 Bq/l from the second one) and with low standard deviation and variance values;

2) Conduit springs (i.e., BS15_S01) with very variable values (between 17.5 Bq/l (min) and 33.5 Bq/l (max)) and with low standard deviation and variance values;

3) Cave resurgence springs with highly variable values (between 0.5 Bq/l (min) and 6.5 Bq/l (max)).

There is, therefore, a spatial variability in Radon activity concentration, which is shown in Fig. 4. As for the seasonal variability, the two basal springs of the Cillito group do not show any relevant difference in Radon concentration during the year. At the conduit spring (BS15_S01), more varying values have been obtained: they are a little higher in the recharge period (average value: 26.4 Bq/l) than in the discharge one (mean value: 23 Bq/l). For the resurgence spring some higher values (6.5 Bq/l) have been obtained at the beginning of the discharge period, while in the other months there are data with little variability.

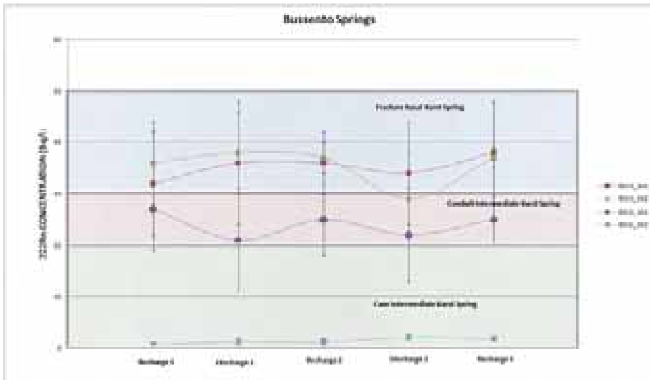

Fig. 4 – Seasonal variability of the three “families” of Radon concentration in the Bussento karst springs.

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The role of universities in the creation of geoparks in West Africa: the Senegalese example.

Guisse A. ([a]), Siby S. ([b]) & Ngom P. M. ([c])

([a]) Department of Plant Biology, Cheikh Anta Diop University of Dakar (Senegal), P.O. Box; 5005 E-mail: alguisse@orange.sn
([b]) Department of Geology, Cheikh Anta Diop University of Dakar (Senegal), P.O. Box; 5005
([c]) Department of Geology, Cheikh Anta Diop University of Dakar (Senegal), P.O. Box; 5005

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ABSTRACT

In Senegal and in French speaking African countries, universities teach different subjects in their departments. In addition, they strive to strengthen the students' sense of citizenship by providing them with pluridisciplinary and interdisciplinary experiences. The discovery of different environments of the countries enhances the students' knowledge and behavior and significantly contributes to enhance their sense of citizenship and to turn them into good actors of change in their society

Between 2001 and 2010, 1,500 Senegalese students and their supervisors have been to eight rural communities and five urban departments where they have taken care of and treated

44,156 patients planted 336,195 trees of different species in 1,516.98 ha, taught how to read and write to 1,122 individuals in three different local languages and given basic computer knowledge to 383 people.

Geoparks are well limited areas, created to promote local economic development, with not only geological peculiarities but also archealogical, historical or cultural signification. They use the same pluridisciplinary and intredisciplinary methods . These sites classified for protection, education and sustainable development based on the following key three concepts: Conservation, Education and Sustainable development; the same which underlie citizenship activities, and which are found in our university courses and areas of research. Because of the above mentioned reasons, we think that African universities can play a important part in the creation of Geoparks in Senegal in particular and in Africa in general.

KEY WORDS: Geopark, conservation, education, sustainable development, citizenship

CONCEPT

Enhance the students' knowledge and turn them into actors of change for the benefit of their society.

There has been a rapid increase in the number of student population in African universities in the last few years. And very few programs have included systematic placement in rural areas for students of medicine, sciences of life and earth, computer science or social sciences. The posting and fixation of educated africans in rural areas raise many problems related to difficulty of adaptation and dearth of information on the social economic environment and problems of development specific to rural areas.

Our objective is to send students during the holidays to rural areas in order to carry out the following four activities: reforestation, literacy classes in local languages, computing, and sanitation. Because we take into account the exixting environmental challenges, the activies will take place in deprived areas and along the the Great Green Wall. To this end CAD students invite and will be going along with students from different parts of the world. In addition to helping face environmental, sanitation, illeteracy challenges, and digital gap, these campaigns will enable the students to realize that they can significantly contribute to improve the local people's living standards and at the same time, gain some experience and maturity.

METHODS OF IMPLEMENTATION

A) Citizenship Camps Units

CAD has cre ated within the university the Citizenship Camp Bureau. This office is daily managed by students under the supervision of four teachers with the following profiles: écologist, MD, linguist and computer scientist. The Bureau recruits volontary students for the different campaigns, drafting of agreements with partners, management of the camps, annual meeting with the different partners to whom are explained what has been achieved during the camps. Every camp brings together forty students of which twenty are involved in the sanitation campaign (students of medicine, pharmacy, dental surgery), and five carry out literacy and basic computer science classes.

B) Partnership

The CAD works with the ministries in charge of the four sub sectors and with various partners willing to fulfill their social responsibilities or mission by supporting the university citizeship ancivities. The camps are funded by contributions from the partners and donnations. Conventions are signed with the partners by the university, and each party has well defined commitments.

C) Restitution

Every year, the activity reasults are presented to the partners. The university puts the information in are posted in a web site in the university gate. At the restitution ceremony, certificates are delivered to the students, the supervisors, partners and to the communities which had hosted the students. Il is also an opportunity for the partners and local people to give their impression and voice their appreciation.

EXPECTED RESULTS

- Enhance the student's citizenship awareness;
- Enable the students to realize they have a responsibility in their society and train their so that they may become actors of social changes
- Valorise the students, help them gain other experiences and start the myth of social transformation;
- Have an impact on reforestation, preservation of the environment and biodiversity;
- Améliorer l'accessibilité aux soins médicaux des populations en zones rurales;
- Contribute to the fight against illiteracy;
- Disseminate the ICT in the rural areas and bridge the digital gap;
- Help participating students better understand each other and promote the concept of citizenship and peace throughout the world.

RESULTS OBTAINED WITH CAD CITIZENSHIP ACTIVITIES

A) Visited sites (show on a map)

Mboro, Fandène, Khombole (before 2004), Niakhène (2004), Gossas, Sokone, Nianing (2005), Gandon, Tessekéré, Ross-Béthio, Diama (2007), Kédougou, Widu Thiengoly (2008) Labgar, Loughéré Thioly (2009). Total 08 Rural communities and 05 Communes.

Fig. 1 - Visited sites

B) Results obtained

Literacy	Computer science	Reforestation	Health	Students
1,122 Learners	383 Innitiated	336,195 Plants i.e 1,516.98 ha	44,156 Patients	1,500 Participants
Three national languages: wolof, pular et serere	Various levels: Word, Excel, Power-Point…	5 to 7 species *Anacardium occidental*, *Acacia senegal*, *Balanites aegyptiaca*, *Sclerocarya birrea*	Various pathologies: Malaria, Mal nutrition, Chronic diseases…	Biologists, Ecologists, MD, Pharmacists, Dental surgeons, Linguists

Table 1 - Results

TRANSITION TOWARDS GEOPARKS

DEFINITION OF GEOPARKS:

According to the Geoparks network charters, it is a territory with well defined limits, and surface large enough to contribute the local economic development. It has a certain number of geological heritage noticeable because of their beauty or scarcity. It should not only have a geological meaning, but also an ecological, archaeological, historical or cultural meaning.

The Earth Heritage sites must be part of an integrated concept of protection, education and sustainable development, whose objectives can only be reached through an approach with three components: Conservation, Education, Sustainable development.

CONSERVATION

The aims of a GEOPARC are the preservation of significant geological peculiarities promotion of methods for their excellent conservation.

The management authority of each Geoparks puts in place adequate protection measures, in collaboration with partner universities, concerned geological services or statutory bodies, in accordance with existing local traditions and legislative obligations.

The conservation programs are on interdisciplinary research and capacity building in the areas of geology, geophysics, environment, including sustainable management and development of the Earth environment and its mineral and energy resources. The programs are also interested in the observation of the earth and reduction of natural risks and safeguard of the geological assets.

EDUCATION DUCATION

Geoparks organise activities and provides logistics to convey geoscientific and environmental concepts to the public at large, thanks to the protected and commented geosites but also museums, information centers, walking tracks, guided visits, teaching material, exhibitions, seminars, etc. ...

Geoparks also promoted scientific research and cooperation with universities and research institutes, and promotes exchange between geoscientists and the local people

A Prerequisite for any Geoparks is the development and exploitation of teaching programs for different levels in order to show the link between the geological and ecological heritage and the other heritage: natural, cultural et immaterial, but also to propose primary schools official teaching programs or specific activities for the children such as days of the environment, entertainment with fossils, Earth Heritage...

In its programs of education, the Geoparks must provide both formal and informal programs to adults and tailored programs to senior citizens. It should also educate the local people who will serve as relays to teach either people Geoparks which are limited areas with very important ecological or geo diversity proper features. They should therefore work with higher education institutes in order to conduct an active scientific research in Earth Sciences or Ecology or other subjects in order to enhance our knowledge of the Earth, its environment and future evolution.

A Geopark can be considered as an active laboratory where people can do scientific research ranging from the highest university level to the most accessible level for any curious visitor who wants to understand the operation of the earth system, how we extract the minerals we need for modern technology, the mapping of our cities, how to use the natural landscapes for our advantage, how to produce energy for our cars.

Hence the necessity to develop our capacities in the Earth Sciences at all levels: with primary school pupils, secondary school students, higher education students, field workers, but also decision makers, and this public at large and institutions

SUSTAINABLE DEVELOPMENT

Even if an area has very special features and geological world famous assets, it may not be defined as a world Geoparks if there is no sustainable local development plan and local inhabitants. This development must have the shape of sustainable tourism with for example, the creation of walking tracks or cycling tracks , training of local people to have local tourist guides, or again the creation by service providers of amenities and accommodations for tourist, good international sustainable environment practices. This can also be a mere commitment by the local people to take better care of the environment while keeping their traditional practices, dignity and rights. The creation of a World Geoparks cannot suceed without the support of the local people

A Geopark promotes economic activities and sustainable development through tourism by emphasizing on the links between our communities and the Earth. Indeed the Earth plays a part in the shaping our identities, design of our agricultural practices, building materials and methods, popular mythology, folklore traditions. The Geoparks emphasizes on those links with typical local activities in order to attract an ever growing number of visitors, and promote local social economic development with the promotion of a label of quality related to the natural local heritage. All this encourages the creation of artisanal and family enterprises in the areas or geotourism and creation of local products.

Thus in our continent, and in Senegal in particular, we note that because of historic or academic reasons, interdisciplinary and interdisciplinary are more common in universities in the areas of studies and research, Furthermore there are some experiments deeply rooted in those notions. And these two approaches are necessary and indispensable for the creation of Geoparks; reason why we think that these teaching and research institutions are excellent grounds for the creation of Geoparks in Senegal and in Africa.

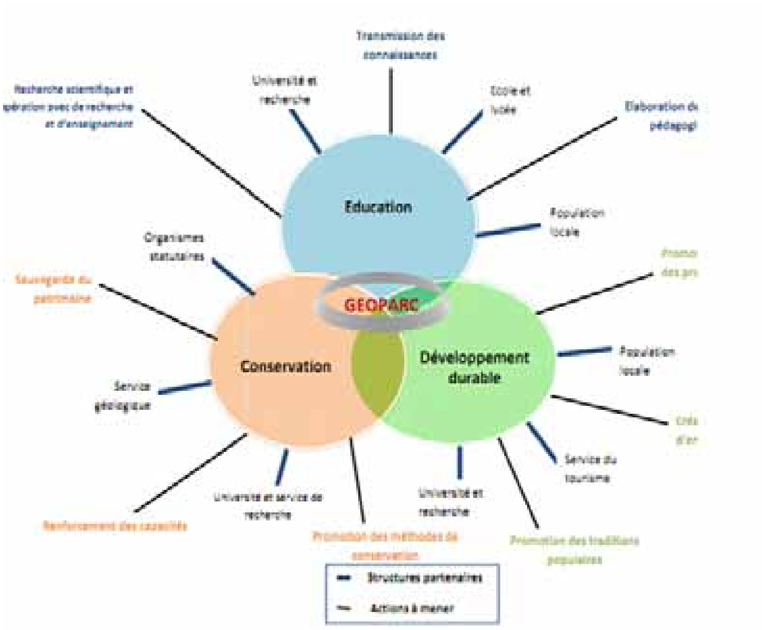

Fig. 2- Partnership and interactions in a geopark.

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

“GeoVision” project: how to increase both knowledge and awareness on natural hazards in the Massif des Bauges Geopark (French northern Pre-Alps)

Hobléa F. ([a]) & Gallino-Josnin S. ([b])

([a]) EDYTEM, UMR CNRS-University of Savoie, Pôle Montagne, Technolac, 73 376 Le Bourget du Lac, Cédex France. E-mail: fabien.hoblea@univ-savoie.fr
([b]) Massif des Bauges Regional Nature Park, Maison du Parc, 73 630, Le Châtelard, France.

ABSTRACT

The Bauges regional nature park belongs to the European Geoparks Network (EGN) since September 2011. Its geological frame is typical of a subalpine massif, with sedimentary rocks and a folded structure. Its top exceeds 2200 m. It is a mountainous area susceptible to natural hazards such as landslides, avalanches and flash floods.

Natural hazards are therefore a major issue in the Bauges Geopark, both in terms of scientific knowledge and public awareness. Here is presented a novel tool for the monitoring of flash floods in a cave which is the exsurgence of the main karst system of the Bauges Geopark. This tool, named “GeoVision”, is being developed in a dual purpose of scientific knowledge and to present the phenomenon to the public, in particular to reduce the risk for the tourists and the cavers visiting this free access geosite. It is a non-invasive monitoring system using digital imaging and laser scanning. It is the heart of a participatory and citizen science project called “Flood hunters”. These approach and tool can be used for other types of natural hazards and processes both spectacular and dangerous.

KEY WORDS: natural hazards, Geopark, monitoring system, Bauges Massif, citizen science.

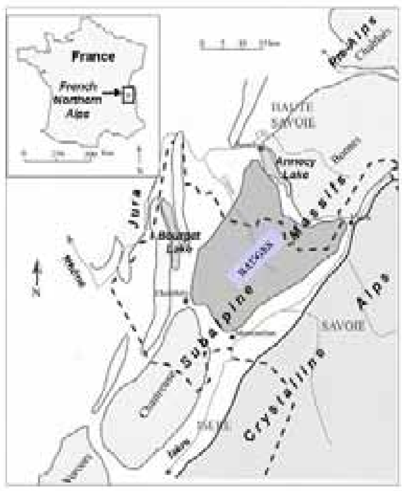

Fig. 1 – Location of the Massif des Bauges in the French northern Pre-Alps

INTRODUCTION

The Massif des Bauges, which lies between the cities of Chambéry (Savoie) and Annecy (Haute-Savoie), is part of the French northern Pre-Alps (fig. 1). The area is a regional park and was designated a European and Global Geopark in September 2011.

This paper aims to demonstrate through the example of the Massif des Bauges, how a territory such as a Geopark should manage natural hazards and risks not only as dangers to forecast and prevent, but also as a full part of the geoheritage which merits to be showed and explained to the public. In this order, researchers of University of Savoie, projects managers and hydro-geologist of the Massif des Bauges Geopark collaborated to set up a prototype of a new type of monitoring station for both the study and the presentation of the flash floods of one of the major Bauges’s karst system and geosite, the Prérouge karst system.

I – THE MASSIF DES BAUGES: A TERRITORY SUSCEPTIBLE TO NATURAL HAZARDS

GEOLOGICAL AND PHYSICAL CONTEXT

From a geological point of view, the Massif des Bauges belongs to the subalpine domain, as its neighbours, Chartreuse and Vercors (Hobléa, 2013, fig. 1). Its structure is characterized by folded sedimentary rocks (Mesozoïc and Cenozoïc ages). Superficial deposits such as till and scree, mostly inherited from the quaternary glacial episodes, cover a large part of the area. Karst landscape and networks are also ubiquitous, especially in the urgonian limestones (Aptian-Barremian).

The relief is mountainous, with steep drops (altitudes between 250 m up to 2200 m) and steep slopes (limestones cliffs overhanging marly slopes).

The Massif des Bauges mountain climate is very wet (1800 mm/year at 1000m asl), with snowy winters and fast snow melting during the spring.

The massif gives rise to the Chéran River. Its average flow rate is 8 m3/s, with seasonal variations following a rain-snow regime: maximum in April (12.5 m3/s); minimum in August (3.5 m3/s). But the extreme discharges are very contrasting, with low water that can fall below 0.5 m3/s and floods that can exceed 250 m3/s.

A RICH PANEL OF NATURAL HAZARDS

In these conditions, the Massif des Bauges Geopark is affected by the full range of natural hazards met in mountain areas, like flash floods, avalanches, landslides and mudflows, rock falls and collapse… Major events occurred in a relatively recent past, like the Plainpalais rock avalanche in the Middel Ages, or the landslide and mudflows of Les Garins-Nant des Granges that caused big damages to the Châtelard Village (main village of the Bauges Massif) in 1931. This last event and the protection works to reduce the risk are now being presented to the public through a geotrail, in accordance to the Bauges Geopark initiative (Desbois, this volume). This example reveals the dilemma that the local authorities have to face: in the one hand the obligation by the law to assess and reduce the risk, and in the other hand the temptation, as Geopark, to include natural hazards as full part of the local geoheritage, promoting them through geotourism and education, that can lead to the paradoxical idea that natural processes and sites inducing natural hazards must be protected!

We present below how this dilemma is challenged in the Bauges Geopark, taking the example of flash floods risk from karst origin. This kind of flood, both spectacular and dangerous, is being monitored by a novel tool called "GeoVision", linked with a citizen science project named "Flood Hunters".

II – "GEOVISION": A MONITORING SYSTEM TO ASSESS AND OBSERVE KARST FLASH FLOODS

AIMS AND STUDY SITE

The Massif des Bauges houses some of France's most-highly extensive karst networks. These ones are part of very transmissive karst systems connected to springs directly feeding the local rivers (Chéran, etc.). The names given by local people in some of theses springs reveals the violence of their floods: "*Pissieu*" ("strong flow"), "*Bourbouillon*" (noisy water bulge and maelstrom). Because of this brutality, conventional flow-rate monitoring systems are quickly destroyed, making difficult the recording of scientific data about flood frequency and intensity. To overcome this difficulty, we are developing a novel monitoring system, called "GeoVision".

This name indicates that it is a multi-functional tool, not only conceived for scientific monitoring, but also for educational purpose (Hoblea et al., 2011), especially on the thematic of natural hazards and risks.

It has been tested in the Massif des Bauges Geopark to study floods of Prérouge cave. This cave is a major geosite of the Massif des Bauges, part of the Savoie's longest and deepest cave network (55 km long and 860 m of uneven). The permanent spring of the karst system is the Prérouge Spring, located 100 m close to Prérouge cave. The cave is an overflow outlet, active only during floods. It is an easy access cave, visited both by experienced and novice cavers, as well as pupils and tourists. But the cave can become a trap in case of flash flood (fig. 2 and 4). During the last decades occurred a rescue of blocked pupils and another incident concerning cavers surprised by the sudden coming of a flood wave (in 2005).

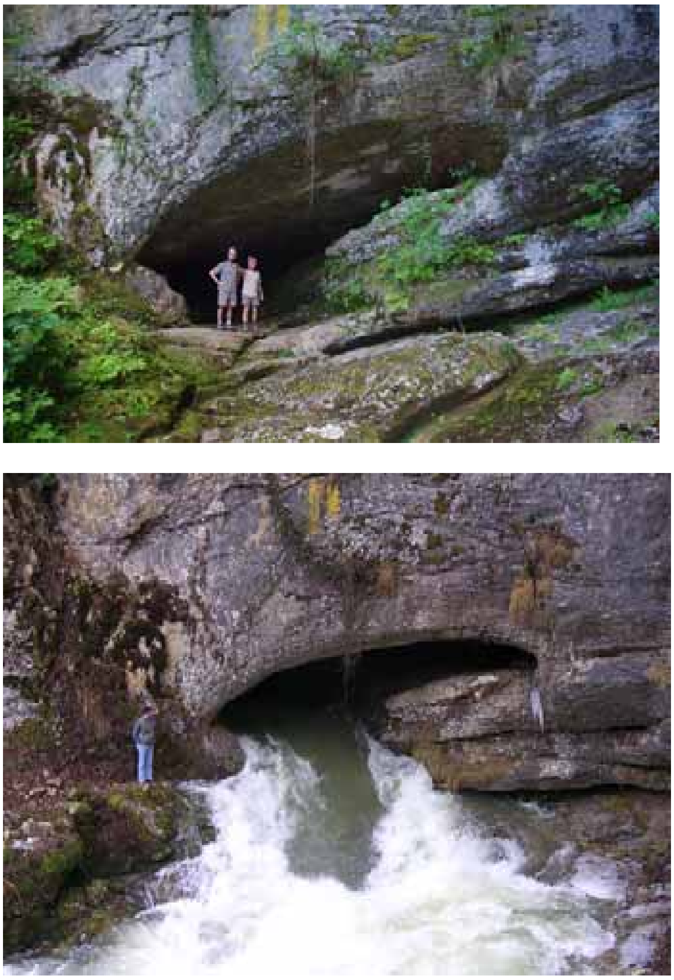

Fig. 2 – Prérouge cave in dry conditions (up) and during the 16-02-2006 flood (low). Such flash flood can occur very suddenly and represent a danger for

METHODOLOGY

GeoVision is based on non-intrusive video monitoring and measurements combining cameras and laser scanning.

It is derived from the "HyMAGE-TIP" tool (Fourquet, 2005; Fourquet et al., 2010), now promoted under the name "Imagine solution" (Imagery for nature and environment monitoring), being developed by a start-up associated with G.M. Saulnier, researcher in EDYTEM-CNRS-University of

Savoie, who invented the process for the monitoring and forecasting of river floods.

For the moment, for technical constraints due to the site configuration, GeoVision is not able to function directly on line in real time like the Imagine process can do it. In the present GeoVision device, two images of the cave entrance, with 1 s of time laps between them, are taken every 30 minutes, using a Campbell Scientific CC5X camera located on the top of a disused transformer facing the cave. The images files produced are collected every two months for laboratory processing. Flood sequences are isolated and the corresponding pictures are assembled to make a film of the flood events. Beforehand, high-resolution laser scanning of the flood channel has been carried out using a 3D LIDAR. 3DReshaper software is then used to overlay images onto the digital terrain model, in order to measure the water height on each image (fig. 3). This information is used to determine the wetted perimeter. In situ flow velocity measurements according to the water height allow then, after weighting by the friction coefficient, to calculate the discharge rate. The flood hydrogram could so be obtained by processing the discharge rates. But a problem remains: the flash floods events of Prérouge cave often occur or continue during the night. Now the type of camera used does not allow the night vision, so what the data are incomplete and we have to reconstruct the lacking part of the hydrograms by

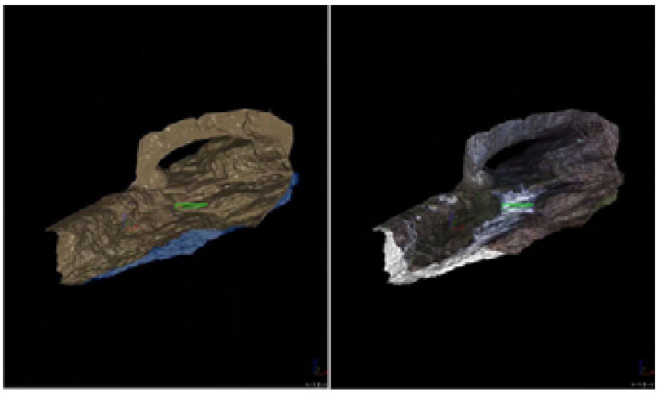

Fig. 3 – Image processing with 3D Reshaper for the measurement of the flood water level in the outlet channel of Prérouge cave, by overlaying photographies from GeoVision onto DEM obtained by laser-scanning. The image on the left is the "bare" DEM; on the right a GeoVision photography as been overlain onto the DEM, showing a flood flow springing from the cave (central white stripe under the green line) .

crossed interpolation and rainfall-flow correlation.

First results and discussion

The GeoVision monitoring system is functioning since December 2012. During the three first months, from 15.12.2012 to 15.03.2013, GeoVision detected ten flood events springing from Prérouge cave, characterizing an abnormally wet beginning of winter season. In this context, the rainfall-discharge correlation shows that 5 mm/h rainfall intensity during 4 to 6 hours is sufficient to induce a flooding springing from the cave, that occurs also 4 to 5 hours after the beginning of the rainfall (fig. 5). The intensity of the flood was very variable, with flow peaks between 0.5 and 5 m3/s. The drying of the outlet takes 10 to 13 hours (but water level into the cave may remain high during several days, preventing access (or coming back!) to the cavers. The images analysis reveals that before the flooding of the cave entrance, water springs from a stratification joint just below the cave doorstep (fig. 4). This observation is very important and useful as indicator of imminent danger of flooding.

Fig. 4 – When the water began to spring from the stratification joint below the cave doorstep (A), this is a signal of imminent flood, which can occur a few minutes as one hour later (B).

The ability to simultaneously display pictures of floods and their corresponding hydrograms (fig. 5) is supposed to make GeoVision an attractive educational tool.

Perspectives and developments: from "GeoVision" to "Flood Hunters" educational and participatory science program

Currently, GeoVision films require laboratory processing before they can be put online, but we hope we will soon be able to show live pictures via an Internet connection. The system will also be improved by lighting night shots, in order to capture whole flood events,

As well as providing an efficient tool for monitoring flood frequencies and flood functioning, GeoVision can also be used to show flood events to the public. But if displaying on line videos of fascinating natural events is a funny way to catch the attention of the public, it is not sufficient to make the viewer understand what he is seeing. That is the reason why we propose to launch a participatory and citizen science project, focused in a first time on the flood hazard. Aiming to increase the knowledge and the understanding of the karst systems flashfloods in the Chéran valley, it is based on the GeoVision monitoring station. But after discovering the matter thanks to the dedicated website, the participants are invited to become "flood hunters", producing and sharing their own testimony, observations, reporting and video/photographies which will be compiled and analysed with scientists on the website thanks to on line collaborative tools. In fine, this approach should increase the awareness of the users and visitors of the Prérouge cave on flood risk, as well as the general awareness of the public on natural hazards. Both "GeoVision" and "Flood Hunters" experiences should indeed be transposable to the whole panel of natural hazards and spectacular dynamic earth processes that occur in the Bauges Massif as well as in a lot of other mountain Geoparks.

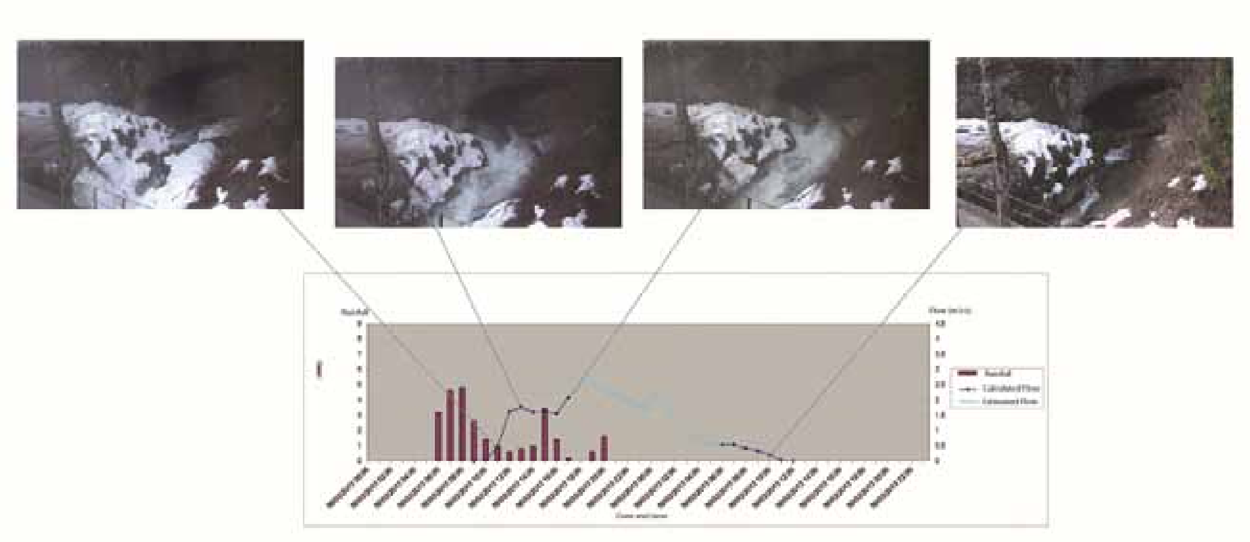

Fig. 5 – Illustrated hydrogram of the Prérouge cave's flood event of 8 and 9th March 2013 showing the rainfall-flow correlation.

CONCLUSION

The GeoVision project is a representative example of innovative tool developed in the Massif des Bauges Geopark for a renewed approach of natural hazards and risks. This example contributes to define how natural hazards, which represent of course a major issue in term of Civil Protection and land planning, can also be integrated in a territorial development project as part of the geoheritage, so becoming paradoxically a local resource!

ACKNOWLEDGMENTS

We thank students and colleagues of EDYTEM that participated actively to set up the GeoVision experiment, especially Emmanuel Malet, Stéphane Jaillet, Georges-Marie Saulnier, Bastien Chadelle, Fabien Renou, and Baptiste Launay. Special thanks to Jean-Luc Desbois (Bauges Geopark), Pierre Renau (CalcEre), and the Colombo family (owner of the Moulin de Prérouge) for their decisive collaboration in this project.

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Geo-hazards and climate change policies in the Geopark of Central Catalonia

I Costa F. C. ([a])

([a]) Scientific Director. Geoparc de la Catalunya Central. c/ Muralla de Sant Domènech, 24, 08024, Manresa, Catalonia, Spain. E-mail:ferran@geoparc.cat

ABSTRACT

The Geopark of Central Catalonia has forests as predominant land use and the climate is continental Mediterranean with a remarkable winter-summer thermal oscillation and low annual rainfall. The main settlements as well as industries are located in flat areas and river valleys. Subsidence processes, generated by dissolution of evaporite rocks close to the ground surface, and other geological processes like rock falls and landslides are also important in this territory. All these characteristics make the territory prone to specific natural and geological risks.

To foster the use of renewable energies, including geothermics, through the population and private companies in the Geopark territory is also a priority for the county administration. In addition, the Bages County Council leads initiatives in risk prevention plans and in rational and sustainable use of water and energy.

KEY WORDS: Climate change, floods, Geo-hazard, subsidence, renewable energies.

INTRODUCTION

Geopark of Central Catalonia has a surface area of approximately 1,300 km^2 and includes 34 municipalities belonging to the Bages County, plus one, the Collbató municipality, which is located in the Baix Llobregat County. The territory is situated in the central Catalonia.

Despite the growth of urbanization during the last decades (up to 5% of the land surface), the regional natural landscapes preserve their typical character, and the agriculture (approx. 20%) and forests (75%) are predominant land use types of the area. The territory has a continental Mediterranean climate, which is characterized by a remarkable winter-summer thermal oscillation, with relatively low annual rainfall, except in the highest tablelands, at the northeast of the territory.

The location of the settlements as well as industries has been mainly concentrated in the flat areas and the river valleys.

These general characteristics make the territory prone to specific natural hazards, which above all are the forest fires and floods. In addition, the existence of evaporitic rocks, which were dislocated at low depths below the ground by tectonic deformations, represent a geological risk for the subsidence processes, generated especially as a consequence of the rapid dissolution due to river and groundwater interactions. Into a lesser extent, block falls and landslides are other geological processes that affect the territory.

The Geopark territory, managed by the Bages Regional Council, has been giving active support for a long time to local goverments by elaborating emergency plans and by giving advice and guidance on energy optimization and sustaintable energies implementation through different iniciatives.

GEO-HAZARDS

One of the main functions of the Regional Civil Protection Service is to help local governments to elaborate necessary plans with the most favorable outcome in case of emergency. Since its creation in 2008, it helped most of Bages local administrations to plan management of different risks (fires, snowfalls, floods, earthquakes, organization of festivals, etc.).

FLOODS

The most densely inhabited centres and industrial areas in the Geopark territory are concentrated around the most important rivers and dry creek beds. Therefore, in this framework floods represents a type of risk that needs to be controlled or, in case these monitoring measures cannot be accomplished, specific action protocols have to be applied for local administrations and population.

In this respect, the Bages Regional Council gives technical support to local governments in elaborating action plans in case of emergency, drills performing, specific trainings sessions and emergency management. An example of this is the elaboration of plans that set the performance and distribution of human and material resources to improve the response in case of a potential flood.

SUBSIDENCE AND SLOPE PROCESSES

Due to geological determining factors, subsidence processes are very common where evaporitic formations are part of the subsoil. This subsidence has become an important geological risk in towns like Súria, or especially Sallent, where a number of houses and infrastructures have been affected by ground lowering and some had to be evacuated. In some cases, ground instability was caused also by human activity, especially mining. This phenomenon has been studied by the Catalonian Geological Survey and its evolution is been currently monitored.

In areas like Montserrat Mountain and due to its densely jointed rock steep slopes, rock falls become a relevant geological risk for potential damages to religious buildings, roads and also the visitors. Slope instability processes are also characteristic in other areas of the Geopark, such as soil creep in Sallent downhills, that has affected recent constructions.

EARTHQUAKES, FIRES AND OTHER RISKS

The seismic risk in the territory is not the most important one, although in the past some significant earthquakes affecting buildings were registered. The seismic intensity varies between VI and VIII degrees in the MSK scale (from strong to damaging).

Forest fires cyclically become an important threaten for the territory, therefore annual formation and prevention is done.

CLIMATE CHANGE

In this field, the Geopark territory relies on the support of its administrations. From the Regional Council, great deals of projects and initiatives as well as awareness raising actions have been promoted to local administrations and private companies. These projects mainly address both the rational and sustainable use of water and, in the energy field, the efficiency and use of alternative energies, such as biomass and geothermal energy, among others.

Some of the projects are:

Green Region

It is a program of activities to foster, through this brand, the business sector concerned with environmental issues and promote the green-economy at Bages and Central Catalonia. The objective is to consolidate the Bages County as a green region, by promoting the business sector related to sustainability and the so called green-economy and favoring economic growth and sustainability as a differentiator and competitive factor of regional companies.

Regional Energy Agency

It expects the Bages Regional Council to be the leading energetic manager of local governments in order to reduce consumptions and obtain important savings in bills. The main objectives are: a) to know and have control of regional energy consumptions in order to increase the management capability and the use of renewable energies, to allow reducing climate change and to minimise the rest of environmental impacts related to the non-renewable energies use; c) to train professionals, building community awareness and to educate population regarding energy control and management, energy saving and efficiency and renewable energies use.

Likewise, the agency pretends to become a reference to local governments, companies, public and private organizations and general population in obtaining information and guidance on energy issues.

Formation in renewable energies

All levels of training, from elementary school students to the professional level, on the use of renewable energies such as biomass and geothermal energy are accomplished.

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Websig, a tool for management and disclosure of geological and mining heritage at the Geopark of Central Catalonia

I Costa F. C. ([a])

([a]) Scientific Director. Geoparc de la Catalunya Central. c/ Muralla de Sant Domènech, 24, 08024, Manresa, Catalonia, Spain. E-mail:ferran@geoparc.cat

ABSTRACT

New technologies are becoming essential to all areas of life. In management, promotion, disclosure and conservation of geological and mining heritage they are valuable tools since they enable to put on top and correlate any kind of information that could be used to achieve these aims.

The Geopark of Central Catalonia has developed a web page together with a GIS that gives the territory a high capacity for land management and innovative products to keep geotourism organized, among many other implementations, which at once gives the visitor the possibility to create his or her own route to get to know the Park in all of its aspects.

KEY WORDS: Geological and mining heritage, *geolocation*, geotourism, land management, webgis.

INTRODUCTION

As an essential part of geoconservation, marketing and information strategy, the Geopark of Central Catalonia has developed a large-capacity content and user-friendly website: www.geoparc.cat

A geopositioning section has been added to the website, where the user may consult the available information on areas of geological & mining interest, from the inventory made by the *Departament d'Ingenieria Minera i Recursos Naturals* (Escola Politècnica Superior d'Enginyeria de Manresa, Universitat Politècnica de Catalunya (UPC)), included in the first Master Plan of the Park in 2007 (Mata-Perelló *et al.*, 2007).

Regarding geotourism, the advantage of GIS integrating the website is, besides the geological & mining heritage data, the possibility to add all the information users may need, like accommodation, food & beverage, other touristic sites, existing routes, etc. on different base maps in order to design a route that fits their preferences (Fig. 1).

INVENTORY OF SITES OF GEOLOGICAL & MINING INTEREST

The inventory of sites of geological and mining interest of the Geopark has 47 items and was elaborated from 3 pre-existing inventories. Most of the sites of interest came from the Inventory elaborated for the Master Plan of 2007, but also items from the Inventory of Sites of Geological Interest of Catalonia were incorporated, as well as some areas of growing interest beyond the local scale chosen from the geological & paleontological inventory of the municipality of Manresa.

Among the areas of interest, some active geological processes, subsidence, landslides, etc. which are included result in a direct geological risk for residents, due to their location, representing, in some cases, a serious social problem.

GEOPARK WEBSITE AND GIS DESCRIPTION

The home page (Fig. 2) of the Geopark website highlights aspects focused on geotourism like “Visits” to the main centres with geological and/or mining content, “Tourism” suggestions offered by companies or organizations collaborating with the Geopark, and “Georoutes”, showing Geopark routes connecting the different centres enabling visitors to know the areas while travelling between them.

These main banners are found with other tabs that link to the general information on the park. Aspects like “What is the Geopark”, “Geological & Mining Heritage”, “Geotourism” and “Training & Research” have been brought into focus.

Finally, the links to schedule, news, photos, general information (how to arrive, European Geoparks Network, tourism…) are found in the lower part of the site. It is worth noting the Geolocation section, which we refer to in this manuscript.

Fig. 1 – Map of the Geopark of Central Catalonia with the location of the sites of geological & mining interest that are part of the inventory as they appear in the GIS display. In the left-hand menu visitors can select different options in order to design their own route.

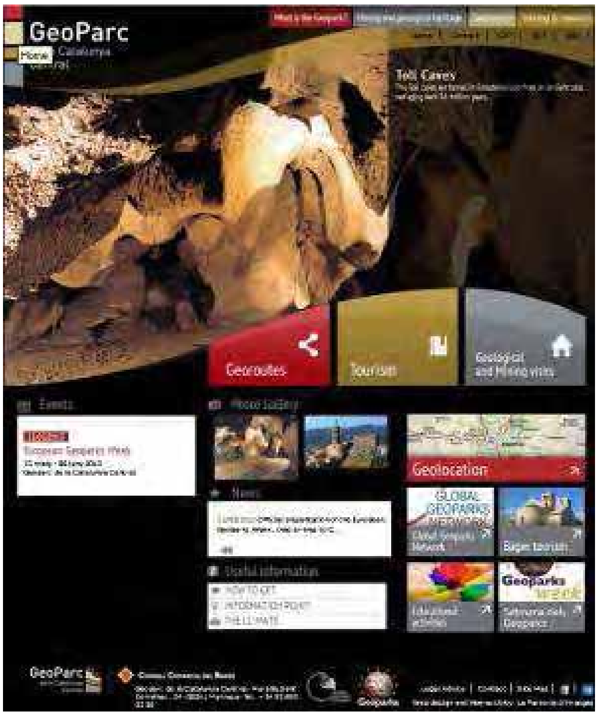

Fig. 1 – Homepage of the Geopark website.

GEOLOCATION

By accessing this application the user, either the territory manager or the visitor, has the option of visualizing on the same base map a great deal of information. In this sense, the main menu has the following options: Geopark boundaries, Sites of interest (geological and mining), Geopark Infrastructure (visitors centres and information offices), Routes (by car, MTB, on foot), spots of touristic interest (art and nature, Romanesque, religious and architectural heritage, fountains, museums, towers and castles, other touristic routes, etc.) accommodation, food and beverage and service companies (Fig. 3). All these fields can be active or inactive at the same time to fit the user's preferences.

The zoom allows identifying a more detailed positioning of the points along the way, in addition to the options and basic information like scale, coordinates, distance in meters, etc. The information icon on the top tool bar allows clicking on each symbol of the map and getting the information referring to the point appearing on the left side of the screen, in the "Result" section.

With regard to the content related to the sites of geological and mining interest, it is worth noting that information cards have been enabled with the aim of giving detailed information

Fig. 3 – Map of the Geopark of Central Catalonia with the location of the sites of touristic interest. The menu includes art and nature, Romanesque heritage, religious and architectural heritage, fountains, museums, towers and castles, other touristic routes, etc. This information can be added to the geological and mining sites of interest and to the proposed routes.

of each and every site. These cards have a short introduction and description of the way point as well as the coordinates. Detailed information is given on the zone access, recommendations of use and possible links to additional information, existing routes considering the visit to the area, documentation on the Internet, articles, etc (Fig. 4)

A more specific section gives the user, who can either be an expert in geology or simply interested in it, detailed information about the geological units, age and type of rocks, information on the spatial formation or its evolution regarding active geological processes, access to the geological map, etc.

All this information is easily accessible and concentrated on the website which contributes to the knowledge and advertisement of the resources and services the Geopark offers.

CONCLUSIONS

The Geopark website is meant to be a powerful and useful tool regarding two principal aspects: 1) heritage and territory management, essential for Geopark managers, and 2) advertise and inform not only visitors but also residents about the heritage resources and services found at the Geopark.

Although it is true that a Geopark must pay special attention to its geology and mining, it should not neglect the rest of its heritage, either natural, cultural, historical, traditional, etc. or those services and organizations committed to and collaborating with the Geopark in order to jointly develop activities on site based on the principles of sustainability and care of the environment, the landscape and the identity.

Given its recent set up, the application is still in its first stage and it is too soon to yield results or having an assessment.

Fig. 4 – Example of a fact sheet, in Catalan. First of all there is a general description with basic data from the site. The rest of the tabs guide the visitor to other contents such as geology, accesses, use recommendations and other links of interest to web pages or online documents.

ACKNOWLEDGMENTS

The project for the Geopark of Central Catalonia GIS and website was financed by the *Servei d'Ocupaci de Catalunya (SOC)*. Its design and interactivity were outsourced.

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The Protection and Utilization of "Yuntai Landform"

Jian-hua F.([a]), Xin-hao L. ([a]), Yu-qi D. ([b]) & Zheng Z. ([a])

([a]) Henan Institute of Geological Survey China. fangjh1959@163.com
([b]) Jiaozuo Bureau of Land and Resources China

ABSTRACT

This paper describes the characteristics of "Yuntai Landform" geological heritage landscape in Yuntai Mountain Global Geopark, China; Jiaozuo city also takes the opportunity of the brand of "Yuntai Mountain Global Geopark" to promote natural tourism in Jiaozuo. It also discusses the protection and utilization methods of "Yuntai Landform". The unknown Yuntai Mountain, with the help of the global geopark brand, becomes world-famous and has gained successful experiences in geological heritage conservation, natural tourism and economic development. Moreover, Jiaozuo city becomes the typical model of economic transition of mining city in China. The experiences of the sustainable utilization of natural resources of Yuntai Moutain Global Geo-park have practical reference significance for similar geoparks in the world.

KEY WORDS: Global Geo-park utilization Yuntai Landform

INTRODUCTION

Yuntai Moutain Global Geo-park situates in the northwest of Jiaozuo,Henan province, China. Its geographic coordinates are east longitude 112°44′40″～113°26′45″, northern latitude 35°11′25″～35°29′40″. The geopark has a total area of 556 square kilometers, it is a comprehensive geopark formed in the background of rift fault in East Asia, dominated by geological landform and water landscape, supplemented by natural ecology and cultural landscape. The main geological landform is called "Yuntai Landform", which refers to the cambrian-ordovician outcropped sections in Taihang mountain areas of China. It is a carbonate landscape characterised by various forms of long cliff, urn gorge, enclosed gorge, narrow gorge and hanging valley.

THE CHARACTERISTICS OF "YUNTAI LANDFORM" GEOLOGICAL HERITAGE LANDSCAPE

In the tectonic environment of rifting, the new tectonic movements dominated by extension have lasted from the paleogene period to today, forming the Taihang block mountain, which results in the decoupling and splitting of the thick near-horizontal sedimentary clastic rock and carbonate rock formations that formed in the environment of mesoproterozoic and paleozoic marine environment. Due to the erosion of water, they became the "Yuntai Landform" featured by the groups of gorges standing one after another, peaks and valleys alternating, cliffs making a long wall and terracing, which is of biggest ornamental and utilization value of the natural tourism. The "Yuntai Landform" mainly includes Red Stone Gorge, Quanpu Gorge, Tanpu Gorge, Dogwood Peak, Longji Great Wall, Yuntai Sky Waterfall and so on. Among them, Red Stone Gorge and Longji Great Wall are the most fantastic spots. Red Stone Gorge is a linear gorge developed in the red quartz sandstones（at 113°21′23″E，35°25′52″N）. The red sandstones formed in the mesoproterozoic period which is 1.2 billion years ago, and the gorge was formed 2.6 Ma ago, because of the intense uplift of the new tectonic movement and the profound cutting of water erosion, the red cliff broken wall is as high as 150 meters and the blue water red gorge hanging highly above it were formed. Longji Great Wall is a dragon's back shaped ridge clamped between two gorges（at 112°47′52″E，35°12′54″N）), the whole ridge is made up of limestone, the near horizontal beddings and two groups of vertical joints cut the limestone into blocks of all sizes together, seeming like a stone wall piled up by giant stones, just like a "natural great wall" created by the nature.

Fig.1- Red Stone Gorge

Fig. 2- Longji Great Wall

THE PROTECTION OF “YUNTAI LANDFORM” GEOLOGICAL HRITAGE LANDSCAPE

Yuntai Moutain Global Geo-park complies with the aim of constructing a Global Geoparks Network, it attaches importance to the protection of “Yuntai Landform”. After the approval of the geopark, the Yuntai Moutain Global Geo-park Administration was set up to exercise the management for the geopark. There are some protective measures for geological heritage: first of all, the geopark was divided into several areas according to different functions, such as geological heritage protection zone, sightseeing zone and service zone. In the protection zone, people are not allowed to destruct the geological landform, only approved researchers, administrative staff and special tourists have access to it, mainly carry out the activities relating research and protection. There should not be irrelevant industries nor buildings in the sightseeing zone. In the service zone, there is strict control over the population and the buildings, the irrelevant industries are restricted, the industries do harm to the environment are also refused. Secondly, formulate regulations and rules of geological heritage protection, forbidden activities such as mining, project construction in the geopark, offenders will be punished by law; establish warning board at the vulnerable spots or adopt protective measures to avoid the destruction. Thirdly, for exposed mountain, set up ecological shelter forest and implement the ecological construction project of “Green Hills and Clear Waters”; spray to green is adopted in the environmental management for the exposed rocks and mountains caused by mining, treat the mountainous environment in an overall way. The investment for the protection of geological heritage goes into the protection of the geological heritage. For example, overhead trails are set up over a giant ripple stone geological heritage landscape, which is not only convenient transportation for travel people , but also plays a protective role in geological heritage. Since 2004, investment has totaled more than 60 million RMB in the added overhead trails, guardrails, fences, paved passages, spray to green in exposed mountains and so on. These protective measures effectively protect the geological heritage landscape of “Yuntai Landform”, making a sustainable utilization of the natural geological heritage landscape in the geopark.

THE UTILIZATION OF “YUNTAI LANDFORM” GEOLOGICAL HERITAGE LANDSCAPE

Yuntai Moutain Global Geo-park uses the distribution characteristics of the “Yuntai Landform” geological heritage landscape to set up 5 garden areas namely Yuntai Mountain, Qinglong Gorge, Fenglin Gorge, Qingtian River and Shennong Mountain. It also uses the scientific value of “Yuntai Landform” geological heritage landscape to carry out several scientific researches, such as “Study on Geological Background of Main Landscapes in Yuntai Mountain”, “A Comparison between Yuntai Landforn and Grand Canyon in America” etc. These researches have made scientific researches on “Yuntai Landform” walk from the geopark to Taihang Mountain and go abroad to the Colorado in the USA. From the comparison between the typical geological landforms to analysis of evolution, all demonstrate that “Yuntai Landform” is a typical representative of ladder-shape valley landforms, as well as has worldwide scientificality, typicality of valley landscape and systematicness of evolution. Based on the solid foundation of research achievements, Yuntai Mountain Administration has set up cooperative relations with colleges and universities, becoming a scientific research base. With joint efforts, they organize summer camp named “geoscience, resources and protection” for children, which is themed by “save resources and protect environment”, promoting the popularization of geoscience among children and making them realize the importance of protecting the environment. Make use of the ornamental value of “Yuntai Landform” geological landscape and develop the nature tourism of the geopark, which results in rapid increase of the annual passenger flow and drives the sustainable development of local economy. Along with the rising popularity of the geopark, it also has boosted the development of tourism industry and the employment. Since the Global Geopark Network was established in 2004, the tourists' number and the income of entrance ticket have been rising rapidly. Accroding to statistics, in 2007, the geopark received 12.0275 million tourists, making 0.36 billion yuan RMB income from entrance tickets, the comprehensive tourism income was 93.0 billion yuan RMB. To 2011, the geopark has received a total tourist number of 22.8125 million, 0.7 billion yuan RMB income from entrance tickets, the comprehensive tourism income was 17.192 billion yuan RMB.

The scientific natural tourism in Yuntai Moutain Global Geo-park is attracting more and more tourists in the world; its popularity also has spreaded from local province to the whole country and beyond. Through the international activities and conferences of the Global Geopark Network , its influence has extended all over the globe. The development history of Yuntai Mountain has gained itself a worldwide fame from the brand of the Global Geopark Network, which has helped it make achievements in geological heritage protection, nature tourism and boost local economy. The traditional quarrying and mining which consuming resources are replacing by the environment friendly natural landscape tourism, the foundation of sustainable development of regional economy has come into being. Moreover, Jiaozuo city becomes the typical model of economic transition of mining city in China. The experiences of the sustainable utilization of natural resources of Yuntai Moutain Global Geo-park have practical reference significance for similar geoparks in the world.

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Reykjanes Geopark Project – A Peninsula still being born

Jónsson E. S. ([a]), Guðmundsson S. ([b]) & Kristinsdóttir B. ([c])

([a]) Reykjanes Geopark Project, Graenasbraut 506, 235 Reykjanesbaer, Iceland. E-mail: eggert@heklan.is
([b]) Keilir, Atlantic Center of Excellence, Graenasbraut 910, 235 Reykjanesbaer, Iceland. E-mail: sverrirgu@keilir.net
([c]) Heklan, Suðurnes Regional Development Agency, Skogarbraut 945, 235 Reykjanesbaer, Iceland. E-mail: berglind@sss.is

ABSTRACT

Reykjanes Geopark has applied for admission to the European Geoparks Network and Global Geoparks Network. Reykjanes Geopark is located in SW-Iceland, close to the capital area. The Reykjanes Peninsula is a young section of Iceland. It is a land-born, highly volcanic obliquely spreading subaerial portion of the Mid-Atlantic Ridge in SW-Iceland. The plate boundary between the North-American and the Euroasian plate runs ashore at the SW-tip of the peninsula.

KEY WORDS: Reykjanes, Iceland, Project, plate boundaries,

INTRODUCTION

Reykjanes Geopark is located at the Reykjanes Peninsula, where the Mid-Atlantic Ridge rises above sea level. The volcanic and geothermal activity along with the ever-changing landscape makes the Reykjanes peninsula one of the best open and living textbook of geology in the world.

THE GEOLOGY OF REYKJANES GEOPARK

The Reykjanes Geopark Project gets its name from the Reykjanes peninsula, where the Mid-Atlantic Ridge rises above sea level. Originally the peninsula got its name from the high-temperature geothermal areas found on the peninsula but the Icelandic word „reykur“ can be translated as steam.

The establishment of a Geopark in the Reykjanes region at the end of 2012 is part of a long process. For decades, people in the region have discussed how to promote and raise public awareness of the region´s geological heritage. The idea has always been to establish some kind of a park for that purpose, often referred to as “Volcano Park”.

In 2008 Grindavíkurbær, one of the municipalities, started working on a policy regarding the use and protection of natural resources. The idea of Reykjanes Geopark was conceived at the same time and the municipality published a report on the idea. The idea was well received by the other municipalities in the region, the local community and other partners. It is now part of the Regional Plans for the Reykjanes peninsula 2008-2024.

The plans state that the Reykjanes region should be eligible as a Geopark due to its geological history, formation, resource utilization and culture. The emphasis for the Reykjanes region is to illustrate the diverse conjunction of nature and culture, to inform and educate and to create jobs that are based on the uniqueness of the area.

The preparations for the Geopark have been led by the municipalities and later funded partly by Iceland 2020 – governmental policy statement for the economy and community.

A working committee, consisting of one governor from each municipality, has met regularly since then to form a shared vision and strategy for the proposed Geopark. It consists of one government official from each municipality. There are also representatives from Heklan regional development centre, Reykjanes Tourist Board, Keilir - Atlantic Center of Excellence, geothermal power company HS Orka Ltd. and Blue Lagoon Ltd. Other organizations, companies and individuals have also participated in the project.

Reykjanes Geopark Project was formally established on the 13th of November 2012. A new board was formed at that point. Reykjanes Geopark Project applied for EGN membership last year.

LOCATION, PHYSICAL CHARACTERISTICS AND LAND USE

The Reykjanes Geopark is located in SW-Iceland, close to the capital area. It is located on the Reykjanes Peninsula and reaches from Reykjanestá in the west, where the Mid Atlantic Ridge axis comes ashore, to the inlet of Herdísarvík in the east. From Reykjavík it is a 20 minute drive to the boundary of the Geopark.

Reykjanes Geopark has a total administrative area of 829 km2 which is approx. 0,85% of Iceland. The Geopark covers five municipalities (Grindavík, Reykjanesbær, Sandgerðisbær, Sveitarfélagið Garður and Sveitar-félagið Vogar), total population is around 21.500.

Reykjanes region is suffering the highest unemployment ration in Iceland with roughly 50% higher unemployment than Icelandic average. Establishment of a Geopark in the region is one of our tools to fight back and create jobs.

The Reykjanes Geopark area is a peninsula which offers a variety of landscapes, including fissures, lava fields and geothermal activity. Large parts of the lowland are covered by extensive lava fields allowing little vegetation. Because of little vegetation making it difficult to practice traditional agriculture at Reykjanes and for a long time, agriculture has not been an important factor for the local economy. The lava is mostly covered with moss which doesn't require much soil. The area is relatively flat with the highest point being 391 meters. The lava fields contain many cracks and fissures both below and at the surface. The rift and geosite Hrafnagjá is the longest, nearly 12 km.

The Geopark area is rich in natural resources. Several high temperature geothermal areas are found along the peninsula. In the eastern part of the Geopark are mountains called Brennisteinnsfjöll or Sulfur Mountains. As the name implies, there were small mines in the area in the late 19th century but mining didn‘t last long. Traditionally, fisheries have always been the main economic activity in Reykjanes. There is a large number of landing sites, where local fishermen would push their boats out to sea and then drag them back full of fish. Today there are eight harbours along the peninsula, including some of the nation´s biggest fishing-industry harbours.

The geology of Reykjanes Geopark

The Reykjanes Peninsula is a young section of Iceland. It is a land-born, highly volcanic obliquely spreading subaerial portion of the Mid-Atlantic Ridge in SW-Iceland. The plate boundary between the North-American and the Euroasian plate runs ashore at the SW-tip of the peninsula (e.g. Einarsson, 1991; Vadon and Sigmundsson, 1997; Hreinsdóttir et al. 2001). According to detailed observations of the surface motion, the South part of the peninsula is moving towards the East and the North part towards the West; the two plates part at an average rate of ~2 cm/yr (e.g. Hreinsdóttir et al., 2001; Guðmundsson et al., 2002). The movements, however, consist of complex time varying mixture of subsidence, uplift and surface rifting (e.g. Vadon and Sigmundsson, 1997; Guðmundsson et al. 2002).

The geological history consists of ~1000-1200 year cycle involving 300-400 years of volcanism altering to ~800 years of tectonism. Thus, the present period of earthquake activity and transcurrent faulting may be nearing its end after almost 800 years of volcanic rest. The peninsula contains late Quaternary volcanic palagonite tuff and pillow lava formations as fells and mountains from the last glacial periods. Also widespread basaltic lava flows and volcanic structures from interglacial periods. Four central volcanic systems and fissure swarms line the peninsula from SW to NE, containing open fissures, faults, high-temperature geothermal fields and numerous volcanic fissures (e.g. Clifton et al., 2003). These are lined with various monogenetic craters. Many small and large lava shields are found in the area, some made of primitive mantle melt. Eruptions have occurred in the three westernmost systems during the past millennium; in the 10/11th centuries, in 1151-1180 and 1210-1240.

The capital area of Iceland is located on the Reykjanes peninsula. Thus, the Geopark area is in the nearest vicinity of most of the main research institutes of Iceland, and serves as an accessible research laboratory to observe and study geological and geophysical processes, many of which are unique worldwide. Some of the first benchmarks, set up in the purpose of confirming the continental drift theory of Alfred Wegner, are located on the peninsula. During the last two decades, a relatively dense GPS geodetic network have been measured in the area, supplemented with satellite borne interferometry and other geodetic instruments, to observe the crustal deformation and seismic activity. The largest signals observed are the plate movements and subsidence centered on the geothermal areas. The data is e.g. used to study crustal stresses related to future earthquakes, infer volume of surface uplift/subsidence and to calibrate models showing the effects of different geodynamic forcing.

Geotourism, geo-education and geo-heritage

For a long time, the Reykjanes region was known mainly for its fishing industry and the long lasting presence of the US Iceland Defence Force at Keflavík Airport. Both provided a great deal of work for the local population. As mention earlier, the army base was closed in 2006 and fishing and fish processing in the region have declined in recent years. Even though the fish processing is declining at some places, the Reykjanes Geopark is one of the best places to get to know the Icelandic fishing industry and its rich history.

Tourism is one of the fastest-growing sectors of the Icelandic economy. It is very important to the Reykjanes area and one of the main sources of income for many families.

In recent years, the emphasis in the region´s marketing for tourists has been on the geology of the area. Reykjanes Geopark has a great potential for geotourism due to the region´s rich geological heritage, great geo-diversity, local knowledge and people's awareness of the land and volcanism. The region already enjoys some tradition in geotourism, geological attraction, local food and handcraft. The establishment of Reykjanes Geopark will further these activities.

Reykjanes Geopark will cooperate with various partners in tourism by creating a network of guides, museums, tour operators, hotels, restaurants, and so on. This cooperation will be based on the concept of responsible and sustainable tourism, conserving the geological and geographical character of the area, as well as the natural and cultural heritage. The goal is the prosperity of the local population.

As stated before, the number of visitors to the proposed Geopark is constantly increasing and in some places the number of tourists is so high that it is at the upper limits of tolerance of the present infrastructure and management. Reykjanes Geopark members are dedicated to further development of sustainable tourism in the region. Therefore, it is one of the Geoparks´s tasks to monitor sites, particularly regarding conservation, environmental degradation and carrying capacity.

Large part of the proposed Geopark is defined as nature protection areas according to Icelandic laws. These areas have different terms as to what actions are permissible within their boundaries.

It is the Geopark´s aim to raise awareness of geo-conservation and promote the geological heritage of the region by informing the public. The Geopark and its cooperators will produce and provide education materials explanatory signs and booklets.

Reykjanes Geopark will develop educational programs in good cooperation with Keilir - Atlantic Center of Excellence to inform the participants about the philosophy of Geoparks. Special emphasis will be on the Reykjanes region, e.g. a program for local guides.

The Reyjanes region has in recent years become a popular site for geography oriented school trips to Iceland. One of the tour operators in this field is GeoCamp Iceland, a sicence camp based in the area. It is a camp for young students who are interested in geology and all other aspects of scientific education and who want to explore these subjects further.

The strange and beautiful landscape of Reykjanes has, since the first's settlers came to Iceland, been explained through oral tradition. Elves, trolls, ghosts, outlaws and magical spells play a large role in those stories. Icelanders do not battle trolls any more but the beliefs still remain. They know that man must both live with and preserve nature. By doing so, good overcomes evil. Those stories have passed on from generation to generation of Icelanders.

It is our job to pass on those stories as well as to inform people about the geology of the region based on new knowledge and science. The main story we will focus on in the Reykjanes Geopark is how a peninsula is still being born today. You don't have to read the book, just look under your feet. The Reykjanes peninsula is a living textbook of geology. In the Reykjanes Geopark, we have a story to tell.

CONCLUSION

Reykjanes is a peninsula of contrasts and diversity. We, the people living there and the people who lived there before us, have learned to adapt to the powerful forces of the earth and how important it is for us to live in harmony with nature. People in the region have been regularly reminded of the importance of geology, both for good and bad.

All of our goals may be achieved within the framework of EGN and GGN, with the support of, and in cooperation with, other Geoparks. Reykjanes Geopark´s primary focus is to raise public understanding and awareness of geoheritage and geoconservation in the Reykjanes peninsula by developing various programs. Other goals are promotion of tourism, education, and research and development of tourist infrastructure in the region. It is our belief that we can create new tourism products as a Geopark, with regards to geotourism, biotourism and cultural tourism.

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

Geoparks in east africa – Exploring some of the challenges and opportunites to adapting the model in Ethiopia

Karkut J. ([a])

([a]) Touch TD Ltd., London, United Kingdom. j.karkut@btopenworld.com

ABSTRACT

As highlighted in the call for papers for this European Geoparks Conference 2013, the African continent is richly endowed with a dramatic and diverse geoheritage. In many of its countries and regions there is a latent but often underused potential for conserving and sustaining that heritage as well as connecting landscapes and features in to the tourism value chain. Using the case study of Ethiopia, this paper explores some of the critical flash points and issues that must be understood and overcome if the Geoparks model and expansion of the global network can effectively be applied to include the undeniable wealth of geoheritage that is abundant across the vast and dramatic landscapes of this corner of East Africa.
The paper is based upon fieldwork, interviews, observations and group discussions that have been conducted with academicians, politicians, policy makers and practitioners across a 3 year British Council funded project entitled 'Sustainable Community-Based Tourism in Ethiopia – A Turning Point'.

INTRODUCTION

As mapped out in fine detail by Asrat et al. (2008), the geological heritage and geodiversity that is spectacularly exposed across great swathes of Ethiopian territory, can certainly stake a strong claim to being amongst the most significant within the continent either in terms of Scientific quality, Rarity, Aesthetic appeal or Educational value. From highlands rising up to well over 4,000m, to the lowlands of the rift valley dipping to 120m below sea level in the Danokil depression, and suites of rocks representing all major ages and forms, there are certainly no shortage of possible geosites around which to consider the structuring of a potential geopark territory. In many locations there are combinations of expressions of geological, natural and cultural heritage all shaped and influenced by the underlying landscape.

But simply identifying and mapping sites of geoheritage that may be of significance to conservation, tourism and development is only one angle and activity that will be required if the geopark model is to be successfully applied within an African and in this case Ethiopian context. As is now familiar to all 54 (as of June 2013) territories in the European Geoparks Network, the establishing and maintenance of a successful geopark is a challenging balance between issues of conservation, education and sustainable development primarily through tourism reflecting that landscape. Equally there is another fine balance between the fundamental core of any geopark consortium which is to be drawn from local community structures at a grass roots level,

> …to enable the inhabitants to re-appropriate the values of the territory's heritage and actively participate in the territory's cultural revitalization as a whole. EGN (2011)

whilst at the same time have the capacity to engage with high level governmental and inter-governmental structures in order to allow access to funding opportunities and to fit in with UNESCO protocols and structures at national and transnational levels.

This balancing act is further complicated by the diversity of political, economic, cultural and developmental settings within which geoparks have now been established across the global network. The type of situation that can emerge if those balances are not maintained, has been candidly reflected upon by colleagues from Universiti Kebangsaan Malaysia, when researching local community perspectives within the Langkawi Geopark in Malaysia. Azman et al. (2011) explain that they found there were very differing levels of engagement with activities around the geopark, with the local community broadly having a weak grasp of the geoparks concept. They concluded that for those local residents to actively contribute towards and benefit from the efforts of the geopark, they needed be offered wider information and incentives, with demonstrable benefits being distributed evenly and equitably across the community (Azman et al., 2011).

The realization within the Langkawi Geopark that a greater degree of community engagement was required, came some time after the formation of the geopark and its management structure. But examination of local participation in the management of heritage sites in a number of localities in Sub-Saharan Africa, has indicated that it is preferable if the process of engagement begins at the design phase, including the stages of 'interpretation, management and conservation' (Phillips, 2008). The emphasis in locations considered to successfully reconcile the interests of the local people's, their land use interests and those of heritage or conservation managers and researchers, is one where those communities are actively empowered and a key part of the management of all components of heritage. One location often cited in this way is the Ngorogoro World Heritage Site in Tanzania, where the local Masai people are integral in the management of that landscape (Chirikure et al., 2010).

However, sites such as Ngorogoro are very much the exception in terms of conservation and management. In Ethiopia, one of the greatest challenges in territories where heritage resources are located, comes from the competing pressures of other activities such as farming or logging for heating and construction. Even in areas with significant layers of conservation protection, where there are grave economic pressures within the resident populations and insufficient political will to implement enforcement of laws, then conflicts arise. This is most dramatically acted out inside many national park boundaries across Ethiopia, where competition for grazing lands has lead to encroachment of pastoralists in to lands that have been designated for wildlife conservation. Such conflicts of interest and sometimes actual armed conflicts, do not bode well for those seeking to conserve geological sites within potential geopark localities in Ethiopia.

These issues are not new to this part of East Africa, and longitudinal research through Addis Ababa University has outlined that community awareness, engagement and human capacity building are the critical strategic areas that need to be addressed if community driven sustainable development initiatives such as geoparks are to successfully emerge (Feseha, 2012). For this to happen, it involves utilizing the heritage 'as an economic resource' (Chirikure et al., 2010) and one of the most effective methods of identifying where and how linkages between elements such as geoheritage and tourism can occur is through 'value chain analysis' (VCA). VCA in terms of a tourist destination,

> …requires estimating the value of total tourist expenditure and disaggregating this into the different functional areas (i.e. accommodation, food and beverages, shopping, transport, excursions, etc.) where spending takes place. The 'value' in each functional area is then assessed to estimate the proportion that accrues to different participants and whether there are barriers to entry or other constraints' (Ashley & Mitchell, 2007).

If appreciation of the value chain connecting the geological heritage in Ethiopia, to tourism and join up with other sectors such as agriculture, then significant efforts are required to ensure the language and means of communication to stakeholders and communities is not overly academic or scientific. Equally, the participation of communities in developing and managing their heritage resources, must be seen not as 'an event but a process which evolves over time' (Chirikure, 2010).

Furthermore, in a land sometimes described as consisting of '80 peoples and 80 languages', the one feature that cannot be easily arrived at when seeking community participation in Ethiopia, is a homogenous voice or opinion. Although Ethiopia did not suffer the burden of colonial occupation and associated land appropriation, it has succumbed to internal ideological and external border wars. The consequence of this has been that since the change to a democratic regime in 1991, Ethiopia has 'instituted a unique political order…widely know as ethnic federalism' (Feyissa, 2011). The subsequent structure involves a complex arrangement of partially centralised and partially devolved responsibilities, crossing between woreda (district), regions and federal authorities. Consequently a concept like Geoparks faces significant organisational challenges if the grass roots community involvement and the top down state level UNESCO structures are to be understood and reconciled together. Equally, if engagement with tourism stakeholders and aid-funded development sources are to be utilised by an aspiring Ethiopian geopark project, then a subtle understanding and playing of the political economy and political structures is required.

Such concerns are most graphically acted out in the Afar region in the North East of Ethiopia. Afar is host to probably the most unique and valuable of all geoheritage resources in the country. In the far north of the state are the areas of most dynamic rifting including a number of active volcanoes, the most well know being Erte Ale which contains one of the rarest volcanological features on the planet, a long-standing lava lake. Whilst in the central part of the state is the site where 'Lucy' and other prominent palaeo-anthropological findings were discovered. In normal circumstances, these sites might be considered to be the jewel in the crown of any Ethiopian geopark initiative. But because of extreme difficulties with physical accessibility, and a long-standing 'Afar political resistance against their economic marginalisation' (Feyissa, 2011), that has lead to sporadic armed conflicts, those assets are for all but the most wealthy and hardy tourists effectively out of bounds.

However, it is inappropriate to consider such tensions and issues collectively and simply as a matter of ‘security’, which once resolved could allow the successful development of geotourism or a geopark. Rather, with the embedding in places such as Afar of effective community participation tools, and identifying the components and blockages along the tourism value-chain, then the development of geopark projects and local consortia can contribute to sustainable development, education and awareness building and have a net effect of stabilising a region with security concerns.

It is apparent therefore, that the establishment of the geoparks model in Ethiopia requires extensive research and collaboration to further understand issues across a wide range of disciplinary boundaries. In particular deeper analysis has to be conducted as to how community participation may be stimulated, where the tourism value chain lies and what blockages need to be overcome if there is to be an equitable and sustainable distribution of benefits. Equally, a strong grasp of the local and regional nuances of the political economy and the unique federal structures is vital if well-meaning developments towards establishing geoparks are not to come aground on a rocky political reef.

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

Monts d'Ardèche Geopark Project: reconnecting people with the geoheritage

Nicolas KLEE ([a]), Marc LUTZ ([a])

(a) Parc naturel régional Monts d'Ardèche, Domaine de Rochemure, 07 380 Jaujac, France. E-mail: nklee@parc-monts-ardeche.fr ; mlutz@parc-monts-ardeche.fr

ABSTRACT

Located in the south east of France, on the western edge of Massif Central, the Regional Natural Park of Monts d'Ardèche is an Aspiring Geopark, which offers a fantastic geological heritage. The geological diversity in this area includes various elements linked to volcanism: well conserved strombolian cones, tens of kilometers of basalt columns, and other interesting geological objects such as granitic chaos, dinosaur's footprints, etc.

Although the Aspiring Geopark is well structured in terms of outreach and education, the Geopark label would help to highlight the geological richness of the area and raise awareness about this unique region. The tourism policy of the Park is based on sustainable tourism (the Park is awarded as Charter Area for Sustainable Tourism in Protected Area since 2011), and its development project is systematically based on the promotion of cultural and natural heritage. These heritages are naturally linked to the geological settings, which shaped the landscapes of Ardèche and created the right conditions for human settlement on this territory. However, the geological history is rarely integrated in the tourism activities. Connecting the discovery of the territory to the explanation of its origins seems to be the right way to offer a very special experience to everyone.

KEY WORDS: geotourism, Ardèche, public awareness.

INTRODUCTION

The Regional Natural Park of Monts d'Ardèche offers a mosaic of landscapes covering a mountainous territory, providing gorgeous and diverse sceneries: picturesque villages at the foot of volcanoes, deep gorges formed by raging torrents, etc. Located in the south of France, on the eastern edge of the Massif Central in the south west of the Rhône-Alpes region, the park covers almost a third (ca 180,000 ha) of the administrative department of Ardèche, including 132 villages.

At the interface between Massif Central and the Rhône valley, Monts d'Ardèche are crossed by numerous side valleys including the Ardèche river and its tributaries, as well as the Eyrieux river. This results in marked reliefs, exceptional landscapes and major natural areas.

Being a crossroads between Massif Central, the Mediterranean region and the Rhône valley is a valuable asset for Monts d'Ardèche. The Park includes six typical landscape units, each of them presenting remarkable features. In the northern part of the Park, "Region des sucs" presents volcanic phenomena such as Mont Gerbier, famous for sheltering the sources of the Loire, whereas "Plateau de Vernoux" shows remarkable meadows. In the central part, "Serres Boutiérots" offer smooth and rolling hills and "Cévennes Ardéchoise" presents deep wooded valleys and the so-called "Ardèche Young volcanoes". The "Cevennes Piedmont" in the southern part is marked by terraced vineyards based on Triassic sandstones. Southern Cevennes lay further south and cover a wide area from a Pretriassic peneplain to an arid shale slope.

Created in April 2001 through a Prime ministerial decree, the Regional Natural Park of Monts d'Ardèche is administrated by a local body, which proposed in 2012 that the Park becomes the fifth Geopark in France. This aspiring Geopark currently meets the three requirements to become a Geopark: an extraordinary geological heritage, a network of local stakeholders strongly involved in education projects and in the enhancement of geosites, and a strong policy for the development of geotourism. To achieve the Geopark project, the appropriation of geoheritage knowledge by local communities also needs to be further developed.

GEOLOGICAL SETTING

The Regional Natural Park of Monts d'Ardèche presents an extraordinary geological heritage that marks the landscape and contributes to the richness of the territory. This heritage is meaningful in term of education and economic development.

The territory can firstly be seen as a show-room for any geological ages dating back to 300 million years (pre-Triassic peneplain, Triassic sandstone, rocks of Late Quaternary, etc.).

In addition, the presence of different volcanic episodes has strongly marked the territory with visible traces in the landscape: strombolian craters, basalt columns, necks and dykes, maar, etc.

Ardèche is one of the few French regions where it is possible to find visible elements of the earth history over such a long period. This is due to its specific position on both the crystalline massif and the vast sedimentary basin of the southeastern sector. Many events explain this geological diversity. The most important are the formation of the Hercynian chain and its erosion which all together form the largest part of the heart of the Park. To better understand the rich geological heritage of Park of Monts d'Ardèche, a brief history of the geological folding of this territory is needed.

Between Carboniferous and Triassic, while the Hercynian chain was eroded, lakes have been formed. Sediments gave rise to irregular beds of sedimentary rocks that now form the Cevennes piedmont. The lush vegetation of that time, through the accumulation of organic matter, has been the source of coal layers which have been used for decades in the Prades-Jaujac coalfield.

Other important features of this period are the presence of dinosaurs during the Triassic in the south of the Park. The Triassic sandstone slabs have kept a very fine footprints collection corresponding to twenty different species.

During the Jurassic and Cretaceous, the sea covered much of the Ardèche for at least 120 million years. The sea has allowed the formation of the bulk of sedimentary rocks, which dominate in the marl and limestone above. It can be found only at the margin of the Park.

When the sea retreated at the end of Cretaceous, crystal Ardèche raised, while the lower Ardèche collapsed. The great step (1,600 vertical meters), between lower Ardèche and the mountains is the effect of this large general movement, which created the typical slope of the Park.

The most remarkable landscapes find their origin in volcanism, which appeared only during the Miocene period, 12 million years ago in “Pays des Sucs”. This volcanic history spans over 6 million years and concerns many volcanoes, a number of them being easily recognizable by their peculiar form of "sugar loaf" due to the viscosity of lava.

Most of the area has almost not been affected by the following two eruptive phases (volcanism of Coiron between 8 and 6 million years ago, and volcanism of the Devès that surrounds it, between 2 and 1 million years ago). The centre of the most recent eruptive phase created the “Ardèche Young Volcanoes”.

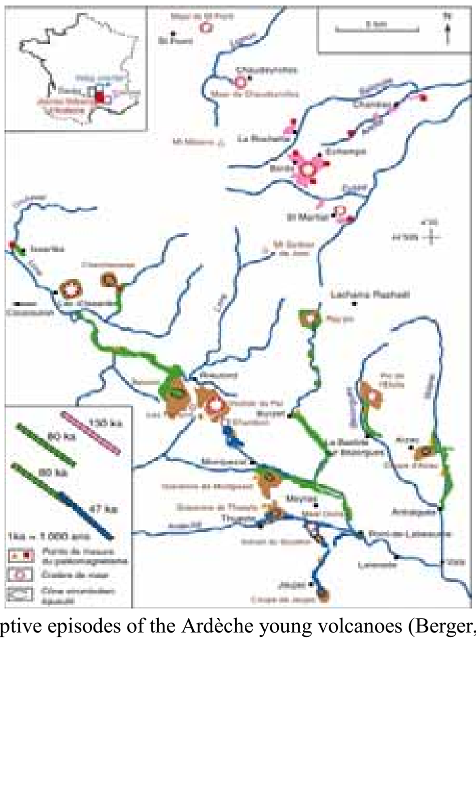

Fig. 1- Eruptive episodes of the Ardèche young volcanoes (Berger, 2007).

A GEOTOURISM POLICY

The approval process for the aspiring Geopark of Monts d'Ardèche must also be seen in the broader context of the registration of Grotte Chauvet (the earliest known cave paintings) on the UNESCO World Heritage List. Through its international dimension, the Geopark project will contribute to strengthen the French application for the UNESCO label, as it deals with a theme very close to Grotte Chauvet. In fact, for the latter geology and paleontology respectively interrelated being twin sciences enriching one another. Historical scales are also very close, the Volcano of Jaujac (one of the Ardèche Young Volcanoes) for example being only 36,000 years old. Artists who painted Grotte Chauvet may have witnessed the eruptive phenomena in Ardèche. A facsimile of Grotte Chauvet, based on the model of the so-called "Lascaux 2", is planned to open to the general public at the end of 2014.

The opening of this facsimile is a chance for the aspiring Geopark, as it might modify the type of tourism in Ardèche. Today, Ardèche is considered as a nature destination allowing outdoor activities in beautiful and preserved landscapes. Through the opening of Grotte Chauvet facsimile and its possible labelling by UNESCO, the aspiring Geopark of Monts d’Ardèche will have the opportunity to develop and promote more in depth the interpretation of landscapes and of the geological history.

Through the development of geosites, the design of trails and the edition of discovery guides, Park of Monts d'Ardèche, with the support of local scientists, will create the conditions needed for the development of geotourism. Nevertheless, it is urgent to structure and reinforce the position of geotourism in Ardèche, especially in terms of marketing. Therefore the Park is involved in the broader project “Road of volcanism in Massif Central”, which is developed in partnership between two other Regional Parks and the organism in charge of tourism development in Massif Central. The involvement of the Park in this regional project highlights will allow to position its greatest geosites in a broader network of important French sites, identified for volcanism (e.g. Vulcania, Puy de Dome, Lac Pavin, etc.), and it will also reinforce the image of Monts d’Ardèche as a great geotourism destination.

Fig. 2 - Interpretive trail in the volcanic area "Pays des Sucs", (PNRMA, 2012).

Creating the conditions for the appropriation of geoheritage by inhabitants

Excepting for amateur geologists for whom Monts d'Ardèche constitutes an outstanding place for discovery, the general public ignores the rich geological heritage, especially related to volcanism. Most inhabitants of the Park ignore that the area has been shaped by volcanic activity, whose heritage can still be seen today through a large number of volcanoes and their basalt columns.

The nature of volcanic events that marked the French territory were first described in Ardèche in the late 18th century, and they were documented by publications of Guettard, Malsherbes, Faujas-de-Saint-Fond and Giraud-Soulavie. This scientific enthusiasm was then diverted from Ardèche and focused more on the Auvergne region.

Due to its reduced surface and its position away from the large massive Auvergne (notably Chaîne des Puys), this province has been left aside by geoscientists for decades. Fortunately, publications by Emmanuel Tobi Berger (1973-1981) drew again attention to Monts d'Ardèche, which is certainly one of the most interesting territories in France regarding volcanism.

Fig. 3- Guided tour on "Jaujac Giant's Causeway", (PNRMA, 2012).

The Regional Natural Park of Monts d'Ardèche has been working with local scientists on the development of geotourism and geoeducation in Ardèche for twelve years, especially trough interpretation projects. However, local people are less interested in actions valuing the geoheritage, which they think are targeted at tourists. One objective of the Park is to raise public awareness on the importance of geological heritage. Today, various stakeholders work to enhance the architectural and natural heritage, but few is done about geology. Even in the field of natural heritage, the attention is drawn to fauna and flora, but rarely to the geoheritage. The Geopark label would help to reconcile people with the geological history of their territory, as it explains part of modern life as well as human history.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

"Geosite of the Year": cooperation of stakeholders in the development, management and promotion of the Úrkút Palaeokarst Nature Conservation Area in Bakony–Balaton Geopark, Hungary

Knauer A.([a])

([a]) Geotourism Officer, Bakony–Balaton Geopark Group, Balaton-felvidéki National Park Directorate, 16 Kossuth 8229, Csopak, Hungary. E-mail: anna.knauer@bakony-balaton-geopark.hu

ABSTRACT

The Úrkút Palaeokarst Nature Conservation Area, one of the geosites in Bakony–Balaton Geopark, Hungary, was provided with interpretive facilities in 2004 and was partly renovated in 2012 by joining forces of local organisations, the local government, the local mining company and the leading body of the Geopark, the Balaton-felvidéki National Park Directorate.

The label "Geosite of the Year" was first given to this geosite by the Geopark organisation. It has been an effective tool to promote not only the site itself but also the positive effects of cooperation, thus presenting a good example for other communities in the Geopark. The events for the promotion of the site as the "Geosite of the Year" organised by the Geo-park organisation and assisted by the members of the local community have strengthened the cooperation of these stakeholders. The conservation, development and sustainable utilisation of the geosite are to be continued together with these Geopark Partners based on a common strategy.

KEY WORDS: community, cooperation, geopark, interpretation, manganese, Palaeokarst, promotion.

LOCATION OF THE SITE

The area of the Bakony–Balaton European and Global Geopark in Hungary extends to 3241 km^2, including 151 municipalities. Amongst the 45 geosites of the Geopark, the Úrkút Palaeokarst Geosite is located at the edge of Úrkút, a village with 2,000 inhabitants in the Bakony Mountains, which is a less developed part of the Geopark from the point of view of economy and tourism, compared to the southern areas of the Geopark where the holiday zone of Lake Balaton Tourism Region can be found.

However, several factors make it an attractive destination for geotourists as the Úrkút Palaeokarst geosite is one of the most famous geological interpretive sites in Hungary, a unique and picturesque geological location, free to visit. The lower part of the site has been made accessible by stairs and provided with information boards and a picnic area. A 50 pages long information booklet has also been published on the geology of the site, although it has rather a scientific than an interpretive approach.

Fig. 1 – Area of the Bakony–Balaton Geopark. The location of Úrkút Palaeokarst Nature Conservation Area is indicated with a star.

Besides geological knowledge dissemination, this very spectacular and unique area serves education as a location of school excursions and university field trips. Research on the formation of manganese ore (which is still being discussed) attracts many scientific experts to Úrkút.

Moreover, the village has a nice atmosphere and crystal clear air as it is surrounded by forests and some important attractions are also nearby (e.g. adventure caving tours of the Szentgáli-kőlik Cave and the internationally renowned Herend Porcelain Manufactory and Museum). The village is easy to reach by public transport, by car, by bicycle and also on foot, because the National Blue hiking trail – leading across the country – crosses the geosite, which have attracted thousands of hikers to this geological curiosity. The Road of Water Seekers, a thematic route also touches the site and the Basalt Karst geological nature trail, developed by the Geopark organisation, can be found in the vicinity.

FROM MINING TO PROTECTION

The site had been functioning as a pit where manganese ore was extracted by hand tools at the beginning of the last century. According to previous research results that are better known by the public, the unique, 70-million-year-old palaeokarst features owe their existence not only to this method of mining but also to the fact that the overlying Eocene limestone has protected them from erosion. Therefore, the mineral ore-bearing palaeokarstic land forms have been perfectly preserved. In an area of an extent of a few hundreds of metres, a series of vertical-walled, cauldron-like dolines have been dissolved in the Lower Jurassic limestone. They are of a diameter of 30 m and of the same depth. The surface of thresholds and highs between the karstic depressions underwent considerable karrentification. All these took place under the end-Cretaceous tropical climate. What gives its uniqueness is that in Úrkút it is Jurassic limestone that was undergone to karst processes and the consequent fissures in it were filled with oxidic manganese ore (Vadász 1952, Szabó 1977, Pocsai & Sasvári 2005, Futó 2011).

However, the most recent geochemical, mineralogical and sedimentological results conclude that the formations, seeming to be of karstic origin, in fact developed at the bottom of the sea around 180 million years ago and were dissolved because of solutions streaming upwards (geofluids). The cherty-ferrous oxidic manganese ore was precipitated from geofluids rising from the depth with the help of bacteria (Bíró et al., 2009, Polgári et al., 2009, Bíró et al., 2012, Polgári et al., 2012).

The site was declared protected in 1951 as the Úrkút Palaeokarst Nature Conservation Area with a national level of protection. This geosite is owned by the State and managed by the Balaton-felvidéki National Park Directorate (a regional state organisation), the leading organisation of the Bakony–Balaton Geopark.

As a result of its mining history, the villagers are closely linked to the geosite and especially the older inhabitants consider it as part of their own identity.

DEVELOPMENT OF THE INTERPRETATION FACILITIES

The development at the site was implemented in 2004–2005 in cooperation with several organisations. The financial background of the development was provided by the local manganese ore mining company, the Mangán Mining and Processing Ltd., the General Electric Company and a state environmental fund (Környezetvédelmi Alap Célelőirányzat). The clearing of the geosite, the construction works, the creation of the guide booklet and the nature trail was implemented by one of the Geopark Partners of the Bakony–Balaton Geopark, the Pangea Cultural and Environmental Association that operates in the region. The establishment of the stairway and of the nature trail was also initiated and supported by a local civil organisation, the Úrkút Village and Culture Association.

During the years the condition of the interpretive boards and the stairways had deteriorated and renovation became necessary. Initiated by the local civil association and the local government in 2012, with the cooperation of these stakeholders, the leading organisation of the Bakony–Balaton Geopark and the local mining company the interpretation facilities of the site have been almost fully renovated.

Fig. 2 – Clearing the 30 m high cliffs of vegetation in 2012. The professional alpinist contracted to do this work can be seen to the right, in red overall.

"GEOSITE OF THE YEAR" IN THE BAKONY–BALATON GEOPARK

Besides undertaking and financing a substantial part of the renewing works, the Bakony–Balaton Geopark also created a special way of promoting the site and gave the new label "Geosite of the Year in the Bakony–Balaton Geopark" first to the Úrkút Palaeokarst Nature Conservation Area, for the year 2013.

It is always important to cooperate with local stakeholders in the development, management and promotion of geosites in Geoparks. The enthusiasm and commitment of the local community of Úrkút added a very important element to the content of the label "Geosite of the Year"; therefore the label has become not only a good tool for the promotion of a geosite but also a clear message for the communities of the Geopark about the advantages of the cooperation of stakeholders.

The promotion of the geosite under the label "Geosite of the Year in the Bakony–Balaton Geopark" consists of several elements. On the occasion of the International Earth Day, a guided geotour was organised at the site. The European Geoparks Week is a European-wide festival of Geoparks with the aim of raising public awareness of geoconservation, geotourism, related educational activities and the importance of involving local communities in these activities, contributing to local sustainable economic development. Within this festival and as part of the European Minerals Day, a geological and botanical guided tour was organised in the surroundings of the village and in the Palaeokarst site in May. Following the holistic approach of Geoparks, this tour was guided not only by a trained geotour-guide but also by a ranger of the national park directorate and by the technical manager of the local manganese ore mining company. The tour was followed by the opening of a photo exhibition on the Cultural Heritage of Bakony–Balaton Geopark and the exhibition of minerals and fossils from nearby collections, lent by the Mining Museum of Ajka, the Mineral Collection of the local government of Halimba and the Mineral Collection of the Village Museum of Úrkút. This exhibition was organised by the local government, the association and the geopark organisation.

The Bakony–Balaton Geopark Contest for elementary school students of the Geopark comprised exercises in connection with the Úrkút Palaeokarst Nature Conservation Area. After the contest – in which 68 teams participated – some of the mentors of the students have booked guided geotours to the site. Other events where the geosite has been promoted as the "Geosite of the Year in the Bakony–Balaton Geopark" are occasions where the Bakony–Balaton Geopark Group of the national park directorate, a separate organisational unit for the management of the Geopark usually promotes the Geopark: festivals and ecological fairs within the Geopark, a two-day long event in Budapest, the capital of Hungary where geological heritage of Hungary, geological research and education is promoted. The printed and online media, the website and the Facebook page of the Geopark have been other indispensable tools for promotion.

Fig. 3 – More than 40 participants enjoyed the guided geotour on the International Earth Day in 2013.

FROM COOPERATING STAKEHOLDERS TO GEOPARK PARTNERS

The development and the promotion of this geosite will not finish at the end of the year 2013. As a result of the successful cooperation of the stakeholders, strengthened by intensive, continuous common activities during the year 2013, the local government, the civil association and the mining company are to become official Geopark Partners of Bakony–Balaton Geopark. They also plan to incorporate the conservation, interpretation and promotion of the local geological site into their future strategy, with mutual support of each other in achieving this common goal. Their future strategy is to be harmonized in a multilateral cooperation agreement. New Geopark Partners – e.g. educational institutions, regional tourism organisations, restaurants, accommodations, geotour-guides, researchers, museums, other geosites' communities in the Geopark and in the European Geoparks Network – are to be involved in the cooperation which can contribute to the sustainable development of the local economy and can become a good example for other communities.

ACKNOWLEDGMENTS

I thank Barnabás Korbély, Head of the Bakony–Balaton Geopark Group and also a good friend of mine, who helped me in the compilation of the article and provided the map and a photo (Fig. 1) for this publication. I would like to thank Farkas Gábor who has kindly allowed me to use his photo (Fig 3) for this article. I would also like to thank Dr Tamás Vigh's help in connection with the new scientific results concerning the area. Finally I thank my husband for his continuous support and my parents for making me love geology.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

Rokua Geopark (Finland) – developing local economy

Krökki V.

Rokua Geopark Kiviharjunlenkki 4, 90220 OULU, Finland. E-mail: vesa.krokki@humanpolis.fi

ABSTRACT

Rokua Geopark has been given a big responsibility in developing its area. Municipalities, businesses and local people are expecting to see positive changes in the Geopark areas economy following the raising awareness and developing tourism industry. The Geopark responds with new developing strategy prepared in local working groups joining the efforts of local organizations and people.

KEY WORDS: Geopark strategy; Local development, tourism, working groups, Master plan

INTRODUCTION

Rokua Geopark was accepted into the Global and European Geoparks Networks in October 2010 during the 9th EGN Conference in Lesvos, Greece. The Geopark is situated in Northern Finland, about 200 km south of the Arctic Circle between the cities of Oulu and Kajaani.

For the most part Rokua Geopark is located in sparsely populated countryside which has been suffering from migration into bigger cities. Nowadays the traditional livelihoods like agriculture and forestry offer jobs to ever fewer people leaving people unemployed. In many cases tourism is seen as the most promising way of creating new jobs. The area has some strong companies in the tourism sector, but more companies and better services are needed in order to provide new jobs for the local people and better quality services for the tourists.

Coming from this background one of the most important tasks of Rokua Geopark is to develop economic activities in the area, especially in the tourism sector. The obligation comes from the municipalities and local businesses which are expecting to see a positive change in the areas economy.

The Geopark gathers the municipality officials, business owners, regional tourism marketing actors and regional tourism developers into its working groups in which the Geopark strategies and activities are decided.

The Geopark working groups have prepared the Rokua Geopark strategy for years 2012 to 2022. The strategy was accepted by the Geopark board of directors in November 2012. The strategy gives guidelines and aims for the Geopark activities. The strategy focuses on the Geoparks management, financing, infrastructure development and developing tourism and educational activities. As continuation to the strategy work a developing plan for the Geopark is being prepared. The Master plan describes in more detail the activities and financing needed to achieve the goals described in the strategy.

Results have already been accomplished following the publicity received after the Geopark membership and the new way of working and joining efforts of different organizations in the area. Until now 13 privately owned companies are using the Rokua Geopark logo in promoting their activities and products and the Geopark has got a privately owned company to take care of the information services in the main information center. The Geopark has gathered the businesses and municipalities under the Rokua Geopark visibility in tourism fairs. Furthermore the Geopark has received lots of good media attention, for example the territory and its activities have been presented in the Finland’s most popular Television breakfast shows as well as they have been presented in several magazines and newspaper articles. The Geopark has also been able to attract some new customer groups to the area, the amount of people coming from abroad has been growing as well as the amount of people coming to explore and experience the area. Tour operators have also been showing new interest towards the area. In general the livelihood, visibility and significance of our area has risen after the Geopark membership.

For the future this territory still have lots of challenges in developing our area to more economically sustainable, attractive and better known among visitors coming from Finland and abroad. These goals and challenges are described in the Rokua Geopark strategy and Master Plan. One part of the activities is preparing new Geopark sites to better cover the whole Geopark area and theme.

To measure the effectiveness of the Geopark activities, the Geopark and the department of Geography from University of Oulu have started a follow-up study on the changes the Geopark affects in the areas economy. The first part of the study was made in 2011 from the economic statistics of year 2009, a year before the Global Geopark status. The second part of the study is intended to be made from the economic statistics of year 2014, after four years of functioning as a Geopark.

Fig. 1 – A group of local teachers testing a new Geopark board game made for school children as well as visitors coming to explore and learn of the area

Best practice in co-operation between the European and Global Geopark Muskau Arch and the World Heritage Fürst-Pückler-Park Muskau

Kupetz M. [(a)]

(a) Geopark Muskauer Faltenbogen, c/o Schulweg 1a, D-03055 Cottbus, Germany, manfred.kupetz@t-online.de

ABSTRACT

The World Heritage Fürst-Pückler-Park Muskau and the European and Global Geopark Muskau began to cultivate their co-cooperation in the time between about 1998 and 2000. In comparison with the 580 km² Muskau Arch landscape the 830 hectare Fürst-Pückler-Park is a punctiform cultural highlight. So the concept of a “Fürst-Pückler-Park and man made landscape” was created. The idea was to develop tourist relationships and links between the “park spot” and the “park area”. Tourists should get the opportunity not only to spend some hours in the world heritage but to linger more extensive in the surrounding geopark. Step by step the co-operation grows. Now we are organizing joint events, the prolongation of a former historic rail way is used for tourism between geopark area in general and the World Heritage itself. Medium term we prepare common projects for an International Garden show which is planned in 2027.

KEY WORDS: Global and European geopark, UNESCO World Heritage, co-operation, sustainable development

REGIONAL CONTEXT

Both, world heritage and geopark are transnational German-Polish sites. Between 1815 and 1845 Prince Hermann Pückler created a famous landscape park on both sides of the river Lusatian Neisse (German: Lausitzer Neiße, Polish: Nysa Łużycka) near the little town Muskau. The park area is 830 hectare and compises free parts, the Upper Park, the Under Park and the Hill Park. In 2004 the Pückler Park was inscribed in the UNESCO´s list of World Heritage. First ideas of the Muskau Arch date in the year 1994. The real geopark concept was worked out/ compiled from 1998 to 2000. After a start-up phase our geopark was evaluated in 2006 as National German geopark and in 2011 as National polish geopark.

Lusatian area in general was a historic and partly recent centre of lignite mining. That’s why the International Building Exhibition was created to promote the change from a mining district into a post-mining landscape. Muskau Arch composes the Eastern random of this industrial area. The industrial time has already been brought to an end in 1970ies. The region is only slightly settled (about 60.000 inhabitants in an area of 580 km²).

So in this region IBA Fürst-Pückler-Land were created two projects: Fürst-Pückler-Park Bad Muskau and Geopark Muskau Arch. Beginning at the end of the 1990ies the Fürst-Pückler-Park management and the initiators of the geopark worked together in order to initiate synergy effects for the visitors and the region at all (Projektkatalog 1999).

LINK-UP BETWEEN CULTRAL AND GEOLOGICAL HERITAGE

Fig. 1 – Sketchmap of the World Heritage Fürst Pückler Park with accentuation of river terraces (greay shaded and mineral springs)after Damzog & Kupetz in: Kupetz & Kupetz [Ed.] (2009):

Fig. 2 – Drinking fountain with woodenpavilion in the so called Bath Park in Bad Muskau, detail from a lithograph from Gustav Täubert 1867

Prince Pückler used the geomorphological conditions of the river valley for his park arrangement. In general the valley cut about 30 m deep into the geological Muskau Arch push end moraine. Furthermore on the park side are two well developed main river terraces. The glacial slopes and terraces were very attractive geomorphological conditions for the park arrangement, and Prince Hermann Pückler used them very artful (fig 1).

At the river slopes about two dozen springs arise. Most of them are iron-sulfate mineral springs. In the last third of the 19th century they originated the health resort of Bad Muskau (remark that Bad means Bath; (fig 2).

Last but not least the area of the so called Hill Park was an large alum shale mine. In 1869 the park and garden inspector Karl Eduard Petzold incorporated the alum waste heaps into the park design. So far we know this is the oldest bequeathed mining recultivation at all.

CO-OPERATION BETWEEN GLOBAL AND EUROPEAN GEOPARK AND WORLD HERITAGE

Based on the above mentioned features the representatives of the Fürst-Pückler-Park and the geopark developed the idea to link both parks each other. In comparison with the 580 km²

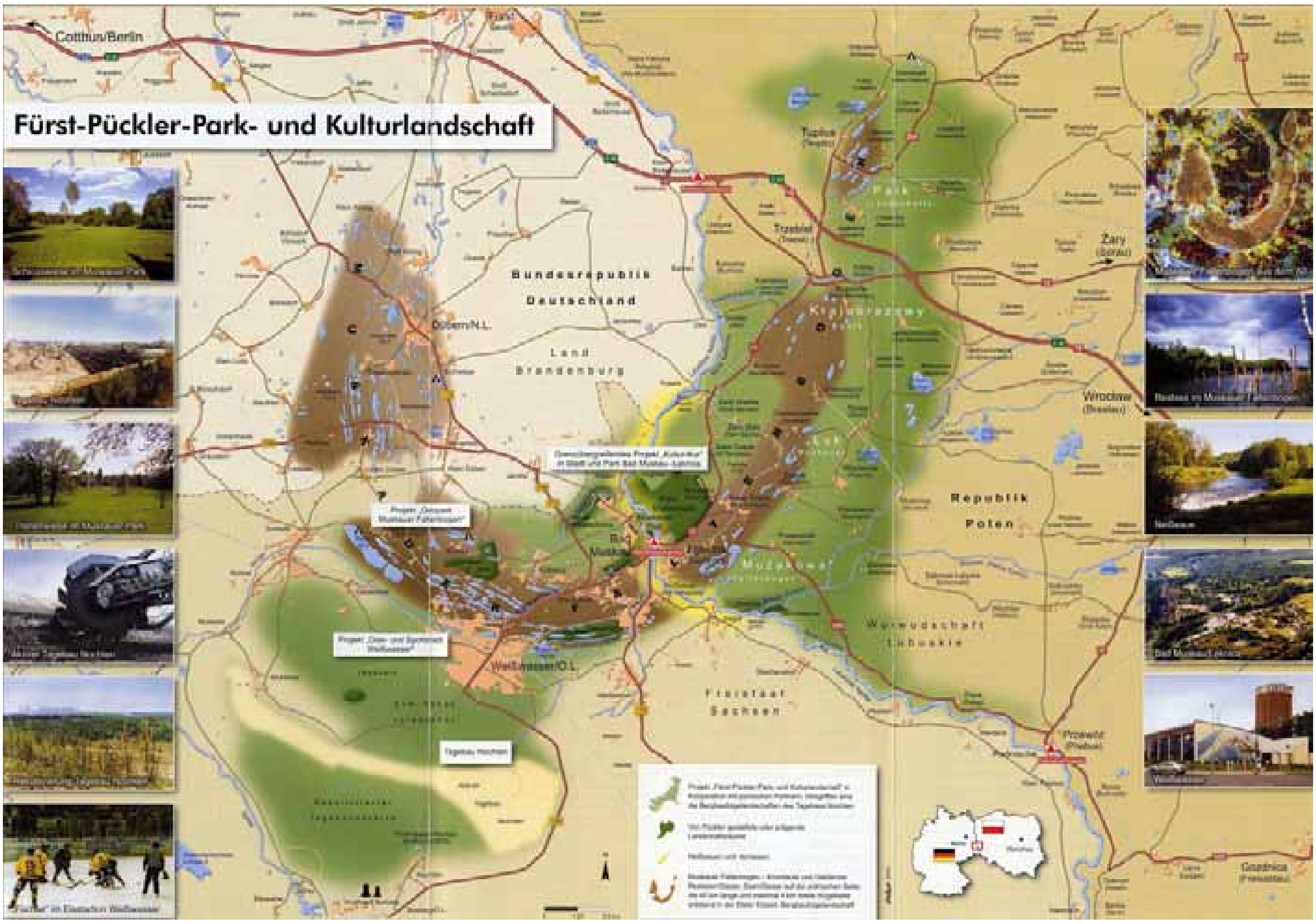

Fig. 3: The concept of . "Fürst-Pückler-Park and man made landscape", backside of a leaflet Panning & Mielchen (2002).

Muskau Arch landscape the 830 hectare Fürst-Pückler-Park is a punctiform cultural highlight. So the concept of a "Fürst-Pückler-Park and man made landscape" was created. The idea was to develop tourist relationships and links between the "park spot" and the "park area". Tourists should receive the opportunity not only to spend some hours in the world heritage but to linger more extensive in the surrounding geopark (fig 3).

Moreover both parks are divided into a German part and a Polish part too. That's why the goal of the co-operation is also to promote German-Polish measures at different levels.

TANGIBLE CO-OPERATION

World Heritage guides get further education in geological, geomorphological and geopark features. Additionally the relationships between geological history, occurrence and use of raw material (lignite, clay for ceramics, alum clay, glass sand and meadow ore) as well as the mining recultivation is emphasized.

Fig. 4 – Opening of the Day of Geotop event in the Fürst Pückler Park on September by the Park Director Cord Panning (left), after Lang, D. & Kupetz, M. (2007):

Traditionally the third Sunday in September is the "Day of Geotops". On this day everywhere geological excursions or some other event in coherence with geosites are organized. Beginning in 2006 the "Day of Geoptops" starts in our World Heritage site and now it is a common event (fig. 4). The opening event of the geopark season takes place traditionally in the so called New Castle of the Fürst-Pückler-Park since 2012.

On August 30th in 2013 the last section of the reconstructed New Castle in the World Heritage will be opened. A part of this reconstruction is a new designed castle-tower. The geopark will establish an information point inside. The topics are the geological Muskau Arch structure (space photos and images), wind blown pebbles as ice age indicator and iron sulphate mineral springs.

FUTURE PROJECTS

The project of the next 2-3 years is the extension of the existing historical rail way into the centre of the Fürst-Pückler-Park. This is an important item to improve the tourist infrastructure between geopark and world Heritage.

The geotourist path "Babina" in Polish part of the geopark (see contribution of Kożma et al. in this issue) will be connected directly with two new paths in a next step.

Long-term the town Weißwasser situated in the German part of the geopark is preparing an International Garden Exhibition (IGA) in 2027. First Ideas were developed at Brandenburgian Technical University (BTU) Cottbus, Chair Regional Planning (fig. 5). Now in 2013 a professional feasibility study is investigated the potential of the IGA idea. The town Weißwasser as well as the World Heritage and the Muskau Geopark promote this project.

Fig. 5 – First Ideas for an International Garden Exhibition (IGA) at the Muskau Arch area, developed in student's project from April to July 2012 at the Brandenburgian Technical University (BTU) Cottbus, Chair Regional Planning Prof. Brigitte Scholz (unpublished). The three main topica are landscape parks, historical mining, and ice age

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Geotourism in Ireland: examples from the Irish Global Geoparks

Lemon K.([a]) & Gatley S. ([b])

([a]) Geological Survey of Northern Ireland, Colby House, Stranmillis Court, Belfast, BT9 5BF, Northern Ireland. E-mail: kirstin.lemon@detini.gov.uk
([b]) Geological Survey of Ireland, Beggars, Bush, Haddington Road, Dublin 4, Ireland.

ABSTRACT

Geotourism has a long and successful history on the island of Ireland with evidence of tourism based on geological heritage dating back as far as the late 17th century.

Some of the main tourism attractions on the island are geotourism based and include the world-famous Cliffs of Moher, the fourth most popular paying visitor attraction in Ireland, and the UNESCO World Heritage Site at the Giant's Causeway that is the second most popular paying visitor attraction in Northern Ireland.

Recent changes in strategy from all three of the national tourism authorities have led to the recognition of geology and landscape as a viable contributor to the tourism product of the island as a whole. This provides a fantastic opportunity for all those working in and developing geotourism products to really benefit from the marketing force of the national tourism authorities.

There are currently three Global Geoparks on the island of Ireland; the Copper Coast Geopark, the Marble Arch Caves Global Geopark and the Burren & Cliffs of Moher Geopark, all of whom have worked with the national tourism authorities to assist in the increased awareness of geological tourism as whole.

There is still a lot of work to do, with many areas of geological significance currently underdeveloped but with continued support from the Geological Survey of Northern Ireland and the Geological Survey of Ireland, it is expected that geotourism will increase greatly over the coming years and that Ireland will remain as a key player in the field of geotourism.

KEY WORDS: Burren & Cliffs of Moher Geopark, Copper Coast Geopark, Ireland, Marble Arch Caves Global Geopark, Northern Ireland.

INTRODUCTION

Located to the north-west of continental Europe, the island of Ireland covers an area of just under 84,500km^2. Despite its small size, the island has an extremely diverse geology.

The oldest rocks at 1.8 billion years are found off the coast of County Donegal in the far north of Ireland. During this time and up to about 440 million years ago, the Irish landmass was divided in two, with both halves being located on opposite edges of the Iapetus Ocean. Between 400 and 300 million years ago north-west Europe was covered by a shallow tropical sea, that eventually created limestone which now makes up approximately two-thirds of the bedrock of Ireland. By 250 million years ago, Ireland was at desert latitudes creating aeolian and evaporite deposits, and then 150 million years ago was once again submerged by a shallow sea creating chalk deposits. About 65 million years ago, when the North Atlantic Ocean began to open, huge amounts of volcanic activity occurred resulting in the formation of the Giant's Causeway and ultimately producing the largest basalt plateau in Europe. From 25 million years ago, Ireland was close to its present position and considerable soil development began. Since about 2 million years ago, Ireland has undergone a series of glaciations that have ultimately had the most significant impact on the Irish landscape.

Fig. 1 – Geological map of the island of Ireland.

This diverse geology as also led to a variety of natural landscapes with the large central lowlands being underlain by limestone, and the surrounding coastal mountains being made up of a variety of rock types including granite (e.g. Mourne Mountains and Wicklow Mountains), schist (e.g. Ox Mountains and Sperrin Mountains) and sandstone (e.g.

MacGillycuddy's Reeks).

The underlying geology has also influenced the abundant watercourses on the island including, but not exclusively, the main river, the Shannon, and the important lakes of Lough Neagh, Lough Allen and Lough Derg.

The location of Ireland as an island in the Atlantic Ocean has also had an extreme impact on its coastal landscapes, with some of the most impressive geology being located at the coast including the sea cliffs at Slieve League in County Donegal, and the Cliffs of Moher in County Clare.

EARLY GEOTOURISM IN IRELAND

Geotourism on the island of Ireland is nothing new; in fact visitors have been flocking to Irish shores in search of the scenic landscape for which the island is now famous for centuries.

Some of the earliest recorded examples of geotourism come from the Giant's Causeway in County Antrim. A late 17th century paper was presented to the Royal Society by a fellow of Trinity College Dublin announcing the discovery of such a geological wonder. This was quickly followed by a series of watercolour paintings of the site by the Dublin artist Susanna Drury in 1739. The paintings were famous throughout Europe and since then visitors have been coming to the Giant's Causeway in their thousands to catch a glimpse of the once enigmatic basalt columns.

The 18th century was another peak time for geotourism in Ireland with the dramatic rise in the popularity of 'taking the waters'. Travelling to inland natural spas was a fashionable pastime for the wealthy city dwelling population from all over Ireland and the United Kingdom. The need to escape from the heavily polluted cities combined with the reputed health giving properties of natural mineral water brought huge numbers of visitors to previously unknown villages and towns, many of which only developed as a result of such geotourism. One of the first examples of such tourism is the village of Spa, near Ballynahinch in County Down that was first used as a spa resort in the late 18th century. The village takes its name from the sulphur and iron spa wells located just outside the village, and because of these, Assembly Rooms, a maze and a hotel were all built to accommodate the huge volumes of tourists that came to 'take the waters'. Lisdoonvarna in County Clare, is another example of a spa town, one that developed in the early 19th century purely as a result of the need to provide facilities for the influx of visitors wanting to visit the spas.

Apart from the geological phenomenon of the Giant's Causeway and the supposed health benefits of the spa towns, millions of visitors have come to the island to simply experience the landscape and scenery.

The Victorians were the first to really embrace the idea of 'holidays'. Industrialization at this time brought with it the creation of a new middle-class, with more disposable income and more importantly, time off work to spend on visiting other places. Ever keen to visit picturesque unspoiled landscapes, areas such as the Ring of Kerry in County Kerry became popular during Victorian times with much of the characteristic tourism infrastructure of the area dating back to this time.

MODERN GEOTOURISM IN IRELAND

Given the long history of geotourism on the island of Ireland, it is not surprising that some of the most successful tourist attractions are those based on geology and landscape.

The Cliffs of Moher visitor centre, in County Clare, and part of the Burren and Cliffs of Moher Geopark is one of the most successful and popular visitor attractions in Ireland. The cliffs vary in height from 120 to 214 metres and offer stunning views over the Atlantic Ocean. Composed of horizontally-bedded Namurian shales and sandstones, apart from offering magnificent views, they also provide a great outdoor classroom for thousands of university students every year. The innovative visitor centre opened in 2007 and attracts just under one million visitors every year, making this the fourth most popular paying tourist attraction in Ireland, with the preceding three attractions all being within Dublin City.

The Giant's Causeway visitor centre opened in 2012, after the previous centre was destroyed in a fire. The €20 million project to complete the new visitor centre was funded by the Northern Ireland Tourist Board and the Department of Enterprise and Investment (a department within the Northern Ireland Civil Service), and such a huge amount of money is testament to the popularity of the site that attracts just fewer than 800,000 visitors every year. The Giant's Causeway and the Causeway Coast is the only UNESCO World Heritage Site on the island of Ireland inscribed due to its natural heritage, something that has added to the popularity of the site as a whole, with the thousands of polygonal basaltic columns being admired by both tourists and scientists alike. The 2011 visitor statistics reveal that the Giant's Causeway was the second most popular paying visitor attraction in Northern Ireland. However, it should be noted that these statistics predate the opening of the new visitor centre in 2012.

GEOLOGY WITHIN TOURISM POLICY

Tourism makes a significant contribution to the Irish economy and to a lesser degree to the Northern Irish economy. Due to the political setting of the island of Ireland, there are a number of national tourism authorities that promote the tourism industry.

Tourism Ireland is responsible for marketing the entire island of Ireland overseas as a tourism destination. The overseas markets to the island of Ireland as a whole are, in order of visitor numbers, Great Britain, the USA, mainland Europe (notably France, Germany and Nordic countries), followed by Australia and developing markets (especially China and India).

Fáilte Ireland is the National Tourism Development Authority for Ireland and have the role of supporting the tourism industry, and working to sustain Ireland as a high-quality and competitive tourism destination. This is done through domestic marketing within Ireland and Northern Ireland.

The Northern Ireland Tourist Board (NITB) is responsible for the development of tourism and marketing of Northern Ireland as a tourist destination to domestic tourists within Northern Ireland and Ireland.

The three tourism authorities all work very closely together and all have moved away from so-called signature projects which identify individual locations to channel marketing efforts. The move towards experiential tourism has provided a great opportunity to include geology and landscape within national tourism policy.

In 2012 the Tourism Recovery Taskforce (made up of the three national tourism authorities, in addition to the Irish Tourism Industry Confederation and a select few private tourism operators) produced a 'Path to Growth' strategy in which they identified four different experience types once of which is 'Awakening the Senses – stimulating and profound experiences within natural and unspoiled landscapes'.

NITB went one step further than this and in their October 2012 publication 'Northern Ireland Tourism: Priorities for Growth' they identified 'Naturally Northern Ireland' as a signature experience, and went on to identify 'geology' as a supporting experience.

The recognition of landscapes and more specifically, geology as a contributor to the island of Ireland's tourism product is significant, and provides a vote of confidence to geotourism ventures throughout the island.

GLOBAL GEOPARKS IN IRELAND

Supported by both the Geological Survey of Northern Ireland and the Geological Survey of Ireland, there are three Global Geoparks on island of Ireland. All of the Geoparks have worked with the relevant national tourism authorities to

Fig. 2 – Map of the island of Ireland showing the location of the three Global Geoparks.

increase the awareness of geology and landscape and the role these can play within tourism.

Copper Coast Geopark

Located on the South East coast of Ireland, the Copper Coast Geopark in County Waterford was awarded Geopark status in 2001 and is one of the smallest Global Geoparks. The area's geology spans the last 460 million years, with coastal exposures showing spectacular Ordovician volcanic features marking the subducted edge of the Iapetus Ocean, 360 million year old Devonian desert sandstones and recent glacial till. The copper-bearing lodes in the Ordovician rocks gave the area its name and its important 19th century copper-mining industry

Fig. 3 – Tankardstown Engine House, part of the Copper Coast Geopark, County Waterford.

based around Tankardstown, the legacy of which is now being promoted as a tourist attraction. Through a strong network of local support and several EU-funded projects, the Geopark has continued to strengthen this well-established brand for promoting geotourism in this corner of Ireland. Managed by local community groups, the Copper Coast Geopark is aiming to expand its territory both inland (encompassing the Comeragh Mountains with their wealth of glacial, archaeological and industrial heritage) and offshore, by integrating and promoting 3D seabed data (INFOMAR survey), to potentially become the first offshore Geopark. The Geopark has also marked this year with the opening of its new visitor centre in Bunmahon with varied exhibits on its geology, mining and social past.

Marble Arch Caves Global Geopark

The world's first cross-border Global Geopark, the Marble Arch Caves Global Geopark straddles the border between County Fermanagh (Northern Ireland) and County Cavan (Ireland). Centred on the already well established Marble Arch Caves show caves, the Geopark includes a diverse range of landscapes including rugged uplands, expansive lakes, rolling drumlins and hidden caves. The main focus of the Geopark is on the Carboniferous shallow marine limestone within which can be found the famous Marble Arch Caves. However, a huge diversity of geology can be found throughout the Geopark including Dalradian metamorphic rocks (the oldest rocks in Northern Ireland), Ordovician and Silurian sedimentary rocks from the floor of the long-disappeared Iapetus Ocean, nationally important Carboniferous fluvio-deltaic sequences, Palaeogene intrusive igneous rocks associated with the opening of the North Atlantic Ocean, and a host of glacial deposits and erosive features from the Quaternary that have shaped the majority of the landscapes seen in the Geopark. The Geopark is jointly managed by local authorities in both Northern Ireland (Fermanagh District Council) and Ireland (Cavan County

Fig. 4 – Marble Arch Caves, part of the Marble Arch Caves Global Geopark, County Fermanagh and County Cavan.

Council), who work together to promote this as the premier tourism destination in the North West of the island of Ireland. The Geopark works closely with local education providers to offer a variety of educational resources from pre-school level right up to university level, and suitable for the national curriculum in both Northern Ireland and Ireland. The Geopark has also had a significant role to play in bringing together local communities that have traditionally been separated due to political unrest in the last few decades. This has been achieved through community projects including the development of the Geopark Local Tour Guides Programme which aims to empower local communities as local tour guides within the Geopark, and giving them a means of generating sustainable tourism revenue from the local landscapes.

Burren & Cliffs of Moher Geopark

The world renowned vertical sea cliffs of the Cliffs of Moher on the western coast of Ireland and the bare limestone hills of the Burren are the backdrop for the range of activities within the Burren & Cliffs of Moher Geopark. This already well-established tourism destination in County Clare was awarded Global Geopark status in 2011 with the aim of using its world recognized geological heritage, interweaved with its delicate ecosystems and rich cultural heritage to entice tourists to spend more time in the region. The Geopark landscape is shaped by 300 to 350 million year old Carboniferous shallow marine limestones and deltaic shales, and glacial deposits from the last 2 million years. The distinctive karst limestone features of the Burren include limestone pavements, caves, swallow holes and spring systems. The huge thickness of younger deltaic sediments is now revealed as the layers of the imposing Cliffs of Moher. This striking geology supports a unique flora and important archaeology and folklore. The Geopark has strong community support, including from farmers who run their own heritage tours cooperative, and there are a diverse range of educational and cultural centres. The Geopark is working hard to become a sustainable tourist destination

Fig. 5 – The Cliffs of Moher, part of the Burren & Cliffs of Moher Geopark, County Clare.

through partnerships with the Burren Ecotourism Network (BEN) and sustainable tour operators.

CONCLUSIONS

Geotourism is now a word that is used readily by all sectors of the tourism industry and is no longer seen as being a niche market. On the island of Ireland as a whole, the recognition of geology and landscape as a viable contributor to the tourism industry is something that can only benefit those that are developing or already have developed geotourism facilities.

However, there is still a lot more that can be done. The geology of the island of Ireland is so diverse that there are many more areas that could benefit from geotourism especially those that have been previously ignored by national tourism strategies. With support from the national tourism authorities and both the Geological Survey of Northern Ireland and the Geological Survey of Ireland, it is hoped in the coming years that the full geotourism potential of the island of Ireland will be realized.

ACKNOWLEDGMENTS

We thank the staff and representatives of Copper Coast Geopark, Marble Arch Caves Global Geopark, and Burren & Cliffs of Moher Geopark. Particular thanks should go to John Galloway and Mike Sweeney (Copper Coast Geopark), Richard Watson (Marble Arch Caves Global Geopark), and Carol Gleeson (Burren & Cliffs of Moher Geopark).

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Scotland's Geodiversity Charter: a step forward for Scottish Geoparks

Lemon K. ([a]), Barron H. F. ([b]) & Gordon J. E.([c])

([a]) Geological Survey of Northern Ireland, Colby House, Stranmillis Road, Belfast, BT9 5BF, Northern Ireland, UK. E-mail: kirstin.lemon@detini.gov.uk
([b]) British Geological Survey, Murchison House, West Mains Road, Edinburgh, EH9 3LA, Scotland, UK.
([c]) School of Geography & Geosciences, University of St Andrews, Fife, KY16 9AL, Scotland, UK

ABSTRACT

Scotland's Geodiversity Charter was launched in June 2012 to demonstrate and promote the wider values of Scotland's geological heritage. The four main aims of the charter are to raise awareness of the importance of geodiversity, integrate geodiversity into relevant policies, conserve and enhance geodiversity, and to improve our understanding of the wider role of geodiversity.

Led by the voluntary geoconservation sector through the Scottish Geodiversity Forum, the Charter has over 45 signatories to date including public bodies, NGOs, industry and landowner representatives, geoconservation groups and Geoparks.
Both Shetland Geopark and North West Highlands Geopark are actively embracing the aims of the charter, primarily by raising awareness of geodiversity and through the integration of geoconservation into relevant policies, both locally and regionally.

Ultimately, Scotland's Geodiversity Charter will encourage a large number of stakeholders to work together to provide positive benefits for both people and the environment.

KEY WORDS: Scotland, geodiversity, Geopark Shetland, North West Highlands Geopark

INTRODUCTION

The role and relevance of the conservation and promotion of geodiversity have gained much greater appreciation throughout Europe in the last decade. The significant role that geodiversity plays in relation to landscape, biodiversity, economic development, climate change adaptation, the built and cultural heritage, and people's health and well-being was recognized in the *European Manifesto on Earth Heritage and Geodiversity (2004)*.

At an international level the importance of geological heritage has also been highlighted by the Committee of Ministers of the Council of Europe particularly when implementing the European Landscape Convention, and also by the IUCN who have identified that "the conservation and management of geological heritage needs to be integrated by governments into their national goals and programmes" (IUCN 2008).

In addition, since 2004 the Global Geoparks Network (GGN), supported by UNESCO, has been promoting geodiversity as a tool for sustainable tourism and economic development, and to demonstrate the wider influence of geodiversity on society (McKeever *et al.* 2010).

SCOTTISH GEODIVERSITY FORUM

Scotland's geological heritage has long been recognized by the geological community as being internationally important, notably in the Geological Conservation Review (Ellis 2011). However, relatively little consideration has been given to the wider value of such geodiversity, except by a few select enlightened organizations and individuals. The Scottish Geodiversity Forum was established in 2011 to address this issue, and aims to promote and widen the influence of Scotland's geodiversity in addition to providing a mechanism to influence national and local policies in education, community involvement and health, the development of tourism and the wider economy. There are three key areas of the Forum's work: 1) local site conservation, Government and Local Authority policy and Geodiversity Action Planning; 2) geodiversity interpretation and tourism development; and 3) events for young people and families.

Members of the Forum include local geoconservation groups, the industry, education and academic sectors, related government and non-governmental organizations, interested individuals as well as the two Scottish Global Geoparks, Geopark Shetland and North West Highlands Geopark.

SCOTLAND'S GEODIVERSITY CHARTER

In recognition of the value of Scotland's geodiversity, the voluntary geoconservation sector, through the Scottish Geodiversity Forum and facilitated by key organizations such as Scottish Natural Heritage (SNH), the British

Geological Survey (BGS) and the Scottish Government took the lead in developing Scotland's Geodiversity Charter.

Developed to demonstrate and promote the wider values of geoheritage, Scotland's Geodiversity Charter also sets out a more integrated and strategic approach to the conservation of geodiversity and landscape, and the associated biodiversity. In a report prepared by SNH and the BGS it was demonstrated that geodiversity delivers or underpins many different types of ecosystem service and provides a wide range of benefits for society and the environment (Gordon & Barron 2011). Furthermore, the provision of a strategic framework would highlight the wider role and benefits of geodiversity and associated geoconservation activities, and would facilitate their integration into the existing policy framework (Gordon & Barron 2012).

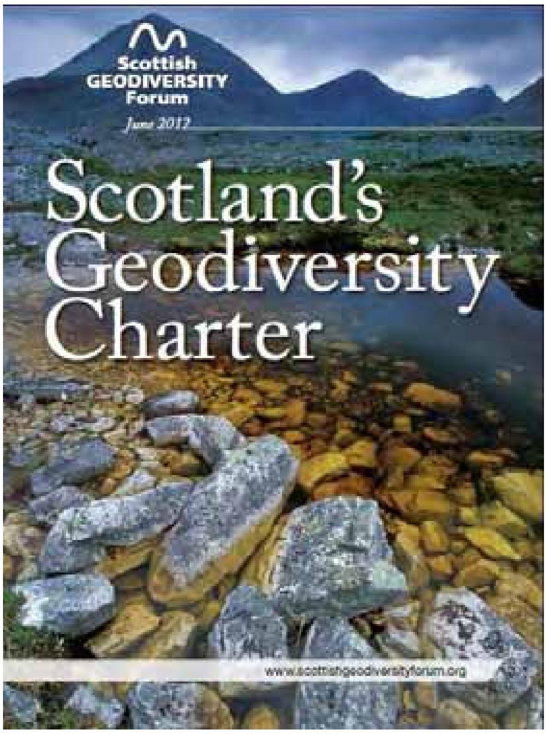

Fig. 1 – Scotland's Geodiversity Charter

Signatories of the charter commit to maintaining and enhancing geodiversity as well as recognizing its contribution to natural heritage, habitats and species, adaptation to changes in climate, sustainable economic development, historical and cultural development, and public health. In addition, the Charter encourages determined and collective action from all sectors to ensure that Scottish geodiversity is adequately conserved and promoted.

There are four main areas of activity within the Charter:

1. Raising awareness of the importance of geodiversity and its wider links with landscape, culture and sense of place, and encouraging a sense of pride through education (at all levels including schools, universities and life-long learning, promotion and interpretation;

2. Integration of geodiversity in relevant policies to ensure sustainable management of the natural heritage, land and water at a landscape/ecosystem scale for the wider benefit of Scotland's people, environment and the economy;

3. Conservation and enhancement of our geoheritage and its special character within existing designated sites and areas, by further designation of local sites, and in the wider rural, urban and marine environments; and

4. Research to improve our understanding of the role of geodiversity in providing benefits to ecosystems and people, and to address key knowledge gaps such as the functional links between geodiversity and biodiversity in terrestrial, freshwater and marine environments.

Scotland's Geodiversity Charter was launched by Stewart Stevenson MSP, Minister for Environment and Climate Change in June 2012. There are now over 45 signatories to the Charter, including public bodies, NGOs, industry and landowner representative groups, geoconservation groups and of course, Geoparks.

GLOBAL GEOPARKS IN SCOTLAND

Scotland has two UNESCO-endorsed Global Geoparks, both of which are signatories to, and whose key strategic aims align very closely with Scotland's Geodiversity Charter. The aim of all Global Geoparks is to use their geological heritage as a tool for sustainable development and economic development, and at the same time, actively promote and protect not only the geodiversity, but also the biodiversity, and the built and cultural heritage of the area.

Within the context of Scotland's Geodiversity Charter, the key strategic aims of Scottish Global Geoparks are to help conserve Scotland's geological heritage and highlight its links with natural and cultural heritage. At the same time the Scottish Geoparks aim to derive economic and social benefits from sustainable use of Scotland's geological heritage, and to work with stakeholders such as communities, schools and other organizations to realize Geopark potential through a range of projects and activities.

Geopark Shetland

Shetland is a group of more than 100 islands, and a community of around 22,000 people. It has long been recognized for its wildlife and archaeology and since 2010 for Geopark Shetland.

Geopark Shetland played a key role in developing Scotland's Geodiversity Charter and has made significant achievements in delivering some of the key strategic aims, most notably in raising awareness, integration of geodiversity into relevant policies and in the conservation and enhancement of geodiversity.

Some of the ways that Geopark Shetland has raised the awareness of Scotland's geodiversity include: 1) working with local authorities to provide gateway signage into the Geopark at both Sumburgh Airport and Northlinks Ferry Terminal; 2)

Fig. 2 – School pupils learning about Shetland's geodiversity in Geopark Shetland

provision of information for tourists and tourism providers on local geology; and 3) providing specialized outdoor learning opportunities for a wide ranging audience.

Policy integration has been achieved by including geodiversity within the Shetland Development Plan, and the Shetland Geosites register created by Shetland Geopark is now being used by the Shetland Islands Council Planning Department to offer local protection to sites of geological significance.

North West Highlands Geopark

North West Highlands Geopark is a company limited by

Fig. 3 – Interpretation panels along the Rock Route in the North West Highlands Geopark

guarantee, supported by the five community councils of the Geopark, together with the relevant statutory bodies and their representatives.

The North West Highlands Geopark has made significant achievements in helping to deliver the aims of the charter most notable through raising awareness of the area's geological heritage and also through the integration of geodiversity into relevant policy.

In association with SNH, the Geopark has developed a series of innovative geodiversity interpretation facilities including the Knockan Crag interpretation centre and the Rock Route, which is a series of interpretation panels along roadsides throughout the area. In addition to this, a very successful accredited evening geology course is organized, with special focus on the geology of the Geopark.

The Geopark is strongly supported by The Highland Council, the local authority responsible for one-third of the landmass of Scotland. Scotland's Geodiversity Charter was adopted as policy by the Council after a report was produced by the Environment and Development Strategy Committee, thus ensuring that the aims of the charter are incorporated into local authority policy.

CONCLUSIONS

Integration of geodiversity in wider policy and decision frameworks is now essential to ensure a more realistic approach to looking after our geological heritage. By taking a more holistic approach it means that geodiversity will be viewed in a broader context and its influence on biodiversity and landscapes as well as its contribution to broader environmental, economic and social issues will encourage stakeholders to work together to achieve a greater awareness and understanding of geodiversity so that it can deliver positive benefits for both people and the environment at local, national and international levels.

ACKNOWLEDGMENTS

We thank the staff and representatives of both Geopark Shetland and North West Highlands Geopark for providing information and expertise, most notably Cllr George Farlow, Robina Barton and Peter Harrison. HFP published with permission of the Executive Director of the British Geological Survey.

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Free Wi-Fi transforms El Hierro into the world's first Smart Island

López de Ávila A., Muñoz N. & García S. ([a])

([a]) Sociedad Estatal para la Gestión de la Innovación y las Tecnologías Turísticas (SEGITTUR); José Lázaro Galdiano, 4-3ª, 28036 Madrid, Spain. E-mail: prensa@segittur.es

ABSTRACT

The island of El Hierro has become the first "Smart Island" in the world, thanks to the installation of a free Wi-Fi system at 26 points around the island. This represents numerous advantages for the territory's development, as well as a direct benefit for the island's inhabitants and for the tourists who visit it every year. The initiative, financed by the Spanish Ministry of Industry, Energy and Tourism, is part of a set of measures designed to alleviate the negative impact of the 2011 volcanic eruption in El Hierro.

This project has succeeded in positioning El Hierro as one of the first Smart Tourist Destinations in the world, since the free WiFi system not only offers convenient Internet connection for citizens and visitors, but also enables other services to be managed by means of sensors, including video-surveillance of traffic, fire prevention, or waste management. For the Geopark project it represents a useful tool as it discloses and educates about our geological heritage and geodiversity.

KEY WORDS: El Hierro, Geopark Project, Geosite, Segittur, Smart Tourist Destination, WI-FI system.

THANKS TO ITS FREE WI-FI, EL HIERRO IS CURRENTLY THE WORLD'S FIRST SMART ISLAND

The 2011 volcanic eruption on the island of El Hierro (Spain) had negative consequences for the island in various different sectors, ranging from the economy and tourism and including retail and business.

In view of this situation, in 2012 the central government enacted a series of tax and labour measures designed to mitigate the loss of activity produced as a result of this event. However, given the seriousness of the impact of the seismic-volcanic crisis on the island's economy it became clear that further action was required to be taken.

Thus on 6 March, the Ministry of Industry, Energy and Tourism launched the Special Action Programme (PAE/El Hierro 2012) aimed at encouraging business activity by means of the deployment of a series of sector-wide actions to support tourism, stimulate business and industry, and promote the new information and communication technologies on the island.

As a part of this programme it was decided that the State Company for Tourism Technology and Innovation Management -Sociedad Estatal para la Gestión de la Innovación y las Tecnologías Turísticas (SEGITTUR)- would be responsible of developing six lines of action aimed at stimulating directly or indirectly the tourist activity on the island.

The study and the preparation of the candidacy to Geopark of the Island El Hierro in cooperation with the Cabildo of El Hierro and three municipal districts (La Frontera, Valverde and El Pinar) are included among these lines of action, and this candidacy was presented on the 1 October 2012.

The areas of El Hierro which may become part of the Geopark which will be integrated in the European Geoparks Network have been analysed. From a tourism point of view, this will position the geological resources of the Island.

According to the lines of action developed to dynamize the Island after the volcanic eruption, we will focus on the installation of free Wi-Fi on the island by means of 26 access points distributed among the three municipal districts of El Hierro –El Pinar, La Frontera and Valverde– by selecting various population centres and key tourist interest areas, given that the objective of the initiative is to provide visitors with the opportunity to share their experience of these destinations with their contacts.

The Wi-Fi network has been sized to permit the transfer of remote data for the management of services by using sensors in conjunction with the centralised processing of information. The services that will be managed through this network, in operation since 18 March 2013, include the video-surveillance of traffic, in addition to other applications under study such as fire prevention systems and the sensorisation of waste containers and drinking water silos to allow improved management.

One of the purposes of this Wi-Fi network is to enable tourists –from the moment they get off the plane– to share the experience of their trip with their contacts via the social networks, and to use the Internet to enhance their stay in the destination.

The installation of the network has not been easy, as part of this island's uniqueness is due to the particular characteristics

Fig. 1 – El Hierro Free WiFi network (round spots). Data from SEGITTUR & Google.

of the terrain. The fact that some areas of the island are not supplied with electricity or a 3G network has led to the use of renewable energies to guarantee the operation of the Wi-Fi system.

In order to ensure that the antennas merge as harmoniously as possible with the landscape, the huts, antennas and solar panels have been designed to be camouflaged with the surrounding environment. It is particularly worth highlighting the use of volcanic-type rocks instead of brick in order to reduce the visual impact in such a distinctive and highly natural environment as it is found on this unique island of El Hierro.

This action has enabled El Hierro to become the first Smart Island in the world. But what exactly is a Smart Island? It is an island capable of remaining informed at all times of certain aspects of its management and of reacting intelligently to any variations. To achieve this, there are three requirements: sensorisation, data transfer and intelligent management of the information.

The Smart Island forms part of the project entitled "Smart Tourist Destinations", implemented by the Spanish Government's Ministry of Industry, Energy and Tourism as part of the Strategic Spanish Tourism Plan (PNIT) 2012-2015, and managed by the State Company for Tourism Technology and Innovation Management -Sociedad Estatal para la Gestión de la Innovación y las Tecnologías Turísticas (SEGITTUR)-.

For decades, Spain has been in the top positions of world tourism rankings: it is the world leader in sun and beach tourism, it is in 4^{th} position in international tourist arrivals (2011) and 2^{nd} in revenues generated by tourism (2011).

In order to keep this position, Spain has to boost its tourism sector setting goals and taking the necessary steps, after considering the diverse factors influencing this sector, such as globalisation, changes of habits, environmental respect, transportation costs, and especially the progress towards an information-based society and the importance of new technologies.

In these circumstances, it is needed to create a new model linking tourism to the "smart" concept. The predecessors of this model are the "smart cities" (Shaw, 1993; Horan, 2000; Mitchell, 2007; Bâtâgan, 2011, Murray et al., 2012), but in this case the model focuses on the motivations and needs of the Segittur, pioneer in implementing "Smart Tourism

Fig. 2 – Solar-powered antenna (Mirador de Bascos)
visitor and the destination itself.

Destinations".

Segittur has implemented a new programme based on researching and developing "Smart Tourist Destinations". This project is officially recognised through the Strategic Spanish Tourism Plan (PNIT), approved by the Spanish Government Cabinet in June 2012. It includes concepts such us sustainability, knowledge and technological innovation related to tourist destinations. The implementation of this new strategy represents the destinations shift towards a new model that replaces the old ones: quality destinations or purely sustainable destinations. The fusion of these concepts creates a brand new one: "Smart Tourist Destinations".

After months doing research and consulting private and public stakeholders, a smart tourist destination has been defined as (De Pablo & Molas, 2012): "An innovative tourist destination, built on an infrastructure of state-of-the-art technology, guaranteeing the sustainable development of tourist development areas, accessible to everyone, which facilitates the visitor's interaction and integration with the destination and increases the quality of the experience". As a result, it stimulates competitiveness through innovation, which leads to an improved perception of the destination and a greater productive capacity for companies, generating a better quality of life for residents.

The backbone of a "Smart Tourist Destination" is the tourist development area (Castells, 2005). Its two basic pillars are: new information and communication technologies (NICT) and sustainable development. Garreau (1991); Castells (2005).

A tourist development area focused on the environmental, cultural and socioeconomic aspects it contains, endowed with an intelligent system that captures information in order to be analysed and, which understands events in real time in order to facilitate decision-making processes by the authorities and visitors interactions with the destination. Here is when landware® and smart tourist destinations concepts match.

IMPLEMENTING SMART DESTINATIONS

The innovations driving the development of Smart Tourist Destinations are intended to establish the appropriate mechanisms to each destination in order to facilitate a faster incorporation of innovations, endowing them with technology, promoting sustainable development (along its three main axes: economic, socio-cultural and environmental), and creating comprehensive tourist experiences (Foronda & García, 2009).

The implementation of sample pilots in destinations takes on an undisputable significance, since the pilots will serve as models for replicating the actions at other destinations.

The initial list of pilot destinations has been selected giving preference to mature destinations in the process of reconversion and to small and very singular places. The goal is to convert them into "living labs" and learn from them in order to apply this knowledge to other destinations.

When identifying destinations, it is necessary to consider the cross-cutting nature of tourism activity, which will cause a domino effect in many sectors and which will be benefited by actions in the tourism sector (Lathrop & Ruma, 2010).

The list of actions to be implemented in the pilot destinations meets a series of requirements for innovation and technology and includes free WiFi connection, apps to interact with the destination (real time information, exchange between destination managers- nature, historic or cultural information, emergencies…-, private suppliers-offers from restaurants, additional products and services, theatres-, etc.) and visitors, renewable energy plants, sensors to obtain data in order to manage real time traffic, the flow of people, temperature, quality of water and air, etc. Garreau (1991); Castells (2005).

BENEFITS OF CONVERTING A DESTINATION INTO A SMART TOURIST DESTINATION

The complexity and heterogeneity of a Smart Tourist Destination requires the concerted actions of private companies, public administrations, training institutions and RDI institutions, to create and bring about an integrated action plan involving aspects beyond strictly tourism: technological, economic, infrastructure, environmental, structural, legal, artistic, etc. Garreau (1991); Castells (2005).

Implementing this new model, which means, aligning land-innovation-technology with tourism and its stakeholders, makes destinations more competitive and increases the revenues of the private sector by creating other innovative resources, and by improving the efficiency of productive and distribution process in a win-win dialogue between offers and visitors, which in the end, drives the sustainable development of the destination, improving the quality of life of the residents and experience of the visitors.

BENEFITS FOR MANAGING GEOLOGICAL HERITAGE AND GEODIVERSITY

It should be stressed that Wi-Fi is a very important instrument for the Geopark project. In the selection of the access points, geological spaces (Geosites) have been taken into account. Thus, visitors can retrieve through the Geoparks QR codes, additional information to those available on panels, interpretation centers and Internet. This tool has allowed to device an inclusive strategy which also adapts to the needs of geology teaching for different ages.

In short, the Strategy of Smart Tourist Destinations in which is involved the Island of El Hierro as one of the eleven sample pilots, is an example of best practices which can be successfully exported to other territories with similar difficulties and aspirations.

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The Sea Cliff Mass Rating geomechanical classification for the rocky coastal management plan

Lucchetti A. ([a]), Brandolini P. ([b]), Robbiano A. ([a]), Firpo M. ([b]) & Faccini F. ([b])

([a]) Engineering geologist, Corso Garibaldi, 58, 16043, Chiavari (GE), Italy. E-mail: ada.lucchetti@libero.it, geotecam@libero.it
([b]) Department of Earth, Environment and Life Sciences, University of Genoa, corso Europa, 26, 16132, Genoa, Italy. E-mail: brando@unige.it, faccini@unige.it, firpo@dipteris.it

ABSTRACT

Coastal rocky cliffs are landforms affected by abrupt and quick morphological changing. Their analysis is essential to evaluate the susceptibility to coastal instability. In this study we analyze the aspects and factors that contribute to the stability of rocky coasts and we propose a method to develop coastal hazard and risk maps.

The existing geomechanical classifications are not complete to represent the dynamics of a sea cliff, as they do not take into account the action of the sea waves.

So we propose a new classification Sea Cliff Mass Rating (SCMR), which partly takes the index Slope Mass Rating (SMR) by Romana. The new classification considers the conditions of the rock, the condition of discontinuities and introduces the sea wave action.

The SCMR index has been applied to the coastal stretch between Genova and Camogli (Eastern Liguria), providing significant results.

KEY WORDS: rocky coastal hazard, Sea Cliff Mass Rating, sea cliff instability

INTRODUCTION

The sea cliffs can be considered as a significant vertical, or near vertical, rock scarp at whose base the wave action acts (Sunamura, 1992). Their stability depends on many factors: the characteristics and strength of the rock mass, the presence and conditions of discontinuities, the geometric relationships between joints and slope, weathering, the wave action and human intervention (Greenwood & Orford, 2008). Therefore all these elements must be evaluated in the study of a sea cliff.

The characteristics of the rock and the joints can be assessed through many geomechanical classifications most widely used; the Slope Mass Rating (SMR) index of Romana (1993) best represents the dynamics of the cliffs from the static point of view, as it takes into account the geometric relationships between discontinuity and slope.

The action of the waves depends on their characteristics (direction, L, H) and sea bottom depth; these factors determine the energy that the sea waves discharge on the rock scarp (Coastal Engineering Research Center, 2002).

When strength of the sea wave is higher than the resistance of the rock the sea cliff retreat; if the energy of the wave is lower than the resistance of the rock the cliff is affected by weathering, due to rainfall, wind and haloclasty (Sunamura, 1992).

The human action along the sea cliffs is mainly due to the presence of buildings, constructions and infrastructures at their top and to the presence of bathing facilities at the base.

Characteristics of the rock and wave action are key aspects to consider to define the quality of a cliff. Therefore to represent the dynamic of a sea cliff has been studied a new classification based on SMR index, introducing a new parameter that takes into account the action of the sea wave action. Five classes of susceptibility of coastal instability have been identified for classifying the sea cliffs according to their quality and state of stability. This new rating has been tested along the coastal stretch between Genova-Nervi and Camogli (Eastern Liguria).

STUDY AREA

The study coastal area extends from Nervi Stream to the port of Camogli (Eastern Liguria).

The sea cliffs have an average height of between 10 and 30 m, in some areas exceeding 50 m, mainly with steepness near vertical. The cliffs are formed in Mt. Antola Flysch (Cretaceous–Palaeocene), composed of marly limestones, marls, limestones, sandstones and shales (Brandolini *et alii*, 2009). This formation has been affected by brittle-ductile deformations (Corsi *et alii*, 2001), which led to with a very complex settings layers attitude along the coast. The flysch shows many discontinuities, which maintain the same geometric relationships with the layering (Fig.1).

The rocky coast is interrupted by small beaches at the mouths of major streams (Chelli & Pappalardo, 2008).

The area is highly anthropized: the top of the cliffs is characterized by numerous buildings, by major roads (Via

Aurelia) and by railway (line Genova-La Spezia) which often runs in a tunnel. At the base of the cliffs there are some small bathing facilities and private marinas (Brandolini *et alii*, 2006).

The cliffs are affected by Libeccio (SW) and Scirocco (SE) sea waves. The Libeccio determines the highest waves and with more energy (Brandolini *et alii*, 2007).

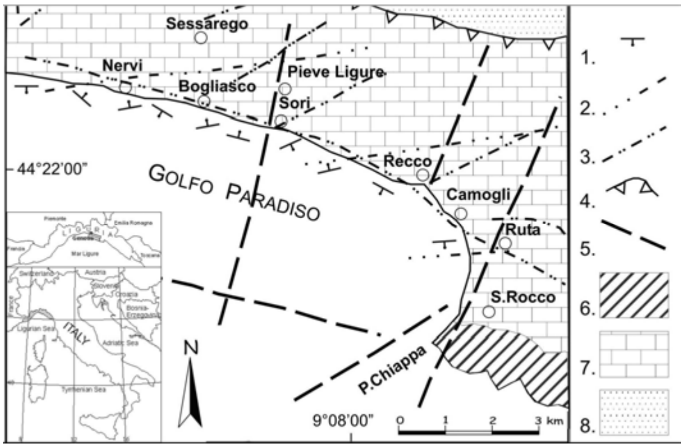

Fig. 1 – Geological sketch map. Legend: 1. attitude; 2. axial trace (phase 1); 3. axial trace (phase 2); 4. tectonic contact; 5. tectonic lineation; 6. Portofino Conglomerate; 7. Antola Unit; 8. Gottero Unit.

METHODS

Maps and aerial photos of various periods from the nineteenth century to the present were examined and compared in order to determine the retreat of coastal cliffs. In particular topographical surveys of Camogli and Mulinetti area of the late nineteenth century and early twentieth century allowed to evaluate the retreat of the cliff: they were was measured the distances between some buildings (still existing) and the edge of the cliff in the former survey and compared with the current ones measured on the field.

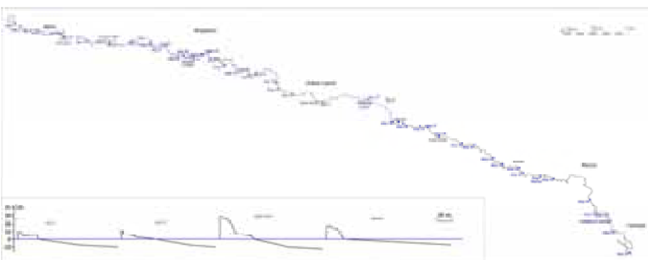

Fig. 2 – Location of geomechanical stations and some significative sea cliff profiles

The geological-geomorphological and geomechanical surveys conducted along the coast allowed to highlight the current condition of coastal cliffs and to obtain the data necessary to apply the geomechanical classifications of wider use in current geological literature: Rock Mass Rating (RMR - Bieniawski, 1989), Slope Mass Rating (SMR - Romana, 1985, 1993), Rock Mass Strenght (RMS - Selby, 1980) and Geological Strenght Index (GSI - Marinos & Hoek, 2000).

These classifications have been applied in over 40 geomechanical stations along the study area. For each station it has been reconstructed the topographic profile of emerged and submerged cliff, in order to identify the morphology of the seabed (Figs. 2, 3).

The potential rock failure mechanisms along the cliffs have been studied through the DIPS kinematic analysis code (Rocscience Inc., 2010).

The fundamental parameters of the wave action such as height and period, were used to derive the wave height and the seabed depth in the breaking zone, the wave energy, for different return times.

For studying the sea cliffs it has been chosen a return period of 10 years because it was considered the most appropriate in relation to their geomorphological evolution.

All phases of study of a sea cliff have been collected in the new classification Sea Cliff Mass Rating (SCMR), derived from the index of SMR Roman and represented by the following formula:

$$SCMR = R1+R2+R3+R4+R5 + (F1*F2*F3) + F4_m - M$$

where

R1, R2, R3, R4, R5 are the parameters taken from the classification RMR of Bieniawski;

F1, F2 e F3 are the parameters taken from the classification SMR of Romana;

$F4_m$ is a parameter that takes into account any works carried out on the cliff, according to the following principle: the score decreases with the number of interventions as without such works the cliff would not be stable;

Fig. 3 – Seacliff located below the cemetery of Sori.

M introduces the sea wave action and is given by the sum of three parameters:

i) M1 takes into consideration how the sea waves reach the rock wall (broken or breaking waves) and the sea wave energy, evaluated with the relation $E = (1/8)*\rho g Hs^2$;

ii) M2 is a function of the inclination α of the cliff: if the scarp is vertical sea waves transmit the maximum energy to cliff, therefore the pressure applied by the sea waves is directly proportional to the angle α;

iii) M3 is defined by the angle θ formed between the sea waves direction and the coast line, considering that when the sea wave hit perpendicularly the coast line it discharges the higher pressure on the cliff face.

The SCMR classification must be applied to all the families of joints and for all types of sea waves hitting the base of the cliff; the lowest score obtained is that one representative of the cliff.

Depending on the range of values obtained the class of the cliff have been identified. The five classes of quality of SMR classification have been maintained (Tab. 1).

RESULTS

The retreat of coastal cliffs is not constant and is between 0.5 m and 5 m in 100 years, with an average retreat of 2 cm/year. These values are consistent with the rates of retreat known in literature (Pierre, 2006; Lim et al., 2010)

The detailed geomechanical survey showed that in general the rock mass is of fair quality and characterized by the presence of two main families of discontinuity; joints have a persistence of between 3 m and 20 m, are characterized by smooth or slightly rough surfaces, from slightly to highly weathered; the spacing is mainly between 20 cm and 60 cm.

The joints can be closed or opened up to a very wide aperture, with a prevalence of aperture between 0.1 mm and 5 mm; the filling, when present, is usually less than 5 mm and is made of calcite or clay.

The evaluation of the potential of kinematic failure movements in the rock mass has highlighted the possibility of planar and wedge slidings and secondly of topplings.

From what happened in last years and by historical research it has been found that the main kinematics movements failure occurred as a result of stormy sea waves (Andriani & Walsh, 2007).

Among the geomechanical classifications, the SMR Romana was the most suitable to represent the characteristics of the sea cliffs in static conditions, as it takes into account the geometry between joints and slope, using appropriate parameters; also provides guidance on the possible rock slope failure geometry and kinematics that could occur along the rock wall and the eventual consolidation works.

By the application of SMR index the studied cliffs show mostly fair condition (11 in good condition, 4 in poor condition and 2 in very poor condition).

The analysis of sea wave action for return period of 10 years has shown that the sea waves come almost always already broken when hit the cliff, and only in the coastal stretches of Corsanico in Pieve Ligure and of Punta Ferretto in Sori, the sea waves are just breaking against the rock wall.

Applying all obtained data in the proposed SCMR classification they have been found 14 sea cliffs of fair quality, 13 of poor quality, 10 from poor to fair quality, 6 from fair to poor quality, 4 of very poor quality, 3 from fair to good quality and 2 from very poor to poor quality (Fig. 4).

DISCUSSION AND CONCLUSION

SCMR	100 - 81	80 - 61	60 - 41	40 - 21	20 - 0
class	I	II	III	IV	V
description	very good	good	fair	bad	very bad
stability	completely stable	stable	partially stable	unstable	completely unstable
failure	none	some blocks	some joints or many wedges	planar or big wedges	big planar or soil-like
stabilizzation	none	occasional	systematic	important/corrective	reexcavation

Tab. 1 – Quality classes of seacliffs by the application of SCMR Classification

The results obtained with the SCMR classification allow

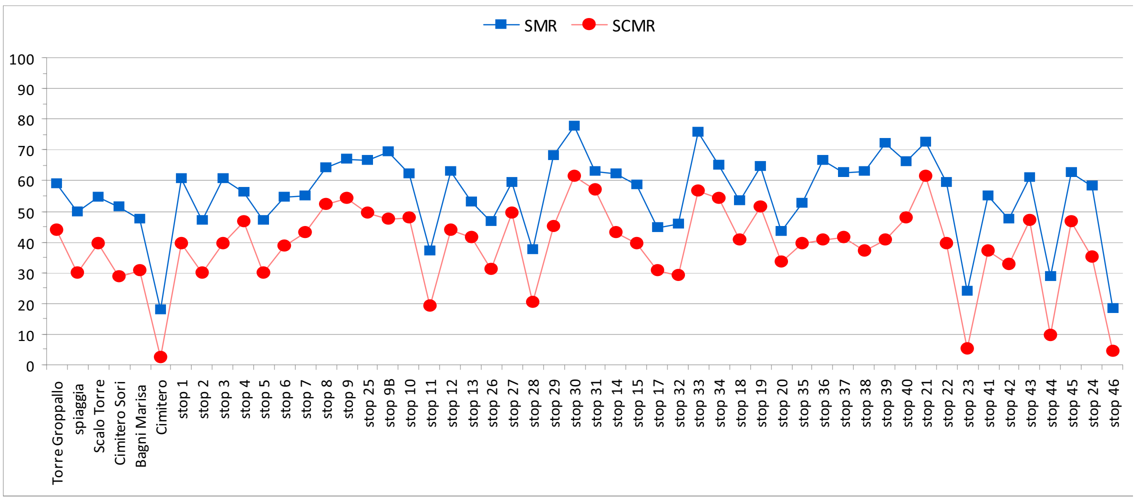

Fig. 4 – Average values of SMR and SCMR classifications

better differentiation of sea cliffs and are consistent with what was observed on the field. Therefore the analysis of the action of the sea wave is fundamental for the comprehension of the dynamics of the cliffs.

These results were used to prepare a coastal geomorphological hazard map.

The classes of susceptibility to coastal instability closely follow the classes of the SCMR Classification: very high susceptibility, including the active landslides and cliffs with SCMR value = 0-20; high susceptibility, including the deep-seated gravitational slope deformations (D.S.G.S.D.) and the cliffs with value SCMR = 21-40; medium susceptibility including cliffs with value SCMR = 41-60; low susceptibility, including cliffs with value SCMR = 61-80; very low susceptibility, including the beaches and cliffs with SCMR value = 81-100. It has been inserted a sixth class "reinforced or artificial coast" to represent the maritime and harbor works and others anthropogenic interventions that have completely obliterated the cliff.

From the geomorphological hazard map was derived a coastal risk map, just considering the elements at risk present in a buffer zone of 30 m, starting from the edge of the sea cliff scarp. Crossing in a matrix the classes of susceptibility to coastal instability with those of the elements at risk, we have identified five classes of coastal risk: very high, high, medium, low and very low.

In general medium and high susceptibility areas prevail; areas with very high hazard correspond mainly with the areas where active landslides were found; only two sea cliffs with low susceptibility were found.

The areas at very high risk primarily correspond with the very high susceptibility areas and in particular with high hazard cliffs where at the top the Aurelia road and/or Genova-La Spezia railway line are present.

The proposed Sea Cliff Mass Rating (SCMR classification) showed to be useful to diversify the rock walls and to identify the problems of the examined coast.

This new classification takes into consideration parameters friendly to use for the sea wave action in order to determine a the sea cliff zoning aimed to coastal land planning.

The thematic maps of geomorphological hazard and risk could be taken, therefore, as guidelines for coastal zone land management, currently addressed just only in part in the Basin Master Plan in Liguria. Moreover this issue is of primary importance for coastal protected areas such as Portofino, Cinque Terre and Portovenere parks in the eastern Liguria and Beigua geopark in the western sector of the region.

For sure the proposed method and classification are susceptible to indepth study: it will be appropriate to apply the method to other areas of Liguria and of Italy, in order to verify the feasibility of application of the SCMR classification modeled in sea cliffs shaped in other bedrock and affected by different sea waves actions.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

Landscape, wine and enhancement of territory

Lugeri F. R.([a]), Farabollini P. ([b]), Amadio V.([c]), Giannella G. ([d]) & Aldighieri B. ([e])

([a]) ISPRA Via Brancati 48, 00144 Rome, Italy. E-mail:francesca.lugeri@isprambiente.it
([b]) Università di Camerino,Camerino (MC) Italy
([c]) Università Mediterranea Reggio Calabria, Italy
([d]) Via C. Fadda 7, 00100 Rome, Italy
([e]) CNR IDPA, Via M. Bianco. Milano

ABSTRACT

The social-economical scenario of an area is strictly linked to the geological one: even at different scales, the endogenous and exogenous processes, and the rocks, as elements of the landscape, condition the evolution of environment and form the base of spatial-temporal development of a region.

By integrating different information about the geo-morphological arrangement and the land use of a region, it is possible to study the territory and the link between landscapes and wine production areas.

Wine production is in fact one of the most important activities in the Italian economy and culture and, at the same time, is an expression of the landscape: in this way it could be a “medium” to communicate the landscape, its origin, its history.

Wines, as well as other cultural expressions, are strictly linked to the territory: the popularization of the geo-environmental heritage walks on the same paths of tourism. A special attention should be devoted to an original link (already performed in some other countries) between landscapes, eno-tourism and sports: a new field for new actions, in order to promote a sustainable development in Italy, as well as a more sensible culture of responsible wine consumption.

The modern technology offers new powerful tools: the GIS are able to synthesize, manage and represent a large amount of data; thanks to GIS it’s almost easy to reach an evaluation of the state of the studied landscapes, referring to the dual risk/resource which characterizes our country. A further interesting opportunity is to discover, agricultural wine areas of special geological, environmental and cultural value, which in some cases can be considered geosites.

KEY WORDS: GIS, Landscape, Society, Territory, Wine.

INTRODUCTION

A territory's identity is formed by a combination of morphological, naturalistic and anthropic elements: natural beauty, climate, wine and food, archaeology, and culture. The connection between people and their territory, which is expressed through landscape, is a surprising resource for a society, and which, if managed in the right way, can promote sustainable development. Interaction with one's environment is a continual and delicate process in which balance and harmony, rather than specific targets, should be the guiding principles.

In a country such as Italy in which culture and tradition have always been strongly tied to territory through its wine, oenological production and viticulture assume an extremely important role, up to afinancial one, especially in these times of crisis.

Establishing an interest for wine by a process of recognition of territory through its manifestation in landscape, can lead to the realisation of effective strategies for territory management (Brilha 2002) and improvement aimed at reach the consensus and participation of the local population, strategies aimed at the attainment of goals based on a more stable and shared well-being. The arrival of GIS marked a media revolution as well as an integrated management of data, a quick and secure sharing of data, and above all, a flexible utilisation of instruments and content according to different levels of complexity and requirements opening up new possibilities for diverse and new operators. In this context, landscape remains the key to interpretation on a path that winds in time and space and that combines the history of civilizations.

LANDSCAPE ECOLOGY APPROACH

Landscape Ecology offers a new scientific approach to the study of landscape, (Forman & Godron 1986) while on the socio-political front the European Convention on Landscape sets forth its important functions: cultural, ecological, environmental, and social (Amadio V. 2003) .

One of the projects aimed at conveying a recognition of the Italian national territory is the Carta della Natura (APAT 2003) (Amadio et Al. 2002), which provides various scales of analysis that are important for a study of different types of problems. In particular, one phase of this project led to the identification of the physiographic units of landscape realised through:

- the interpretation of images obtained from airplanes and satellites that lead to a synoptic study of a territory
-supervision of the countryside

-use of bibliographic data, in particular thematic cartography

The topographic base of reference is that of the IGM to the scale of 1:250.000. For the GIS we used the raster numerical base, separated in ten informative levels.

The identified landscape typologies (37 types) were defined on the basis of a series of criteria that derive from a synthetic observation of the principle characteristics of the structure of landscape on a regional scale. The litho-morphological criteria, for example, is evident in the denomination itself of the many typologies (landscape, at the regional scale and in general, is characterised primarily by the morphological structure which is in turn tied to the lithology of the substrata). Moreover, it is worthwhile analysing the relationship between a landscape and its neighbouring landscapes.

The soil cover is another element that characterises landscape and deserves a separate discussion. We observed that, apart from the territories which are strongly humanised such as the metropolitan areas, there is a clear correspondence, on the regional scale, between the soil cover pattern and the typology identified by the physiographic criteria. .Another important aspect is the climate, which helps to determine the configuration of the landscape influencing the soil cover and the forms in relief due to the action of external processes. To this end we observed that types that are analogous yet located in different climatic contexts display different landscape structures. The climatic influence, in the context of landscape variability on the regional level, is explicated on a general hierarchical level.

Fig. 1- Map of the landscape units of Italy

Landscape and wine

In recent years there has been an increased attention to wine production and to the promotion of this leading product on the national and international market. Wine, the protagonist of Italian culture represents a connection with the land, (Cita et Al. 2004) (Colacicchi R, Parotto M 2006).

For its diffusion, its constant presence in history and for its true nature, wine is therefore a way towards a geo-ecological-environmental understanding. A direct public participation implies a greater awareness of the interaction with the environment and consequently induces a more informed consumption. Modern media and technological means used for geo-territorial studies (GIS) provide further and powerful instruments for spreading and sharing knowledge. This approach to the use of natural resources and traditional cultures, could help promote local development that is favourable for production and employment. Modern mapping is suggested as a new tool for these aims and is enriched with greater potential for presenting comparisons and syntheses that are useful instruments in many situations: technical, scientific, educational. A special attention is devoted to tourism, that's at the same time a chance for the local development and for a creative approach in the educational programs. The cultural component in touristic tours can be enriched with some scientific information on landscapes and geology; oeno-gastronomic tourism offers new chances, referring to the link among earth and its products (Montanari et al. 2008). The customer and the consumer must recognize and feel this link: they must be able to find the land in its wine. The Landscape Physiografic Unit Map provides a different and wider point of view on many themes and allows to frame the studied areas into a Territorial/Environmental System. At the same time, the landscape analysis and the physiographic units, allows us to locate the "Geoheritage" areas, such as some peculiar association of natural (Geomorphosites) and cultural (historical cultivations) landscapes.. The National Park of the Cilento, vallo di Diano and Alburni, an UNESCO heritage site and a national park for its invaluable naturalistic environemnt, can be considered a particular case on the socio-economic level**..**

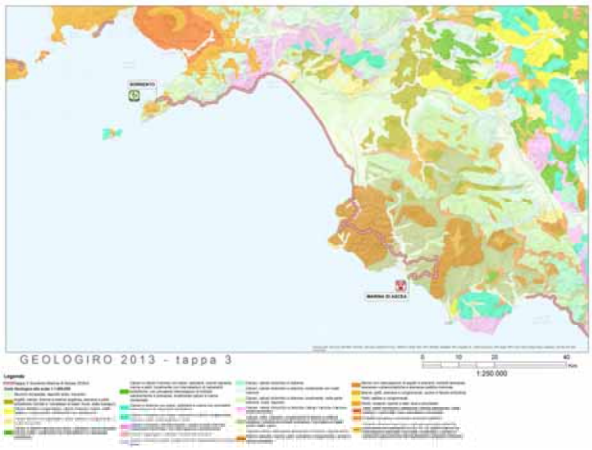

Fig. 2 - A synthetic geological map of Cilento area, one of the most important stages in the "Giro d'Italia" 2013

The wines of Cilento and their "cultivar" express the distinctiveness of the cultivation of the wine production of the territory, (Marre A 2004) and recount at the same time the difficulties of the use of the soil in territories characterised by a particular geographic context. (fig. 1, fig. 2) . It was in these places where the Mediterranean diet was first identified. Nature and culture are synthesised, integrated and described by means of maps realised by the Informative Territorial Systems. It is thus possible to carry out and share with the population a balanced management of a territory and an enhancement of places, also by means of local products which so are so deeply rooted in the land.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

Contributions of the Azores Geopark to the geotourism development in the archipelago

Machado M.([a]), Viveiros C. ([b]), Lima A. ([c]) & Lima E. A.([d])

([a]) ARDE – Association for Regional Development / Azores Geopark, Portugal. E-mail: marisamachado@uac.pt
([b]) ARDE – Association for Regional Development / Azores Geopark, Portugal. E-mail: carlaviveiros@uac.pt
([c]) Speleological Association "Os Montanheiros" / Azores Geopark, Portugal. E-mail: annafilima@gmail.com
([d]) Geosciences Department, Azores University / Azores Geopark, Portugal. E-mail: evalima@azoresgeopark.com

ABSTRACT

The Azores Archipelago has a vast and rich geodiversity that is an important basis for the growth of Geotourism in this territory.

At the aim of the Azores Geopark policies to develop Geotourism in the archipelago, workshops have been provided for students of tourism courses. These workshops are divided in two parts: theoretical and practical. On the first it is explained to the students some concepts related to geotourism; in the second part the students have the opportunity to make a field trip to the geosites of its island and take a closer look at the geological aspects, mainly its geotouristic potential and the need to implement geoconservation measures on those geosites.

The Azores Geopark is also developing a "Azores Geotouristic Guide", where are described geosites with geotouristic interest and activities that can be done in those sites (*e.g.* guided tours, walking trails, canyoning, diving, nature photography, among others).

Beyond these, some thematic routes were also developed, with the main goal to develop rural areas with geological interest and to promote the local sustainable development.

KEY WORDS: Azores Geopark, geotourism potential, guide, workshops.

INTRODUCTION

Geotourism was defined for the first time by Hose (1995) as "the provision of interpretive and service facilities to enable tourists to acquire knowledge and understanding of the geology and geomorphology of a site (including its contribution to the development of the Earth sciences) beyond the level of mere aesthetic appreciation". The Geotourism is based on geodiversity (Brilha, 2005), on sustainability and their goals include the promotion of geodiversity, the environmental education and the geoconservation.

Geotourism has been recently developed in the Azores Archipelago, due to its rich geodiversity, being the volcanic landscape the main ex-libris of the touristic promotion, with a huge geotouristic potential (Nunes *et al.*, 2010). The nine azorean islands offer a wide range of experiences and emotions that are linked with other values like biodiversity, history and cultural heritage, providing the visitors with unforgettable experiences. All those reasons are the basis for the promotion and the development of geotourism strategies as the aim of the Azores Geopark.

AZORES GEOPARK

The Azores Archipelago is located on the North Atlantic and is composed by nine islands of volcanic origin that are distributed in geographic terms in three groups (Fig. 1).

The Azores geodiversity presents elements closely linked to the dynamics of Planet Earth, in particular, the volcanism and geotectonic of this Atlantic region, with the archipelago as a natural laboratory of volcanic geodiversity. Its morphology is characterized by different types of volcanoes, hydrothermal fields, volcanic ridges, volcanic lakes, black sand beaches and volcanic caves, among others (Lima, 2009).

The international relevance of the Azorean geodiversity, the high number and quality of its geosites and the undoubted importance of its geological heritage, together with the rich biological and cultural heritage, all supported on a major effort of the Azores Government to implement geoconservation and environmental education policies, strongly justified the creation of the Azores Geopark (Lima *et al.*, 2010).

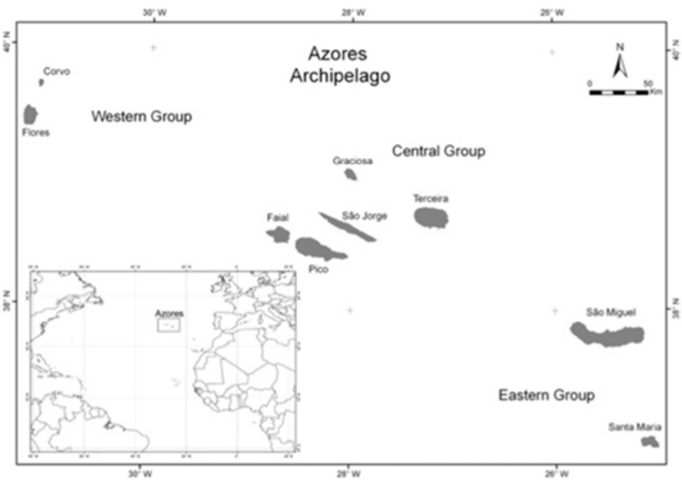

Fig. 1 – Azores Archipelago.

GEOTOURISTIC POTENTIAL

Since the early days of settlement of the islands (in the fifteenth century), the azorean people have a strong connection with “their” volcanoes, living several volcanic eruptions and experiencing many earthquakes. Therefore, the culture is closely linked with volcanoes, namely in festivities and architecture. Given the strong catholic faith of the inhabitants and the lack of scientific knowledge about these catastrophic natural events, the azoreans created religious events in order to “calm down the wrath of God”, such as processions and pilgrimages. In the architecture, it is possible to see old manor houses, monasteries, churches and fortresses built with the rocks existing on each island.

The volcanoes and Man relationship is also imprinted on the stone walls that divide some rural terrains, the enjoyment of thermal baths, the gastronomy (namely the famous azorean dish “Cozido das Furnas”, cooked on the geothermal soil) or different types of mineral and thermal waters with therapeutic properties commonly used by the population (*e.g.* Viveiros *et al.*, 2012).

The natural landscapes of the archipelago and the rich azorean culture, which fascinates local population and visitors, are the starting point for the development of geotourism. The geodiversity richness, together with the appropriate infrastructures (*e.g.* viewpoints and visitors centers) enables to create new touristic products, including a geotouristic guide and georoutes.

GEOTOURISM GUIDE

Several materials and products are being developed to promote geotourism in the archipelago, in the field. One example is the “Azores Geotouristic Guide” that is being prepared to support travelers and tourists that visit the islands, but also to assist the tourism companies to promote their products and services.

The guide is composed by selected sites (mainly geosites) in the nine islands, and surrounding sea floor. Some of these sites have already a national or international recognition status, namely as UNESCO World Heritage Sites (*e.g.* Historical Centre of Angra do Heroísmo City, in Terceira Island and the Landscape of the Pico Island Vineyard Culture) or the 7 Wonders of Portugal (Lagoa do Fogo lake and Sete Cidades Volcanic Landscape, in São Miguel island).

The guide includes information about the nine islands, organized accordingly to its geographic location, and are suggested places to visit, as a way to provide to the visitor a fruitful and enjoying trip. For each one it is explained its geological characteristics and geotouristic potential (*e.g.* guided tours, walking trails, canyoning, diving, nature photography, among others). Several of these sites are already equipped with viewpoints, interpretation and environmental centers, parking places and other useful facilities that ensure important touristic services.

With the creation of the “Azores Geotouristic Guide”, the Azores Geopark intends to: i) provide a better knowledge and new experiences to visitors about the relevant geological heritage and geodiversity of the Azores; ii) improve the involvement of the local population and companies on touristic activities; iii) contribute to the improvement and economic sustainability of existing infrastructures and iv) contribute to the development of new touristic products (*e.g.* geo-products).

GEOTOURISM WORKSHOPS

As a way to promote geotourism among local stakeholders, workshops were developed especially targeted, at this stage, to students of tourism courses from professional/technical schools. These workshops include two parts, a theoretical part and a practical one.

On the first part, several topics are presented, namely: i) geotourism, geopark, geodiversity, geoheritage and geoconservation concepts; ii) the characteristics of a geotourist; iii) finally is shown the geotouristic potential of the archipelago, highlighting the island where the workshop is provided.

In the practical and second part of the workshops, the students are divided in small groups (four or five people) with the goal to create geotours. Geotours can be a half day, one day or two days long, with an itinerary, proposed activities, suggestions of logistic issues (*e.g.* restaurants and accommodation). The practical part also includes field trips to the geosites of the island (Fig. 2, 3 and 4), to better understand their geological aspects, geotouristic potencial and to apprehend the social, cultural, historical and ethnographic linkages with geology of those sites.

Efforts are being done to recycle the knowledge of the touristic companies staff about the geotourism activites of each island, being a continuous work initiated on the “2011 Meeting of Touristic Activities – Geotourism” co-organized by the Azores Geopark and ART – Regional Association of Tourism.

Fig. 2 – Geotourism workshop in S. Miguel Island.

Fig. 3 – Geotourism workshop field trip in S. Miguel Island.

Fig. 4 – Geotourism workshop field trip in Pico Island.

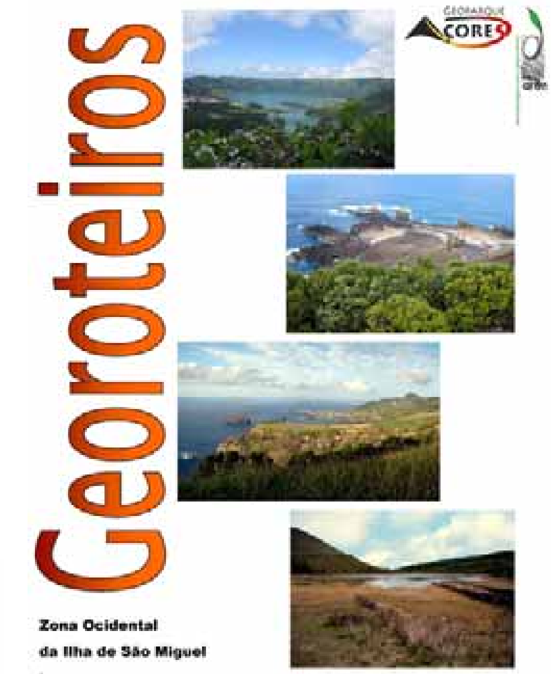

Fig. 5 – Georoutes at the west zone of São Miguel Island.

GEOROUTES

To promote geotourism in the archipelago the geopark staff is working on georoutes. These georoutes suggest different itineraries along the island geosites and geolandscapes, include leisure and educational activities, suggest restaurant meals or thematic picnics and recommend the visit to some cultural infrastructures (*e.g.* museums, churches, ethnographic centers).

The georoutes were established for multiple periods of time (half a day, one or two days - according to the availability of the visitor/geotourist) and can be performed autonomously or with a guide.

The development of these thematic routes in all the islands have the goal to develop rural areas with geological interest and to promote the local sustainable development. There were already developed and promoted georoutes to the west zone of São Miguel island (Fig. 5), the island of Santa Maria and Pico island.

These georoutes includes a brief description of the island and all sites to visit (mainly geosites), existing infrastructures to assist the geotourist and a list of activities that can be performed. There are, also, some logistic information on accommodation, restaurants and local tourist animation companies.

For the west zone of São Miguel two routes of a day and four routes of two days were done; for Santa Maria it were performed two routes of a day and two routes of two days; and for Pico island it was created routes of one day, two days and five days. These georoutes includes a brief description of the island and all sites to visit (geosites), existing infrastructures to assist the geotourist and a list of activities that can be performed. In these routes is also available useful information on accommodation, catering and local tourist animation companies.

The Azores geotourism is also supported on different thematic routes that promotes the Region based on the volcanism and the geolandscapes: i) the Volcanic Caves Route; ii) the Belvederes Route; iii) the Walking Trails Route; iv) the Thermal Route; v) the Science and Interpretation Centers Route and vi) Urban Georoutes.

The Volcanic Caves Route, to "discover the subterranean world of the islands", valuing the volcanic caves and associated visitors centers, such as "Gruta das Torres" (Pico island), "Gruta do Carvão" (São Miguel island), "Furna do Enxofre" (Graciosa island) and "Algar do Carvão" and "Gruta do Natal" (Terceira island).

The Belvederes Route, to "discover, by car, the Azores volcanic landscapes", valuing the numerous belvederes ("Miradouros", in Portuguese), and observation points that exist on all islands of the archipelago, often superbly located, with support devices (e.g. benches, fences, parking areas, restrooms) and often impeccably maintained.

The Walking Trails Route, to "discover, by foot, the Azores geosites", enhancing the Regional Network of Walks and other trails in Azores, with about 100 different options.

The Thermal Route, to "discover and enjoy the power of Azores volcanism", taking advantage on the benefits in terms of health and well-being of the Azorean thermal waters and mud, as in Ferraria, Furnas, Caldeiras da Ribeira Grande, Caldeira Velha and Poça da D. Beija (São Miguel island), Carapacho (Graciosa island), Varadouro (Faial island), and Furnas do Enxofre (Terceira island).

The Science and Interpretation Centers Route, "to learn and interpret the Azorean volcanic phenomena", valuing the 25 science, interpretation and visitors centers existing in all the islands, such as the Capelinhos Volcano Interpretation Center (Faial island), the Mountain House (Pico island) or the Astronomical Observatory and the ExpoLAB (São Miguel island).

The Urban Georoutes, to "discover the geology of my village/town", that allow local population and visitors to see and learn about the rocks in buildings and monuments and to understand about the geology of urban areas.

FINAL REMARKS

The promotion and development of geotourism is a key issue and a priority goal of the Azores Geopark, based on the rich Azorean geodiversity, the high number and quality of its geosites and the undoubted importance of its geological heritage.

To improve the geotourism quality in the territory, new actions and initiatives are being implemented, including the creation and implementation of georoutes, the offer of geotourism workshops for target publics (*e.g.* tourism professionals and students) and the "Azores Geotouristic Guide".

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Itinerary geological between the municipality of Piedecuesta to La Mesa de los Santos (Santander), use of geological heritage.

Mantilla E. ([a]) & Villabona J. J. ([b])

([a]) Faculty of Engineering Physic and chemical, University Industry of Santander, Bucaramanga, Colombia. E-mail: erikmantilla7723@hotmail.com
([b]) University Industry of Santander

ABSTRACT

This written work seeks to highlight the geoscience community some of the most representative geocitios lilmite located in the southwestern part of the Santander massif some sedimentary rocks outcropping of upper Jurassic-Lower Cretaceous granite intruded by pescader that through a methodological process could be fundamental basis select to taken most representative characteristics, among these are: Rarity, location, didactic, conservation status, size and dimensions, among other scientific interest. Since each geocitio I mean look geomorlogico pede, structural, mineralogical, lithological, stratigraphic by which I can I will study, analyze and interpret the different processes that occurred throughout history geological and gave rise to what we have today.

At present natural resources aesthetic (landscape) are not recognized or exploited by governments and by the people themselves, despite knowing its existence between Piedecuesta The geological route - Cable Car Station (Mesa de Los Santos), is justified the growing need to provide the knowledge assessment, protection and use of geological heritage from its rich landscape, geodiversity and geological formations that provide educational potential, educational, cultural and geotourism.

Key Words: Granite of Pescadero, Geocitios, Geological Heritage.

INTRODUCTION

The geosciences in the course of the years has tried to give answers and solutions to man in each of the areas of development, today comes the need to classify natural resources not only as extraction and processing entities but also as an environment where we can observe and appreciate natural service enjoy a worthy and important to human and sustainable development of any society and give them the value they deserve to be indisputably irreplaceable.

Because of this Society is starting to look a right, a necessity and a duty to protect the environment, promote sustainable place for future generations left a carefully preserved, including geological features of exceptional interest. The definition of geological heritage is the set of natural geological resources of scientific, cultural and / or educational, whether geological formations and structures, landforms, minerals, rocks, meteorites, fossils, soils and other geological events that reveal, study and interpret the origin and evolution of the earth, the processes that have shaped, climates and landscapes of the past and present and the origin and evolution of life (Carcavilla et al., 2008).

Currently, the study of geological seeks to identify, evaluate, preserve and disclose those places that have a high value in relation to the earth sciences. Therefore, the main lines of work in relation to geological heritage are: inventory, legislation, and dissemination geoconservation which are closely related to geodiversity, which is defined on the website of the British Geological Survey as ¨ the variety of geological environments, phenomena and processes that give rise to landscapes, rocks, minerals, fossils and soils which provide the framework for the development of life on Earth ¨ (www.britishgeologicalsurvey.com).

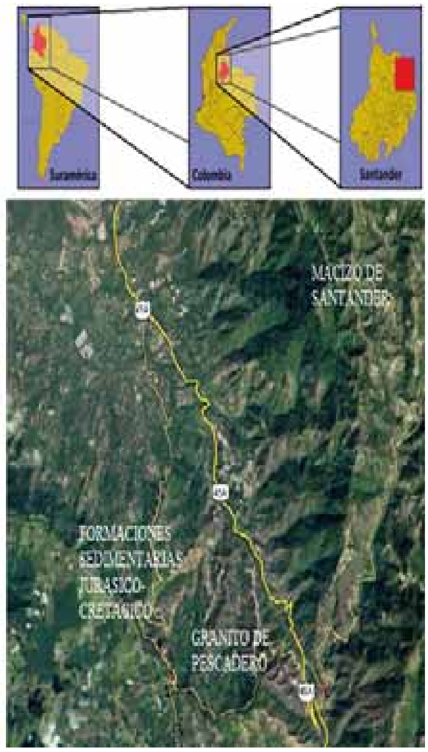

Fig. 1: Geographical localization

PAPER PRESENTATION

The Cordillera Oriental of Colombia is built of Mesozoic and Tertiary strata, deformed chiefly during Tertiary orogenesis. These materials form a sedimentary cover, overlying a basement of lower Paleozoic (and Precambrian?) metamorphic and igneous rocks, and of little deformed and nonmetamorphic Upper Paleozoic rocks, which often behaved mechanically as part of the cover.

No metamorphism took place during the Tertiary orogenesis, and the main structural features of the chain are determined by the relationship between basement and cover. The basement crops out within the chain in two massifs, Santander and Quetame-Garzón, arranged *en chelon. (Julivert 1970).*

GEOLOGICAL SETTING

In the study area the regional geology and landscape forms obey a sequence of events occurring since the Precambrian period (945 Ma), a period in which the territory of Santander was part of a "megaterrano" whose base was probably connected with the Guyana Shield. The oldest rocks in the area belong to Bucaramanga Gneiss, originated as a result of processes of basement metamorphism and plutonism original subsequent uplift and erosion of these rocks led to the formation of deposits Silgará training during the Devonian (Paleozoic) , and then Floresta and Diamond formations, which outcrop in the area not assessed.

The Triassic and Jurassic are represented by La Corcova Cuarzomonzonitas and Santa Barbara and the Pescadero Granite, formed in major events of volcanism and intrusion, which further erosion and deposition in continental environments led to the formation of Pigs and Jordan. By the time the "megaterreno ancestral" began split, with the fault systems limit N-NE and NW-SE, whose main element is the failure of Bucaramanga - Santa Marta, a result of which some areas began to sink, which marked the beginning of the formation of basins in what is now the middle valleys of Magdalena and Cesar. With the advance of the sea to the continent during the Cretaceous period (120 m), most of what is now the Eastern Cordillera was subject to flooding, with consequent deposition of the sediments that constitute the formations Tambor, Rosablanca Straw tablazo and Simití. This process continued until the Late Cretaceous and early Tertiary (65 Ma), at which the seas began their retreat to their current position and started lifting parallel Santander Massif, east of the fault Bucaramanga. It is noteworthy that the Precambrian basement in this massif represents the oldest socket entire eastern Colombian

During the Oligocene and Miocene occurred more drastic rising phase of the Eastern Cordillera, and the erosion of most of the sedimentary rocks and Santander Massif area Barichara tables, Villanueva, Los Santos, Ruitoque and Lebrija. Finally in the Pliocene and Pleistocene occurred a new phase of uplift, weathering, erosion, sediment transport and deposition, responsible for the current landscape configuration, due to rock mass disectación by major water currents, sediment deposition in the lower parts and the formation of mountains, hills and valleys are landforms present.

STRATIGRAPHIC UNITS

Bucaramanga gneiss (PEB)

The original name of Bucaramanga gneiss was used by (Goldsmith et al. 1971) and later proposed by (Ward et al. 1973). This unit has the mountain front type locality (Cerro Morro The Jewish and Black) east of Bucaramanga. Presents good exposure in Bucaramanga roads - Pamplona, Bucaramanga - Killing and Berlin - streaks. The radiometric dating of Rb / Sr whole rock a broken neisbiotítico near the Volcano were 680 ± 140 m, while another K / Ar dating of the Santa Marta-Bucaramanga Fault in hornbléndico gneiss near Ocana presented an age of 950 ± 40 m, which places it in the upper Proterozoic.

The drive units are overlying the Paleozoic, Jurassic and Cretaceous yet. Elcontacto of this training unit that overlies Silgará in many places, has not been determined exactly, because there are many similarities between these two lithological units. Formation has been intruded by felsic plutons of Paleozoic and Jurassic.

Silgar Formation (PDs)

Name proposed by (Ward et al. 1973) to refer to a sequence of rocks whose type section is located in the Quebrada Silgará, a tributary of the River Salamanca, west of Cáchira. Stratigraphic relationships, compositional differences and some structural data, so least suggest that the formation overlies the gneiss Silgará Bucaramanga and infrayacediscordantemente to Tibet and Forest formations of the Devonian. A Silgará Training tentatively assigned an age from Cambrian to Ordovician (Ward et al. 1973), equivalent in part to the group Quetame (Campbell, 1965), the group Güejar (Trumpy, 1943) and may be compared with the series of Perijá (Raddelli, 1962; Forero, 1969, 1970, Tschanz et al., 1969).

Corresponds to a sequence of metamorphosed clastic rocks of Devonian, consisting of slates, phyllites, metalimolitasfilíticas, silver and shale moscovíticos metaareniscas smaller proportion of medium to fine grained, and composed of quartz, feldspar, muscovite and chlorite clay minerals, these rocks foliations parallel structures comprising thin layers with strong folding. Some outcrops of this formation are exposed and show their composition unchanged in the river canyons and Chicamocha

Manco where climatic conditions are rather dry and warm, in areas of high rainfall and moisture very easily weathered, forming thick clay soil profiles to arcillolimoso, yellow to red, which develops abundant vegetation. Silgará formation outcrops west of the Bucaramanga fault, occupying about 10% of total study area. These rocks are well exposed along the road Bucaramanga - San Gil and the road from Los Curos to Los Santos.

Granite Pescadero (JRgp)

It is dominated by a granite leucocratic, fine-grained, named for the existence of outcrops in the Pescadero area, considered a variety of Mogotes Batholith. Corresponds to an igneous rock intruded between the Triassic and Jurassic porphyritic texture to Phaneritic, with the presence of some very coarse grained dikes and other pegmatite type very fine grained rhyolite type, its color is pink to orange due to the richness of pink feldspar, quartz and mica biotite, muscovite pegmatite containing large sheet. It is an elongated pluton somewhat irregular, located west of the Bucaramanga fault, where the fresh, intrudes Silgará training and its fragments are part of the basal conglomerate Jordan training. Its rocks meteorizan gravoarenoso forming a porous soil colored, very superficial.

Gir n Formation (Jg)

Initially the term" series" Giron was created by (Hettner 1892) to designate a west of Bucaramanga megasecuenciaaflorante around Giron Santander. They advanced studies and between them stands the (Trumpy 1943) but was (Langenheim 1954) who set the type section in the Lebrija River narrows and divided into three members: one sandy bottom (750 m), one intermediate muddy (1.250 m) and an upper sand (1,500 m) for a total thickness of 3,500 m. Giron Formation stratigraphic discontinuity lies in Bocas about training and Jordan and infrayace formation conformably Saints (Drum). For Girón Group has been established upper Jurassic - Early Cretaceous (Pons, 1982). It has generally been correlated with the formation of Upper Jurassic La Quinta in western Venezuela (Oppenheim, 1940). It is composed of sedimentary rocks of the Jurassic period, which mainly relate to reddish conglomeratic sandstones of medium to coarse grained, layered up to 4 m thick, and conglomerate of quartz pebbles and shingle, interspersed with levels reddish brown siltstones and mudstones, and gray silty claystones, gray-green and mottled. Although its main mineral is quartz, quartzose sandstones and conglomerates, also integrates some feldspar and quartz and feldspar mudstones. This formation crops out in the northwestern sector of the study area, on the sidewalks San Pio and San Miguel, occupying about 1% of its total length.

Tambor Formation (Kita)

Was defined first by (Cediel 1968) and redefined by (Laverde 1985). On type locality, the thickness is 218 m. The lower contact of this unit is a stratigraphic discontinuity with the formation of Pigs, while the upper contact is consistent with the formation overlying Summit. The Saints or Tambor Formation is considered old Berriasian (Cediel, 1968; Etayo and (Rodriguez, 1985). Lithologically training is comparable to Black River Catatumbo basin-Maracaibo. Tambor Formation is a sequence of Lower Cretaceous sedimentary rocks of Origin transitional between continental and marine, white sandstone consists of medium to coarse grained, quartzose, friable in some areas, moderate to well cemented in layers up to 3 m, with little clay matrix, and intercalated with siltstones and reddish lodolitaspardo. In some sectors are slightly conglomeratic sandstones and are interspersed with thin claystones levels. Outcrops on the sidewalks The Cocoa, Cabrera and El Salado, towards the western end of the study area, occupying a narrow strip covering 1% of its total area. This formation crops out in the northwestern sector of the study area, on the sidewalks San Pio and San Miguel, occupying about 1% of its total length.

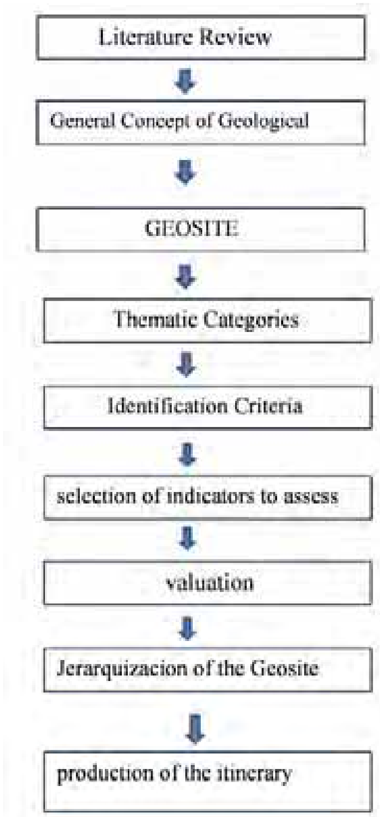

Fig. 2- Methodology flow chart

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Geopark Nord – an initiative to establish a geopark in the Ofoten district, Nordland County, Norway

Markusson E. ([a]), Sandøy R.([b]), Roll A. M. ([b]), Normark H.([c]), Slettjord L.([d]) & Jenssen T. A. ([e])

([a]) Ofoten Regional Council, Pb. 61, 8539 Bogen i Ofoten, Norway. E-mail: eysteinm@ofotraadet.no
([b]) Ofoten Outdoor Recreation Council, c/o Narvik kommune, 8512 Narvik, Norway
([c]) Narvik Regional Chamber of Commerce, Pb. 75, 8501 Narvik, Norway
([d]) Museum Nord – Narvik, Administrasjonsveien 3, 8514 Narvik, Norway
([e]) Narvik University College, Pb. 385, 8505 Narvik, Norway

ABSTRACT

Ofoten is a treasure trove for anyone curious about minerals and rocks. Ancient bedrock lies side by side with younger rock. Ofoten has granite and gabbro solidified deep in the crust, rock formed by volcanic activity, and schist and marble transformed from shale and fosifiliferous limestone. Fjords and steep mountains characterize the landscape. Among these is Stetinden, awarded as Norway's National Mountain. Ecologically the area spans from middle boreal through northern boreal and into the alpine zones, from sea level to high mountain plains. There are long traditions for mining and numerous abandoned mines and quarries. The major town of Narvik was established in 1902 on shipping of iron ore transported by rail from Sweden.

The area is located within geographical markers 68,36 N, 18,09 E, 67,31 N, 15,56 E totaling a land area of 3293 km^2. The population is 25740 whereof the Saami, an indigenous people of Northern Fennoscandia, constitutes a significant proportion. Local authorities in the district have launched an initiative to establish a geopark based on knowledge transfer to schools and general public, research and development and geotourism. The main topics of the geopark will be outstanding landscapes and fjords, Geo-sites and resources in Saami mythology and tradition, industrial heritage and old rocks.

KEY WORDS: Geopark, Norway, Ofoten, Narvik, fjord, Fennoscandia

INTRODUCTION

The district of Ofoten (Fig.1), comprised of the municipalities of Ballangen, Evenes, Narvik, Tjeldsund and Tysfjord, is characterized by varied landscapes with alpine mountains and narrow fjords, as well as open valleys and tundra. The district has long traditions in mining going back at least 300 years and several mines are still active today. Local authorities have launched an initiative to establish a geopark based on geology, tradition and use of natural resources. This short paper, outlining a poster to be presented for the 12th European Geoparks Conference, will describe the initiative as it stands by June 2013.

BACKGROUND

THE GEOLOGY OF OFOTEN IN BRIEF

The varied, exciting geology of Ofoten has been formed during three periods in Earth's history. In the southeast and west there are rocks from the Precambrian, the basement. These are from 1700 to 2200 million years old. In the middle of the district there is a series of slice-like nappes lying on top of the basement – the Ofoten Synform. These are rocks that were thrust into place 400-430 million years ago. Ice and water have excavated the valleys and fjords and left surficial deposits to form the landscape we see today in the course of the 40 glaciations that have occurred during the last 2,5 million years. (Bargel et al., 1995; Blomlie, 2012).

Fig. 1 – Map showing Fennoscandia, the Baltics and North-western Russia, the red marker indicating the town of Narvik. Map from www.norgeskart.no

MINING – PAST AND PRESENT

The district of Ofoten has a rich history of mining and quarrying. People here have earned a living from treasure found in the mountains for centuries, be it through prospecting, seasonal work or employment in large companies. The mines and quarries have met different fates. When a deposit was no longer profitable, galleries, tips and buildings were abandoned. They were often in remote locations, which were rarely visited and gradually forgotten. In more central places, the settlement and cultural landscape are marked by the former activity. But the history and quarrying in the district is not just about works that have died. The communities of Kjøpsvik, Drag, Hekkelstrand and Narvik have large companies that are very much alive (Blomlie, 2012). In 2012 a total of 18,3 million tons of iron ore was shipped out from Narvik harbor.

GEOGRAPHY AND HISTORY

The district is located within geographical markers 68,36 N, 18,09 E, 67,31 N, 15,56 E totaling a land area of 3293 km2 (Fig. 1). The population of the district totaled 25740 in 2012. The largest town, Narvik, has a population of approximately 14000.

Traditionally the area has been habituated by two groups of people: the homesteaders and the Saami, the latter being an indigenous people of Northern Fennoscandia. There are both similarities and differences in the way the peoples have used and related to nature and natural resources both materialistic and spiritually.

Historically, the inhabitants of the district made their living from a whole suite of trades. As farming was common but quite marginal, fishing was a necessity for all households and most would have to engage in work outside the household, mining and quarrying being an important occupation (Pettersen, 1988).

Ecologically the area spans from middle boreal through northern boreal and into the alpine zones, from sea level to high mountain plains.

INFRASTRUCTURE

In addition to the railway connecting the town of Narvik to the European railway network and the international harbor, the district is connected by air through Harstad/Narvik Airport, Evenes and by road by the by the E6 from South to North and the E10 from East to West. The town of Narvik has several business class hotels and restaurants catering travellers all seasons.

KNOWLEDGE BASE

The geology of the district is well mapped by the scientific community and is popularized by the Norwegian Geological Survey (Bargel et al., 1995). Furthermore, Museum Nord has documented the history, geology and precise location of 38 heritage sites in the book "Treasure in the Mountains" (Blomlie, 2012). Currently there is ongoing work to mark the paths and to establish information boards about these sites. Furthermore, Museum Nord, with its departments in Ballangen, Narvik and Tysfjord and Vardobaiki Museum (Saami museum) holds a large collection of documentation and artifacts, in addition to exhibitions. Also, Museum Nord – Narvik, is an anchor point in ERIH – The European Route of Industrial Heritage.

GEOPARK NORD – AN OUTLINE

We suggest establishing a geopark based on knowledge transfer to schools and general public, research and development and geotourism. The main topics of the geopark will be:

- Outstanding landscapes and fjords

e.g. Stetind (fig. 3) – Recognized as the National mountain of Norway in a public voting. Local authorities have launched an initiative to develop geotourism based on the mountain.

In the fjords and mountains in the district there are lots of traces of the ice-ages and glaciations that the district has seen (Bargel et al., 1995).

- Geo-sites and resources in Saami mythology and tradition

There are well-documented uses of geosites in Saami tradition, both in mythological contexts and in practical use of geo-resources. This topic should be developed to integrate history, mythology and human ecology with geo-resources and landscapes.

- Industrial heritage

e.g. Bjørkåsen mines, an abandoned copper mine close to the town of Ballangen. The entire society surrounding the mine is well documented by Museum Nord. During 2013-14 the entire area of the mining area will be marked and signed to give access and give information about the area.

Ofotbanen (the Ofoten railway) (fig. 2), completed in 1902 to carry iron ore from Sweden to the harbor of Narvik is a spectacular journey from tundra plains to the fjord landscapes of Northern Norway. The railway is a tourist attraction today but has a large potential foer further development.

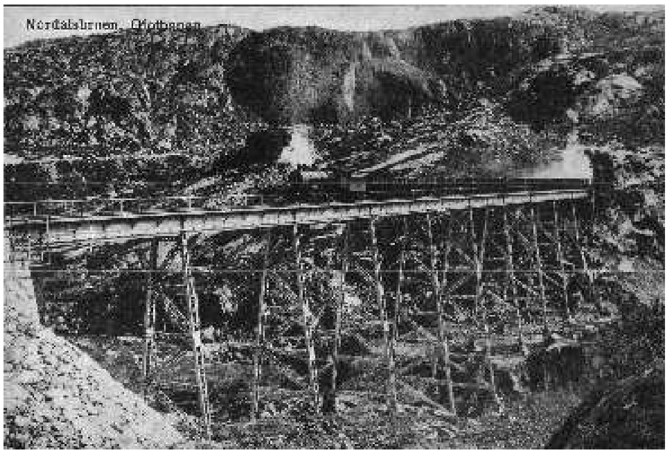

Fig. 2 –Historic photo from the spectacular 42 km railway "Ofotbanen" finished in 1902 for the transportation of iron ore from Sweden to the harbor of Narvik. In 2012 it totaled more than 18 million tons.

- Old rocks

e.g. at several locations in the Rombaken area there are several good, easy accessible and well accessible examples of the oldest rocks in Northern Europe, 2,200 million years old, e.g. the Rombak window (Bargel et al., 1995).

There is already a large amount of geosites precisely documented and some are marked and signed. As outlined above there is ongoing work to mark more of the already documented sites.

We envision a main information centre located in the town of Narvik supported by the departments of Museum and other museums in the district. Although the project has its foundation in the Ofoten district, neighboring districts in Sweden and Norway offer many complementary geosites and landscapes. It is our intention to invite the districts of Swedish Lapland, Lofoten, Salten, Southern Troms and Vesterålen to cooperate in the project.

Currently a project group is working on the concept for the geopark that will be outlined in the poster session of the 12th EGN Conference.

Fig. 3 –Stetind – The National mountain of Norway (1336 m).

ACKNOWLEDGMENTS

We wish to thank Kristin Ragnes, Rolv Dahl, Ingvar Lindahl and Ola Torsteinsen for valuable input.

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Lanzarote Geopark Project. Identification of the Area. Geological Heritage

Mateo Mederos M. E. ([a])

([a]) Environmental Service. Cabildo de Lanzarote. Avda. Fred Olsen, s/n. 35500 Arrecife. Lanzarote. Canary Islands. Spain. E-mail: elenamateo67@gmail.com

ABSTRACT

The island of Lanzarote with its islets located at the Northeast of the island are proposed as a new Geopark of the European Geoparks Network (EGN). The extension of the entire proposed area is 906 km^2 and is within the Autonomous Community of Canary, in Spain. The area is located at the following coordinates: latitude 29º 25’ N and 28º 50’ N and longitude 13º 20’ W and 13º 52’ W and are separated by a strip of sea about 100 km from the Northwest edge of the African continent. Among the most interesting feature of the geology of the proposed Geopark appears the coexistence between historical eruptions in areas of relief declined by erosion and the existence of marine deposits with paleontological loads. The eruptions in Timanfaya took place between the years 1730 and the 1736 and represent a volcanic episode of the first order for its scientific interest, because it was one of the biggest basaltic volcanic events, the surface covered and for the presence of ultramafic and sedimentary xenoliths and geochemical variation of its lavas.

KEY WORDS: Historical eruptions, hydromagmatic episodes, Lanzarote Geopark Project, marine paleontological site, massif, Timanfaya.

IDENTIFICATION OF THE AREA

The suggested area in Lanzarote Geopark Project circumscribe to the whole island of Lanzarote and its small islands or La Graciosa, Montaña Clara, Roque del Este, Roque del Oeste and Alegranza, located in the north and known as “Archipielago Chinijo”. They are administrative integrated in Lanzarote.

Lanzarote island’s surface area is 862 km^2. However if we add Archipielago Chinijo’s surface area, 44 km^2, it goes up to 906 km^2 (Gonzalez et al., 2002).

In its oval shape, Lanzarote has two mountain ranges, Famara in the north and Ajaches in the south. Island’s oldest geologic materials can be found in both massifs. There’s also a minor mountain ranges throughout the island, mostly orientated to NE-SW. Finally we should highlight a 200 km^2 area, “Campo de Fuego de Timanfaya” where eruptions took place from 1730-1736 and makes up around a quarter of the island’s surface area (González et al., 2002).

The highest peak is “Las Peñas del Chache” rising to 670 m above sea level within Famara mountain range.

In 1402, commanded by the French Normand Jean de Bethencourt, Lanzarote became the first of Canary Islands to be conquered, founding the first settlement in the area known as Rubicon (Alemán, 2007).

With a population in 1587 of 600 people and density of only 0,71 inhabitants per km^2, it was a hostile and war area throughout the years (Gonzalez et al., 2002). In 2012, census showed a total of 142.132 inhabitants and a density of 168 inhabitants per km^2 (Instituto Canario de Estadística, ISTAC).

The island’s capital, Arrecife, is home to most of the population. In 2012, census showed a total of 56.284 inhabitants (Instituto Nacional de Estadística, INE). Lanzarote is divided into the following seven district councils: Teguise, Haría, Tías, San Bartolomé, Arrecife, Yaiza and Tinajo.

Tourism is the most important element to the economy of Lanzarote followed by construction, industry and finally agriculture (ISTAC).

The island is part of the Autonomus Community of the Canary Islands, in Spain. Each of the sever major islands is ruled by an island council named Cabildo Insular.

PROPOSED GEOPARK LOCATION

The territory offered as a Geopark comprises Lanzarote Island and the small islands of the “Archipiélago Chinijo”, all located between the following geographic coordinates: latitude 29º 25’ N to 28º 50’ N and longitude 13º 20’ W to 13º 52’ W.

Lanzarote is the northern most island in the Canary Islands and along with Fuerteventura constitute the most eastern islands, separated from African continent by a belt of sea of about 100 km distance between the nearest points.

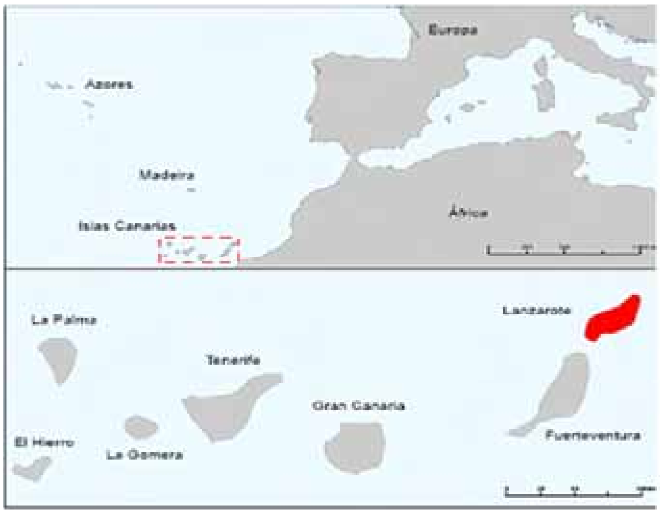

Fig. 1 –Location of Lanzarote. Observe its proximity to the African continent.

Fig. 2 –Ajaches Massif is the place with the oldest subaerial materials on the island and it corresponds to an area dismantled by erosion

PHYSICAL DESCRIPTION OF LANZAROTE GEOPARK PROPOSED

Lanzarote is worldwide known as "The island of the volcanoes", largely because of the continuous eruptions that took place in the years 1730-36. It has to be taken into consideration that along with Fuerteventura is one of the oldest island in the archipelago. Aged and lowered by erosion, evolved forms of relief and newly created rocks predominate in Lanzarote.

Furthermore, the desert climate with consequent lack of rain makes volcanic structures be preserved as in a museum (González, et al., 2002).

EXISTING ROCK TYPES IN THE AREA PROPOSED AS A GEOPARK

With regard to the petrologic characteristics of volcanic rocks in Lanzarote it has to be highlighted a chemical anomaly as high silica content shown in some of its basalts. Of particular importance are xenoliths enveloped in recent lava flows. Thanks to these xenoliths trapped by the ascent magma, we can know the insular substrate in great depth, this is a depth of 70 km where they are generated.

Trachyte dikes can be also found among the volcanic rocks in the southern part of island. In addition to the volcanic rocks, sedimentary formations like: eolian sand, sand and pebble beaches, conglomerate and sand and ravine deposits (Araña & Carracedo, 1979, Aparicio et al., 2000, IGME, 2005).

GEOLOGICAL HISTORY

Like the rest of Canary Islands, Lanzarote has a submarine growth period on which only indirect data are given through a geothermal exploration at 2.700 m depth in the 70s last century. This exploration has enabled to identify last sediments (Paleocene Middle-Late) deposited before the first submarine volcanic emissions (Oligocene Middle-Early). The lithology and stratification of these sediments indicate a sedimentary environment typical of the great depths (turbidites) and the approximate age of 60 million years which mark the beginning of the seabed rising (Araña & Carracedo, 1979; Gonzalez et al., 2002; Carracedo, 2011).

Lanzarote and Fuerteventura rise as a single volcanic complex above a seabed of 3.000 m depth in the western margin and 1.500 m in the eastern margin corresponding to the the African border and orientated to N35º-E40º (IGME, 2005), according to a possible fracture parallel to the coast of the African continent (González et al., 2002).

First subaereal constructive period occurred between 15,5 m.y. and 13,4 m.y. producing Ajaches Massif southeast of the island. This was followed by an erosive period shaping the relief.

Volcanic activity in Famara begun 10,2 m.y. ago in three pulses (10,2 m.y. to 8,3 m.y.; 6,7 m.y. to 5,3 m.y.;3,9 m.y. to 3,8 m.y.) separated by inactive intervals characterized by geological discordances.

At the same time the middle unit of Famara Massif was forming, volcanism emerged in different points of the island, finding materials around 6 m.y. without producing bid edifices but building first they built the first land-based bridge between northern island or Famara and southern island or Ajaches. Once these emissions finished, a period of dismantling erosion started, going on until 2,5 m.y. ago.

A second eruptive cycle in the Early Quaternary built emitting centers in the Famara and Ajaches borders. From 700.000 b.p. to the present, volcanism reinforces its fissural nature in such a way that the different emitting centers are building according to a linear arrangement or in chain clearly orientated northeast-southwest, particularly between the two ancient massifs, transforming the former coastline gaining more insular territory. Fissural nature stays until nowadays (Araña&Carracedo, 1979; Araña et al., 1997, Anguita et al., 2002; González et al., 2002; Romero, 2003; IGME, 2005;

Barrera et al., 2010: Carracedo, 2011).

The eruptions that took place in Timanfaya between 1730-1736 represent a volcanic events in historical times.

Among the aspects distinguished from the eruption it can stand out it's the duration of almost seven years, the covered area with approximately 200 km^2 and the volume emitted of more than 1 km^3 using different mouths aligned on a fracture of 14 km. Also is important to emphasize the geochemical variation of these lavas and the presence of ultramafic and sedimentary xenoliths.

The last eruptions on the island were in 1824 with three mouths opened up on a fracture (Araña et al., 1997). Lanzarote also show marine deposits with fossil fauna. These deposits are attributed to different glacioeustatic marine episodes mainly Pleistocene episodes. Three fossil species (*Saccostrea chili, Nerita emiliana and Strombus coronatus*) characterize all the marine deposits from southern Lanzarote (Meco, 2006).

Other two curious marine sedimentary deposits in an eminently volcanic territory are a Mid Pleistocene tsunami at Piedra Alta, along the southwestern coast. It's a deposit twenty meters above the present sea level displays bathial and circalittoral marine species, disorderly mixed with terrestrial elements, possibly a tsunami caused by a giant landslide in the nearly Famara Massif (Meco, 2006). And on the other hand the fossils of large size eggs found in the northern part of the island (source of Gusa) from the Miocene (Meco, 2003).

GEOSITES WITHIN THE PROPOSED GEOPARK

Currently there isn't any official list where Geologic interesting points can be located. Mining and Geology Spanish Institute (IGME) has defined a number of "Geologic Interest Points", such "Points" are defined as areas though. Hence, it's one of the objectives of the candidacy of Lanzarote as European Geopark to establish a complete list where all those exact place known for their special characteristics allowing to interpret and evaluate the geological processes that have acted in that area included.

However those areas defined by the IGME are mentioned

Fig. 4 –El Golfo is a submarine volcano formed in shallow waters.

below:

ARCHIPIÉLAGO CHINIJO

Northern islets of Lanzarote. Best place to study the early growth stage of a volcanic island (Nuez et al., 1997) .

HYDROMAGMATIC EPISODES OF LANZAROTE

Examples of the eruptive processes occurrence generated by the interaction between water and magma, in the areas closed to the coast. Therefore, in some cases they are indicators of the paleogeographic location of the coast.

MALPAÍS DE LA CORONA

Indicates in a single eruption the typical Quaternary morphologic eruptive features of the island.

MARINE ABRASION SURFACE AND RAISED BEACHES

Vertical movements of the island, are recorded in the different layers of these deposits on different heights above the current sea level. Marine deposits, some of them with a great variety of species, are visible in all of them.

Fig. 3 –Montaña Clara (to the end) and Roque del Oeste islets. The sea has destroyed part of the Montaña Clara Caldera. Roque del Oeste is formed by two lavas.

Fig. 5 –The eolian sand field moves around the island in a corridor northwest-east.

Fig. 6 –Timanfaya National Park. Lava field with fissure characteristic eruption.

EOLIAN SAND FIELD OF "EL JABLE"

Noted for its landscape, geomorphologic and tourist value. It is also interesting of Paleoclimatology aspects knowledge of the island's late Quaternary.

HISTORICAL ERUPTIONS OF TIMANFAYA

The best historical volcanism referent in Canary Islands (IGME, 2005)

FAMARA MASSIF

An ancient volcanic massif, quite dismantled where external processes have acted profoundly changed its initial morphology.

Fig. 6 An ancient volcanic massif, quite dismantled where external processes have acted profoundly changed its initial morphology.

ACKNOWLEDGMENTS

I thank all the co-workers of the Environmental Service, Departament of Historic Heritage and the House of Volcanoes of the Cabildo Insular de Lanzarote and D. Luis Pascual González (P.N. Timanfaya) for all the cooperation received. I especially wanted to thank corrections in the translation and methodology made by Laura Becerril Carretero, Alejandro Martínez García and Lucía and Remedios Mateo Mederos and of corse thanks to family Armas-Mateo.

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Geological map with thematic elements and submerged landscapes map of national Park of Cilento, Vallo di Diano and Alburni - European and Global Geopark: an example of using carg project data

Muraro C. ([a]), Papasodaro F. ([a]), Lettieri M. ([a]), Guida D. ([b]), Aloia A. ([c]) & Todisco F. ([d])

([a]) Geological Survey of Italy/Land Protection and Georesources Department – Italian National Institute for Environnement Protection and Research (ISPRA)
([b]) Department of Civil Engineering – University of Salerno
([c]) National Park of Cilento, Vallo di Diano and Alburni – European and Global Geopark
([d]) Via IV Novembre, 4 - 80053 Castellammare Di Stabia (NA)

ABSTRACT

The Geological map with thematic elements and submerged landscapes map of National Park of Cilento, Vallo di Diano and Alburni - European and Global Geopark, scale 1:110,000, has been realized through the collaboration between the Geological Survey of Italy/Land Protection and Georesources Department – Italian National Institute for Environnement Protection and Research (ISPRA) and the National Park of Cilento, Vallo di Diano and Alburni – European and Global Geopark. The map was carried out through a reasoned synthesis of CARG Project data contained in the 1:50,000 scale, n. 502 Agropoli, n. 519 Capo Palinuro, n. 520 Sapri geological sheets, currently being completed, and n. 503 Vallo della Lucania (APAT, 2005) and n. 504 Sala Consilina (ISPRA, 2010) geological sheets. This map strongly highlights the potential application of the CARG Project. It is accompanied by a detailed legend that gives informations about the lithostratigraphic units cropping out within the Geopark. The map has been enriched with the geomorphological and hydrogeological elements which has been considered as more relevant. In addition, the Geological map has been completed with a detailed insert map, at 1:30,000 scale, describing geological-geomorphological and bionomic features of the marine areas facing the Park.

KEY WORDS: Geopark, CARG Project, Southern Apennine, Geological map, Submerged landscapes map.

PURPOSES

The knowledge of the territory as a whole both in terms of physical environmental aspects of the geological and geomorphological context and in terms of compatibility between them and the potential transformation of land use is essential for managing the delicate environmental balance. Data acquisition aimed at forecast involves a significant commitment because it is based on activities and systematic longlasting actions. It requires detailed surveys, evaluation, data processing and analysis. These are necessary for organically structuring a wealth of knowledge to support any initiative, intervention and precise action to safeguard the environment and ensure public safety with respect to the effects of natural disasters.

The cartography project of the New Geological Map of Italy at 1:50,000 scale- CARG Project founded and carried out by the Geological Survey of Italy (SGI) falls within this framework. The aims of the CARG Project is to achieve a basic knowledge of the territory as essential tool to initiate actions aimed at environmental protection and planning.

The National Park of Cilento, Vallo di Diano and Alburni, that has recently received the award of "Geopark" and was included in the European and Global Geopark Network under the auspices of UNESCO, has proposed to the SGI a cooperation aimed to realize a Geological map of the Park area at an appropriate scale to allow an overview of the geology of the Park. The SGI has welcomed the initiative also considering the opportunity to point out one of the possible uses of CARG Project data.

The very complex geology of the Park has been interested over the years by numerous studies and is still under debate for some controversial aspects. One of the most important result of the CARG Project consisted in having favored the coordination at national level of geological sheets, through scientific meetings promoted by the Geological Survey of Italy to reach shared solutions on the different geological interpretations or at least on aspects of cartographic relevance.

In this context have been produced the 1:50,000 n. 502 Agropoli, n. 519 Capo Palinuro, n. 520 Sapri geological sheets resulting from the agreement between SGI and the Campania Region (Law 226/99), currently being completed, and n. 503 Vallo della Lucania (APAT, 2005) and n. 504 Sala Consilina (ISPRA, 2010) geological sheets - object of an agreement between the SGI and the University of Naples Federico II (Law 438/95). These geological sheets have formed the basis for the realization of the *"Geological Map with thematic elements and submerged landscapes map of Cilento, Vallo di Diano and Alburni Park"*, at scale 1:110,000. For the areas that were not "covered" by the 1:50,000 CARG Project, data were recovered from the 1:100,000 n. 198 Eboli (SGI, 1970), n. 199 Potenza (SGI, 1969) and n. 210 Lauria (SGI, 1970) geological sheets.

Through a reasoned synthesis of the abovementioned sheets and contents of their explanatory notes we could produce an original map with both applicative and informative purposes. In addition, the map has been enriched with the most significant geomorphological and hydrogeological features along with information concerning the archaeo-zoological and geological heritage of value, including some geological sites that have been inventoried by the Park and are currently in the process of being formalized, according to the ISPRA guidelines. The map has been completed with the drawing and description of the geological-geomorphological and bionomic characteristics of the marine areas facing the Park.

Also this latter elaborations have been carried out starting from the geological survey of marine areas included in the abovementioned CARG sheets; submerged areas survey has been made possible thanks to co-financing made available by the Campania Region, in order to complete the geological maps CARG already in progress: this insight represents the most qualifying and distinguishing features of the Campania CARG Project.

This Geological map therefore represents the official reference for the institutional activities of the Park body, as well as a tool aimed at developing the scientific and popular knowledge of the geology of the park within a wider audience.

METHODOLOGIES

The main criterion adopted for the production of the summary Geological map and for the organization of the Legend was to divide the different lithotypes and deposits outcropping in the Park's territory according to their geodynamic context and depending on the time of their deposition with respect to the formation of the Apennine chain, i.e. before, during or after the orogeny. Therefore it was necessary to homogenize the amount of data available and their different interpretations and to make interpretive choices to unify the different lithostratigraphic units, based on the criterion adopted and on the map scale. The lithostratigraphic units were classified as PRE-OROGENIC, SYN-OROGENIC and POST-OROGENIC units. The deposits of the geological substrate (pre- and syn-orogenic) were further subdivided according to their palaeogeographic domain (internal units and external units, see discussion below) and depositional environment (pelagic basin, slope, carbonate platform/ramp, foredeep basin, thrust top basin).

For the Quaternary deposits (post-orogenic units), characterized by a wide variety of lithologies, categories of deposits based on the process of origin were defined; marine, beach and aeolian deposits were grouped on the basis of their depositional environment (coastal deposits). In terms of age, the deposits were broadly differentiated into two groups, old and recent/current, the latter comprising deposits that preserve morphologies clearly related to their process of origin, and which are directly linked to the evolution of the relief currently observable. For consistency with the geological sheets mentioned above, the ages here reported do not take into account the recent changes mentioned in the chronostratigraphic scale (Gibbard *et al.*, 2010), which have lowered the Plio-Pleistocene boundary at the base of the Gelasian.

In order to facilitate the reading of the map, the codification of the mapped units and the relevant elements of the Legend was performed by numbering the lithologies, facies associations and/or deposits. The lithostratigraphic and/or sinthemic unit names used in the CARG Project are shown in brackets in the descriptions of the Legend, in order to facilitate further study by the reader. For each Legend's unit a brief description of the lithology, thickness, lower and upper boundaries, detailed depositional environment, when possible, and age is reported. In the Legend, the units have been described from top to bottom, from the youngest to the oldest, respecting, as much as possible, the order of the overlapping geometry. In this way, the unifications and the divisions of the Legend also take into account the major geological events of regional importance that occurred over time.

The map is supplied with a Tectonic scheme representing the emplacement of the main tectonic and stratigraphic units (see discussion below) consisting of deposits formed in different geodynamic settings and then involved in the compressive deformation (e.g. the Alburno-Cervati-Pollino tectonic Unit which includes both pre-orogenic carbonate deposits and syn-orogenic foredeep deposits). The scheme represents a further synthesis of the data reported in the map and provides more complete information on the tectonics.

GEOLOGICAL SETTING

The Cilento, Vallo di Diano e Alburni National Park encloses an internal sector of the Southern Apennine chain whose current geological setting is the result of a complex series of tectonic events occurred between the Lower Miocene and the Pleistocene. The Southern Apennines chain is an east-verging nappe complex, originated from the interaction between the African plate, the European plate and other microplates. The propagation of the orogenic deformation spread from West to East affecting more and more external paleogeographic domains of the ancient Tethys Sea. The study of the deposits outcropping in the Southern Apennine chain supports the hypothesis of a complex Mesozoic-Tertiary palaeogeography characterized by the presence of carbonate platforms and pelagic basins. Although the debate on their number and extension is still ongoing, a palinspastic reconstruction of the area considers the sequence of a Liguride-Sicilide oceanic basinal domain, the Campania-Lucania platform (or internal carbonate platform), the Lagonegro basin, the Abruzzi-Campania platform (or external carbonate platform), the Molisano basin and the Apulia platform.

During the Lower Miocene, a first compressive phase determined the stacking of the more internal units (Ligurids), forming an accretionary wedge sutured in the Middle Miocene by the deposition of a thrust top succession (Cilento Group). Later, at least since the Tortonian, the internal units overlapped the external units, consisting of carbonate platform domains. In the Upper Miocene, the migration of the chain-foredeep-foreland system progressively involved the external units by determining the overlap of platform units over basinal units. Thrust tectonics was accompanied and/or followed by a transcurrent tectonic phase. The subsequent transcurrent and, above all, distensive Plio-Pleistocene events, related to the opening of the Tyrrhenian back-arc basin, led to the dismemberment and dislocation at different heights of the piles previously stacked and determined the present-day setting of the chain.

The geological setting and the subsequent unit descriptions are based on the abundant references mentioned in the abovementioned geological sheet (Sgrosso *et al.*, 2010; Martelli *et al.*, 2005).

POST-OROGENIC UNITS

These units include all of the marine-coastal and continental sediments deposited since the complete emersion of the area which, due to the absence of dated deposits, is presumably referred to the late Miocene, as suggested by morphoevolutive reconstructions made in the Mount Bulgheria area, where the presence of marine deposits provides important chronological constraints.

The Plio-Quaternary stratigraphic record is unevenly distributed within the territory of the Park; it is well represented in the small coastal plains, in the Mount Bulgheria area, where marine deposits of various ages (Lower Pleistocene-Present) crop out, and in the tectonic depressions of Licusati, Sanza and Vallo di Diano. In the remaining areas, particularly in the presence of the highly erodible terrigenous substrate, the occurrence of the Plio-Quaternary deposits is extremely irregular. Such irregularity could be largely due to the Quaternary uplift occurred in the area, which lead to the deepening of the river valleys and, in the long term, to the preponderance of the erosional processes over those of accumulation.

After the rise above sea level, the area was initially (Lower-Middle Pliocene) affected by the formation of several orders of palaeosurfaces, variously faulted and dissected and then occurring at various elevations (500 to 1000 m of altitude on Mount Bulgheria). The Centola Conglomerates *Auct.* wedged in these surfaces. The Centola Conglomerates are the oldest continental deposits cropping out in the Park (Centola Conglomerates, Rofrano and Faraone River *p.p.* synthems of the CARG sheets) and record the oldest events of denudation which interested the area, as corroborated by the lithology of the clasts formed essentially at the expense of the Cilento Group units, the highest units of the substrate in this orogenic area. These alluvial deposits are associated with an ancient hydrographic network whose original layout is difficult to reconstruct. The Centola Conglomerates *Auct.* have been dated by various authors to different ages, ranging from Pliocene to Lower Pleistocene, as they probably group several depositional stages.

In the Mount Bulgheria area, at the end of the Pliocene, the deposition of the Centola Conglomerates (Rofrano synthem) was followed by the formation of the Camerota-Licusati basin, a meridian trending structural depression filled mainly with lacustrine sediments (Licusati synthem). The age of the Camerota-Licusati basin lacustrine deposits is constrained by the age of the overlying marine deposits, dated as Santernian. The faults responsible for forming the Camerota-Licusati basin cut and displace at various altitudes the Centola Conglomerates.

From the Lower Pleistocene to the end of the Holocene, the coastline of the Park records marine-transitional sequences placed at gradually lower elevations and preserved mainly in the area of the Mount Bulgheria promontory, between Agropoli and Ogliastro Marina and in Palinuro. The deposits of each cycle consist of facies typical of different sub-environments of the coastal depositional system: beach to infralittoral sands and calcarenites; conglomerates, gravels and calcarenites, in places cross-bedded, with bioclasts of beach depositional environment; massive to cross stratified aeolian sands. Deposits related to the oldest transgressive events (Camerota and Lentiscosa synthems) crop out in the Mount Bulgheria area between the current coastline and an elevation of approximately 400 m a.s.l.; they are disjointed and arranged at various altitudes due to extensional tectonics and the concomitant regional uplift. The facies sequences occurring at Palinuro and between Agropoli and Ogliastro Marina, both in outcrop and/or borehole, are instead related to transgressive-regressive cycles of the Middle Pleistocene-Holocene; they show a transition from lagoonal to beach and continental environments. The best exposures of the Middle Pleistocene deposits (Gulf of Policastro synthem) are in the Santa Maria di Castellabate area, along the beach of Le Saline, north of Palinuro and Lido Ficocelle; according to the CARG cartography, the deposits date back to the stage 7 of the isotope stratigraphy. The most significant Upper Pleistocene outcrops (Tyrrhenian, stage 5 of the isotope stratigraphy) are present in the plain of Santa Maria di Castellabate, in the small bay of San Marco and in the area of Palinuro (Palinuro synthem). Upper Pleistocene marine deposits, partially covering a wide erosional plain, crop out near Punta Licosa.

Simultaneously, and in more internal areas, sedimentation of fluvial deposits took place; at first, river paths partially matched with those of Centola Conglomerates (Faraone River synthem) and then migrated to finally coincide with the current drainage network (Bussento River synthem; Vallone Secco subsynthem; Valle del Lambro synthem; alluvial terraces; current alluvial deposits).

The most common continental deposits consist of talus slopes and eluvial-colluvial deposits of various ages which are widely distributed throughout the whole area of the Park at the base of the slopes and inside the dolines and karst fields largely present on the carbonate reliefs. They may locally include torrential deposits and accumulations of ancient landslides that, as a result of the processes of remodelling and the presence of vegetation, no longer exhibit the typical morphological characteristics of landslide deposits. The widespread outcrop of argillaceous lithotypes and alternations of rocks with different degrees of competence led to the massive presence of landslide deposits which, however, because of their areal extent, are poorly represented in this map.

SYN-OROGENIC UNITS

A distinction was made between thrust top deposits, sedimented in more or less confined basins formed above the accretionary wedge, and foredeep deposits.

Thrust top deposits include a Middle Miocene sedimentary cycle, the "Cilento Group", deposited onto the already deformed internal units (Ligurids and the “Parasicilide terrains”), whose contact is stratigraphically unconformable with the underlaying group. The group includes: the Pollica sandstones (unit 17), consisting of arenaceous-pelitic turbidites interbedded with thin pelitic layers and sandstones up to a metre thick, dated as Middle Burdigalian-Langhian; the San Mauro Formation (unit 16), consisting of fine to coarse arenaceous-pelitic turbidites at the base, and an upward prevalence of arenaceous levels, dated as Langhian *p.p.*-Lower Tortonian *p.p.* and characterized by the presence of olistostromes and marly-calcareous megabeds ("fogliarine"; f1 and f2 key-beds in the map); the Monte Sacro conglomerates (unit 13), consisting of both crystalline and sedimentary clasts and dated as post Lower Tortonian deposits which constitute the coarse end member of the sedimentary cycle of the group. These units geologically characterize all of the western and coastal areas of the Park, uninterruptedly from Agropoli to Acciaroli, and further southward between Marina di Pisciotta and S. Nicola also forming the mountain reliefs of Mount Stella, Mount Sacro and Mount Centaurino, where basic rocks and pillow lavas are found in the olistostromes. The Albidona Formation (unit 15) also belongs to the group; this formation outcrops only in the south-eastern spurs of the Park and consists of arenaceous-pelitic turbidites and, subordinately, of calcareous-marly turbidites, Langhian *p.p.*-Lower Tortonian *p.p.* in age.

The Piaggine Formation (unit 14), consisting of Upper Tortonian calcirudites, calcarenites, arenaceous and pelitic-arenaceous turbidites, is a typical thrust top deposit whose sedimentation took place in a more or less confined basin and was strongly influenced by the synsedimentary tectonics; this unit indicates the ending of the sedimentation linked to the Miocene transgressive-regressive cycles which unconformably rest on both the foredeep deposits (unit 18) and the carbonate platform terms (units 27, 28, 29) of the Alburno-Cervati-Pollino Mounts succession.

The Middle Burdigalian-Langhian *p.p.* terrains of the Bifurto Formation (unit 18) belong to the foredeep deposits; this formation marks the definitive drowning of the carbonate platform, before the onset of the tectonogenesis. The formation, consisting entirely of turbidites, is widespread in the north-eastern portion of the park, where it crops out almost exclusively in structural and topographic depressions. The outcrops, whose thickness ranges from a few metres to a few hundred metres, are often found in tectonic contact with the underlying Trentinara Formation and onto the Cretaceous carbonate deposits, as a result of a décollement slip.

PRE-OROGENIC INTERNAL UNITS

The internal units represent palaeogeographic domains in which a pelagic basinal sedimentation occurred on a thinned continental or oceanic crust. In literature, these deposits, dated between the Eocene and the Lower Miocene, sometimes are improperly referred to as "flyschoid" because of the contributions by turbidity currents that characterize them in some portions. The exact location of these palaeogeographic units, certainly more internal than the Apennine external domains, is still under debate and these sequences have assumed the role of pre-orogenic structural-stratigraphic units in their own right and are known in literature as Ligurid Units (Nord Calabrese tectonic Unit), "Parasicilid terrains" (Castelnuovo Cilento tectonic Unit), Sicilid Units (Valle del Calore tectonic Unit) and are reported as such in both the Geological map and the Tectonic scheme. These successions outcrop extensively in Cilento and Lucania and are characterized by tectonic boundaries which are often difficult to interpret, since they were affected by polyphasic tectonics.

The Nord Calabrese tectonic Unit is largely widespread and constitutes the upper part of the well known "Ligurid Complex "; the unit consists of a basinal succession characterized by calcilutites and argillites, often silicified, with calcareous and mixed turbiditic contributions increasingly frequent, especially in the middle-upper portion (units 19-20, Crete Nere Formation, Saraceno Formation and Cannicchio sandstone), dated as Upper Bartonian-Burdigalian *p.p.*

The Castelnuovo Cilento tectonic Unit, consisting of shales, marls, arenaceous-pelitic and, rarely, carbonate turbidites (unit 21, shales of Genesio, marls and calcarenites of the Torrente Trenico, and Pianelli sandstones), is a pelagic basin/toe of slope succession fed mainly by silicoclastic turbidites. This unit geometrically underlies the Nord Calabrese Unit and is tectonically bounded at the base by deposits attributable to the Sicilid tectonic Unit. This unit crops out along the road from Mount Vesalo to the Trenico river, near Castelnuovo Cilento and in the area between Corleto Monforte and Laurino.

The Valle del Calore tectonic Unit consists of a sequence of shales and marls with intercalations of carbonate turbidites (unit 22, Mount Sant'Arcangelo Formation, upper “Argille Varicolori”, “Argille Varicolori” of Tempa Rotonda, Albanella sandstones), Eocene-Lower Miocene in age, which was deposited in a deep pelagic basin with a turbiditic supply. This unit is tectonically interjected between the "Parasicilid terrains" and the carbonate platform deposits of the Alburno-Cervati-Pollino Mounts Succession. These deposits crop up in little patches in the Northern and Southern areas of the Park.

PRE-OROGENIC EXTERNAL UNITS

The external units were deposited on a continental crust and are characterized by sedimentary successions of both Meso-Cenozoic carbonate platform/ramp and pelagic basin/slope facies.

Basin, slope and proximal basin deposits. The Mount Bulgheria Succession is formed by basin, slope/proximal basin deposits which constitute the inner edge of the Campania-Lucania platform, that is, the transition between the carbonate platform and the internal pelagic basins. These units crop out exclusively in the Southern portion of the Park.

The succession of Mount Bulgheria is characterized by a high variability of deposits indicating a continuous change in the depositional environments, from a carbonate platform, to slope/ proximal basin and pelagic basin, due to erosive and/or non-depositional phases and synsedimentary extensional tectonics. The succession is characterized at the base by Upper Triassic-Lower Jurassic *p.p.* carbonate platform deposits (unit 30, described below) that, following an extensional tectonics of the Lower Jurassic, pass into deposits of slope and basin facies of the upper Sinemurian-Aalenian, consisting of cherty calcilutites, calcarenites and marly limestones (unit 26, cherty limestones and marls of Mount Bulgheria). On the abovementioned deposits, rest strongly bioclastic deposits of both proximal and distal escarpment, referred to the Middle Jurassic *p.p.* and the Upper Cretaceous time interval (unit 25, oolitic and bioclastic limestones of Mount Croce del Calvario, ellipsactinia limestones and bio-lithoclastic limestones with rudists). The occurrence of a probable tectonic phase caused a change in the sedimentation style from a bioclastic facies to condensed pelagic deposits lacking of coarse clastic supplies from the platform (unit 24, basal part; condensed Scaglia) which evolve into purely basinal deposits, consisting of shales and marly limestones, with a fining- thinning and probably deepening upward-type stratigraphic trend (unit 24, middle upper part, shales and limestones of San Giovanni a Piro), Late Cretaceous-Burdigalian in age. The unit consisting of the Maastrichtian-Chattian limestones and shales of Roccagloriosa (unit 23) represents a basinal succession, heteropic with the Mount Bulgheria Succession, which is characterized by a higher supply of debris, particularly in the Cretaceous deposits, and greater thicknesses. These deposits outcrop exclusively in the Roccagloriosa area, in the Southern part of the Park.

The Mount Bulgheria (units 30, 26, 25, 24) and Roccagloriosa (unit 23) Successions form the Mount Bulgheria tectonic Unit in the Tectonic scheme.

Carbonate platform and carbonate ramp deposits. The oldest carbonate platform deposits consist of Upper Rhaetian gray and saccharoidal dolostones (30, lower part), characterized by a facies indicating restricted circulation. These deposits characterize the basal portion of the Mount Bulgheria and the Alburni-Cervati-Pollino Mounts Successions. Above them rest the Mount Crivo limestones (30, upper part), about 400 m thick, suggesting the occurrence of the sedimentation in a Lower Sinemurian, open hydrodynamic circulation, carbonate platform. Both these deposits represent the "palaeoplatform" preceding the Early Jurassic tectonic phase that led to its dismemberment and the following differentiation in platform, slope and pelagic basin areas.

The subsequent carbonate platform and ramp deposits, spanning from Lower Jurassic *p.p.* to Lower Miocene, belong exclusively to the Alburno-Cervati-Pollino Mounts Succession which reaches a total thickness of about 4000 m and outcrops extensively in the Northern and Eastern areas of the Park. This succesion consists of both internal platform deposits (unit 29, Cladocoropsis and Clypeina limestones and requienid and gastropods limestones), consisting of Bathonian *p.p.*-Cenomanian *p.p.* calcarenites and calcilutites and carbonate margin deposits, represented by Upper Albian *p.p.* - Maastrichtian *p.p.* gray-light brown calcarenites and calcilutites with rudists (unit 28, rudist and orbitolinid limestones and radiolitid limestones). The majority of the carbonate reliefs in the Park's territory (Alburni Mounts, Mount Cervati, Mount Chianello - Soprano, Mount Motola-Cocuzzo) are formed by Cretacic deposits. After the Paleogene *hiatus*, the tertiary deposits of carbonate ramp facies, open shelf-type and subsequently Miocene carbonate ramp deposits dominated by a foramol-type association (unit 27, Trentinara Formation, Cerchiara Formation and Roccadaspide Formation) were deposited on top of the Cretaceous units and were separated from the underlying deposits by a transgressive angular unconformity. The Alburno-Cervati-Pollino tectonic Unit shown in the Tectonic scheme includes both the pre-orogenic carbonate deposits (units 30, 29, 28, 27) and the foredeep deposits of the Bifurto Formation (unit 18).

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Geopark projects in Finland

Nenonen J. ([a]) & Tervo T. ([b])

([a]) Geological Survey of Finland, P.O.Box 1237 (Neulaniementie 5), 70211, Kuopio, Finland. E-mail: jari.nenonen@gtk.fi
([b]) Geological Survey of Finland, P.O.Box 1237 (Neulaniementie 5), 70211, Kuopio, Finland. E-mail: tapani.tervo@gtk.fi

NATIONAL PRINCIPLES AND FACTORS OF THE GEOPARK-PROJECTS IN FINLAND

The Geological Survey of Finland (GTK) has worked for several years with the clear aim of spreading knowledge about geological heritage to the public, to the tourism sector, and to places of education. GTK also provides professional help to the authorities and the local projects in their work to create new Geoparks in Finland. GTK also has a representative in the national Geoparks committee established in 2013. It monitors and instructs Finnish organisations who want to acquire Geopark status.

GTK's opinion is that at the national level we should avoid granting Geopark status to multiple areas with exactly same themes. In order to coordinate projects, four nationally significant and area-specific themes have been chosen from Finland's geological history to direct the planning of new Geopark candidates.

1) Finland's bedrock is among the oldest in Europe (age range 3.5–1.55 Ga). Rock types and their structures tell us about the development stages of our planet. There are also a number of historical mines in the area and some of them have been restored into tourist attractions.
2) Finland's soil mainly formed 14,000–10,000 years ago from loose soil types deposited by the melt water from the Fennoscandian ice sheets. In a way, geology is an indicator of the long-term development of the climate on the northern hemisphere. Some of the geomorphological formations created by the glacier have international significance.
3) The labyrinth created by approximately 56,000 lakes is a geological nature type unique to Finland. Water areas cover 10 per cent of Finland's area. The lake network has been created as a result of post-glacial rebound and related tilting of the land surface. The lake nature is complemented the Baltic Sea's land uplift coasts.
4) Originally mires accounted for a third of Finland's land area. Peatlands have been created during the last 10,000 years and together with northern Sweden's, Kola Peninsula's and the Republic of Karelia's mires they form a unique northern European string bog zone.
Rokua, the first Finnish Geopark, profiled as the **heritage of the ice age**, was accepted into the Global and European Geoparks Networks in October 2010 during the 9th EGN Conference in Lesvos, Greece. Rokua Geopark has increased interest in the Geoparks Network and its benefits to tourism in Finland. Currently, there are five areas in Finland that want to join the Geoparks Network. We aim to develop the areas so that they would meet the criteria of the esteemed and prestigious Geopark status in the coming years.

Ivalojoki River is known for its rich nugget gold deposits and the geology related to them. The area has a colourful history of 145 years of gold panning, which has been commercialized to attract tourists. The area is located within the region inhabited by the Sami people on the border of the arctic tundra. The area is also a reindeer herding area.

Pyhä-Luosto is a barren fell area. Its centre has been protected and declared a national park partly because of its geology. Its unique characteristics include sand and gravel layers that were deposited over 2 Ga ago and later metamorphosed into quartzite and conglomerate. Despite their age, the original structure of the layers has been preserved extraordinarily well. Today the area is one of the Finland's most popular hiking and skiing resorts.

Korouoma is a gorge valley some 30 km in length. In places, its slopes can be 130 metres in height. During the final stages of the last glacial period, the fracture formed in the 1.8 Ga-old granite acted as a huge meltwater channel. Nowadays, icefalls as high as 60 metres form on the slopes of the gorge in winter. The area is one of the best ice climbing locations in Finland. Along the bottom sediment plateau of the gorge is a hiking route where one can see among geology also remains of old historic farming.

North Karelia is a Geopark candidate because its heartland consists of Koli quartzite hill sequence that has been elected as one of the Finnish national landscapes. The area's bedrock and its local peculiarities provide a "window" into the Earth's development 2.8–1.8 billion years ago. The area also includes the most important mine in Finnish mining history. It has been carefully restored into a museum and commercialized to attract tourists. Old mining history is also visible in many geosites all over the area. One example of those are the iron works where lake iron was used as raw material for steel production.

Southern Saimaa is one of the most representative lake areas in Finland. It is located in the intersection of geological key sites where the Vuoksi River that regulated the development of eastern Finland's Lake District intersects with the arch-shaped Salpausselkä end formations. The Salpausselkä end formations were formed during the cold climate periods 12,500–11,500 years ago. When satellite images became more common, they were thought to be the most beautiful terrain formations created by glaciers on the northern hemisphere.

During the lake phases of Saimaa, humans arrived in the area. They were fishers and hunters. They left behind rock paintings which can be seen in Astuvansalmi. The Astuvansalmi rock paintings is the largest collection of rock paintings found in Scandinavia, comprising about 70 paintings. The oldest paintings were made about 3000–2500 BC. The Saimaa ringed seal (*Pusa hispida saimensis*) is among the most endangered seals in the world. The only existing population of these seals is found in Lake Saimaa. The population is descended from ringed seals that were separated from the rest when the land rose after the last ice age. The Saimaa ringed seal has been protected since 1955.

Fig. 1 – Today in Finland there is five areas with aim to join in European Geoparks Network.

Fig. 2 – Ivalojoki River, Pyhä-Luosto, North Karelia and Southern Saimaa, new geopark-kandidates in Finland.

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

Integrating intangible cultural heritage into the geopark; stories of the land, nature and lifestyles of the people of the Oki Islands Geopark

Nobe, K ([a]) & Sadkowsky, T ([b])

([a]) Oki Islands Geopark Promotion Committee, 24 Shioguchi Minatomachi, Okinoshima Town, Oki-gun, Shimane Prefecture, Japan. E-mail: oki-geopark.n@pref.shimane.lg.jp
([b]) Oki Islands Geopark Promotion Committee, 24 Shioguchi Minatomachi, Okinoshima Town, Oki-gun, Shimane Prefecture, Japan. E-mail: oki-geopark.n@pref.shimane.lg.jp

Document type: Article.
Manuscript history: received ………… 2013; accepted ………….. 2013; editorial responsibility and handling by Domenico Calcaterra.

ABSTRACT

In order to achieve the sustainable development of the geopark it is important to convey the value of the geopark in a way that is both comprehensible and appealing to a wide range of people. This paper will introduce the efforts of the Oki Islands Geopark to utilize the connections between the geological resources and the intangible cultural heritage of the geopark in order to create 'geostories' that a wide range of visitors to the geopark can understand and enjoy.

KEY WORDS: Oki Island Geopark, sustainability, intangible cultural heritage, connections

INTRODUCTION

In his keynote address at the 5th International UNESCO Conference on Geoparks at Unzen Geopark, Japan in 2012, Guy Martini addressed the importance of integrating intangible cultural heritage in geoparks for the sustainable development of the geopark region. In response to this, how best to incorporate intangible cultural heritage in geopark activities has become a topic for discussion in recent geopark meetings and symposiums in Japan. Unfortunately, Japanese geoparks have limited experience in this area, and while they have rapidly increased since their onset in 2009 (Watanabe, 2011), they are struggling to appeal to tourists who do not have a specific interest in geology. This situation is a result of a pervasive misconception in Japan that geoparks are solely a place to observe the geological features of an area. This constricted view of geoparks was likely propagated because the geoparks movement in Japan has been largely presented as an area in which geology can be used as a new resource for regional promotion. This has significantly limited the geopark's ability to appeal to those without a specific interest in geology.

The Oki Islands Geopark was fortunate to recognize this issue in the early stages of the geopark movement, and developed an approach that emphasizes the connections between the geological heritage, intangible cultural heritage and the ecological heritage of the geopark. This paper will introduce the efforts of the Oki Islands Geopark to integrate intangible cultural heritage into geopark activities, including the overall message of the geopark and the creation of 'geostories'. This approach is not only instrumental in raising the value of the other heritage of the geopark, but also enables a wider range of people to appreciate and comprehend the geological heritage of the geopark.

GEOPARK ACTIVITIES IN JAPAN

Preparation for geopark activity in Japan was commenced by a group of geologists in 2005, and in 2007 the Japan Geopark Association was established with areas striving to become geoparks at the center of the movement. In 2008, the Japan Geoparks Committee (hereafter JGC) was established in order to undertake site inspections for aspiring Japanese geoparks. Eventually, in 2009 the Japan Geopark Association became the Japan Geoparks Network (hereafter JGN), Japan's national network of geoparks (Watanabe, 2011). There are currently 25 geopark members of the JGN, five of which are members of the Global Geoparks Network (hereafter GGN) which functions under the auspices of UNESCO. There are also 18 aspiring JGN members. Altogether, this makes 43 active participants in the geoparks movement in Japan (Japan Geoparks Network, 2012).

Evidently, the geoparks initiative has spread rapidly around Japan. The reason for this can be identified in the following two points: a) effectiveness in stimulating regional rejuvenation, and b) effectiveness in promoting education about the region. More specifically, the first point refers to the rediscovery of resources in the region and the stimulation of economic activity such as geopark tours and products. The second point refers to fostering local people's love and pride of the region, development of human resources and creation of new areas of expertise, and connecting to educational facilities, such as schools and universities in the region.

However, despite the successes of geoparks in these areas, Japan's geoparks still have a major task on their hands. This task is attracting a wider range of visitors to the geopark, which is essential for achieving the long-term economic sustainability of the geopark (one of the pillars of the geopark's philosophy).

While education in schools and public education of the geopark has brought about an increase in the number of people utilizing previously neglected facilities, as well as an increase in field trips for students or geology specialists, in most cases a substantial increase in regular visitors to the geopark has not been achieved.

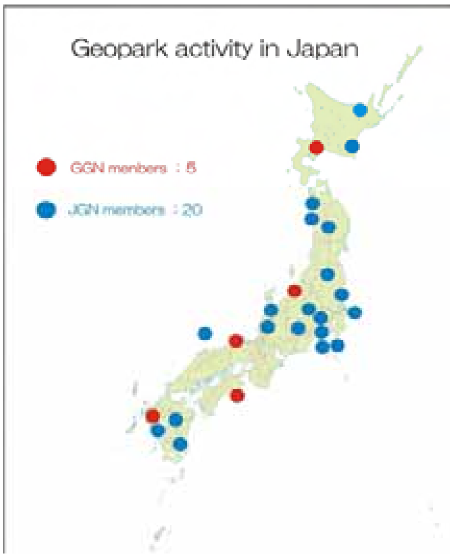

Fig. 1 – GGN and JGN members in Japan.

One reason for this may be a declining interest in earth sciences in Japan. Currently less than 3% of students study earth sciences in secondary school (Tamura, 2008). For the same reason, major tourism industry actors show reluctance to take on proposed geopark tours and commence the sale of geopark products, limiting the geopark's ability to extend its reach around the region. Also, while many tourists have heard about the geopark, this has not necessarily been their inspiration for travelling to the Oki Islands. Another reason is related to the formulation of 'geostories' in geoparks around Japan. The presence of such stories is a required component in the evaluation for geoparks aspiring to become members of the JGN, and as a result, geoparks in Japan actively construct geopark stories and geotours. However, these stories often only utilize the geological resources of the area, and consequently fail to appeal to many people. On the other hand, the approach of the Oki Islands Geopark is to encourage visitors to 'discover connections' between the geological, natural and cultural heritages of the geopark, and utilize geostories that identify the intricate relationships between them (Oki Islands Geopark, 2012).

APPROACH OF THE OKI ISLANDS GEOPARK

The Oki Islands Geopark is Japan's only volcanic island geopark. The islands are composed of four inhabited and around 180 uninhabited islands and islets nestled alongside the Japanese Archipelago. The geopark area also incorporates the surrounding marine environment as an element that is central to the way of life and industries of the Oki Islands people (Oki Islands Geopark Promotion Committee, 2011).

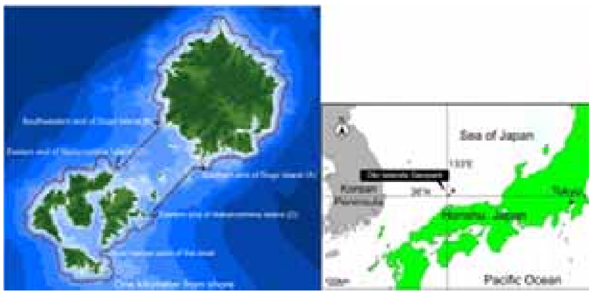

Fig. 2 – Oki Islands Geopark location and boundary

The islands have a long history. Archaeological artifacts reveal that people have been in Oki for at least 30,000 years (Tsutsumi, 2004). The islands also feature in the creation mythology of the nation's oldest written chronicles (the Kojiki written in 712, and the Nihon Shoki written in 720), and were designated 'islands of exile' in the ancient judicial system implemented in 724. For hundreds of years royalty and nobles (most notably two emperors during the middle ages) were exiled to the islands, leaving behind significant cultural legacies. The Oki Islands are also renowned for their spectacular coastal scenery and abundant nature. As of 1963, the islands were made part of the 'Daisen-Oki National Park' (Oki Islands Geopark Promotion Committee, 2011). As a unique place with a rich historical and natural landscape, tourism on the islands flourished. However, in recent years changing trends in tourism within Japan have brought about a continuous decline in the number of visitors to the islands and a negative impact on the economy and labor force.

Before the geopark initiative took place, in May 2003 a group of residents and organizations in the region formed an organization called the 'Machi-zukuri Group' (town revitalization group) which aimed to reverse this trend and stimulate the region and tourism industry. Believing that in order for regional development and promotion to take place, the people of Oki first needed to be educated about the value of their home and understand its importance, the Machi-zukuri Group commenced a series of lectures and ecotours about the nature, history, culture and geology of the islands for the local people (Oki Islands Geopark Promotion Committee, 2011). The central goal of this activity was to identify connections between the way of life of the local people, including intangible cultural heritage, and the natural resources of the islands to create stories that those without specialist knowledge could value and enjoy. This movement significantly influenced the core philosophy of the Oki Islands Geopark which emphasizes the connections between the geological history of the land, the unique ecosystem, and the lifestyles and traditions of the people (Fig. 3).

For those who do not initially have an interest in geology, the beautiful scenery, unique plants and animals, and ancient and diverse culture of the Oki Islands are windows into understanding the geological value of the geopark. Using this approach, visitors and locals alike obtain an enlightened understanding of the intricate connections between these elements, and discover the relevance of geology in our histories, culture and everyday lives. The geopark hopes that this knowledge will encourage people to actively help preserve and protect the geopark's heritage.

The geostories introduce geology by drawing links to the diverse and unique ecosystem and cultural landscape of the islands. In order to do so accurately, academic advisors in multiple faculties, including historians, biologists and anthropologists as well as geologists have been closely involved in the Oki Islands Geopark.

Fig. 3 – Philosophy of the Oki Islands Geopark

INCORPORATING INTANGIBLE CULTURAL HERITAGE INTO THE GEOPARK

One geostory of the Oki Islands Geopark revolves around *makihata*, a unique intangible cultural heritage of the Oki Islands. Makihata is a four-field livestock and crop rotation farming method that was developed in the Oki Islands during the Middle Ages, and continued up to 1970. Land for makihata accounted for all of the farming land on the islands, and fields for livestock and three different grains were rotated according to a four-year cycle. Makihata fields were divided by stone walls (Fujii, 1958).

Fig. 4 – Remains of Makihata Stone Walls and Makihata Cycle.

Crop rotation farming methods were utilized around Europe and Asia in the Middle Ages, however the four-field farming method is unique to Oki and no similar system took place in the rest of Japan (Fujii, 1958). Why was this system developed and carried out only in the Oki Islands? The following points demonstrate how this primary industry was a product of the combination of geological characteristics of the islands.

Geography

Firstly, the islands' remote geographical location in the Sea of Japan meant that they were very isolated from the mainland of Japan throughout history. Particularly during the winter, rough seas made importing food from the mainland unfeasible. The islands needed a food production system that would allow them to be entirely self-sufficient.

Topography

However, the volcanic islands, in particular the Dozen Islands (a caldera landscape), have a very undulating landscape with very little flat land. This meant it was necessary to divide all land usable for farming, including creating terraced fields.

Geology

The terrain of the islands features many steep rocky slopes and infertile soil. This land could be improved by rotating crops and utilizing livestock for fertilization. Cows and horses were placed on the fields as part of the crop-stock rotation cycle. The livestock was also used for labor and food.

Though Fujii (1958) discussed the significance of makihata early on, it had not been utilized as a main tourism or educational resource prior to the geopark. Aside from being precious cultural heritage of the islands, the geopark can draw connections between makihata and the formation of the Dozen Caldera; the geography, topography and geology to explain how this unique way of life was developed. This has enabled the use of the remaining makihata stone walls in the Dozen Islands as an important resource for education and tourism, and helped raise the value of what is important cultural heritage for the people of the Oki Islands.

Thus, by introducing the characteristics of makihata farming and then outlining the geological factors that gave birth to this system, the geopark can identify the relationship between this unique industry, and the geology of the islands in a way that visitors who do not have an interest in geology can understand and appreciate. For those who do have more of an interest in geology, their interest can be enhanced by further explaination of the volcanic activity and geological characteristics of the land. On the other hand, describing the formation and geology of the land without reference to makihata would fail to capture the interest of many people. In this way, the intangible heritage is an important resource for understanding the value of the geological heritage of the geopark, and its relevance to the lifestyles of the people.

DIVERSITY OF INTANGIBLE CULTURAL HERITAGE IN THE GEOPARK

Aside from makihata, a significant number of intangible cultural properties have been preserved on the Oki Islands. Of these, 24 have been designated Intangible Cultural Properties at the national, prefectural and municipal levels. These properties are closely related to the geological heritage of the islands, as is exemplified by the following points.

 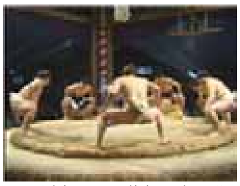

Fig.5–Renge-e-mai Dance & Oki Traditional Sumo

Classification	National	Prefectural	Municipal	Total
Number	2	7	15	24

Fig. 6 – Designated Intangible Cultural Properties

Obsidian and the exchange of culture in ancient times

Obsidian produced in Oki has been excavated and utilized to make stone tools since ancient times. Archaeological studies have revealed that Oki obsidian was transported throughout Japan, predominantly around the Chugoku Region (south-western Japan), from at least 30,000 years ago. It is thought that this culturally valuable rock was the medium for the cultural exchange of people and culture in ancient times, and culture from many different areas around Japan spread along this obsidian trading route (Tsutsumi, 2004).

Culture brought by the central government's system of exile

The Oki Islands were designated 'islands of exile' in the 8th century due to their remote geographical location. During the Middle Ages, nobles and royalty who had committed offenses or were on the losing side of battles were exiled here, bringing with them high-class culture from the capital. One cultural practice *ushi-tsuki*, or 'Bull Sumo', was said to have been introduced in order to entertain the exiled Emperor Gotoba in the 12th century. Later in the early modern period, lower class criminals were also sent to Oki and consequently culture of the common class was also added to the mix of culture on the islands.

Ancient culture preserved on the islands

Much of the intangible cultural heritage of the islands is a classical form that has disappeared from elsewhere in Japan but that has been preserved on the islands up until this day. One reason for this is the geographical environment of the islands. Though culture from the mainland was transmitted to the islands since ancient times for the above reasons, cultural influence from outside was comparatively minimal, allowing culture to remain uninfluenced by change on the mainland. One example of this is Oki Traditional Sumo, which has retained a societal significance not present in sumo in the rest of Japan (Kodama, 2009).

Aside from the geographical isolation of the islands, the mountainous terrain of the islands created by volcanic activity and subsequent erosion was also instrumental in fostering the preservation and development of culture. Numerous settlements around the island were historically very isolated from neighboring settlements by the surrounding mountains and sea. This isolation is thought to have limited interactions between settlements and fostered the high cultural diversity still present within the islands today. (Oki Islands Geopark Promotion Committee, 2011).

As evidenced above, the diverse intangible cultural heritage of the Oki Islands was born from the geological heritage of the geopark; the geology, geography and topography. These connections between intangible cultural heritage and the land can be integrated into geostories that both the local people and visitors are intrigued by, an important method for creating an appealing and enjoyable geopark for those without scientific knowledge of geology. Using this method, the Oki Islands Geopark has designated 16 different geosites identifying the connections between the geography and geology and the lifestyles of the people, and 16 identifying the connections between geography and geology and the ecosystem (Oki Islands Geopark Promotion Committee, 2012).

As an indication of the effectiveness of this method of appealing to visitors of the geopark, in recent years the islands have seen an increase in the amount of time visitors have spent in Oki. While tourism in Oki has seen an overall decline in visitors over recent years, there has been an increase in the length of stay to the geopark. Previously, visitors tended to stay in Oki for 2 nights, 3 days, whereas in recent years their length

Year	2007	2008	2009	2010	2011	2012
Nights Spent	32,984	35,503	36,476	36,618	36,613	37,185

Fig. 7 – Number of nights spent in the Dozen Area (Oki Islands Tourism Association, 2012)

Year	2007	2008	2009	2010	2011	2012
Visitor Numbers	135,505	134,767	131,235	131,672	130,543	126,684

Fig. 8 – Visitor numbers for the Oki Region (Oki Islands Tourism Association, 2012)

※1.2009：JGN Membership
※2.2012：GGN Site Inspection
※3.2011：Great East Japan Earthquake

of stay has increased to 3 nights, 4 days or 4 nights, 5 days.

This can be considered a success of the geopark's ability to provide stories revealing the connections between geological resources, ecosystem and the lifestyles of the people, which are appealing to a wide range of tourists.

Incorporating intangible cultural heritage into the geopark activities is instrumental in making the geological heritage of the geopark accessible to a wider range of people, and ensuring the sustainability of the geopark. The importance of this issue has recently been addressed within the Japan Geoparks Network, however adopting geopark philosophies that integrate this heritage has yet to be actualized in most cases. The Oki Islands Geopark efforts to incorporate intangible cultural heritage and natural heritage into geostories and the overall geopark theme provide insight into how this can be achieved.

ACKNOWLEDGMENTS

The authors would like to thank members of the Japan Geoparks Network and the European Geoparks Network for giving us the opportunity to introduce the initiatives of the Oki Islands Geopark. Also, our sincere thanks go to the many advisors of the Oki Islands Geopark Promotion Committee who have allowed us to come this far, and especially Kouji Yawata who has been the chief driving force behind the geopark movement.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

Ranking and Classifying the Azores Islands Geosites (Portugal)

Nunes J. C. ([a]) & Lima E. A. ([b])

([a]) Geosciences Department, Azores University / Azores Geopark, Portugal. E-mail: jcnunes@uac.pt
([b]) Geosciences Department, Azores University / Azores Geopark, Portugal. E-mail: evalima@uac.pt; evalima@azoresgeopark.com

ABSTRACT

Inventory, characterization and classification of geosites is a key issue on geoconservation, and the classification of geosites should be based on a quantitative approach, namely the evaluation of geosites relevance.

In the Azores Islands, the study of the 27 volcanic systems and the 1750 monogenetic volcanic centers existing in the territory, together with tectonic, paleontological and other features, were the starting point for the establishment of methodologies to identify, characterize and quantify the Azorean geodiversity and geosites. Among the 121 geosites of the Azores Islands, the work done identified 6 geosites of international relevance and 52 geosites of national relevance, which supported the implementation of the European and Global Azores Geopark, the 53rd territory of the EGN.

KEY WORDS: Azores geopark, geodiversity, geosites, ranking, relevance, volcanic landforms.

INTRODUCTION

A well supported geoconservation strategy should accommodate the following steps (Brilha, 2005): i) geosites inventory; ii) geosites relevance quantification; iii) classification of geosites; iv) conservation of geosites; v) valuing and awarness of the geological heritage, and vi) geosites monitoring.

In this work it is presented a general overview of the work carried out in the Azores Archipelago focused on the inventory of the Azorean geodiversity and geosites, its characterization and its quantification through the evaluation of the geosites relevance. That work started in 2005 and established the baseline for the implementation of the Azores Geopark (e.g. Nunes, 2005; Nunes & Costa, 2005; Lima & Nunes, 2006; Lima, 2007; Lima et al., 2009).

AZORES GEODIVERSITY AND GEOSITES

The Azores archipelago is located in the Atlantic Ocean, at the distance of 1815 km from the Mainland Portugal. The archipelago is formed by nine islands and several islets, which are dispersed along a strip with 600 km length and with a WNW-ESE trend (Fig 1). From a geological point of view, all the Azores islands are of volcanic origin and are oceanic islands that emerged from the surrounding seafloor due to the progressively piled up of submarine volcanic products, a process that should have started about 36 million years ago.

The Azores archipelago emerges from the Azores *Plateau* (or Azores Platform), an extensive area of irregular bathymetry, defined by the 2,000 meters bathymetric line and which makes the transitions to the surrounding abyssal seafloor (Fig 1.). In terms of the global geodynamics, the archipelago is located at the triple junction of the Eurasian, North American and African (or Nubian) lithospheric plates.

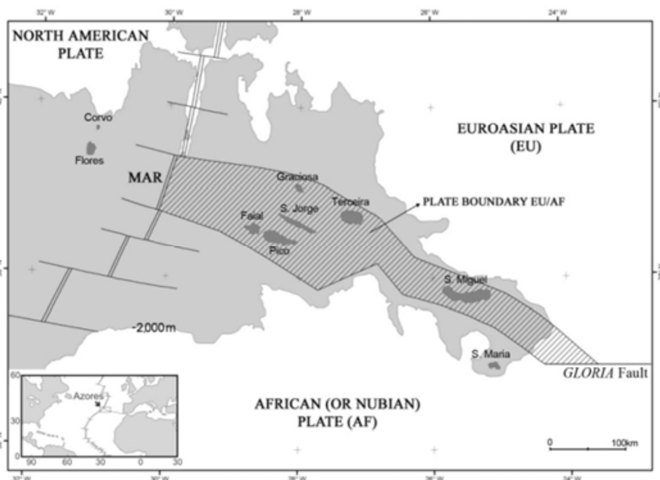

Fig. 1 – Azores islands general geotectonic framework. MAR: Mid Atlantic Ridge (in: Nunes et al., 2008). The 2,000 m bathymetric line defines the Azores *Plateau*.

On the Azores archipelago there are 27 main volcanic systems, 16 of those are polygenetic volcanoes (most of them silicic volcanoes with summit subsidence calderas) and 11 are basaltic fissural volcanic systems (Nunes et al., 2011) frequently in the form of more or less extensive volcanic ridges. Of these systems, 9 polygenetic volcanoes and 7 basaltic fissural volcanic zones are considered active (though in a dormant state) – Nunes et al., 2004) – located on São Miguel, Terceira, Graciosa, São Jorge, Pico and Faial islands and on the D. João de Castro Bank. Offshore, there are several active submarine volcanic ridges, like the Monaco Bank (South from São Miguel), Princes Alice Bank (SW from Faial) or the submarine volcanic ridge to East of Pico Island.

There are more than 1750 monogenetic volcanoes dispersed along the 9 islands (Nunes et al., 2011) either on the polygenetic volcanoes (on the flanks and inside the calderas), either on the basaltic fissural volcanic areas. These monogenetic eruptive centers include scoria and spatter cones, trachytic domes and *coul es,* tuff rings and tuff cones, *maars* and eruptive fissures Nunes et al., 2004) which frequently define local or regional volcanotectonic lineaments.

This wide diversity of landforms, together with the different types of rocks, structures and features represent the important geodiversity of the Azores islands. With should be emphasized that even being a small territory (2324 sq.km), the islands enclose a worth mentioning geodiversity, especially of volcanoes and volcanic landforms.

The inventory and characterization of the geosites that exist in the territory took in consideration its geological characteristics, the eruptive history of each Azorean island and the elements of geological heritage identified in the islands and in the surrounding seafloor (Lima, 2007). Together with the intrinsic knowledge of the Azores territory, several national and foreigner researchers with assignments about the Azores in several areas have also contributed to this inventory (e.g. Gaspar, 1996, Madeira, 1998, Guest et al., 1999), which resulted in a sustained and wide approach, although open to improvements.

The work done allowed the identification and characterization of 121 geosites spread over the nine islands and the surrounding seafloor which ensures the representativeness of the geodiversity of the Azores and reflects its geological and eruptive history of about 10 million years. From these, 57 geosites were selected as priority for the development of geoconservation strategies and for the implementation of valuing actions at the aim of the Azores Geopark. These are distributed by Santa Maria (5), São Miguel (10), Terceira (7), Graciosa (5), São Jorge (5), Pico (8), Faial (6), Flores (6) and Corvo (3) islands, and the Azores Plateau seafloor (2).

TYPES OF GEOSITES

Given the wide geodiversity of the Azores archipelago, the sites identified in the territory were grouped in different categories, depending on its geomorphological, geological and volcanological characteristics (Table 1). For the volcanism and volcanic landforms aspects it was generally adopted the classification of Woods (2009) – Table 2.

Table 1 – Categories established for the Azores geosites.

Sea cliffs
Calderas
Volcanic caves
Fields of scoria and spatter cones
Surtseyan tuff cones
Volcanic ridges
Quaternary deposits (e.g. beaches and slope deposits - “fajãs”)
Prismatic and spheroidal jointing
Domes and *coul es*
Historical eruptions
Sub-volcanic structures (e.g. necks and dykes)
Tectonic structures (e.g. faults and *grabens*)
Lava deltas (or lava “fajãs”)
Weathering phenomena/mud deposits - “barreiros”
Fossiliferous deposits
Volcanic lakes
Coastal lagoons
Pahoehoe lava fields - “lajidos”
Maars
Fluvial valleys
Polygenetic volcanoes
Areas of hydrothermal activity
Others

Table 2 – Classification of volcanoes and volcanic landforms. Adapted from Woods (2009).

Monogenetic landforms and fields • cinder or scoria cones, (Surtseyan) tuff cones, and (Taalian) tuff rings • maars (subaqueous/submarine) and diatremes • intra- or subglacial volcanoes: tuyas (table mountains) and mobergs • endogenous and exogenous domes, and coulées • lava flows and fields, including small scale lava flow forms • continental flood basalts, plains and plateaus basalt provinces • ash flows and ignimbrite sheets, plains and plateaus
Polygenetic volcanoes and calderas • Hawaiian shields; Galapagos, Icelandic, and Scutulum-type shields • Stratovolcanoes: simple with summit crater, composite with sector collape scar and/or a caldera; compound or multiple volcanoes • intermediate-silicic multivent centres that lack a central cone; rhyolithic centres; silicic volcanic lava field with multiple domes and calderas • caldera types: explosion (Somma), collapse-explosion (Krakatao), collapse of Hawaiian shield volcano, collapse in basement and resurgent caldera (Valles), large and complex resurgent calderas (Toba) • volcano-tectonic depressions (Taupo Volcanic Zone)
Volcanic landforms resulting from eruptive and/or erosional processes • avalanche caldera from a flank failure of magmatic, gravitational, or mixed origin • erosional calderas (e.g., Haleakala, Maui; La Reunion cirques)
Volcanic landforms resulting from denudation and inversion of relief • eroded cone (parasol ribbing), eroded pyroclastic-flow deposit and sheet • sub-volcanic small scale forms: necks, culots, dykes, sills • eroded lava flow, inverted relief and planeze/mesa • roots of palaeo-volcano, cauldron, and hypovolcanic complex
Morphological changes in volcanic-surrounding landscapes • volcano construct and induced change in drainage pattern at

a regional scale
• drainage blockage, avulsion, impoundment and lake-breakout, etc.

RANKING AND CLASSIFYING THE AZOREAN GEOSITES: MAIN RESULTS

To quantify the relevance of the Azorean geosites two complementary approaches were used. At first, the analysis of the relevance of the geosites was performed based on the work by Lima (2007), which adapted to the territorial and geological reality of the Azores archipelago the methodology developed by Brilha (2005). The analysis is based on a set of criteria grouped in three classes: (A) criteria intrinsic to the geosite, (B) criteria related to the potential use of the geosite, and (C) criteria related with the need for protection. Each criteria is quantified on a 1 to 5 scale, and the methodology allows to determine the level of relevance (international/national or regional/local) of the geosites.

In addition, it was done a second evaluation of the scientific value of the 121 geosites in the Azores archipelago and of its degree of vulnerability, taking into account criteria commonly used in several other European countries. This evaluation was done in the context of the Framework 26 (FR26) of the research project "Identification, characterization and conservation of geological heritage: a geoconservation strategy for Portugal", funded by the Portuguese FCT - Foundation for Science and Technology (2007-2010), and with Chief-scientist José Brilha (Minho University). The project sought to implement, in whole Portuguese territory, a methodology for the inventory and the classification of geological heritage, from the perspective of its geoconservation, valorization and dissemination (Brilha, 2010; Brilha et al., 2010).

With those approaches with was possible to rank the Azores geosites relevance and to sort a list with its Relevance Index (see Tables 3 and 4). The International, National or Regional relevance of the Azores geosites was established supported on those approaches, and also on the intrinsic value of the Azores geosites gathered from the scientific knowledge of the territory by the geopark's staff team.

Table 3. Azorean geosites of international relevance.

Relevance Index (FR26)	Geosite Description	Geosite Code	Main Remarks and justification
100	Mid-Atlantic Ridge and deep-sea hydrothermal fields	MAR 2	Global tectonic boundary
82,5	Caldera of Furnas silicic polygenetic volcano	SMG 1	Hydrothermal and hydrological system (mineral, thermal and CO_2-spring gas waters) richness
82,5	Pico Mountain polygenetic volcano	PIC 6	3rd highest central volcano on North Atlantic
77,5	Graciosa volcano caldera and "Furna do Enxofre" volcanic cave	GRA 1	Size, shape and genesis of the volcanic cave
75	Capelinhos volcano and "Costado da Nau" volcano	FAI 6	relevance of Capelinhos eruption for Volcanology science
75	Algar do Carvão volcanic pit	TER 1	Top ten worldwide volcanic cave in terms of mineral deposits (silica speleothemes)

Additionally it was considered since the beginning that the inventory of the geosites of the Azores archipelago should focus on those more representative, thus with at least Regional relevance. This way, potential geosites of Local relevance were not considered on the inventory, even such sites might be studied on future approaches.

Figures 2 and 3 show Monte Brasil (Terceira Island) and Ilhéus da Madalena (Pico Island) surtseyan tuff cones, two Azorean geosites of National relevance of the same category (see Table 1), even with a different Relevance Index (see Table 4). For the higher position of Monte Brasil on the ranking contributes its well preserved shape, the fact that this is the biggest Azorean tuff cone, the scientific values identified (e.g. geomorphological, paleontological, petrological, stratigraphic) and its high relevant cultural and historical values, located on an UNESCO WH site (Nunes et al., 2011).

Fig. 2 – Monte Brasil (Terceira Island) surtseyan tuff cones geosite, located in the Angra do Heroismo UNESCO World Heritage site.

Fig. 3 – Ilhéus da Madalena (Pico Island), the remaings of a tuff cone deeply affected by sea erosion.

FINAL REMARKS

Geoconservation, together with Education and Sustainable Development (through Geotourism) are the 3 pillars of geoparks, seen as an holistic approach to promote local communities and enhance development with respect with the natural/geological values.

In this context, the adequate implementation of geoconservation strategies, including the inventory, characterizations and quantification of geosites, ensures that the geological values existing in a territory are properly taken in consideration in the local and regional development policies. This is one of the main goals of Azores Geopark, considering that the volcanic landscapes are the best product of Azores Geotourism.

Table 4. Azorean geosites of national relevance.

Relevance Index (Lima, 2007)	Geosite	Geosite Code
49	Caldeira	FAI 1
48,3	Caldeiras Negra, Comprida, Seca e Branca	FLO 1
48	Praia Formosa e Prainha	SMA 15
47,3	Caldeira de Santa Bárbara e Mistérios Negros	TER 2
47,2	Caldeira do vulcão das Sete Cidades	SMG 2
47	Caldeiras Rasa e Funda das Lajes	FLO 2
46,8	Arriba das Fajãs dos Vimes – São João	SJO 1
46,8	Monte Brasil	TER 5
46,7	Ponta do Cintrão - Ladeira da Velha	SMG 19
46,4	Fajã Grande e Fajãzinha	FLO 3
46,3	Fajãs dos Cubres e da Caldeira do Sto Cristo	SJO 4
46,2	Caldeirão	COR 1
46,2	Caldeira do vulcão do Fogo	SMG 3
46	Pico Alto, Biscoito Rachado e Biscoito da Ferraria	TER 6
45,7	Fajã lávica e ilhéus dos Mosteiros	SMG 14
45	Graben de Pedro Miguel	FAI 2
44,7	Monte da Guia e Porto Pim	FAI 3
44,7	Ponta do Castelo	SMA 4
44,5	Ponta da Ferraria e Pico das Camarinhas	SMG 8
43,8	Salto da Farinha	SMG 22
43,8	Rocha dos Bordões	FLO 6
43,3	Morro do Castelo Branco	FAI 4
43,2	Vale da Ribeira da Cruz e Ponta da Caveira	FLO 11
42,8	Lajido da Criação Velha	PIC 15
42,8	Ponta do Carapacho, Ponta da Restinga e Ilhéu de Baixo	GRA 5
42,5	Vale das Ribeiras da Badanela e Além Fazenda	FLO 12
42,5	Lajido de Santa Luzia	PIC 5
42,5	Graben das Lajes	TER 9
42,3	Mistério da Urzelina	SJO 7
42,2	Ponta da Barca e Ilhéu da Baleia	GRA 3
42,2	Barreiro da Malbusca	SMA 11
41,8	Morro de Velas e Morro de Lemos	SJO 5
41,8	Morro das Capelas	SMG 15
41,8	Barreiro da Faneca	SMA 1
41,7	Baía do Tagarete e Ponta do Norte	SMA 9
41,3	Ilhéu de Vila Franca	SMG 6
40,8	Ponta Furada	FAI 9
40,5	Arribas da Serra Branca e Baía do Filipe	GRA 6
40,5	Fontanário da Ribeira Seca	SMG 26
40,3	Porto Afonso e Redondo	GRA 4
40,2	Ponta da Ilha	PIC 8
40	Pedreira do Campo	SMA 2
40	Poço da Pedreira	SMA 3
39,7	Porto de Vila do Porto	SMA 14
39,5	Costa Nordeste	FLO 7
39,3	Ilhéus das Cabras	TER 10
39,3	Ribeira do Maloás	SMA 5
39,2	Ilhéus da Madalena	PIC 4
39,2	Pisão - Praia (Água d'Alto)	SMG 18
38,8	Salto do Cabrito	SMG 23
38,8	Campo Geotérmico do Vulcão do Fogo	SMG 27
37,7	Cabeço Debaixo da Rocha	PIC 18

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ApuanGeoLab:
a new educational structure in the Apuan Alps Geopark (Italy)

Ottria G. ([a]), Amorfini A. ([b]) & Bartelletti A. ([c])

([a]) CNR, Institute of Geosciences and Earth Resources, via S. Maria, 53, 56126, Pisa, Italy; Apuan Alps Geopark, via Simon Musico, 8, 54100, Massa, Italy. E-mail: ottria@igg.cnr.it
([b]) Apuan Alps Geopark, "Research and conservation" Service, via Simon Musico, 8, 54100, Massa, Italy. E-mail:aamorfini@parcapuane.it
([c]) Apuan Alps Geopark, Direction, via Simon Musico, 8, 54100, Massa, Italy: E-mail:abartelletti@parcapuane.it

ABSTRACT

The Apuan Alps Geopark has planned and created ApuanGeoLab, an interactive museum aimed to disseminate knowledge about concepts in the Earth Sciences and to improve the understanding of the connection between the local geological evolution and global processes. Along the visit trail every visitor is a "geologist for a day", starting on a journey that provides an explanation of the physical and chemical mechanisms that shaped and modified the planet Earth in geologic time, from global to local, from "Gaia" to "Apua".

ApuanGeoLab, opened to the public in May 2013, is located in the village of Equi Terme, in the northern sector of the Apuan Alps Geopark. ApuanGeoLab is therefore a new structure that increases the attractiveness of the Cultural Park of the Equi Terme Caves, an existing network of tourist facilities based on nearby geosites and archeosites.

KEY WORDS: Apuan Alps, Earth Sciences, interactive museum.

INTRODUCTION

From the time of its admission to the EGN – GGN Geoparks Network, which took place in September 2011, the Apuan Alps Geopark began work to achieve the planned targets for the future. One of the main and primary goals relating to material assets was the establishment of the ApuanGeoLab.

The Apuan Alps Geopark includes an area characterized by a high value of geodiversity, the interpretation of which provides insight into many fundamental geological processes.

Therefore, with the aim of spreading the knowledge of its geological heritage and making the connection between the local geological evolution and the global geological processes easier, the Apuan Alps Geopark planned the ApuanGeoLab.

This is an educational laboratory where it will be possible to find out more about Earth Sciences concepts, reserving an important role for socially relevant issues, such as climate change, geological hazards and environmental degradation.

The ApuanGeoLab is designed first and foremost for students of primary and secondary schools and the hope is that it will be attractive not only for schools in the Apuan territory but also for other schools in Tuscany and surrounding regions.

However, all visitors to the Geopark, and in particular the Equi Terme area (Fig. 1), can enjoy the ApuanGeoLab that is designed to raise geological questions at different levels of knowledge and be an opportunity for visitors interested in geology to further their knowledge of specific aspects of geology.

In fact, the ApuanGeoLab is not an isolated structure in the territory but is a new facility that integrates and enriches the karst-palaeontological Park of Equi Terme Caves which offers multidisciplinary attractions, including a network of geosites

Fig. 1 – The village of Equi Terme (Fivizzano Municipality) which hosts the ApuanGeoLab.

Fig. 2 – The entrance of the ApuanGeoLab.

and archeosites.

The ApuanGeoLab is housed in a restored building, formerly used as a school, located in the small old village of Equi Terme, in the territory of the Fivizzano Municipality at the northern boundary of the Apuan Alps Geopark (Fig. 2).

Although small, the village hosts a train station on Lucca-Aulla line and therefore may represent a possible destination for sustainable tourism. Equi Terme can also be easily reached by car, since it is about 25 km from the motorway (Aulla toll booth).

THE APUANGEOLAB

The ApuanGeoLab is an interactive museum aimed at the dissemination of Earth Sciences. It was conceived as an exhibition hall where mechanical, rather than electronic, exhibits guide visitors along an ideal journey to discover the continuous transformations of Earth in geologic time, from global to local, from “Gaia” to “Apua”. The laboratory aims to help users (pupils and adults) not only to observe but also to experience the interactive exhibits. To make the visit even more engaging, each visitor is asked to answer a questionnaire during the visit trail. At the end of the test, the total score will be calculated and the learner will be classed as a real geologist, a potential geologist or encouraged to improve his/her knowlegde.

The ApuanGeoLab allows visitors to observe the continuous transformations of Earth in geologic time, with the aim of understanding why earthquakes occur and mountains were born, why the Mediterranean was formed and shaped the Apennines, how the Apuan Alps developed their complex structure and how waters have carved their carbonate body, creating intricate galleries and deep wells.

Making his/her way through the three communicating rooms, each visitor is a “geologist for a day”, setting off on a journey that provides the explanation for physical and chemical mechanisms that slowly modify the planet and make it alive.

However before you begin your journey, you have to gear up to be a geologist! In the entrance hall, visitors will find a cloakroom where they can leave their coats and equip themselves with two essential tools (helmet with lamp and compass) that might come in useful for a geologist during his/her adventure to discover first planet Earth, and then the Apuan Alps.

Room 1

“Descend, bold traveller, into the crater of Snæfellsjökull, which the shadow of Scartaris touches before the Kalends of July…and you will attain the centre of the Earth…”. Visitors will find this quote by Jules Verne to welcome them at the entrance of the first exhibition room. The entrance consists of a tunnel that represents the descent towards the centre of planet Earth through which visitors feel the temperature on their bodies increasing.

The first room deals with the Earth’s interior (Fig. 3). The exhibit represents a slice of Earth layered in spherical shells limited by physical and chemical discontinuities. As the layering of Earth has mainly been inferred indirectly using the time of travel of refracted and reflected seismic waves created by earthquakes, the exhibit allows the user to generate an earthquake and to observe in real time the propagation of waves and their behaviour when they meet an “obstacle”, changing direction of propagation.

The key concept of density can be directly learned through the analysis of rock samples of varying composition. This knowledge is immediately useful for the following experience related to a phenomenon of fluid dynamics: the convection currents occurring on the Earth's mantle as the slow creeping circular motion of rocks caused by carrying heat from the interior of the Earth to the surface.

Mantle convection is the driving force that causes tectonic plates to move around the Earth's surface and represents the link to the second room of the ApuanGeolab itinerary.

Room 2

The Earth's surface is divided into a number of tectonic

Fig. 3 – The first room with a slice of Earth and a multimedia exhibit illustrating the mantle convection.

Fig. 4 – Exhibit 5 deals with the theory of plate tectonics.

plates, moving a few centimetres per year like pieces of a puzzle, that are continuously being created and consumed at their opposite plate boundaries.

The ApuanGeoLab tells us why the surface of our planet is perpetually restless, brittle and slow-changing.

Visitors can put their feet on a mechanical platform and try to spread their legs to separate the two continents (Africa and South America) that retain similar geological and paleontological traces, proof of their original union before drifting (Fig.4).

In the next exhibit, the visitor to the ApuanGeoLab can also “activate” a fault generating an earthquake under his/her feet!

This will be an opportunity to scientifically understand the earthquake phenomenon and the seismic risk and hazard in a seismically vulnerable area such as Italy including the Apuan territory.

Then the ApuanGeolab reveals:

- how the mountains “appear”. Again the manual activation of a machine will allow the visitor to deform the rock layers forming a progressively tighter and higher fold (the “mountain range”);

- how the mountains “disappear”. Water, ice and wind are agents that progressively erode the mountains carrying rock debris and depositing it downstream. The interactive exhibit shows how the debris eroded from different rocks and areas of the mountains flows into the hydrographic network and is transported downriver by the main watercourse and then deposited in the plains. “Stone by stone” anyone can build its deposits! (Fig. 5).

Room 3

This room in the ApuanGeoLab is more closely related to the geological processes of the Italian peninsula and specifically to the geological history of the Northern Apennines, including the Apuan Alps. It is the one with the largest number of exhibits, six.

The exhibit entitled “From Thetys Ocean to Mediterranean Sea” describes the paleogeographic setting before the Apuan Alps and its evolution articulated in four main stages (Triassic, Jurassic, Cretaceous and Paleogene).

The interactivity consists in asking the visitors to complete the puzzle of paleogeographic pieces and find the location of the Apuan area during the four geological periods.

However, a crucial moment in the geology of the Apuan Alps is the Jurassic period (about 200 My) when a continental shelf, established in a warm climate with shallow marine waters like the current tropical landscapes, produced carbonate sediments then diagenesized as limestones. After several million years, the Jurassic limestones were involved in the orogeny of the Northern Apennines and affected by metamorphism. The limestones, through perfect recrystallization, turned to marble whose outstanding beauty makes it maybe the best known ornamental stone worldwide.

An “infernal machine”, located in the room subjects the limestones (actually samples of matt white plaster) to an “instantaneous” metamorphism, achieving samples of shining white marble on a conveyor belt.

The following exhibits are dedicated to the Quaternary evolution that shaped the landscape and the underground of the Apuan Alps. The ApuanGeoLab allows the visitor to observe how waters have carved the carbonate body of the Apuan Alps, creating intricate tunnels and deep wells in a karst framework (exhibit 10. Caves: wells and galleries), and running superficial waters have triggered a particular erosional process that has shaped unusual shapes such as huge circular holes (exhibit 11.

Fig. 5 – First steps inside the ApuanGeoLab, enjoying the “Stone by stone” exhibit.

Fig. 6 – First steps inside the ApuanGeolab: room 3 is dedicated to the geological history of the Northern Apennines. The panel on the right illustrates the geology of Equi Terme area and its geosites.

The giants potholes).

The visitors can then observe the column representing the reconstructed "stratigraphy" of the Apuan Alps in which every rock tells a story that can also be connected with main steps of Earth's global paleogeography and the evolution of living forms. The exhibit "The Apuans in geologic time" is also a game: each visitor must take a rock sample from a container and put it in the exact box based on its age.

At the end of the museum trail the geosites that constitute the Cultural Park of the Equi Terme Caves are described.

The Equi Terme Cave is a cave produced by a temporary karst resurgence that stretches over a total of 1.500 m and the visitors can walk along an itinerary of 320 m which includes the Tecchia prehistoric Cave. The visitors are welcomed by the Museum of the Caves, an educational exhibition on the physical landscape of surrounding areas and the paleo-environment in which Neanderthal Man coexisted with cave bears.

The tourists can then enjoy the thermal springs in the pool nearby and the hiking trails along a deeply incised valley (Equi Gorge).

CONCLUSIONS

The strategy and the conceptual plan of the ApuanGeoLab were directly performed by the Apuan Alps Geopark staff, while the project of the museum and the design of machines and exhibits have been developed by Arnica and Aleph 3, cooperative societies for environmental planning and the private company Geo Engineering, based in Turin (Italy).

The ApuanGeoLab is also equipped by a real didactic laboratory located at the first floor of the building, aimed at providing educational experience in the Earth Sciences, where above all the students can study in detail what they learned along the museum trail.

The preview of the ApuanGeoLab for Park operators, such as Park Guides and managers of the tourist structures was held in May, during the Apuan Geoday inserted in European Geoparks Network Week 2013.

A meaningful presence was represented by the Geopark Guides that have attended the initiative as formative moment of their professional curriculum.

The ApuanGeoLab opened to the public during June 2013 and all the information about opening times, tickets, and how to find the scructure are available using the following link http://www.apuanegeopark.it/ENGLISH_VERSION/apuanegeopark_geolab_eng.html.

The correct organization for obtaining a peak performance of the interactive museum cannot neglect the engagement of educational operators highly capable in the management and description of the experiences of the museum trail.

Being aware of this necessity, the Apuan Alps Geopark, during the carrying out of the project, has launched a call to entrust the management of the ApuanGeoLab to a group of professionals with experience and guarantees of adequate skills.

However, it will be a strict engagement of the Apuan Alps Geopark to support and control the management of the interactive museum and its didactic laboratory in order to ensure a high scientific and educational quality level.

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

Aspiring Geoparks in the Czech National Geoparks Network

Pásková M. ([a])

([a]) Department of Recreology and Tourism, University of Hradec Králové, Rokitanského 62, Hradec Králové, 50003 Czech Republic. E-mail: martina.paskova@uhk.cz

ABSTRACT

In the Czech Republic, the geopark concept was developed by the Czech Ministry of the Environment. The main objective is to make local inhabitants more responsible and active in landscape management and development. A basic understanding of both global and local history, ongoing processes and the impacts on daily life form the base for this responsibility and emotion. The Geopark concept completes this mission, thus the Czech National Geoparks Network was created. The main aim is to create optimal conditions for protection, presentation, interpretation and sustainable use of geological heritage in the Czech Republic in the form of support of quality development of national geoparks, based on intensive networking and the nvolvement of local inhabitants.

The Czech Ministry of the Environment has established the Council of National Geoparks. One of the main targets of this institution is to assure relevant standards and verifiable quality management for areas aspiring to membership of the European Geoparks Network (and Global Geoparks Network) under the auspices of UNESCO.

KEY WORDS: Czech Republic, geopark, geotourism national geopark.

THE CZECH NATIONAL GEOPARKS NETWORK

Under the auspices of the Czech Ministry of the Environment, the National Geoparks Network was created in 2006. One of the main objectives of this initiative is to assure relevant standards and verifiable quality management for areas aspiring to membership of the European Geoparks Network (and Global Geoparks Network) under the auspices of UNESCO. A further objective is to create the optimal conditions for protection, presentation, interpretation and sustainable use of geological heritage of the Czech Republic in the form of support of high quality development of national geoparks based on intensive networking and local inhabitants' involvement.

To ensure implementation of those objectives, the Czech Ministry of the Environment has established the Council of National Geoparks. Its members are representatives of four existing national geoparks (Bohemian Paradise Geopark - European and Global Geopark under the auspices of UNESCO and National Geopark, Egeria National Geopark, Iron Mountains National Geopark, GeoLoci National Geopark), the Ministry of the Environment, the Ministry of Regional Development, the Czech Geological Survey, the National Museum, the National Heritage Institute, the Geological Institute of Academy of Science, the Archaeological Institute of Academy of Science, the Czech Commission for UNESCO, the Cave Administration of the Czech Republic, Nature Conservation Agency of the Czech Republic, the National Hiking Center, Charles University and the Masaryk University of Brno (Pásková, 2008).

This Council meets two times per year and its agenda mainly includes issues connected to the performance and progress of four existing national geoparks. The Council also monitors the progress of five national geopark aspirants, the so called "candidate geoparks" with geoscientific importance and geotourism potential recognized by the Council, activities of the National, European and Global Geoparks Network, promotion via the network's website, organization of an annual national geoparks' conference, education via cooperation with universities – students internships in National and European / Global geoparks. The National Geoparks Network has a common logo used by individual geoparks and supports these geoparks mainly from a revolving fund for sustainable development from the Ministry of the Environment. The Council also negotiates with the Ministry for Education, the Ministry of Culture and the Ministry of Agriculture and the regional governments on issues concerning financial support. The support for development of national geoparks is already embedded in the State Tourism Policy and in the promotional strategy of the "CzechTourism" Agency.

The geoparks' movement is experiencing a high degree of activity, which was one of the reasons for introducing the annual National Geoparks Conference. The first one was held this year in April in the National Geopark GeoLoci, which was accompanied by a small exposition of individual geoparks and their local products. The topic of the conference was "Involvement of Local Partners and Public in Geotourism and the Interpretation of Geological Heritage". The competition "People in Geoparks" was launched with the objective to stimulate local inhabitants to discover the geopark in which they are living and to participate in its activities.

THE ASPIRING GEOPARKS

The National Geopark Egeria, the National Geopark GeoLoci and Bavarian - Czech Geopark established the large cross-border Czech-Bavarian Geopark which intends to ask for European Geoparks Network membership. It is situated along the northwestern border of the Bohemian Massif and covers an area of 7.771 km^2 of which more than half lies in Bavaria (Germany). According to Holzförster and Peterek, (2011) dynamic geological processes such as young volcanism, CO_2 emanation, occurrence of earthquakes and geotops density create high geotourism potential. The majority of the area falls under various forms of protection (Holzförster and Peterek, 2011). In the past, the local geo-economic base was the mining industry but nowadays the region relies much more on the spa and tourism sector.

The National Geopark Iron Mountains situated in Eastern Bohemia covers an area of 777 km^2. This private company based geopark has been developing nonprofit environmental education programs focused on hydrogeology and geology for nearly two decades. It intends to submit an application for European Geoparks Network membership within one or two years. In this geopark it is possible to see nearly all the important phenomena and processes representing Czech geology in the scope just of two days.

The Joachim Barrande Geopark situated in the world renowned palaeontologic area of Barrandien is presently working on its certification as a national geopark (thus having now the title "candidate geopark") but it is also a promising area for the European Geoparks Network. The geopark team created an innovative system of mobile geological guides, which can be created by persons interested in geological history and landscape features or just downloaded in various parts of geopark by its visitors.

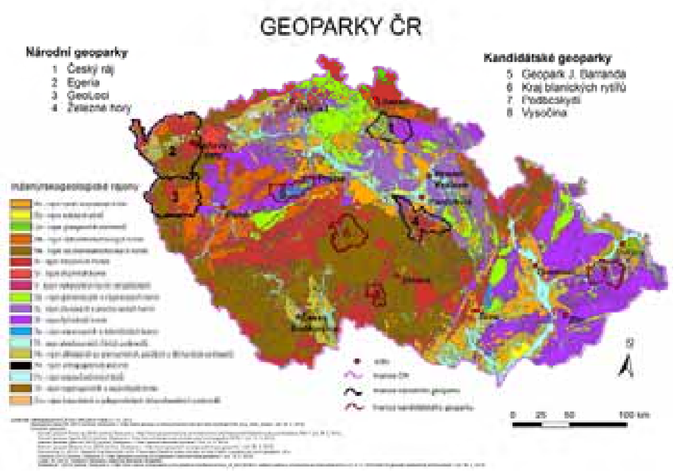

Fig. 1 – Geoparks in the Czech Republic: 1 – 4 are certified national geoparks (2 and 3, together with Bavarian part "Geopark Bayern-Böhmen", are creating border crossing aspiring Czech-Bavarian Geopark) and 5 –8 are so called "candidate geoparks".

GEOTOURISM BEST PRACTICE

An increasing amount of attention is being paid to environmentally innovative forms of tourism, related to high levels of qualification, incomes, environmental and social responsibility, an interpretation standard and interdisciplinary approach (Pásková, 2012). Geotourism as one of these forms shows great dynamism and is marked by its extraordinary emphasis on complexity, an interdisciplinary approach and interpretation quality, thus requiring relatively high level of complexity of qualification, responsibility, creativity and experience (Pásková, 2012). In this specific type of tourism, interpretation plays a key role because it creates the basis for understanding and emotions which have potential to influence the consumption and spatial behavior patterns of visitors (Harris, Griffin a Williams, 2002). The interpretation thus serves as one of the most important tools for the prevention of negative environmental impacts, and not only in situ but it also influences visitors' opinions and attitudes towards nature and landscape conservation in general (Pásková, 2012). Geotourism doesn't mean a narrowly defined "geological tourism" focused just on geological phenomena (Martini et al, 2012) but it also includes natural and human heritage, and tries to find a geologically based interpretation for them. The main challenge is to find the specific way how to interpret the relations between geological, biological and cultural diversity (Pásková 2010).

In the National Geopark GeoLoci (part of Czech Bavarian geopark), the annual festival of performing arts in the countryside called "Landscape Alive!" was launched last year. The aim of the festival is to connect people with nature, inspire them and lead them to develop a piece of art related to the landscape. The first year was dedicated to theatre. With the help of professional actors and artists the site-specific performance "The Woods" was prepared, which was finally introduced to the general public. Afterwards the famous Czech performer Jaroslav Dušek introduced his show inspired by a book by D. M. Ruiz "Four Agreements". This year, the festival will be focused on land-art. Together with landscape architects, sculptors and gardeners, a number of workshops will be organized. Students of art schools, local youth and other participants will make small art interventions in the landscape such as benches, bridges and sculptures. These new objects may attract visitors and help to develop an environmental friendly and innovative tourism.

The National Geopark Egeria has also its special geotourism potential. The National Cultural Monument "Jeroným Mine" represents the 16th century tin mining history in the geopark area. In spite the fact that the mine productivity was never high, its uniqueness lies in the still preserved imprints of hard working miners. After long-lasting and consistent work and cooperation of various institutions and individuals, the part of this unique monument will be opened to the public this year. Demonstration of 16th century tin mining techniques will be presented during guided tours of the mine. . Alternatively, visitors will be provided with audio guide in various languages (English, German, Russian and Polish) to listen to the fabricated (but probable) story from the times of the mine's discovery, which is based real historic events. The aim is to let the visitor go back in time, evoke the atmosphere and create conditions for an exciting experience.

The Iron Mountains National Geopark provides a fascinating "sensual" geotourism program "Heading for water" based on experience of tasting subterranean water on various geotops with the aim of recognizing and understanding the changes in the taste and smell. The objective of this geotourism product is to explain the hydrogeology, hydrochemistry and tectonics of the geopark area in an interesting and nontraditional way, to involve its participants and stimulate them to discover more afterwards. This program was created under the "Geosciences" project financed by the Education for Competitiveness Operational Programme of European Union.

BOHEMIAN PARADISE GEOPARK AS AN INSPIRATION

The Bohemian Paradise Geopark is the first European and Global Geopark under the auspices of UNESCO in the Czech Republic (from the year 2005) but is also a Czech National Geopark. It has a very important role in the National Geoparks Network because it serves as a knowledge, experience and best practice bearer for other three national geoparks (Rídkošil and Pásková, 2012), which intend to join to the European Geoparks Network. As the case of this globally recognized geopark shows, the geopark bottom–up concept represents an attractive and complementary alternative to the protected top-down areas approach not only for their visitors but also for their inhabitants (Pásková 2010, Pásková 2012).

The National Geoparks Network works as a platform for environmentally qualified regional sustainable development, which is positively perceived and followed by the public. The basic objective is to increase geoheritage sensitivity among Czech inhabitants and facilitate their understanding of the history, present and future of the Earth. A related mission is to assist the areas with the potential to become members of the European Geoparks Network in their efforts, but not each national geopark can also be a European Geopark. The main instrument for this is coordinated and consistent guidance from the side of the individual members of the National Geoparks Network who serve as "mentors" to both national and candidate geoparks. The twin approach is another tool to increase the quality of geopark development and provide mutual inspiration and enhance self-control.

The National Geoparks Network represents a promising base for the future National Forum of European Geoparks. It will be created when the second Czech geopark is included into the European Geoparks Network.

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Terras de Cavaleiros Aspiring Geopark: An outreach strategy based on the typology of visitors

Pereira D. ([ab]), Pinto B. ([b]) & Marcos S. ([b])

([a]) Geology Centre of University of Porto, Earth Sciences Department of University of Minho, Campus de Gualtar, Braga 4710-057, Portugal. E-mail: insuad@dct.uminho.pt
([b]) Terras de Cavaleiros Geopark, Macedo de Cavaleiros, Portugal

ABSTRACT

The *Terras de Cavaleiros aspiring Geopark* (TCAG) is established on rare and unique geological, ecological, cultural and scenic values. The local geology has a recognized scientific value and long tradition in research and scientific visits. However, the complexity of the geology requires a strategy of interpretation of the geosites, promotion and implementation of trails, interpretative panels, guided-books, and interpretative centers. The geopark's target groups include its inhabitants, the specialized public in geology, the schools, the geotourists and general tourists. The TCAG has prepared a set of programs suited to the knowledge and interests of each group. The geosites with higher educational and touristic interest have been selected. The TCAG is also aware of the cultural heritage, biodiversity and leisure facilities, specially targeted for non-geological tourism.

KEY WORDS: geopark, geosite, trail, tourism, visitors.

INTRODUCTION

Terras de Cavaleiros aspiring Geopark (TCAG) has an area of 699 km^2 corresponding to the administrative limits of Macedo de Cavaleiros municipality in Northern Portugal (Fig. 1).

The TCAG is under development since 2010 promoting the geological and environmental conservation, social justice and sustained economical development for the territory and its inhabitants. The tourism is based on geological, ecological, cultural, historical, scenic and local identity values, pointing out what is authentic and unique (Pinto et al. 2012).

The TCAG have a complex geology and a detailed inventory and assessment of 40 geosites. Seven of them are already listed in the national geosites inventory, which justifies their higher national/international relevance (Pereira et al, 2012).

The TCAG is also a territory with a rich and diverse historical-cultural heritage. The municipality of Macedo de Cavaleiros is nationally recognized for having a significant range of traditional quality products with national certification (olive oil, sausage, ham, cheese, potatoes, olives, chestnuts, honey and veal and lamb meat, among others). In addition, there are several reference sites for tourism, as the Azibo's

Fig. 1 – Location of *Terras de Cavaleiros aspiring Geopark* (TCAG) in Northern Portugal.

lagoon, with a beach ranked as the best lagoon beach of Portugal, or the Sabor Valley, which allow visitants to enjoy a landscape diversity and floristic richness and unique fauna (Pinto et al. 2012).

The TCAG is conscious about diversity of typology of visitors to its geosites (Dowling, 2012), as well the difficulty of non-specialized public understand complex geological models (Hoss, 2012; Crawford & Black, 2012; Moreira, 2012). Considering these facts, the TCAG has defined a strategy focused on:

- Raising public awareness about geodiversity;
- The understanding of geosites by non-specialized public;
- An appropriate offering for local community, specialists, schools and tourists.

GEOLOGICAL SETTING

The territory of TCAG has a rich and complex geology, mainly expressed by the following geological units, structures and landforms (Pereira et al 2012).

i) Pre-Mesozoic allochthonous geological units, namely:

- Allochthonous Ophiolitic Complex, a complete sequence of the oceanic crust constituted by several types of mafic and ultramafic rocks;
- Allochthonous Upper Complex, representing a whole sequence of continental crust from an ancient continent located far away from the autochthonous domain. This complex is represented by metasediments, orthogneisses, and mafic and ultramafic rocks;
- Major tectonic features, namely thrust faults that marks the contacts between the autochthonous and allochthonous units.

ii) Hercynian granites.

iii) *Cenozoic sediments* representing an ancient drainage system.

iv) Push-up tectonic relieves and strike-slip basins filled by the Cenozoic sediments.

v) *Active faults* related with the Cenozoic sedimentation, the tectonic relieves and the thermal waters.

vi) *Incised river valleys* as the result of a capture process of the ancient Cenozoic endorheic drainage by the present-day Atlantic drainage system.

TARGET: THE INHABITANTS

The TCAG main objective is the sustainable development of its population, comprising 15844 inhabitants. In addition to the benefits from the tourist flow, is intended to implement social, educational and leisure initiatives directly to the population.

In this first stage of the geopark consolidation, the priority is informing the public about the goals and strategies of the TCAG and geoparks in general. The local activities have as main objective that the population recognized itself as the primary beneficiary and target of development. Other priority actions intend to increase the knowledge about the geoheritage. The planned activities include the population and especially the school audience. The promotion and preservation of geosites and other heritage is one of the most important targets of these actions.

The presence of TCAG in tourism fairs, hunting expositions, and other local events has been continuous and is looking for the geopark recognition by local actors, especially the hotel business, and travel agents, among others.

TARGET: SPECIALIZED PUBLIC

The geological heritage that constitutes the fundamental basis for the constitution of TCAG is already known by geologists, researchers and academics in the area of Geology. The richness of this geoheritage has attracted numerous scientific activities, conferences and field trips, as well as field courses in undergraduates and graduate programs.

Based on this tradition, the TCAG assumes the importance of supporting the scientific activity and scientific tourism. The geopark has developed two geological routes designed primarily to support research and teaching of Geology. The shorter route with 50.5 km links 10 geosites within the TCAG. The longest route, with 110 km, extends to the periphery of the TCAG. In order to support these routes were created a guide-book, interpretive panels (Fig. 2), Android and IPhone Apps, and QR Code readers (Fig. 3). The TCAG also offers a geologist prepared to the accompanying of these activities.

Fig. 2 – Interpretative panel in the Geological Trail of *Terras de Cavaleiros aspiring Geopark* (TCAG)

Fig. 3 – QR Code reader in the Geological Trail of *Terras de Cavaleiros aspiring Geopark* (TCAG)

TARGET: SCHOOLS

In order to support the visitation of school-age youth and school groups, the TCAG already has a *Geological Interpretation Centre* (Fig. 4), which is also prepared to assist other types of public.

The TCAG is working on the establishment of an educational program based on the themes included in school curricula. For this purpose is being held the assessment of geosites with high education value (Reynard et al 2007) and the

Fig. 4 – *Geological Interpretation Center* of *Terras de Cavaleiros aspiring Geopark* (TCAG)

conception of educational thematic trails (Garavaglia & Pelfini 2011).

After the selection of these educational geosites, the TCAG will develop the themes contained in the school curricula. The water theme is already in course and soon will be available themes like the natural resources, the constitution of the Earth and the seismic discontinuities, tectonics and earthquakes, among others.

The TCAG has also projected a showroom dedicated to the geological resources, their applications and other social issues such as health. Locally are particularly relevant the tungsten and tin, the antimony, the talc and asbestos, and the thermal waters. This room, with a large interactive component, has as main target the schools and the general public.

TARGET: GEOTOURISTS AND GENERAL TOURISTS

The high scientific value of the complete sequence of the allochthonous Paleozoic units in TCAG does not guarantee by itself the sympathy of tourists. As previously stated, the tourist does not understand the language used in hermetic texts dedicated to specialists.

For geotourist and general tourist support, the TCAG promoted the selection of geosites after the assessment of the touristic interest. These geosites, which always have scientific value, also stand out for its cultural, economic and / or scenic values. In addition to the geoconservation and management issues, its valuation includes outreaches with simplified language versions. Afterwards are presented some examples.

"*Mur s Mine Geosite: Here's tungsten*!" This geosite is dedicated to several outcrops of an open-air mine and to the ruins of support buildings where miners proceeded to the separation of the ore. This mine has exploited tungsten (and also tin), which occurs in quartz veins that can still be observed on that site. The approach is directed to the observation of quartz veins with tungsten, to the industrial applications of tungsten and its strong relationship with the World War II and to the future outlook.

"*Limestone of Salselas Geosite: an example of resource and local economy*". This geosite shows rare rocks in northern Portugal that were exploited in the past. Actually this is an example of utilization of a rare geological feature in the region, which constitutes the raw material of lime, produced in furnaces that still persist in the region.

"*Po o dos Paus Geosite: an ocean in the Land of Knights Aspiring Geopark*". This is a geosite combining scientific and scenic values (Fig.5). In this site the tourist is encouraged to observed rocks that are typical in the ocean depths. They can recognize bands of dark colored rocks (mafic dikes) that broke through a rock with light and dark minerals of larger dimensions (gabbro) (Fig. 6). It is available a simplified explanation about when and how these rocks were formed and about their exotic condition.

Fig. 5 –*Po o dos Paus Geosite: an ocean in the Land of Knights Aspiring Geopark* (*Terras de Cavaleiros aspiring Geopark*)

Fig. 6 – Mafic dykes and gabbro on *Po o dos Paus Geosite: an ocean in the Land of Knights Aspiring Geopark* (*Terras de Cavaleiros aspiring Geopark*)

"*Lagoa Gneisses Geosite: Millions of eyes from a distant continent!*" This is a geosite with high scientific and scenic values. The approach is based on the beauty of the rock in the outcrop, its exotic nature attending to its origin hundreds of kilometres away, and the doubt about the exact age of this occurrence.

The TCAG is also preparing touristic thematic trails that link several geosites. The first three trails are dedicated to the relation between geology and society, the natural hazards and the Earth History.

The trail "*Geological Resourses in the TCAG*", links several geosites like the *Mur s Mine geosite*, the *Limestone of Salselas geosite*, the *Talc abandoned mine geosite*, or the *Asbestos geosite*. This trail emphasizes the importance of the geological resources to the society.

"Geological Faults and Earthquakes in the TCAG" links geosites related with active faults and tectonic landforms, and emphasize the observation of the faults were earthquakes happen and its effects in the landscape.

The "Morais Ocean" trail covers the theme related with the ophiolite sequence. The geosites are presented as exotic occurrences of rocks and seismic discontinuities that are typical of other settings like the ocean floor and Earth's interior and that rarely can be seen on surface.

Within the TCAG territory, the Azibo's lagoon is a protected area dedicated to the biodiversity conservation. This area offers a network of pedestrian paths especially dedicated to biodiversity, namely the observation of different types of insects. In addition to other activities and leisure sites, this area was elected the best lagoon beach in Portugal.

CONCLUSION

The TCAG has all the characteristics that are recognized in the concept of geopark. The geodiversity and the geological heritage have high scientific value and are clearly distinct and complementary of the EGN Portuguese geoparks. This territory has a long tradition of visitation and scientific activity on geology, has a rich biodiversity, active actions of nature conservation and genuine cultural heritage. The territory has rural tradition where dominated the activities of traditional use of natural resources. It is recognized that there is a high potential for growth based on the heritage and tourist activity.

The high relevance of the geological heritage of TCAG is unquestionable. The management of the most important geosites offers no major difficulties in what concerns conservation and protection issues. However, the interpretation of many geosites will constitute a major challenge because they involve a long and complex geological evolution, which is certainly difficult to understand by the general public (Pereira et al, 2012).

Thus, the TCAG is adapting the available programs according to the profile and objectives of the different geopark's visitors. Currently are under development several actions driven to the optimization and promotion of the TCAG and its social and tourist statement.

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Project Idea
"100% Renewable Natural Areas (RE-NATURA)"

Petrick K. ([a]), Escher H. ([b]) & Thjømøe P. ([c])

([a]) All Green Energies, C/ Sant Honorat 32, 2-A; ES-08870 Sitges (Barcelona), Spain. E-mail: kristian.petrick@allgreenenergies.org
([b]) Geopark TERRA.vita, Am Schölerberg 1, DE-49082 Osnabrück, Germany. E-mail: escherh@lkos.de, info@naturpark-terravita.de
([c]) Magma Geopark AS, Sokndalsveien 26, NO-4370 Egersund, Norway. Email: pal.thjomoe@gmail.com, post@magmageopark.com

ABSTRACT

A number of Geoparks proposes to launch a project called "100% Renewable Natural Areas" which has the objective to cover the energy demand of natural areas with renewable energies, while applying highest standards to preserve their flora, fauna and terrain. A focus will be put on awareness raising and communication strategies bringing together stakeholders from the "environmental" and the "energy community" in a joint approach. The project is currently looking for interested consortium members and (co-) funding.

KEY WORDS: Energy efficiency, environmental protection, natural areas, renewable energies, Sustainable Energy Action Plans.

INTRODUCTION

A number of Geoparks (terra-Vita Germany, Magma Norway, Hondsrug Netherlands, Idrija Slovenia) plans to cooperate together with other protected areas, stakeholders and associations like Europarc in a project called "100% Renewable Natural Areas (RE-NATURA)" which has the overall objective to cover the energy demand of natural areas with renewable energies. It is the intention to present the idea at the 12th European Geopark Conference in order to raise interest of the Geopark community, discuss the scope of the project and identify potential sources for financial support.

PROJECT DESCRIPTION

All natural areas dispose of renewable energy resources. However, their inhabitants and visitors still cover to a large extend their energy needs by "importing" energy based on fossil fuels. But the use of polluting energy sources in natural areas is contradictory: on the one hand, the environment in these areas is (often strictly) protected; on the other hand, energy sources are widely used in a way that negatively affects the environment, either locally, in other places or even globally through climate change effects. Therefore also natural areas have a responsibility to reduce their energy needs and to generate – to a reasonable extent – renewable energy locally.

The project uses a broad definition of "natural areas": close to highly protected areas (like National Parks) but also including those encompassing rural areas with significant population and economic activity next to their – partially protected – natural assets and highly attractive landscapes (like Nature Parks and Geoparks). This approach ensures a relevant energy savings potential.

Due to the sensitive environment and existing regulations that ensure the protection of natural areas, a special care has to be taken in the deployment of renewable energy technologies. While roof-top PV may be less controversial, the technologies for geothermal, wind and bio energy may only be applied in well-defined conditions. A strong emphasis will be put on measures for energy efficiency and energy conservation. In addition, aspects like sustainability, biodiversity, social acceptance, sustainable mobility and transport, communication and stakeholder involvement, benefits and opportunities will be elaborated. It also needs to be discussed if natural areas can be used to provide energy to non-protected areas, or if this should be avoided.

An international consortium of some ten partners in different countries is planned to be set up covering all European climate zones. The partners will come from different type of organizations: Natural areas with different degrees of protection (National Parks, Nature parks, Natura 2000 sites, regional parks, biosphere reserves, natural reserves, natural monuments, protected landscapes, geoparks etc), natural area associations (European Geoparks Network, Europarc, UNESCO), associations active in the field of RE deployment in municipalities (like RURENER, Climate Alliance, deENet, etc.), and organizations and NGOs concerned with environmental protection (IUCN, BirdLife, Friends of the Earth, Naturefriends etc.).

One important challenge is the complexity of various public authorities that can have different interests and partially overlapping responsibilities in certain natural areas. This may complicate agreeing on a common RE strategy. By developing Sustainable Energy Action Plans for Natural Areas (SEAP4NA), this project intends to demonstrate how collaboration between different administrations and stakeholders can be effectively organized.

Natural areas appear as an important actor regarding sustainable development, giving them a special educational role, as they attract – in certain cases millions of – visitors. By using their often well-developed communication means (visitors centers, courses, activities, etc.), natural areas can be become inspirational role models for the transition towards renewable energies in Europe.

The project will take into consideration existing strategies and plans as well as other initiatives and policies promoting the local use of renewable energies (like the Covenant of Mayors, UNESCO RENFORUS), European objectives (like the 2020 targets), the SE4All initiative within the Rio+20 process, or previous or current Intelligent Energy Europe or LIFE+ projects (like "100% RES communities" with whom a close collaboration has already been agreed).

MAJOR OUTPUTS & EXPECTED RESULTS

The following outputs and results are foreseen at this stage. Depending on the needs and interests of the consortium members and the availability of funding, the focus may still be adapted~~:~~ as indicated in the following two points.

1. A Handbook "100% Renewable Natural Areas" that provides:

a) a comprehensive analysis regarding environmental, social, administrative, financial, technical issues and potential mitigation measures of RE use in natural areas. It will address the issues of administrative hindrances to the development of RE/EE strategies natural areas, especially taking into account that many natural areas are under the responsibility of different public authorities and extensive coordination may be needed. Recommendations to policy makers, competent authorities and stakeholders will address the strategic dimension of the topic.

b) Guidelines for the development and implementation of Sustainable Energy Action Plans for Natural Areas (SEAP4NA) and 100% RE strategies. The guidelines will consider different sizes and forms of natural area categories and organizational set up (to ensure transferability), methods to calculate RE and EE potentials, calculation of necessary investments, SWOT analyses of different technological solutions, potential financing sources, non-economic/non-technical barriers (environmental, social, administrative), communication strategy, implementation issues etc. The guidelines will be part of the Handbook.

Expected results: this output will lead to an increased knowledge of the major considerations of energy use in natural areas, finance options and how to organise actions towards 100% Renewable Natural Areas. The guidelines will empower natural areas and their inhabitants on Sustainable Energy Management and give them the means to elaborate own energy strategies and SEAP4NAs. It is intended to publish the Handbook through the renowned publishing company Routledge (former Earthscan) that already expressed interest.

2. Knowledge Exchange, Capacity Building Workshops and Communication. A strong emphasis will be put on the interaction between experienced and less-experienced authorities, as well as on the wide-spread communication towards decision makers (local governments, park authorities etc.) and other stakeholders like inhabitants, employees and visitors of natural areas, national and EU institutions, NGOs, industry and business representatives etc.

Expected results: These activities will increase knowledge, experience and awareness among actors and the general public about the linkages between biodiversity, sustainability and renewable energies.

3. Concrete Sustainable Energy Action Plans for Natural Areas for up to ten pilot projects. These SEAP4NAs will define objectives, targets and specific action lists and programs of activities, including their implementation (to the extent possible). Their long term objective will be to reach 100% RE supply. If this output can be realised is largely depending on available funding.

Expected results: The SEAP4NAs will smooth implementation of consistent sustainable energy strategies, increase awareness and foster a more responsible use of energy in natural areas.

BACKGROUND

The project idea was presented in the Intelligent Energy Europe (IEE) Call 2012 but was unfortunately rejected mainly due to the fact that the consortium leader was a consultancy and not one of the natural areas. It was discussed to present the project in the IEE Call 2013 but since the call's priorities had changed, this option was discarded.

The participants in the consortium were the following: Magma Geopark (NO), Eichsfeld Aktiv (DE), WWF Bulgaria (BG); EVE Basque Country (ES); Idrija Heritage Center (SI), Cosea (IT), Comunità Montana Terminio Cervialto (IT), Lake District National Park Authority (UK) as well as consultants from SQ Consult(NL/ES) and Ecoserveis (ES). Most of the consortium members already expressed interest in the re-launch of the project idea.

A total of 18 Letters of Support from local, regional, national and international organizations were provided: RURENER (EU), European Geoparks Network (EU), Europarc (DE), deENet (DE), Geopark Terra-Vita (DE), Idrija Municipality (SI), Regional Council of Dalane (NO), Rogaland Energy Center (NO), Catalan Energy Agency ICAEN (ES), Eurosolar (ES), Ayuntamiento Valdegovía (ES), GDR Sierra de Cazorla (ES), Città Verde (IT), Green Marketing company Simulation Intelligence (IT), ARPA Regional Agengy (IT), Province of Drenthe (NL), Geopark Hondsrug (NL), Persina Nature Park (BG).

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Assessment of coastal erosion in beach-dune system in Western Sardinia

Pilloni M. ([a]) & Ginesu S. ([a]) -

([a])) Department of Nature and Territory Sciences , University of Sassari, Via Piandanna, 4, 07100, Sassari, Italy. E-mail: marapilloni@gmail.com

ABSTRACT

Research conducted in recent years along the coasts have highlighted the vital role of dunes and dune fields in the defense of the beach and of its natural balance. The events that periodically occur along the coasts of Sardinia are the sad evidence of situations that generate conditions of risk and danger for the people and for the infrastructure that revolve around these areas, which are areas of particular appeal and attendance. The dune systems have a key role in the process of beach nourishment of natural beaches by changing the position and shape in response to changing climate marine weather, sea levels and shoreline. This paper describe the results of work carried out in 6 beaches sample to verify the connections between beach erosion/ accretion and frontal dune changes and their role in the nourishment. Several methods of investigation and data survey allowed to have a framework on morphodynamical relations of beach-dune system and the different causes of erosion/accretion in each site. From this relationship we tried to get a survey method that allows to assess and predict long-term beach erosion phenomena, though not manifest in the shoreline variation, through changes in dune morphology and erosion of the frontal dune.

KEY WORDS: Coastal dune, beach-dune interaction, erosion, morphology.

INTRODUCTION

Coastal dunes are a feature of Sardinia's northwest coast; they originated from the regressive cycles of sea level that occurred during the late Pleistocene and Holocene. Their extension vary depending on coastal geomorphological settings, exposure to the prevailing northwesterly and southwesterly winds and human impact that has modified the natural ecosystems with forestry interventions and road infrastructures.

The main purpose of the work reported in this paper was to evaluate the coastal erosion in the largest coastal dune system and to identify a suitable methodology to evaluate erosion in areas with natural beach nourishment.

The six dune system (Fig.1) selected for assessment were: Alghero, Is Arenas, Pistis-Torre dei Corsari, Piscinas-Scivu , Buggeru Gonnesa. These sites were chosen to provide wide geographical coverage and contrasting examples of system attributes and process regimes.

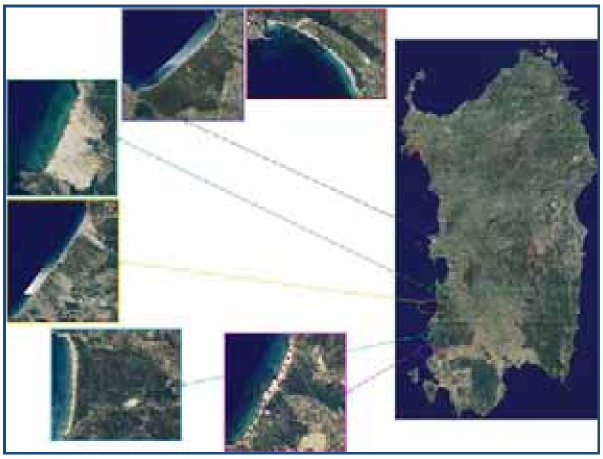

Fig. 1 – Map showing the location of the study areas

The morphological structure in these areas include a beach area with dune field that extends into the backshore for about 2.5 km; the entire beach-dune system is in a large area of natural embayment.

Alghero beach (Maria Pia) deviates from this scheme because is constituted by a dune belt with a pond.

In order to highlight the different weather-dynamic conditions of the beaches, it was conducted an integrated research which allowed to detect the morpho-sedimentological features of the beach, the conservation state of the dunes, the shoreline evolution trend over the last 50 years and the marine weather conditions. In the Buggerru beach was made more detailed analysis with GPS-RTK (Global Positioning System - Real Time Kinematics) to identify the shoreline and beach cross profiles.

The data collected and subsequently processed were included in a GIS platform.

Beach-dune system monitoring has shown a significant different erosion trend at different stations in response to mechanical stress induced by waves and, above all, to different anthropogenic impacts.

MATERIALS AND METHODS

Field survey has included morphological and sedimentological detection to obtain all the information about the beach equilibrium state and to determine the direction of sediment transport.

The morphological parameters (dune base, berm storm, berm, high tide and low tide) detected by GPS station were implemented in GIS to quantify the distances. The slope and quotas were also detected for the Buggerru beach.

A total of 204 sand samples were collected at 6 sandy beaches. Samples were taken at several cross-shore elevations in transects perpendicular to the shore at locations with different morphological features (e.g. crest dune, dune base, berm storm, high and low tide).

Dry sieve analysis was performed using a series of sieves ranging in mesh size from 0.040 mm to 2.00 mm. The statistical parameters of mean, standard deviation, skewness, and kurtosis were estimated in according to the methods proposed by Folk (1966).

Subsequently, the shoreline change over the last 50 years was analyzed in order to assess the developmental aspects and quantify trends.

For shoreline mapping detection a multitemporal dataset spanning the period 1955–2006 was used and made up of archival aerial photographs provided by Regione Sardegna. Except the Buggerru beach where the data was collected until 2010.

Shoreline change evaluations was based on a comparison of historical shoreline positions digitized from aerial photographic data sources with a reference shorelines.

Digitized shorelines were used in the DSAS (*Digital Shoreline Analisys System*) tool (an ArcGIS extension suggested by the USGS) to measure the amplitude of the beach and quantify shoreline changes.

To characterize wave climate at the beach, 22 years of hourly data where analyzed. The database was collected by the Italian Sea Wave Monitoring Network (SWAN) at Alghero station. The data of this station can be used for the entire western coast of the island.

RESULTS

Data analysis of the Alghero wave buoy has shown that the main waves direction is between 285 N and 315 N (Fig.2), hence the prevailing winds are Maestrale and Ponente. Significant wave storms have prevalent direction between III and IV quadrant. In particular, the analysis has shown that in almost 30% of the observed events the waves have direction between 300° and 315° with a high presence of waves amplitude between 2.5m and 4.5m.

The highest value are frequent between November and January, the so-called winter storms, although it is not uncommon to find values of Hs > 6 even in summer.

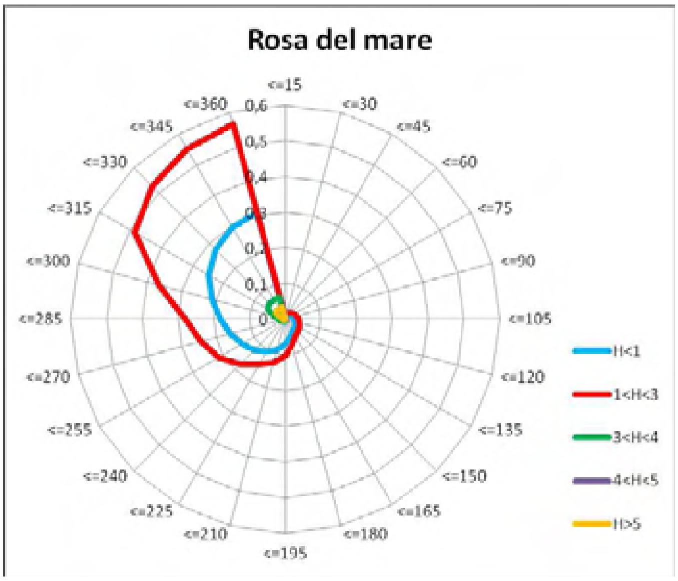

Fig. 2 – Directional wave spectra.

Referring to coastal dynamics, the study has shown that the coastal transport is influenced by wave motion with direction between 273 ° N and 315 ° N, therefore the flow of sediments has mainly direction from north to south, representing an important evolutionary feature of the beaches.

Sedimentological analyses have highlighted that the different dynamics related to sediment transport, erosion and storage are to be put in relation to marine weather and morphological features of the sites.

Beach samples have the typical grain size of the dune sediment. The samples picked up near natural or artificial barriers or fluvial estuary that influence the wave motion's energy have a grain size distribution most complicated.

Beach samples (crest dune, dune base, berm storm and high tide) have shown a well-marked modal class (Fig. 3), with a dispersion very low in grain size distribution, evident consequence of a very selective environment. Analysis of low tides sediment and those relating at the particularity of the sampling sites (elevated waves energy, estuary or dock) have

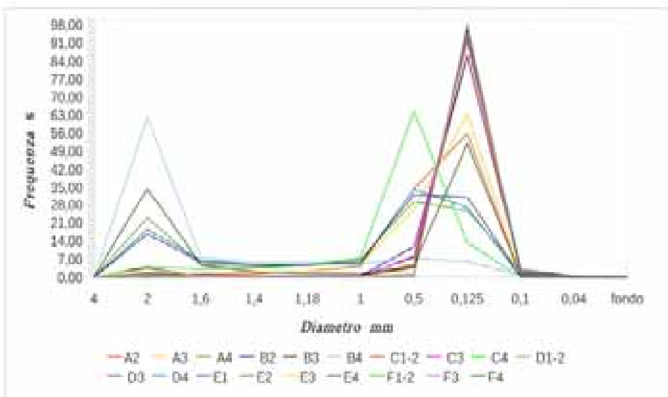

Fig. 3 – Grain size distribution of several samples of Alghero beach.

shown a marked grain size dispersion with bimodal particle size distribution. In the Buggeru and Is Arenas beaches, the the evolution of the shoreline is correlate with the movements of the mouth of the Rio Mannu and the Rio San Salvatore.

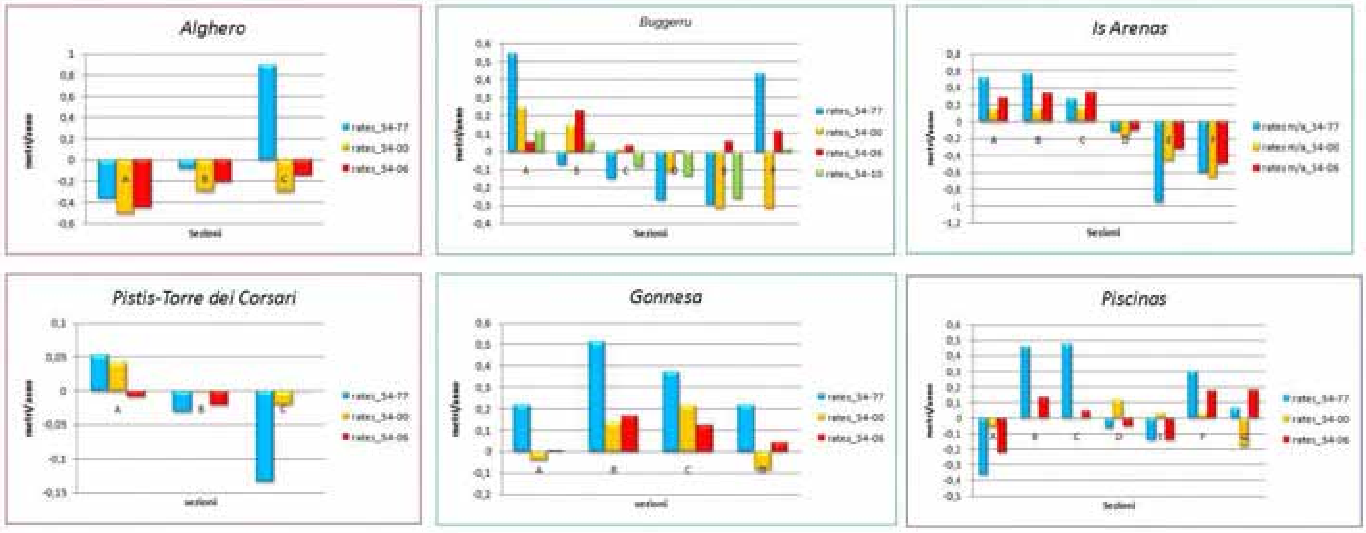

Fig. 4 – Long-term average annual shoreline change rates.

grain size distribution is well marked in almost all analyzed samples pointing out a beach nourishment from the frontal dune in agreement with the greater extension of the dune fields.

In general, samples of emerged beach sediments are moderately well sorted , to indicate a good selective capacity of the means of transport, the wind; while the samples of low tide sediments are poorly sorted because the wave motion removes the finest fraction.

The grain size distribution of sediments is commonly symmetrical in the most of samples of emerged beach, and negatively skewness in the samples of low tide. In the Pistis, Scivu and Buggeru beaches, the skewness of almost all low tide samples is characterized by positive values, indicating a enrichment in very fine sediments, due to frontal dune erosion during the sea storm.

Historical shoreline trend detection have shown that changes are the result of sediment transport mainly in the longshore and nearshore areas in response to intense weather-marine events and littoral drift.

In general, the shoreline changes detected over the past 50 years fall under a buffer-zone up to 30 m, a fairly modest value to be considered beaches in equilibrium state.

The different shoreline trends in the several stretches of the beach is related to the presence of river estuary, beach rock, promontories and anthropogenic works that influence sediment dynamics, transport and erosion direction.

Sectors of each beach were analyzed taking into account morphodynamic conditions in order to identify the different causes of the shoreline changes.

Graphs of shoreline change rates showing the annual average changes for each analyzed sector of beach (Fig. 4).

The survey showed that the sediment displacement in the beaches interested by river estuary is also influenced by the dynamics of the latter in relation to the motion waves.

This is the case of Buggeru (sections A, B and F) where

The same variability has been detected in the north of the Is Arenas beach (section A) where the presence of the Rio Pischinappu influences the shoreline evolution in this area.

This also happens to the Gonnesa beach where the mouth of the Rio Sa Masa (section A) influence the evolution of the coast only until 1977, because later the mouth was closed with consequent formation of a wetland behind the beach, now reclaimed. In the Piscinas beach instead the area between the Rio Piscinas and Rio Naracauli (section A) shows an erosion condition, while the contiguous section (B and C) are in accretion or equilibrium state.

The beach-dune system monitoring has showed a significant different erosion trend at different stations in response to mechanical stress induced by waves and, above all, to different anthropogenic impacts.

Overall, almost of all the beaches were considered in equilibrium state, although with difference in the various sector: Is Arenas (3.9m), Piscinas (0.66m),, Buggeru (-2.5m), Gonnesa (3.8m) and Pistis-Torre dei Corsari (-2.5 m). In the latter beach the 2006 shoreline position is at the same level of 1954.

The highest average rates of shoreline erosion (0,23 m/y) occurred in Alghero beach, where there was a loss of more than 13 meters of shoreline between 1977 and 2006.

This condition is related to the morphological settings of Alghero dune field; in fact this area is characterized by a sandy bar with dunes that protect the Calich's pond, while the other sites are associated with large transgressive dune fields.

These results show that the shoreline change analysis alone is not sufficient to detect the state of equilibrium of the beach-dune system. The field survey has evidenced an overall erosion condition of the frontal dune with sediment transport to the nearshore and then to the offshore zone.

The sediment erosion from the frontal dune is mainly due to the waves motion and in particular to the run up, that removes

Fig. 5 – Windbreaks in the Buggerru dune, building to prevent sand dune drift onto near road.

sand and carries them towards the shoreline. This phenomena is particularly evident in the most extensive beaches, where the

water blade erodes the sand and carries them in the nearshore, as Buggeru, where repeated landslides have removed the shelter belts on the front of the dune (fig. 5).

The erosion of the frontal dune was detected in all sites tested and in some cases it was very marked as the Alghero beach where the wave storm caused a steep erosion sometimes of about 2 meters high.

CONCLUSIONS

The dataset derived by field surveys, sedimentological analysis, shoreline changes mapping, marine weather detection and the further GIS processing has allowed to obtain a good knowledge about morpho-dynamic processes in these beach-dune systems.

First of all, the study has highlighted a critical relationship between beach morphology and frontal dune erosion/accretion status, although there is inevitably some variation due to local factors.

The sedimentological parameters have shown a sediment migration from the foredune towards the shoreline, indicating a natural nourishment of the coast line and simultaneous erosion of the frontal dune. This data is confirmed by shoreline trend analysis that has recorded modest shoreline changes in the last 50 years.

The study have demonstrate that the dune system are an important spatial and temporal resilient factor on short-term and long-term beach erosion. They can modify the position and shape in response to variations in waves energy, climate change, sea level rise and flood.

The results obtained in this study put in evidence that beaches with modest shoreline changes need, however, of long-term detailed monitoring in relation to changes of the frontal dune. It can be considered as an alert factor to loss sediments in the beach-dune system. Then, regular monitoring using multidata source in GIS platform provides a useful means of identifying both local critical parameters and of identifying beach changes, which can be utilized to forecasting and modelling of coastal erosion processes

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

On expedition in the Aspiring geopark the Hondsrug (the Netherlands)

Posthumus C.[a]

([a]) Projectmanagement aspiring Geopark De Hondsrug .Bronnegerstraat 12 9531 Borger, The Netherlands E-mail: C.Posthumus@geoparkdehondsrug .nl

ABSTRACT

The Hondsrug area is a geological unique phenomenon within the Netherlands but also in a European context. The Hondsrug area is a geological complex of linear till ridges of about 60 km in length. Aspiring Geopark the Hondsrug tells the story of the landscape.

KEY WORDS: App, Geo-tourism, Ice age

INTRODUCTION

The Hondsrug region spans five local authority areas in the province of Drenthe. with almost two hundred thousand inhabitants. It is a unique geological area with a very special history, a place where the cultural heritage is closely linked to the land. Although the Hondsrug name is well known, people often know little about the region's historical origins and its rich cultural heritage.

The first idea of becoming a Geopark exists already for five years. An important step was made with a development project which started in January 2011. Five municipalities, the province of Drenthe, nature, cultural, tourist and heritage organisations are the owners of the project.

THE HONDSRUG AREA

The Hondsrug is an area of 930 km² in the north-eastern part of the Netherlands and has about 200.000 inhabitants.

The Hondsrug area is not only a geological unique phenomenon within the Netherlands but also in a European context. The Hondsrug area is a geological complex of linear till ridges of about 60 km in length. It was formed during the Saalian glaciation about 150.000 years ago. During this Ice Age the north of the Netherlands was covered with a layer of ice of about one thousand metres thick. When, at the end of that period the ice was disappearing, a river of ice started to flow from the northwest (now the North sea area) to the southeast over the northern part of the Netherlands all the way to the area of Munster in Germany. This 'ice river' cut deep furrows through the land. They formed the Hondsrug area and the ancient river valleys of the Hunze and the Drentsche Aa. The ridge exists of Saalian till, covered with Weichselian coversand. It is dotted with pingo remnants, dead ice depressions and erratics (with boulders coming all the way from Finland and Sweden, up till 40 tons).

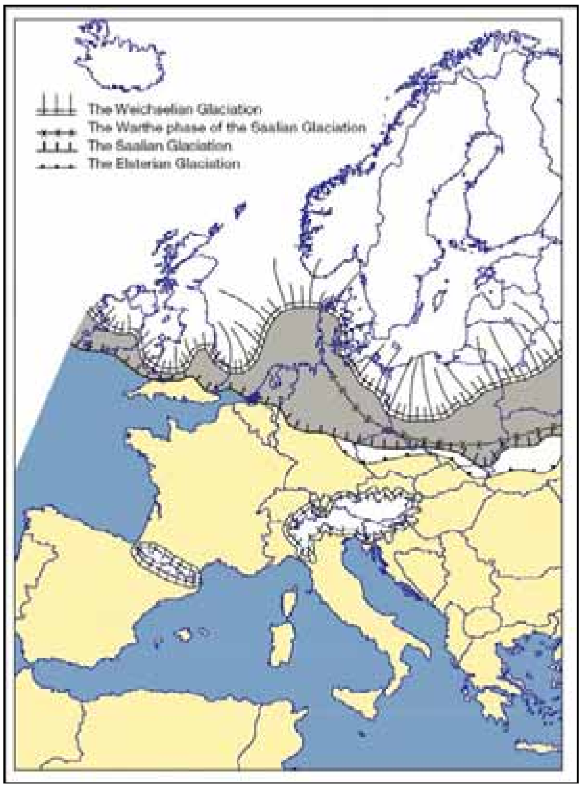

Fig. 1 - Glaciation

THE CULTURAL HISTORY

Around 5500 years ago people discovered that it was a good place to live as a farmer. Well-protected against the dangers of the sea, high and dry above the swamps all around, and with land which could provide a living. Some of the first farmers of the Netherlands started to live here and build 47 prehistoric monuments made from big boulders brought by the Ice Age. They are called hunebedden or passage graves. 90% of the prehistoric Megalithic monuments of the Netherlands are found in this area. The strong relation between geology, nature, cultural history and contemporary culture is very good visible through thousands of landscape objects all around the area.

EXPEDITIONS

Aspiring Geopark the Hondsrug tells the story of the landscape in many different manners. Not only by writing a book but by developing ‘expeditions’. Eleven expeditions will be developed. Some are already there, others are being made in the next few years. The topics of the expeditions are all related to the geology of the area, for example – Ice Age, water, nature, peat, prehistory, war and peace, art and so on. Every expedition exists of a combination of exhibitions in musea, educational programs, geosites opened for the public, hotspots, website, tourist programs, books, new walking and bicycle tours, apps for the smart phones and many other activities and products. Especially the mobile app is very innovative. In this app we use movies, animations, pictures and spoken text to inform people on location about the subject.

The aim of the aspiring Geopark the Hondsrug is to let the inhabitants, school children and tourists discover a piece of the geological history of the earth in a small, but very unique, part of the Netherlands.

WILL WE BECOME A MEMBER OF THE EGN?

This year we made our application to become a member of the European Geopark Network. We already made progress in our aim te become a fully functioning Geopark.

In this presentation we will give you a more detailed description about how visitors can experience the ‘expeditions’ of the Hondsrug area. We will end with a short movie of the Area.

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Fig. 2 - Hunebed Borger

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

Formative mechanisms and process of landforms as the main theme of science popularization activities in Zhangjiajie Global Geopark of China

Qing Huang H. ([a]), Zhang X. ([b]), Song H. ([b]) & Xiao S. ([a])

([a]) Joint Research Center for Zhangjiajie Geomorphology, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, 11A Datun Road, Chaoyang District, Beijing, China. E-mail: huanghq@igsnrr.ac.cn
([b]) Administrative Office of Zhangjiajie Global Geopark, Zhangjiajie City, Hunan, China.

ABSTRACT

The geologically and geomorphologically distinctive sites are of very high scientific, ecological and tourism values, and recent movement on developing a global geopark network has significantly stimulated geo-tourism development in many geoparks. This has imposed considerable challenges to geo-scientists who have so far done a relatively poor job on how to advise geopark managers to carry out science popularization activities, typically on 'what kind of scientific stories your landforms tell', 'how sensitive the distinct landforms are to climate change, tectonic movement and typically human activities', etc. Taking Zhangjiajie Global Geoparkof China as an example, this paper details the progress made by geoscientists for gaining a sound knowledge on the formative mechanisms and processes of the distinct landforms and consequently provides reasonable approaches for geopark managers to apply the scientific knowledge in their science popularization activities.

KEYWORDS: Landforms, Zhangjiajie Global Geopark, Landscape Evolution, Science Popularization, China.

INTRDUCTION

Zhangjiajie Geopark is located in the mountainous area of the western region of Hunan Province of China (Fig. 1). It has been one of the top-listed popular tourism sites in China, famous for its natural beautiful scenery. The landscape in the geopark has been honored as "the most fantastic mountain under heaven" and "a living Chinese landscape painting".

The geopark is covered with forest up to 95% and is the home to a number of endangered plant and animal species. It is also known as a "cultural melting pot" because there are more than 17 ethnic groups living in the area. The abundant and profound culture in relation to the surrounding environment is vividly shown in a famous performance called "Charming Xiang Xi", which has made Zhangjiajie a National Culture Industry Demonstration Base.

The landscape was first brought to public attention when a national forest park was set up in 1980 in the small, remote mountainous community called Zhangjiajie. This is the first forest park of China. In 1992, it was listed into the World Natural Heritage Catalogue by UNESCO, and in 2004 it becamea a member of Global Geopark Network. Tourism development in the geopark has been taking a very fast pace, attracting more and more visitors from home and aboard. Although the rare landscape had not been known to the public until the 1980s, it attracts nearly 10 million tourists including 550 thousand of foreigners in 2012, generating the revenue of about 5.6 billion Chinese Yuan.

Fig. 1 Location of Zhangjiajie Geopark in China

Science popularization is one of major aims of geopark development, but geopark managers face difficulties on how to carry the activities effectively in their parks. They need geo-scientists to give advices on 'what kind of scientific stories the rare landforms tell', 'how sensitive the distinct landforms are to climate change, tectonic movement and typically human activities', etc. By taking Zhangjiajie Global Geopark of China as a typical example, this paper provides a detailed account of the research progress made by geoscientists on: (1) gaining an in-depth understanding of the formative mechanisms and processes of the distinct landforms, and (2) providing scientific advices to geopark managers for effectively carrying out science popularization activities in the geopark.

FORMATIVE MECHANISMS AND PROCESSES OF LANDFORMS IN ZHANGJIAJIE GEOPARK

There are over 300 marvelous scenic spots in Zhangjiajie Global Geopark, with a total area of nearly 400 square kilometers. The outstanding landscape is dominated with the forest of around 3000 vegetated sheer vertical sandstone pillars and peaks, some of which extend up to 350 m high, while more than 1000 are higher than 200 m (Figs. 2-4). Quartz is the predominant material of the sandstone landforms, around 90%. With the changes in season and weather, they constantly present different views to spectators. These landforms are rare in the world for their large number, height and fairly pure composition.

Fig. 2 A typical sandstone pillar in Zhangjiajie Geopark

Field investigations of the formative mechansims and processes of the distinct landforms in Zhangjiajie Global Geopark have been undertaken recently (Yang et al. 2010, 2011). The results show that the landscape was formed in Devonian sandstone beds. The thickness, age and uniformity of Devonian sandstone beds, along with the density, angularity and depth of the joint patterns, have been the key determinants of the morphology and stability of the thin and very high vertical sandstone pillars and the other landforms. The global significance of this landscape reflects the dimensions (height), geomorphic characteristics (stability, craggyness, narrowness etc.) and number/density of sandstone pillars and peaks.

Fig. 3 A typical sandstone wall in Zhangjiajie Geopark

Fig. 4 A broad view of the forest of sandstone pillars and peaks in Zhangjiajie Geopark

Although the distinct landscape is characterized by various sandstone landforms, such as pillars, peaks, walls, tableland, bridges, gorges, lakes and many more, it is evident that the landforms are the results of down-cutting by stream flow in response to the regional gradual uplift. As demonstrated clearly in Fig. 5, the developmental process of the landscape follows a pathway of down-cutting the initial tableland by stream flow, then forming into gullies, and with the continual down-cutting，gullies turning into streams and rivers, leaving various forms of pillars as the remains of the landscape (Yang et al. 2010, 2011).

Indeed, Zhangjiajie Geopark has a humid, monsoon climate, with an annual average rainfall of ~1400mm. Most importantly, the rainfall concentrates mainly in a short period, predominantly from June to September, and almost every year heavy rainfall generates very large floods, the powerful erosive force of which causes considerable erosion in the geopark.

In spite of the significant progress made in research activities, many scientific problems have not been addressed properly. Typically, a sound process-based understanding of controls on pillar morphology and development is lacking and it is not clear about the role of weathering. In addition, the timing and rate of tectonic uplift, erosion/incision history and pillar development, information on long-term paleo-climatic controls on formative processes, enlarging of the vertical joints by stress release and/or valley bulging， and relationships between hillslope, weathering, and fluvial processes all warrant further detailed research. To appreciate the global significance of Zhangjiajie landscape, and associated sandstone landforms, a more extensiveknowledge of the geology and geomorphology of comparable landscapes is still lacking. To date, even the most basic database does not exist, limiting our capacity to assess the comparative evolution, representativeness and significance of any individual locality.

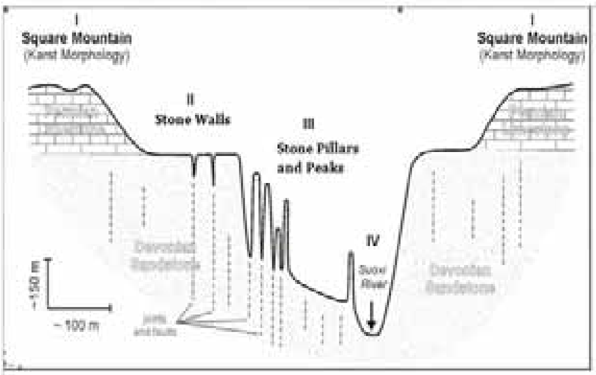

Fig. 5 A schematic map of landforms distribution in Zhangjiajie Geopark

To address these issues, a research center has recently been set up jointly by the Institute of Geographic Sciences and Natural Resources Research of the Chinese Academy of Sciences, the largest research organization in China, and the Wulingyuan Government of Zhangjiajie City. The main objectives of the center are: (1) taking Zhangjiajie Geopark as a natural laboratory to deepen our understanding of the mechanisms and processes behind the development of the rare landscape; (2) providing scientific interpretations about the evolutionary process of the rare landscape to the public so as to reinforce the values of the geoheritage and enhance sustainable tourism development; and (3) providing scientific advices to the management of Zhangjiajie Global Geopark. The detailed information and activities of this center can be obtained from the website:http://www.zjj-geomorph.ac.cn.

THEME OF SCIENCE POPULARIZATION ACTIVITIES IN ZHANGJIAJIE GEOPARK

In recent years, concern for classifying landforms has been experienced in China, where significant sensitivity surrounds the distinctiveness of sandstone landscapes. A number of scientists highlighted a desire for ‘Danxia’ to be adopted as the generic term to define ’continental red-bedlandscapes’ world-wide, and whether the landscape of sandstone in Zhangjiajie Global Geopark reflects a type of Danxia has also received considerable debates. This has brought considerable confusion on how to explain the physical cause and process leading to the distinct landforms in Zhangjiajie Geopark to the public. As pointed out by Brierley et al. (2011) after a detailed field investigation by a group of leading geo-scientists from many parts of the world, however, there is a clear distinction between the sandstone landforms at Zhangjiajie and the Danxia phenomenon.

In Danxia areas, sandstone is usually just one component of the geology, which more often than not is dominated by great thicknesses of conglomerates and/orbreccias, and may also contain mudstone, marl, minerals, some limestone and evaporite. Furthermore, Danxia is a landscape developed on Mesozoic continental deposits, while other apparently similar landscapes may be formed from marine sediments or older sandstones that have been subjected to different phases of lithification.

To recognize the predominant role of cutting-down by stream flow in shaping landforms in Zhangjiajie Geopark and the difference in landform formative mechanisms and processes of the geopark from the Danxia phenomenon is very important for carrying out science popularization activities. As the theme of the geopark is clear and physically reasonable, all activities can take place within the context of the theme. These include:

(1) Setting up display boards and signs at typical scenic spots and providing scientifically reasonable and yet easily understandable explanations to visitors at these sites by replacing those information which do not have a convincing scientific reasoning;
(2) Training tour guiders with reasonable scientific explanations on the formative mechanisms and processes of the distinct landforms so that they can give scientific explanations to tourists, arousing their interests in geo-science and environmental conservation;
(3) Using internet and other media to introduce current research progress in simply languages to the public, typically school students;
(4) Carrying out fun and relaxing activities such as walking or playfields for kids with some programs linking with the theme of the geopark;
(5) Making some popular songs and statements that reflect the theme of the geopark;

(6) Establishing parterships with other global geoparks so as to enhance the global significance of geoparks and learn better management approaches;
(7) Building up a museum or a science center to display research outcomes, images, photos, physical models, research techniques and other relevant information on the landforms so as to enhance the knowledge of the visitors and inspire their interests on geo-science and environmental conservation.

DISCUSSION AND CONCLUSIONS

Geopark development has made significant progress in recent years and yet the distinct landforms of global significance have not received sufficient studies. This has made geopark mangers face serious challenges on how to carry out science popularization activities. By focusing on the distinction of landforms in Zhangjiajie Global Geopark of China, this paper details research progress towards a deeper understanding of the formative mechanisms and process of the distinct landforms in the geopark. It is shown clearly that the mechanisms and formative processes of landforms in Zhangjaijei Global Geopark are different from Danxia landforms. Down-cutting by steam flow is the major driving factor shaping landforms in the geopark. Within the context of this theme, several approaches are proposed for carrying out science popularization activities. While this demonstrates the importance of scientific knowledge in the management of geoparks, it is also clear that at the present this knowledge is very limited and more detailed research needs to be carried out. This is vital for geopark development and all geoparks should provide sufficient support. It is also evident that Zhangjiajie Global geopark is an excellent example of a unique landscape; that warrants further study to fully appreciate and understand its place in the broader scientific significance.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

Agro-environmental land management in the aspiring Geopark of Minorca: highlighting and promoting sustainable use of natural resources through the very first georoute.

Quintana R. ([a]), Poch J. ([b]), Pérez M. ([c]), Febrer A. ([d]), Marí S. ([a]), Juaneda J. ([e]) & Orfila J. L. ([e])

([a]) Institut Menorquí d'Estudis, Camí des Castell, 28 (07702-Maó), Minorca, Spain E-mail: quintanaf@gmail.com
([b]) Departamento de Geología, Edificio C; C2-130, Univ. Autónoma de Barcelona (08193) Cerdanyola del Vallés (Barcelona) Spain. E-mail: joan.poch@gmail.com
([c]) Consultant at EILEAN | Environment and tourism. C/ Bajolí,73 (07714-Maó), Minorca, Spain. E-mail: marta.perez@eilean.com
([d]) Consultant at Context | Online Marketing Strategies. C/ Carritxaret, 18-13 (07749- Es Migjorn Gran), Minorca, Spain. E-mail: antoni@afcontext.com
([e]) Council of Minorca, Minorca Biosphere Reserve Agency. Plaça de la Biosfera, 5 (07703-Maó), Minorca, Spain.

ABSTRACT

In small islands the territory is understood as a limited natural resource. In Minorca about 50% of the territory corresponds to agricultural land use. In that sense, the agrarian sector appears as a strategic sector to ensure environmental and landscape future of the island. One of the strategic focuses of the Minorcan Geopark project model is to highlight and promote sustainable land management through two 8-years existing agro-environmental practices projects: Agricultural Contract of the Biosphere Reserve (CARB) performed by the Council of Minorca and a Sustainable Agricultural Practices Agreement trough land stewardship performed by a local environmental NGO. Both projects have become excellent tools for managing land in a sustainable way. Land properties have shown an increase of biodiversity and the restoration of ethnological heritage. The design of the very first georoute of the aspiring Geopark of Minorca has included guided visits to two of the farms within these projects.

KEY WORDS: limited natural resource, Minorca, sustainable land management, Minorcan Geopark project model, georoute, sustainable agricultural practices.

INTRODUCTION

After taking the official resolution on presenting the Minorca's Geopark candidacy, work has been focused on conceptualize the Minorca Geopark project model. One of the model strategic focuses is the sustainable land management trough sustainable agricultural practices.

Rural areas have become under increasing pressure to rationalize their resource industries in order to remain competitive, often resulting in more monoculture and high resources consumption (i .e. water). However, the society is continually changing its priorities and as a consequence issues such as a guaranteed quality food supply and the preservation of natural values are increasing in importance.

One of the main characteristics of Minorca is the diversity characteristic of nearly all Mediterranean island ecosystems and the good conservation status of them as well as a rich cultural heritage. In that sense, the demand on touristic activities related to the discovering of the natural and cultural heritage has flourished last years. However, environmental, economic and sociocultural sustainability of tourism is also influenced, both directly and indirectly, by the sustainability of other resource stakeholders. In Minorca about 50% of the territory corresponds to agricultural land use. Thus, part of the agrarian sector took a step forward to sustainability.

AGRICULTURAL CONTRACT OF THE BIOSPHERE RESERVE

Given the need to safeguard the cultural landscape as a characteristic island feature, as well as the environment, the Council of Minorca is promoting since 2005 the Agrarian Contract of the Biosphere Reserve (Spanish acronym CARB). The main objective of this initiative is to compensate Minorcan farmers to have maintained their traditional landscape and farming and livestock activity, one of the distinguish features and main tourist attractions on Minorca. It is a mutual agreement between the Island Council and the farm or ranch. The Island Council, in turn, provides aid and compensation, as well as services and specific training.

A total of 180 farms corresponding to approximately 27000 has. (57% of the agrarian land use) are within CARB

SUSTAINABLE AGRICULTURAL PRACTICES AGREEMENT

Sustainable Agricultural Practices Agreement intends to promote systems of management which will bring the objectives of economic viability within reach (fundamental for the survival of the agricultural sector) by conserving the most basic environmental values (fundamental not only to Minorcan society but also so that the agricultural sector can continue to function in the future) On the one hand it is a sustainable plan for a practice with an economic focus, that will help the viability and survival of that practice. On the other hand it entails the conservation of the environmental value of the plant life, animal life and the countryside itself, which will contribute to the quality of life of the whole population. The Sustainable Agricultural Practices Agreement is initially a

Fig. 1 – The Minorca Geopark Project Model and the strategic focuses.

voluntary agreement between two parties: the farm and local NGO.

A total of 25 farms corresponding to 2066, 23 has (4,3% of the agrarian land use) are within this Agreement.

MINORCAN GEOPARK PROJECT MODEL

Since Biosphere Reserve declaration in 1993 enormous amount of scientific and technical work has been done on vast variety of topics as natural and cultural heritage, sustainable development and land management. The Geopark project has become a chance to put together all the different issues aiming to protect and take advantage of all the island's possibilities (economic, tourism, educational, scientific and cultural) based on the island heritage. The Geopark project it is seen as a transfer of knowledge from scientific circles to society and towards economic development.

The Minorcan Geopark Project Model is based on 12 strategic focuses (Fig. 1): geological heritage; ethnological heritage; bronze and iron age Talaiotic culture; sandstone and dry stone architecture; structured network of trails and rural paths; research, education and dissemination; local products; public, social and business sector participation; Biosphere Reserve; sustainable land management; and natural and active tourism.

THE GEOROUTE

The island of Menorca is located at the end of the Balearic Promontory, which is the most north-eastward extension of the Betic Range External Zone (Gelabert, et al., 2005). From a geological and morphological point of view the island is divided in two different halves. The Migjorn or the southern

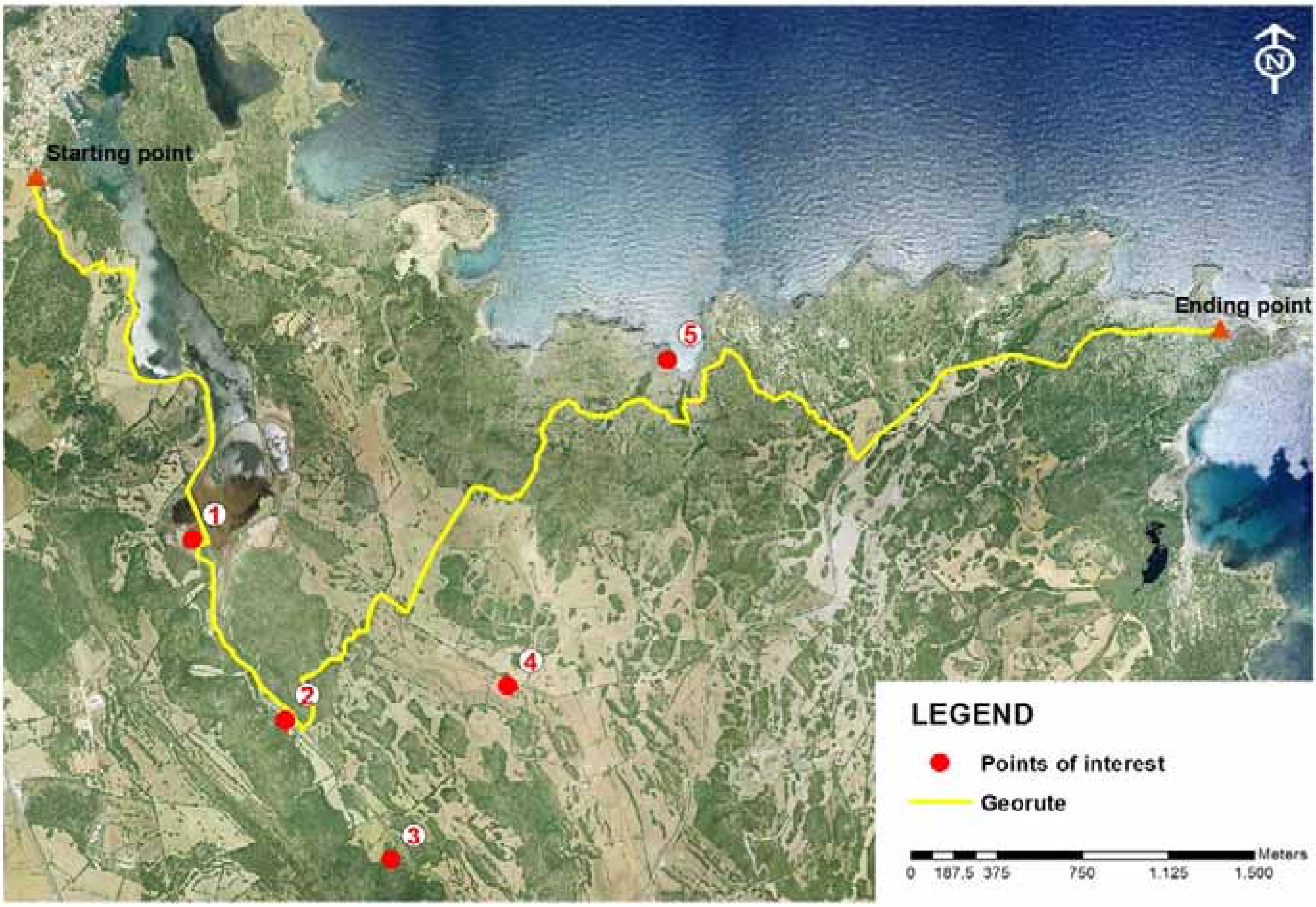

Fig. 2 – The Georoute and the points of interest

area, composed by nearly horizontal Upper Miocene calcarenites and limestones representing a progradational rhodalgal ramp and a reef complex corresponding to a progradational reef-rimmed platform (Pomar et al., 2002). The located in a Natural Park of Minorca, the core area of the Biosphere Reserve zonation (Fig. 2). The area is located at the Tramuntana region presenting Carboniferous rocks made up of shales with sandstones and conglomerate lenses deposited in a turbiditic environment and a sequence composed of Permo-Triassic red shales and sandstones with paleosols corresponding to fluvial sedimentation.

The georoute starts at Addaia residential area and belongs to the Camí de cavalls footpath (GR 223) and finishes at Favàritx Cape. The Camí de Cavalls is an ancient path of 185 km long that surrounds Minorca following the coast crossing gullies, rocky zones, valleys, streams, wetlands and farming areas linking ancient watchtowers and lighthouses. The Camí de Cavalls has become a true window to landscape, meaning to the natural and cultural heritage.

Tramuntana or the northern area, is characterized by folded and faulted Palaeozoic, Mesozoic and Oligocene strata presenting a wide lithological variety (Bourrouilh, 1983). The georoute is

The points of interest are:

- old salines. Nowadays is a hypersaline wetland which supports a large diversity of animals and plants being a major arrival point for migratory birds (1).
- *Capell de Ferro* farm (Sustainable Agricultural Practices Agreement): the story of an abandoned farm transformed into an indigenous red cow stockbreeding (3)
- Triasic red sandstones outcrops (2).
- *Pou d'en Caldes* cove. Turbiditic Carboniferous succession of thin-bedded, fine-grained overbank deposits and quaternary fossil dune remains (5).
- *Mongofra Vell* farm (CARB). Ethnological heritage, cultural landscape and endemic plants as thorny shrubs (4).

Fig. 4 – Traditional well and water trough in Mongofra Vell farm.

Fig. 6 – Signposting at the georoute indicating sites and distances.

The estimated journey time on foot including stopping time at points of interest is 4 hours covering a distance of 10,2 kilometers. Even though the georoute is also suitable for mountain bike and horse riding. This is one of the areas that best defines the rich and varied environments that make up the island's north coast. The georoute starts at a stretch of water at *Port d'Addaia*, where both water vegetation, and salt marsh vegetation is present in an old salines environment. Then the path turns inland where Triasic red sandstones outcrops and typical Minorcan agricultural surroundings formed of ploughed fields, fields for livestock to graze in and areas with Mediterranean bushes are present. Before reaching es *Pou d'en Caldes* cove lithology changes from Triasic to turbiditic Carboniferous succession getting into a dark rock and scarcity of vegetation landscape. The existence nearby *es Pou d'en Caldes* of Quaternary fossil dunes and an Aeolian sequence composed by carbonates in an area with siliceous rocks is a good example about how biodiversity (*phytodiversity*) increases with geodiversity where calcicole plants are present.

Fig. 5 – *Pou d'en Caldes* cove. Turbiditic Carboniferous succession of thin-bedded, fine-grained overbank deposits.

Concerning signposting it is clear throughout the entire georoute (Fig. 6). About the georoute information there are leaflets available at the main tourism information officers and at the Natural Park reception. A catalan, spanish, english and german *Cam de Cavalls* Guidebook is also available. It is planned to use QR codes along the georoute and a downloadable technical datasheet form the Minorca Geoparc Project website.

After some meetings between land owners, Natural Park staff and nature tourism business to explore the possibilities and the interests of launching the georoute, training courses for guides about natural, cultural and land management started. One of the requirements of the land owners to have access to their properties was to plan visits and being done by a guided group.

Work with Natural Park managers has been done in terms of balancing conservation and nature-resource management with the ability to manage visitors flow in a way that both preserves the integrity of the natural environment (geological and botanical) and allows for high-quality and satisfying visitors experience. Also restricted admission (permanent or temporary) to certain parts of the area was planned (i. e. nesting period for some sensitive bird species). After confirming the decrease of some migratory birds nesting at the old salines wetland a change in the itinerary of the georoute is planned in order to avoid human disturbance as well as soil compaction and stream margins erosion. Areas with high concentration of rare endemic plants (i.e. *Apium bermejoi*) are not accessible.

The georoute has been developed with the involvement of different stakeholders: land owners, Natural Park, a local NGO, a local nature tourism enterprise and public institutions.

CONCLUSION

The agricultural community is in charge of a part of the natural resources management. Having a territorially organized countryside means a cultural and landscape contribution that benefits tourism activity, that is positive externalities from agriculture towards the rest of the economy. Trough the georoute it is achieved the dissemination and the promotion of sustainable land management trough sustainable agricultural practices. That is helping to raise the prestige of the sector.

Agricultural practices considered in both projects are those associated with soil conservation, efficient water use, biodiversity, habitat conservation, forest conservation, natural landscape conservation and conservation of rural traditions and culture. Both projects ensure environmentally friendly farm production and high quality value added products and allow compatibility between environmental protection and economic activity. Since conservation and tourism have so much in common, the inclusion of guided visits within these farms in the very first georoute, will strength the partnership between both parties.

ACKNOWLEDGMENTS

Albufera des Grau Natural Park staff, Capell de Ferro farm, Mongofra Vell farm, Maria Teresa Gustems from Menorca en Kayac.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

Cementing the Arouca Geopark (Portugal) extension through the Montemuro Mountain geological and intangible heritage

Rocha D. ([a,b]), Neves R. ([a]), Sá A. ([c,b]) & Duarte A. ([a])

([a]) AGA – Associação Geoparque Arouca, Rua Alfredo Vaz Pinto – Apt. 20, 4540-118 Arouca, Portugal. E-mail: drocha@geoparquearouca.com
([b]) Centro de Geociências da Universidade de Coimbra, Largo Marquês de Pombal, 3000-272 Coimbra, Portugal
([c]) Universidade de Trás-os-Montes e Alto Douro, Departamento de Geologia, Quinta de Prados – Apt. 1013, 5001-801 Vila Real, Portugal

ABSTRACT

Since 2011 that the geological inventory of six neighboring municipalities of the Arouca Geopark has been developed aiming the possible extension of this Global Geopark territory.

The Montemuro Mountain plateau located in northeast part of the Arouca Geopark, and also in the south of Cinfães and in the north of Castro Daire municipalities, has a very rich geological and intangible heritage related to granitic geoforms with similarities with objects, animals or people or with special significance for the local communities.

This heritage could be very important and useful in a future extension of the Arouca Geopark.

KEY WORDS: Arouca Geopark, geological heritage, geopark extension, intangible heritage, Montemuro Mountain.

INTRODUCTION

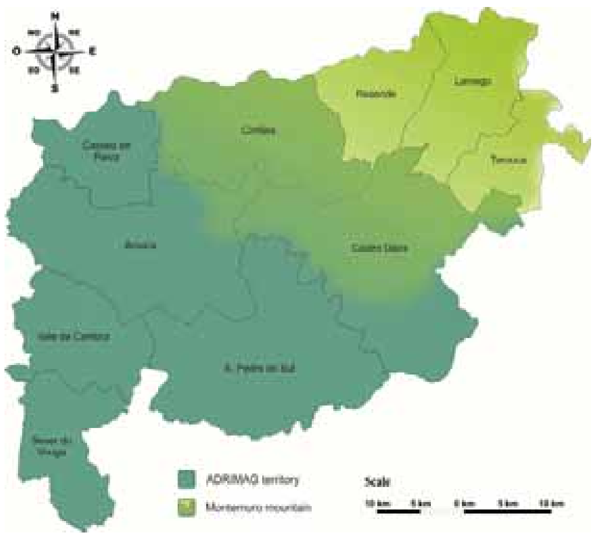
In the north of Portugal there is, since 2009, the Arouca Global Geopark, a territory with 328 km^2, which area corresponds to the administrative borders of the Arouca Municipality (Fig. 1).

During the last two years an intensive work has been carried out aiming the inventory of the geological heritage of six Arouca neighboring municipalities: Castelo de Paiva, Cinfães, Castro Daire, Vale de Cambra, S. Pedro do Sul and Sever do Vouga, covering a total area of 1.690 km^2.

The Montemuro Mountain (Fig. 1) is a massif with steep slopes, measuring 1381 meters at its highest point and displaying a clearly asymmetrical triangular form (Ferreira, 1978; Vieira, 2001; 2008). According to these authors the Montemuro Mountain is located over six municipalities: Arouca, Cinfães, Castro Daire, Resende, Lamego e Tarouca.

The studied region comprises only in the western part of the mountain corresponding to part of the area of Arouca, Cinfães and Castro Daire municipalities.

The Montemuro Mountain plateau is full of granitic geoforms, which are the main aim of the present short note.



MONTEMURO MOUNTAIN GEOLOGICAL SETTING

The Montemuro Mountain has an unmatched beauty and morphologic magnificence but still is a region with a considerable lack of geological knowledge as already recognized by Amorim Girão`s study 'Montemuro. A mais desconhecida serra de Portugal' (Girão, 1940). However since 2001 several researchers have developed few works, concerning the geomorphological heritage inventory and its touristic valorization (Cunha & Vieira, 2004a; 2004b; Vieira, 2001; 2005; 2006; 2007; 2008).

From the geological point of view this mountain has a clear predominance of granitic rocks (74% of the total area), occupying the entire northwest and central sectors. The remaining area is occupied by Neoproterozoic and Paleozoic metassedimentary rocks (Teixeira *et al.*, 1969; Vieira, 2008). In the Montemuro plateau there are many different geoforms caused by several morphogenetic processes that affected this area like grooves, fissures, pedestal forms or taffoni, among others.

THE INTANGIBLE HERITAGE ASSOCIATED TO SOME GRANITIC GEOFORMS

The Intangible Cultural Heritage, or living heritage, consists of practices and expressions, as well as knowledge, skills and values associated therewith, that communities and groups recognize as part of their cultural heritage. It is transmitted from generation to generation, most part orally (UNESCO, 2003).

During the General Conference of UNESCO, in October 2003, it was adopted the Convention for the Safeguarding of the Intangible Cultural Heritage. The preliminary measure for safeguarding the intangible cultural heritage is to ensure its identification and the next stage is to ensure that it is being perpetuated (UNESCO, 2003).

Despite the adverse morphologic and climatic conditions, the Montemuro Mountain has always attracted inhabitants. Proving that the rich archaeological and historical heritage highlighting the 'Montemuro Walls' (*Portas de Montemuro*). This cultural site is located in a strategic and panoramic point to Bestança and Douro valleys (North) and to Paiva valley (South), and was used since immemorial times as a defensive site (Almeida & Belo, 2007).

The granitic geoforms of Montemuro Mountain take special meanings for the local communities. On the one hand there are granitic geoforms that seems objects, animals (zoomorphs) or people (antropomorphs); on the other hand there are granitic geoforms that have special significance for local communities, with some legends and/or traditions associated.

This work presents some inventoried granitic boulders integrated in those referred categories. The methodology used was a bibliographical revision (Almeida & Belo, 2007; Cunha & Vieira, 2004a; 2004b; Ferreira, 1978; Girão, 1940; Mendes, 1997; Silva & Moreira, 1997; Teixeira et al., 1969; Ventura, 2000; 2001; Vieira, 2005; 2006; 2007; 2008), a toponymical review (Carta Militar de Portugal. Folhas nº 136, 137, 146, 147) and field work carried out in mountain villages for questioning local people.

In the Montemuro Mountain several names of granite boulders refer directly or indirectly, with metaphorical descriptions, to the geological heritage of a region and more specifically to its geomorphological characteristics. Some examples are: 'Wedding boulder' (Penedo dos Casamentos), 'Lady`s foot boulder' (*Penedo do Pezinho da Senhora*), 'Beast footprint' (*Pegada da Besta*), 'Fat slab' (*Laje Gorda*), 'Moon boulder' (*Penedo da lua*) 'Drum' (*Tambor*), 'Female dogs boulder' (*Penedo das Cachorras*), 'Woman hood boulder' (*Penedo da Mulher da Capucha*), 'Dolphin muzzle boulder' (*Penedo do Focinho do Golfinho*), 'Little Duck boulder' (*Penedo do Patinho*), 'Hand boulder' (*Penedo da M o*), 'Warrior boulder' (*Penedo Guerreiro*), 'Car boulder' (*Penedo do Carro*), 'Chair boulder' (*Penedo da Cadeira*), 'Hatter boulder' (*Penedo Chapeleiro*), 'Resting boulder' (*Penedo do Descanso*), among others.

Fig. 2 – Pudding boulder (*Penedo Pudim*).

GRANITIC GEOFORMS THAT SEEMS OBJECTS, ANIMALS OR MEN

The similarity of some granitic boulders with objects, animals or even with the men meant they were assigned a name as the 'Pudding boulder', the 'Buttock boulder' and the 'Dog boulder'.

The 'Pudding boulder' (Fig. 2) is located near Rossão village in Castro Daire municipality. It is a boulder with approximately two meters high and present some linear grooves developed vertically on the surface facing the West, without apparent relationship to the structure and texture of the rock.

On the left side of the road that links Gralheira to Vale de Papas (Cinfães municipality), lays a big boulder, locally known as 'Buttock boulder' (Fig. 3) due to its similarity with that part of the human body. This shape is related to the existence of a vertical joint in the granitic boulder. Close to this there's another big boulder, seemed to an egg, which supports part of the mill's wall.

Fig. 3 – Buttock boulder (*Pedra Nalga*).

Fig. 4 – Dog's head boulder (*Penedo Cabe a de C o*).

Fig. 6 – Taffoni in a Boulder of the Moorish woman house (*Casa da Moura*).

Also in Cinfães Municipality occurs a zoomorphic shape referred in the local toponymy as the 'dog's head boulder' (Fig. 4). This boulder is located in a top of a high point of Montemuro Mountain – Malhada region, between the Bestança and Tendais rivers, offering great panoramic views over the following villages: Aveloso, Casais, Sá, Meridãos, Mourelos and Vila Boa de Baixo, Vila Boa de Cima, Soutelo, Bustelo and Alhões. It is visible from its 360° surrounding landscapes, looking always as dog' head, which gave it a big sense of identity as it is well known by all the neighboring communities and it is used as an orientation point. It is also visible from most of the main road that links Cinfães to Castro Daire.

Granitic Geoforms that have special significance for local communities

Integrated in a granitic residual relief (Palouco) and closed to S. Pedro do Campo Chapel and Marcelim village (Cinfães) occur a very mystic granitic geoform of Montemuro Mountain: the Moorish woman house (Fig. 5) at about 1.021 meters of altitude.

Several boulders of the granitic relief shape an open space that the local community says that this place was inhabited by a Moorish woman. Close to this entrance, one of the boulders present a very special taffoni with a shape of a V (1,5x1 meter: Fig. 6). This taffoni originated a legend saying that this was the place where the Moorish woman and her sons slept. Inside there, a human foot was carved on the boulder and a stone serves as 'trasfogueiro' (fireplace) to shepherds to build a fire in order to keep warmed and dry their clothes and shoes.

The tradition of Moorish women legends connected with granite sets seems to be related to the strength and vigour that local communities should be inspired and also as a request for energy and power for their daily struggle in agricultural works. Moorish woman was imagined as a very strong woman, able to carry on her head a big boulder while spinning yarn on a drop spindle and leading a yoke of oxen at once. 'She was strong' they said. These testimonials passing from generations to generations emphasizing the spiritual need that farmers and shepherds had to find in their day to day life (Mendes, 1997; Ventura, 2000).

The 'Health boulder' (Fig. 7) located in Gralheira village (Cinfães) consists of three blocks, two rooted in the bedrock and a third on the top of them. From the geological point of view it is integrated in the pedestal geoforms. Local people use to say that this boulder has great influences to treat those who rest nearby taking advantage of its shadow. In particular the tuberculosis patients should go on around him and mitigated the effects of this terrible disease.

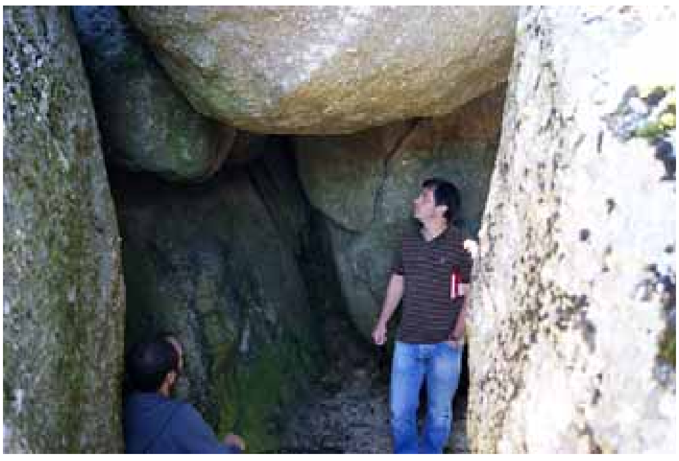


Fig. 5 – Moorish woman house (*Casa da Moura*).

Fig. 7 – Health boulder (*Penedo da Sa de*).

Fig. 7 –Boulder of the stones (*Penedo das Pedras*).

Fig. 9 – The sun at the mark (*O Sol   marca*).

The ‘Boulder of the Stones’ ***(Penedo das Pedras:*** Fig. 7***)*** is located in Gosendinho (Castro Daire), beside the path between this village and Petrarouca (municipality of Lamego) and is related to a peculiar ritual: those who were going to get married should put a small stone on top of the foot and kick it to the top of this boulder. If the small stone didn’t stay there, people should try again until it remains there. This fact will ensure a happy marriage.

During the summertime enormous cattle came to Montemuro Mountain from distant lands looking for better pastures - transhumance (Silva & Moreira, 1997). It is remarkable the way people used some boulders as natural shelters to protect them from rain and other type of climatic adversities. Despite the good number of boulders that look like shelters, the ‘Holed Boulder’ (Fig. 8) is an important for the closest communities due to its special location and good dimensions. It is possible to say that this boulder is the best one concerning the comfort and views.

‘The sun at the mark’ (Fig. 9) is the name of three big boulders lying close to Cimo de Vila village. This natural site stands out clear from the surrounding landscape due to the size and position of the three boulders. This natural mark is used, since long time, as a natural clock (inspired on a sun clock) by the people from the opposite villages in order to share time to use the irrigation water. Since the shadow line of the mountain behind those villages reaches the middle of the three boulders it is time to another owner to change the water course to irrigate his fields. This timesharing of water only works during the spring and summer times and when it was raining people bases time on the hour of the previous day.

Laying on the Mares’ Valley (*Vale das guas*), the ‘Valentines Boulder’ (*Penedo dos Namorados*: Fig. 10) consist on a remarkable set of granite with great panoramic views over the Leomil, Estrela and Caramulo mountains, Gralheira massif and Moura Morta-Reriz fault. Besides the panoramic views, its location between the villages of Rossão (Cinfães municipality) and Moura Morta (Castro Daire municipality) assigned it excellent conditions for lovers to meet, while leading the cattle. Shepherd(ess) from Rossão (the upper side) left the cattle close to Mares’ Valley and shepherd(ess) from Moura Morta left the cattle lower to meet at the this granitic set for romance.

Fig. 8 – Holed Boulder (*Pedra Furada*).

Fig. 10 – Valentines Boulder (*Penedo dos Namorados*).

CONCLUSIONS

The Montemuro Mountain offers a great diversity of granitic geoforms, some of them allowing telling stories of Montemuro communities. This high geological and intangible heritage could be promoted through thematic pedestrian trails with great geotouristic potential. At the same time is important to preserve and promote this heritage to the younger generations and also to the outsiders that demand this territory. In this sense, this heritage could be important in the future as justification for the inclusion of this territory in the Arouca Geopark extension.

ACKNOWLEDGMENTS

We would like to thanks to the Montemuro Mountain inhabitants which contribute for the granitic boulders inventory: Reinaldo Rego (Meridãos, Cinfães), António Duarte (Faifa, Castro Daire), Carlos Teixeira and family, José Maria da Cunha and Abílio Rodrigues Costa (Rossão, Castro Daire), António Jorge (Aveloso, Cinfães), Izilda Cardoso (Macieira, Cinfães), Manuel Resende e Albano Rocha (Fermentãos, Cinfães), Antíloco Oliveira e Adelina Oliveira (Alhões, Cinfães), Orlando Ferreira, Dulce Fernandes, Maria de Lurdes Martins (Bustelo da Laje, Cinfães), Avelino Rodrigues Pedrinho e Gualtino Cardoso (Gosendinho, Castro Daire), Maria Célia Teixeira Matias, Abel Pereira Santos e Virgílio Esteves (Moura Morta, Castro Daire).

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GEOschools Project teaching modules: Teaching Geosciences in the Field - Geoparks and Geosites

Rodrigues J. ([a,b]), de Carvalho C. N. ([a,c,d]) & Catana M. M. ([a,b,c])

([a]) Geopark Naturtejo da Meseta Meridional – European and Global Geopark under UNESCO. Centro Cultural Raiano, Av. Joaquim Morão, 6060-101 Idanha-a-Nova, Portugal. joana225@gmail.com
([b]) Geology Centre of the University of Porto/University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal.
([c]) Municipality of Idanha-a-Nova, Av. Joaquim Morão, 6060-101 Idanha-a-Nova, Portugal.
([d]) Geology Centre of the University of Lisboa, C6, 3rd floor, office 6.3.57, 1749-016 Lisbon, Portugal.

ABSTRACT

GEOschools is a European Union Comenius project whose target is to define a “Framework on Geosciences Literacy Principles” for the secondary school in Europe.

One of the products of this project is the teaching modules reflecting this framework. It will be presented “Teaching Geosciences in the Field: Geoparks and Geosites” module projected for Naturtejo Global Geopark. These are teaching modules, which include material for teachers and worksheets for the students use during fieldtrips.

The proposed approach is based on brainstorming activities around a key-question for each selected geosite that will promote on site observation and debate. Such a teaching approach will develop skills contributing for the education of a conscientious citizen.

“Teaching Geosciences in the Field: Geoparks and Geosites” in Naturtejo Geopark is a privileged area to explore the Geoscientific subjects and including *Geodiversity*, *Geological Heritage*, *Geosites*, *Geoparks* and *Geoconservation*. But also to promote interdisciplinary bridges with approaches in *Archeology*, *Biodiversity* and *Culture*.

KEY WORDS: GEOschools Project, geosites, Naturtejo Global Geopark, teaching module.

INTRODUCTION

GEOschools (http://geoschools.geol.uoa.gr/) is a European Union project supported by the Comenius Lifelong Learning Programme, which brings together geoscientists from universities, museums, geoparks, teaching training institutions and educators and focuses to “translate” geosciences into language and learning opportunities to be understood by school students (Fig. 1).

The main goal of the GEOschools project is to define a “Framework on Geosciences Literacy Principles” (Fermeli et al., 2011), for the general European citizens, to be applied at least for the revision of obligatory school curricula for secondary schools for the participant countries: Greece, Spain, Italy, Portugal and Austria. Main aims of the project are: (a) bridging the gap between scientific knowledge and school knowledge in geosciences; (b) increasing the knowledge of teachers and the ability of students in valuing and appreciating geosciences; (c) improving educational skills of geosciences in European school environment; (d) establishing and sustaining a consortium on research and initiatives on geosciences didactics; and (e) supporting education for sustainability.

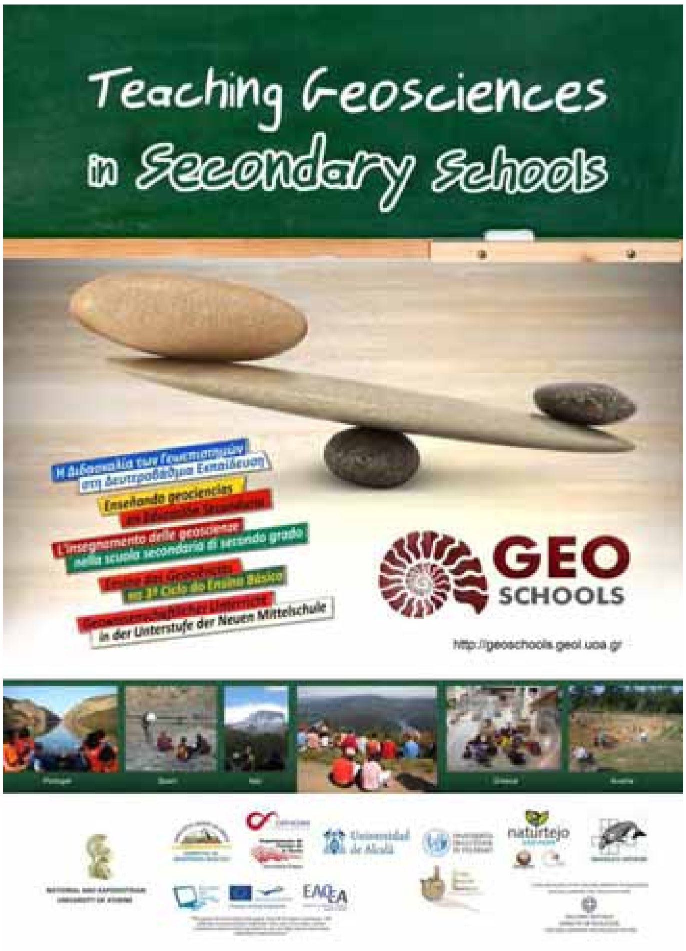

Fig. 1 – GEOschools Project dissemination image (http://geoschools.geol.uoa.gr/).

The key results to be issued during the development of the project are: a curriculum comparison research; students and teachers interest research; a school geosciences dictionary (lexicon); teaching modules on specific subjects, and an interactive website/portal including an e-Newsletter.

TEACHING MODULE. *TEACHING GEOSCIENCES IN THE FIELD: GEOPARK AND GEOSITES*

Naturtejo Geopark, European and Global Geopark under UNESCO since 2006, has about 170 geosites and a geological history with over 600 million years spread in 4627 km^2. The selected geosites for the teaching module include protected areas, archeological sites, and walking trails.

The module "Teaching Geosciences in the Field: Geoparks and Geosites" in Naturtejo Geopark is centered not only in the topic Geoparks and Geosites but also in Geodiversity, Geological Heritage, Geoconservation, Nature Conservation, and Human Impact in the Landscape. It is a privileged site to propose interdisciplinary bridges with approaches in Archeology, Biodiversity and Culture.

In Naturtejo Geopark there are Educational Programmes prepared according to curricula programs of the Portuguese Ministry of Education, which are addressed to all education levels, from kindergarten till university (Catana, 2009a). In the programme "School meets the Geopark", students and teachers visit geosites, museums, carrying out walking trails, boat trips, visit science centres, always guided by the Geopark specialised team. There is also the "Geopark goes to School", where the geopark's team operates several activities inside the classroom or taking the geodiversity around the school. A special annual programmes "Anim'a Rocha" (which may be translated as Hearten Rock), is conceived to support teachers and students all over the school year, is also part of the educational offer. As Education does not finish in the school, the Geopark works to communicate heritages to the public, by fitting particular strategies, with proper tools, specific strategies and specialized guides (Catana, 2009b; Neto de Carvalho, 2009; Rodrigues, 2012).

Geosite Selection

During the I GEOschools Conference, on the scope of the GEOschools Project, about 100 teachers visited selected geosites (Neto de Carvalho et al., 2011, Rodrigues et al., 2011). Besides the recognized scientific importance of the geosites and its pedagogical relevance, already used in the Naturtejo Geopark Educational Programmes, teachers discussed their pedagogical use in classes.

Some of these geosites are also used as examples in Portuguese textbooks for different subjects. All these sites have high pedagogical value, with good legibility and magnitude of the phenomena or processes involved, easy accessibility, most of them with interpretative walking paths, and include one Natural Monument, one National Monument and sites associated with other heritage values.

Monsanto Inselberg was selected because it is one of the best examples of this kind of large scale landform in Portugal. Rises up as a residual relief from Castelo Branco Surface, with a 310 million years history since the magma intrusion and crystallization. This typical granite landscape, covered by giant boulders, displace many examples of granite landforms, including ingenious uses of the granite by Man along millennia and a unique geomorphological-dependent culture. These features make this geosite an excellent open air classroom, where geological, historical and cultural heritage are combined in harmony. It is possible to visit the geosite through the geotourist footpath "Boulders Trail".

Penha Garcia Ichnological Park is one of the ex-libris of Naturtejo Geopark (Fig. 2). It integrates landforms (epigenetic valley), structures (faults, folds, beds, physical and biogenic sedimentary structures) and geological materials (rocks and fossils) with high scientific and pedagogical value. Within the Fossils Trail, that crosses the geosite, it is possible to have a general overview of these different types of coexisting heritage, including popular architecture using quartzite, the Templar Castle, water mills, rock-related habitats for flora and fauna of special interest for conservation. In this sense, Penha Garcia Ichnological Park is considered a Nature Exomuseum.

Fig. 2 – Penha Garcia Ichnological Park during a school visit.

Ponsul Fault is the major tectonic structure in the region and its effects can be observed in several sites of Naturtejo Geopark. It is possible to observe the fresh scarp and the two different blocks in a larger scale geosite (Castelo de Idanha-a-Nova Viewpoint) and also to analyse the recent reverse movement of the fault that thrusted tardi-Variscan granites over the more recent sandstones from Palaeogene (Road 354, Idanha-a-Nova).

Portas de Ródão Natural Monument is one of the ex-libris of Naturtejo Geopark and includes several geosites in its national protected area. From the viewpoints it is possible to appraise the magnitude of the Appalachian-type quartzite crest, the epigenetic gorge and the Ródão Syncline. The relation between Biodiversity and Geodiversity is also very significant in the inaccessible cliffs, with priority habitats.

Fossil Tree logs were selected because they are rare paleobotanical findings in Portugal (Fig. 3). They are two specimens of the few fossils known of the *Annonoxylon teixeirae*, described for the first time in Portugal and still poorly known in the world fossil record. It is possible to observe the presence of interaction marks between distinct insects and the trunks (drilling patterns). The taphonomy of the logs allows reconstructing the climatic conditions in the region for the Miocene in the past.

Portas de Almourão is an impressive epigenetic gorge in the quartzite crest with a cultural landscape where Biodiversity, Archeology and Culture coexist and were threatened for a long time by the construction of a dam that would change this landscape and the ecosystems.

Fig. 3 – Vila Velha de Ródão Fossil Tree logs.

Contents and skills under the "Framework on Geosciences Literacy Principles"

The "Framework on Geosciences Literacy Principles" is the main goal of the GEOschools project. It reflects the results obtained through a curriculum comparison research (Calonge, 2011) and students and teachers interest research based on questionnaires. This Framework embraces the basic topics that every European citizen should study. For each general axis, the most important subjects to be developed and the main skills with related bibliography to support teachers was identified.

After the selection of the geosites, the teaching module was designed considering contents and skills for the secondary school from the "Framework on Geosciences Literacy Principles".

Another tool arising from GEOschools is the School Geosciences Dictionary (Meléndez et al., 2012) focused on the vocabulary of the curricula of high schools. It is a series of glossaries covering the main branches of Geosciences in a multi-lingual version using a language suitable for students.

Development of the strategies and tools for all the geosites

For each geosite there are specific activities related with one key-question, where the students will be actively involved with. These activities encourage the explanation of abovementioned concepts, formulation and confrontation of hypothesis, contributing to the debate and to take decisions due to topics related to Geodiversity, Geological Heritage and Geoparks.

Within the basis of the entire teaching module is the construction of the geological history of Naturtejo Geopark that is revealed trough the activities in the different geosites. This constructivist perspective makes the student active in its learning process.

Each geosite has a main topic, developed through a key-question:

• Monsanto Inselberg (Fig. 4): How does the water shapes the landscape?

Fig. 4 – Monsanto Inselberg: granite landforms and local history.

• Penha Garcia Ichnological Park: Which testimonies do we have about the past environments?
• Ponsul Fault: How do the mountains are formed?
• Portas de Ródão Natural Monument: How does Geodiversity influences Biodiversity, human occupation and activities?
• Fossil Trunks: How these fossils do allow us to recognize climate changes?
• Portas de Almourão: What is the sustainability of the construction of a dam in this geosite?

The module is designed for teachers and it is divided in two main parts: one for teachers and one to be used for students.

The first part presents the themes and geosites, the contents and the dexterities, giving also bibliography for each topic. There are also available tools that the teachers can provide, using common materials and PowerPoint presentations dedicated to all the geosites to use in classes to introduce the fieldtrip or to reinforce it after.

On the second part, teachers have a first worksheet to prepare the fieldwork in the classroom with specific activities to the students targeted to the Naturtejo Geopark. There is also one worksheet for each geosite to explore in the field.

ACKNOWLEDGMENTS

Under the project "GEOschools-teaching geosciences in secondary schools" EACEA-Lifelong Learning: Comenius, ICT and Languages.510508-2010-LLP-GR-COMENIUS-CMP.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

Geology of Beaujolais, northwestern Lyon, France
From stone to heritage and to popular knowledge

Rousselle B.([a]), Besombes C. ([b]) & Barbary A. ([c])

([a]) Musée Espace Pierres Folles, 116 Chemin du Pinay, 69380 St-Jean-des-Vignes, France. E-mail : bruno.rousselle@espace-pierres-folles.fr
([b]) Syndicat Mixte du Beaujolais, 172, boulevard Victor Vermorel, 69400 Villefranche sur Saône, France. E-mail : cbesombes@pays-beaujolais.com
([c]) Syndicat Mixte du Beaujolais, 172, boulevard Victor Vermorel, 69400 Villefranche sur Saône, France. E-mail : abarbary@pays-beaujolais.com

ABSTRACT

The Beaujolais province is located between the Variscan domain of the French Massif Central and the external Alpine domain, and is one of the most complex geological systems in France, with an especially high diversity of rocks, geological processes, and ages. The numerous scientific studies that have focused on this area in the last two centuries have all pointed out its importance for the understanding of the Variscan (Hercynian) orogenic belt, but also of the Mesozoic marine transgression and of the foreland alpine tectonics.

In a region where geology is so varied, its influence on the landscapes and on human activities is particularly strong. Thus, local buildings display a great variety of rocks, resulting in a rich architectural heritage, such as the famous Golden Stone (Pierre Dorée). Wine-growing, forestry and industry benefit fully from this geological diversity.

For many years, local public associations and organizations have created some animations and installations to make the public aware of the features of geological interest: geological trails, museums, geoscope, pedagogical visits and workshops, conferences and various itineraries. All of these aspects combined, unite geology with human activities in the environment and serve as a platform for the Beaujolais application to become a Geopark.

KEY WORDS: Beaujolais, education, France, geology, heritage, mineral resources.

INTRODUCTION

Situated within a few doze kilometres in the North-West of Lyons (France), the Beaujolais province is mostly famous for its wine production and its twelve “controlled appellations” that are exported throughout the world. But beneath the vineyards and the fir forests, which instigate a vast logging industry, farmers, local councils, associations and audiences interested in natural sciences are discovering little by little a great geological diversity and an obvious interest to promote it. Local heritage lovers have been aware of this diversity for years, noting the great variety of building stones, of which the exceptional golden stone architectural heritage provides the best example. Scientists are also aware of this diversity, and many of them still consider the region as a very interesting area for their studies. Indeed, being located at the oriental border of the French Massif Central – a large massif of Variscan genesis, and in the periphery of the great Alpine and external pre-alpine domains, the Beaujolais province is one of the most complex geological areas in France. Almost every big category of rocks and geological phenomena belonging to the internal and external geodynamics of the earth can be observed there. For centuries, men have been enjoying the asset that the great geological diversity of the Beaujolais represents, exploiting its abundant mining resources, its numerous building and crushing materials, and its raw materials (cement, lime, ceramic…). And, for a few decades, local associations and organizations have been promoting this rich potential to bring the Beaujolais geology to the public, to make local authorities aware of it, and to make them realize its determining influence in the constitution of the natural, human, economical and touristic landscape and identity of the region.

MAIN SCIENTIFIC AND HUMAN ASPECTS OF GEOLOGY OF THE BEAUJOLAIS

SOME KEY ELEMENTS OF THE GEOLOGY OF THE BEAUJOLAIS

One of the most complex and diverse geological systems in France (Fig. 1)

Because of its specific geographical position, at the border with the French (Hercynian) Massif Central and at the periphery of the vast Alpine & external prealpine domains of France, the categories and diversity of rocks and of geological phenomena of the Beaujolais area are especially numerous: deep seated and less deep seated acidic magmatic rocks, basic and ultrabasic magmatic rocks from continental or oceanic crust, volcanic and hypovolcanic acidic and basic rocks, from active or passive margins, metamorphic catazonal, mesozonal and epizonal siliceous or carbonated rocks, clastic, clayey or carbonated marine or lacustrine sedimentary rocks, from both internal and external platforms, alluvial and fluvio-glacial rocks, evaporite rocks, etc. Besides, the different geological ages that can be observed in those numerous geological sites cover a large span of the Phanerozoic times, over the three main eras and most periods.

Fig. 1 - Extract from the geologic map of Beaujolais revealing the geological complexity of the basement and the history of this territory. (© Espace Pierres Folles)

Moreover, scientists have acknowledged the importance of the Beaujolais for the study and the understanding of several geological systems, including the magmatic and orogenic Variscan (Hercynian) belt, the Mesozoic marine transgression, the foreland alpine tectonics and the large alluvial and fluvio-glacial systems surrounding the Alps. For more than two centuries, the local bibliography has been enriched with hundreds of articles and books about geology, prehistory, pedology, and physical and human geography (some of the most significant references can be found at the end of this article).

Some remarkable markers of Variscan magmatism and tectonics: the quarry of Cours-La-Ville

In western Beaujolais, at the heart of the eponymous mountains, the visitor will find a former quarry where crushed material used to be extracted, and whose geology sums up almost by itself the main aspects of the magmatic, metamorphic and tectonic phenomena that contributed to the origins of the Variscan basement in the eastern French Massif Central during the Carboniferous period. This leads to the quarry of Cours-la-Ville (Fig. 2). Both rhyolitic and rhyodacitic and Visean folded and epimetamorphised volcano-sedimentary rocks, sometimes containing coal, are associated with Upper Carboniferous vein showing spectacular contact features. All these rocks, with their several nuances, confer a very aesthetic and colorful aspect to this site. Exploited for numerous years, this former quarry used to be one of the most important local sites for the extraction and production of materials used for the construction of roads. Currently abandoned, this site is a major component of the geological heritage of the Beaujolais province - and perhaps of central France - and is the object of a conservation plan that aims to promote its geological assets.

Some remarkable traces of the initiation of the Jurassic marine transgression: the geological path of Pierres Folles

In Southern Beaujolais, at the heart of the Pierres Dorées area, a geological path has been created within an old industrial quarry. The geological series it crosses belongs to the beginning of the Jurassic period (Hettangian and Sinemurian stages) and displays some rare and very visual aspects of the Jurassic transgression (Fig. 3). The visitor can thus admire the scale of these geological features which are usually particularly rare at the outcrop in the Lyon area, or even in the whole country of France. Marly and calcareous sediments of an ancient coastal environment are represented by gypseous marls and clayey and fine-grained limestones which formed in a restricted marine environment. These shallow lagoon and marine embayment are interbedded with shelly or oolithic deposits and coarse-grained tempestites of the shoreface platform. A large proportion of these geological features are usually particularly rare at the outcrop in the area of Lyon, or even in the whole country of France.

A normal fault, which was not visible from the surface before was also discovered when a trench was dug, revealing a very visual and pedagogical marker of the Oligocene perialpine tectonics (Fig. 3).

A highlight of French palaeontology: the Lafarge Ciments quarries of Belmont d’Azergues and the Espace Pierres Folles

Located in the same Pierres Dorées area, in the territory of the Belmont d'Azergues and Charnay villages, the Lafarge quarries exploit a crinoidal yellow limestone of Middle Jurassic

Fig. 2 – Volcano-sedimentary and tectonic series of the Lower Carboniferous and hypovolcanic rocks with metamorphic aureole of the Upper Carboniferous. Quarry of Cours-la-Ville. (© Espace Pierres Folles)

Fig. 3 – The multicolored deposits of internal carbonate platform of Hettangien and a Tertiary normal fault in the geological path of Pierres Folles. (© Espace Pierres Folles)

and some marls of Upper Liassic ages for producing cement. The golden rocks of Aalenian, Toarcian marls contain an exceptional deposit of fossils that are well-known among professionals and palaeontology lovers, notably cephalopods (ammonites, nautiloids and belemnites). Several remnants of marine vertebrates have also been excavated, belonging to numerous species of *Plesiosaurus*, marine crocodiles, but mostly to that of *Ichthyosaurus*, including one of the largest specimens in Europe (*Temnodontosaurus azerguinsis*, 10 meters long). The museum of the Espace Pierres Folles, located at the beginning of the geological trail, displays a complete sample of fossils from the nearby Lafarge quarry and the area of Lyon, in a collection that is a regional reference, and which presents a cast of the giant icthyosaur.

BEAUJOLAIS GEOLOGY, MINERAL RESOURCES AND HUMAN LANDSCAPES

The vineyard landscape: a strong link between geology, wine growing and production of wine

It is well-known that the Beaujolais province is mostly famous for its vineyards and its wines. Abutting the mountains of the High Beaujolais, the eastern facing hillsides, which also benefit from their gentle slopes, are mostly devoted to viticulture, at the precise place where the local geology displays its most admirable diversity. Thus, most of the crus (among which the famous Moulin à Vent, Fleurie, Chénas or Juliénas) are produced on soils overlaying several types of granite. Other wine crus, such as the Cote de Brouilly or the Morgon, are more closely associated with specific rocks types: dioritic and microdioritic schists. Beaujolais-Villages wines essentially grow on polygenic siliceous soils from volcanic and metamorphic rocks. As for Beaujolais wines, red or white, they are produced on siliceous and calcareous soils from southern Beaujolais or on the alluvial rocks of the borders of the Saone River plain.

Aware of the great importance of geology in terms of understanding and delineating of the local terroirs, as well as in terms of consumers' information, viti and vini -cultural organisations still conduct studies in order to characterise better the Beaujolais landscapes and soils.

Forest landscape: a direct bond between geology and logging industry

Covering a large part of the Beaujolais area, especially in the upland, the logging industry also has a rather clear relationship with geology. The areas where the main varieties of trees (fir tree of Douglas and Norway spruce) are planted are a good reflection of repartition areas of the volcanic rocks of the High Beaujolais area (siliceous rhyolitic hypovolcanic rocks).

An abundance of mines and quarries, a reflection of the variety of mineral resources

Thanks to its geological diversity, the Beaujolais has been exploiting various materials, ores, and other useful substances for centuries, an exploitation that is still going on nowadays. The important mining industry of Chessy-Les-Mines has produced copper, iron and sulphur during the Industrial Revolution. Dozens of mines throughout the province have furnished several metals and ores, such as Cu, Fe, Pb, Zn, Have, Sn, Sb, Ag, fluorite and barite. The extraction of hard coal has been used to fuel the lime-kilns where the Carboniferous and Jurassic limestones were calcined. The golden stone is now used for the production of cement. The marls of Lias and the Quaternary clayey alluviums have been exploited until very recently for the production of ceramics. Finally, the volcanic and hypovolcanic rocks from the Carboniferous period are still being exploited to be used as crashing materials, and in the construction of roads.

An outstanding architectural heritage: the strong influence of geology on traditional building

If the geology of the Beaujolais is often covered by vineyards, forests, pastures, or human dwellings, it remains nonetheless noticeable through local architectural heritage. With its rich variety of stones, the local traditional constructions are a real 'permanent exhibition' of the geological terroirs of Beaujolais. Tourists are first struck by the beauty and the particular atmosphere of the Pierres Dorées area (yellow crinoid limestone), in which the village of Oingt figures among one of the most beautiful villages in France. Several other villages, such as Theizé, Jarnioux, or Charnay, display a quaint architecture where the golden stone is prominent, and which arouses approval and admiration of villagers as well as of visitors. Besides, the real imprint of the stone civilisation which influence is so strong in the Beaujolais province is also to be seen in this other minor or major heritage: churches, town halls or simple farms built in porphyroid grey-pinkish or red granite or microgranite, mills and country houses of black or grey volcanic rocks, factories of gneissic greenish schists, chapels of sandstones, castles and cathedrals of oolitic white limestone, wash-tubs, stairs, door and window frames, fences of shelly grey limestone.

GEOLOGY, SCIENCE AND EDUCATION IN BEAUJOLAIS

The Beaujolais, a privileged place for scientific discoveries and research

Making the most of the numerous study fields the geology of the Beaujolais area reveals the more than two centuries of scientific discoveries, especially after the Second World War, when the French geological map was developed and renewed. All the main scientific themes of fundamental or applied geology have been treated there: petrography and magmatism, tectonics, stratigraphy, sedimentology, palaeogeography, palaeontology, palaeoecology, geochemistry, and palaeoclimatology, engineering geology and geotechnics, pedology and prehistory. Even today, this area is still at the heart of several studies and discoveries, notably in sedimentology, or palaeontology, thanks to the participation of Lafarge Cements, and to the undeniable scientific potential of the Jurassic formations of its quarry.

Installations and actions dedicated to the knowledge and the diffusion of the geology of the Beaujolais area

In order to enable the visitors (school trips, families, tourists...) to discover the geological heritage of the Beaujolais, several organisations and associations have set up some public installations and animations: among others, the Pierres Folles geological trail (created by the association of the Espace Pierres Folles and the Syndicat Mixte Beaujolais Azergues), the Mont d'Or geological path (Syndicat Mixte des Monts d'Or), the Glay quarries (Les Amis des Carrières de Glay group and the municipality of St-Germain-Sur-l'Arbresle), the mine of Propières (association 'Patrimoine en Haut Sornin and the municipality of propières), the 'Circuit des Cailloux' (association 'Itinéraires, Patrimoines et Paysages' and the municipality of Régnié-Durette), the geoscope of the Mont Brouilly (association du Pays des Brouilly and the local federation of municipalities). All these sites are assiduously frequented by the public. At the Espace Pierres Folles, a museum dedicated to geology and palaeontology welcomes more than 16,000 visitors per year, and has been developing several cultural, educational and familial animations for more than 20 years.

The Beaujolais: an area of scientific and popular traditions and cultures marked by geology.

Thanks to its great geographical, geological, and oenological assets, as well as to its special position between the French Massif Central and the Alps, the Beaujolais area has attracted naturalists for many years, who have brought and are still bringing a very developed knowledge to the territory. Thus, this region now reveals an important scientific, historic, and popular culture in which geology holds a central position. The numerous initiatives dedicated to the knowledge and the diffusion of the local geology and its heritage, all around its territory, are a good indicator of the attachment of the local associations, public organizations, inhabitants and visitors to this cultural and scientific tradition. The success of the cultural events, the conferences or guided tours, as well as the numerous school trips that take place every year are the best testimony of this affection.

ACKNOWLEDGMENTS

The authors of this article would especially like to thank all of the institutional or associative actors who have been working (sometimes for numerous years) to promote, spread and teach geology and Beaujolais' geological heritage towards the public. Their daily work and dedication enables the popular and scientific knowledge and culture to remain vivid, alive, in constant evolution, and to get public approval.

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QualityCoast and QualityDestination, new standards for sustainable tourism. How to cooperate with the European Geopark Network?

Salman A. ([a]), van den Ancker H. ([b]) & Pejcic M.([b])

([a]) Coastal & Marine Union – EUCC and ECNC Group, PO Box 11232, NL-2301 EE Leiden, a.salman@eucc.net
([b]) Geoheritage NL & European Federation of Geologists – EP Geological Heritage, Oude Bennekomseweg 31, NL-6717LM Ede, info@geoheritage.nl

ABSTRACT

The presentation will address recent trends and developments in international tourism to develop standards and criteria for sustainability.

Three issues will be discussed in more detail. Firstly, the importance of benchmarking in modern international sustainable tourism. Secondly, EUCC's QualityCoast programme and two important new initiatives will be explained. Thirdly, in parallel to QualityCoast, the QualityDestination programme is now open for participation by non-coastal destinations. This initiative is part of a new global standard, based on the Destination Criteria of the Global Sustainable Tourism Council (GSTC). This standard will be the basis for destination certification. In the new certification procedure, the minimum level of policy and performance will be specified for any destination worldwide. The question will be raised whether there is an interest to prepare the standard in partnership with the European Geopark Network or to involve individual Geopark experts.

KEY WORDS: certification, standardization, standards, sustainable, QualityCoast, QualityDestination.

RECENT TRENDS IN INTERNATIONAL TOURISM

Sustainable tourism is on the rise: People are increasingly interested in sustainability issues, not only when selecting their holiday destination, but also at the destination. Tourism eco-labels have become common features in travel brochures and websites. Travel industry suppliers are developing new green programs, governments and international agencies are creating new policies to encourage sustainable practices in tourism (GSTC, 2013). With the emerging tour operator certification, the travel industry will make increasing demands to destinations, expecting them to meet global standards in sustainable tourism management. At ITB 2012 in Berlin tour operators announced that they will in the future only use eco-labels that are GSTC compliant.

Since the draft GSTC Destination Criteria have been presented, leading destinations worldwide have been quick in seizing the new opportunities, to boost the branding of destinations. Fjords of Norway, Okavango, St. Kitts & Nevis, Jackson Hole, Grand Teton & Yellowstone National Parks, Mt. Hangshan (China), Azores, Fuerteventura Biosphere Reserve, all stepped into the procedure in order to become officially recognised frontrunners in sustainable tourism.

THE QUALITY-COAST LABEL

With the QualityCoast programme (www.qualitycoast.info), the Coastal & Marine Union - EUCC aims to offer destinations the most effective way to become sustainable tourism frontrunners. The QualityCoast Policy Award provides destinations with an international sustainability certification for those aspects of their tourism policy and good performance that meet international standards. The Policy Award is issued for a period of two years. The QualityCoast network brings together coastal destinations that share similar values on sustainable development, at the same time maintaining high standards in the quality of their tourism. The comparison with other QualityCoast destinations provides the community with a good picture of its strengths and weaknesses. The international assessment and recommendations by the QualityCoast Jury provides a guidance to be considered in an agenda for improvement. The QualityCoast Policy Award considers efforts for sustainable tourism in the whole territory of a destination: towns, small regions, islands, and parks. QualityCoast is a GSTC-member as well as of leading European networks (e.g. Destinet, ECOTRANS, NECSTOUR). All GSTC criteria have been included in the new QualityCoast Award application procedure (2013).

CRITERIA AND INDICATORS

The QualityCoast Award is an independent international award and certification programme for sustainable tourism of coastal and island destinations that are:

- combining good overall policy performance in sustainable tourism;
- providing transparent information to residents and visitors;
- planning for improvement.

The programme is considering 20 criteria representing five different categories:

1. Nature
2. Environment
3. Local Identity
4. Tourism & Business
5. Host Community & Safety

All criteria are measured through a combination of quantitative and qualitative indicators, on which the applicant must provide information regarding its entire territory.

The titles of the different criteria of the 2013 QualityCoast Policy Award are as follows:

NATURE
1. NATURE & CONSERVATION
2. ACCESS, INFORMATION & EDUCATION
3. GREEN POLICIES
4. OPEN LANDSCAPES
ENVIRONMENT
5. ENVIRONMENTAL MANAGEMENT
6. DESTINATION SPECIFIC INDICATORS
7. WATER MANAGEMENT
8. SUSTAINABLE TRANSPORTATION
9. WASTE & RECYCLING
10. ENERGY & CLIMATE MITIGATION
11. CLIMATE CHANGE ADAPTATION
IDENTITY & CULTURE
12. CULTURAL HERITAGE
13. TERRITORY & TRADITION
14. LOCAL IDENTITY
TOURISM & BUSINESS
15. DESTINATION MANAGEMENT
16. BUSINESS INVOLVEMENT
17. HOSPITALITY & SATISFACTION
HOST COMMUNITY & SAFETY
18. FREEDOM & JUSTICE
19. COMMUNITY PARTICIPATION
20. HEALTH & SAFETY

Criterion 6 (Destination specific indicators) is a very important element of the programme, since indicator sets differ for each type of applicant. Beach resorts will have to provide information on e.g. bathing water quality, beach safety, beach access and Blue Flags.

BENEFITS OF THE QUALITYCOAST AWARD

Benefits for participating destinations may include:

❖ The comparison with other QualityCoast Policy Award destinations through the Jury assessment and report provides the applicant with a good picture of its strengths and weaknesses in an international perspective (SWOT).

❖ Inclusion in the joint international marketing campaign: EUCC carries out a communication programme together with the QualityCoast destinations to promote them as the most attractive destinations for visitors interested in nature and landscape, environment, and cultural identity and to highlight their performance in tourism quality and sustainability. The marketing campaign makes use of media publicity, flyers and brochures for holiday fairs, promotion via the QualityCoast website and social media. The awards are announced through an international press release and at the press conference at an international QualityCoast Event in May, to which all Award winners are be invited. QualityCoast destinations can also participate in a QualityCoast smartphone app.

❖ The QualityCoast Award winners are included in the QualityCoast destinations Top 100 (for the first time launched in May 2012 for the European Union).

❖ The EUCC QualityCoast destinations are also recommended by a number of tour operators of TUI-The Netherlands, in their travel brochures.

❖ The destination's own international tourism marketing can profit from the status of QualityCoast Destination because it is a certification that the tourism management meets global standards. Experience in several countries learns that this can generate media publicity nationally and internationally. Sustainability based marketing efforts will increase the "green profile" of the destination both externally and internally and this will help mainstreaming sustainability on local policy and decision making.

THE QUALITY-DESTINATION LABEL, AN AWARD FOR NON-COASTAL LOCATIONS

Since 2007, QualityCoast was only targeting coastal and island destinations. Inspired by its success, the transparency and credibility, interest has grown among non-coastal destinations for a similar programme for non-coastal destinations. Based upon the QualityCoast experience, the Coastal and Marine Union EUCC and the ECNC, the European Centre of Nature Conservation have joined forces to establish a global certification and award programme that enables any towns, cities, regions and parks to participate and to meet the global sustainability standard of tourism destination. Under the name QualityDestination, the programme is led by ECNC Land & Sea Group EEIG which consists of ECNC, EUCC and Centro Mediterraneo EUCC. Apart from an award and certification programme, QualityDestination offers new approaches to improve tourism destination planning and management and provides effective guidance for long term development plans, to support the local tourism industry and community benefits in sustainable management without depleting natural, environmental and cultural resources.

QualityCoast will now become the specific coastal, island and lakeshore programme of QualityDestination. Both labels apply the same principles and rules, both ensure the same transparency and credibility. Coastal applicants can decide to apply for a QualityDestination Award or for a QualityCoast Award. In the latter case, they will have to comply with a number of coastal indicators. In this way, specific indicator sets have been developed for:

- Coastal, island and lakeshore destinations (the QualityCoast Award);
- City destinations (coastal or non-coastal);
- Rural and agro-tourism destinations;
- Winter sports destinations;
- Natural, national and regional parks (the Nature Award);
- Destinations only interested in the GSTC criteria: a GSTC certification.

There is not a one-size-fits-all, but tailor made solutions can be made for every situation.

INVITATION AND DISCUSSION

The developers of the new global destination programmes invite the European Geoparks Network to consider a partnership for the joint development of a tailor made option for Geoparks, building upon and involving the Geoparks expertise. Another idea is to develop a specific QualityDestination solution for Geoparks, in partnership with Geoparks or Geoparks experts.

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Alternative tourism ideas for Finale Ligure (Italy)

Schiaffino C. F. [a], Cevasco A. [a] & Ferrari M. [a]

([a]) Distav, University of Genoa, Corso Europa, 26, 16100, Genoa, Italy. E-mail: chiara.schiaffino@unige.it

ABSTRACT

In the last decades alternative tourism has become a valid substitute to mass tourism. Due to its low impact on tourist sites and its different organization, alternative tourism should be preferred. This study suggests to put in practice it in Finale Ligure in order to mitigate anthropic impact on beaches, now the most important tourist attraction, and suggest new targets such as sea cliffs. Finale Ligure was chosen since it already makes available an alternative form of tourism such as climbing, albeit on a small scale, and its varying surrounding landscape favors different tourism management choices. If an alternative tourism project was carried out, anthropic pressure on beaches would be reduced and it would be possible to keep them in a better condition for a longer time.

KEY WORDS: alternative tourism, beach, cliff, Finale Ligure.

INTRODUCTION

The aim of this paper is to discuss the potential for alternative tourism in Finale Ligure (Italy), the so-called outdoor capital of Liguria Region.

Due to today's prevailing lifestyle, highly stressful, and to the growing city pollution (Çiğdem et al., 2011), tourism has almost become a necessity and for therefore it grew into one of the most important sources of income for many countries (European Environment Agency, 1999).

In Italy, tourism mainly concentrates on coastal areas, probably due to its particular geographical characteristics with 7375 kilometers of littorals (Legambiente, 2008; GNRAC, 2006) where one may find a great variety of sand beaches, gravel beaches, pocket beaches and rocky cliffs. Italian beaches are so attractive that in the last sixty years they became a veritable synonym of tourism itself (Legambiente, 2008).

"Sun-bathing" tourism is strongly seasonal, and this leads to an overexploitation during summer and underexploitation during the other seasons (European Environment Agency, 1999; Rein et al., 2007). The excessive pressure during summer months brings about not only beaches deterioration, but also management problems due to insufficient facilities (Çiğdem et al., 2011).

As Wilkinson (1989) highlighted, tourism is not inevitably a massive phenomenon, with a short-term concentration on a specific site. It is possible to develop alternative tourism strategies in order to dilute mass tourism concentrated on beach zones and offer tourist product diversification. A more sustainable tourism could not only distribute economic benefits, but it could also help maintaining the beach in its pristine condition as far as possible, minimizing anthropogenic pressure on beach zones (Williams and Morgan, 1995; Sharpey, 2000; Liu, 2003; Jennings, 2004). It is necessary to improve a tourism architecture based on variety, environmental impact minimization and high quality offer, in order to reduce the impact of the stereotypical tourism (Blancas et al., 2010; Wilkinson, 1989).

Alternative tourism should be preferred to mass tourism because its smaller scale is more environmentally conservative, it is based on unique natural attractions and includes more economic sectors (Weaver, 1995).

Finale Ligure, located in Liguria Region, could be considered a model site where a new form of tourism could develop. Its coastal environment is a great potential for alternative tourism.

A LIGURIA CLIFF: FINALE LIGURE

Almost 40% of Ligurian coastline is made of rocky areas, which therefore represent a peculiarly recognizable feature of Liguria coastal landscape. Its coastline is an almost uninterrupted sequence of headlands and bays. Many Ligurian rocky coasts are cliffed coasts, often with living cliffs as the offshoot of very steep slopes. Capo Noli and Finale Ligure cliffs are among the most famous and striking cliffs.

Finale Ligure's rocky coast is set up on Dolomitic limestone, and its evolution is influenced by the different geomechanics characteristics of emerging lithotypes, mainly composed of Dolomitic limestone, dolostone and sericitic quartz schist. Capo Noli and Punta Predani prominences lie where the most resistant lithotypes are found, and the same is true for the famous Caprazoppa, P.ta Crena, Malpasso, Capo Noli and Bergeggi cliffs. They have an irregular stepped outline, due to the fluctuation of the beating line levels (Limoncelli e Marini, 1969; De Stefanis et al., 1985).

Finale Ligure town district (Fig. 1), taking up almost 35 square kilometers, has the typical traits of Ligurian coastal towns, where the most important urban settlements are concentrated along the narrow coastline, leaning against more or less high headlands. However, unlike neighboring villages, this district also boasts many different natural resources. In particular, its rock faces overlooking the sea made Finale Ligure a tourist attraction for climbers. (Touring Club Italiano, 2005).

Fig. 1 – Study area.

TOURISM IN FINALE LIGURE

Finale Ligure is one of the most important Italian climbing sites. There are also various beautiful open sand beaches fully equipped with tourist facilities (Fig. 2) and pocket beaches (Fig. 3).

Fig. 2 – Finale Ligure beach facilities [Courtesy of www.bagnigaribaldi.com]

Fig. 3 – Finale Ligure pocket beaches [Courtesy of Chiara Schiaffino photographer].

Finale Ligure started attracting free climbers around forty years ago. Here there are more than 150 cliffs, distributed in an area of about 10 square kilometers. One of the most attractive features of Finale Ligure cliffs is that a few are located along the coast, giving the possibility to climb while perched right above the sea. Sea cliff climbing draws climbers from all over Italy.

Some cliffed coasts (Tab. 1) are Caprazoppa cliff (Fig. 4), Dancing Dalle cliff (Fig. 5) and Easy Dalle cliff (Fig. 6) (http://www.rockstore.it/climbing/falesie.html http://www.finalebythomas.com/it/falesie.html).

Fig. 4 – Caprazoppa cliff [Courtesy of www.u3finaleligure.it]

Tab. 1 – Finale Ligure sea cliff

Cliff	Number of routes	Start route GPS point	Height (m)	Technical difficulty (scale from 1 to 9a+)	Type of climbing
Caprazoppa	54	--	10-20	6	technical vertical wall and caves
Dancing Dalle	1	N44 11.387 E8 24.872	15	4c-7c	vertical and slightly overhanging slab
Easy Dalle	1	N44 11.431 E8 24.945	12	3a-5a	slab

Fig. 5 - Dancing Dalle cliff [Courtesy of www.finalebythomas.com]

Fig. 6 – Easy Dalle [Courtesy of www.finalebythomas.com]

DISCUSSION AND CONCLUSION

Tourism is not only overcrowded beaches. Efficient management could decrease tourism impact by proposing different options. Alternative tourism strategies prevent the gradual environment deterioration by distributing tourist attractions and creating alternatives.

Alternative tourism in Finale Ligure could be possible thanks to its environmental characteristics, natural resources and geographical position. Furthermore, alternative options can already be found here, and they only need to be organized into a systematic tourist plan promoting local specialties, for example by creating and selling pocket-sized handbooks for tourists describing climbing areas, climbing schools and associations. Clear and easily noticeable boards should be placed, pointing the way to cliffs and also encouraging climbing. Moreover, trail markers should clearly define paths. School groups could also be involved in climbing.

Several advertising campaigns and institutional projects would be needed in order to generate interest and curiosity in traditional tourists and slowly increase interest in cliffs and free climbing. Therefore, a tourist could recognize the different available attractions and wouldn't necessarily spend an entire holiday on a beach. Moreover, a coastal municipality wouldn't be forced to increase accommodation and beach facilities through high environmental impact solutions, but would receive income from climbing tourism as well. This could lessen anthropogenic pressure on beaches and regulate the tourism flow among the many different areas of interest.

ACKNOWLEDGMENTS

The authors would like to thank Dr Francesca Baggio for English revision and translation. Finale Ligure cliff photos courtesy of www.finalebythomas.com. and www.u3finaleligure.it , Finale Ligure beach photo courtesy of www.bagnigaribaldi.com and Chiara Schiaffino photographer.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

The Fossil Heritage of the Geopark Carnic Alps linked to Google Earth

Schönlaub H. P. ([a])

([a]) Geopark Carnic Alps, A-9640 Dellach/Gailtal hp.schoenlaub@aon.at

ABSTRACT (STYLE: HEADING ABSTRACT)

The Carnic and Karavanke Alps of southern Austria, northern Italy and Slovenia contain an almost continuous sequence of sedimentary rocks from the Ordovician to the Triassic, or almost 250 million years of Earth's history.

The Google Earth-based compilation (www.geopark-karnische-alpen.at) provides a summary of more than 100 fossil localities from the Austrian and Italian areas of the Carnic Alps. The continuing record of scientific research on this rich heritage from the second part of the 19[th] century has resulted in several hundred scientific publications dealing with almost all fossil groups ranging from large eye-catching macroscopic creatures to tiny microfossils and nannofossils.

KEY WORDS: Fossils, Geopark Carnic Alps, Google Earth, Palaeozoic.

THE DIVERSITY OF FOSSILS

In the Lower Palaeozoic fossils reveal a record of different marine environments ranging from shallow water lagoonal deposits to coral-stromatoporoid buildups, bounded by fore-reef, slope and off-shore pelagic settings. The faunal spectrum covers planktonic, nectonic and benthonic animal groups such as highly diverse rugose and tabulate corals, trilobites, cephalopods, gastropods, bryozoans, bivalves, brachiopods, echinoderms, graptolites and a huge variety of microfossil groups

Following the Variscan Orogeny, the late Upper Carboniferous and Lower Permian shallow-water deposits range from coastal swamps to those of an intertidal shelf embayment associated with an expanding Tethys Sea. They are characterized by exceptionally rich faunal and floral remains. During the late Lower Permian the accumulation of shelf-edge reef deposits terminated due to uplift weathering and subsequent karstification. This break in the rock sequence ended with the deposition of the sparsely fossiliferous red clastic sediments of the Gröden Formation and the locally evaporitic Bellerophon Formation during Middle and Upper Permian times.

THE FOSSIL DATABASE

The web-based database includes a table of sites in stratigraphic order with the number of the fossil locality, its name, the UTM coordinates, the lithostratigraphic assignment, the dominant fossil groups, a short description of the depositional environment and references to the scientific literature. The database contains 15 Ordovician, 15 Silurian, 31 Devonian, 36 Carboniferous and 11 Permian sites.

CONCLUSION

Google Earth facilitates access to many important fossil localities, and the danger exists that some of the fossil localities might be destroyed or exploited by amateur collectors. Based on the provincial law for the Nature Conservation of Carinthia, however, collecting of minerals and fossils (§ 42) is not permitted either through the use of machines, explosives or by any other mechanical or chemical means. In addition, sampling by hammer, chisel and other means is restricted to those who have received an identification card from the local authorities. Also, scientifically valuable discoveries must be presented to the local governmental institutions. Whether this may help to preserve the fossils for future generations is still unclear. Raising public awareness about this hidden treasure through education seems a better option than erecting barriers in nature.

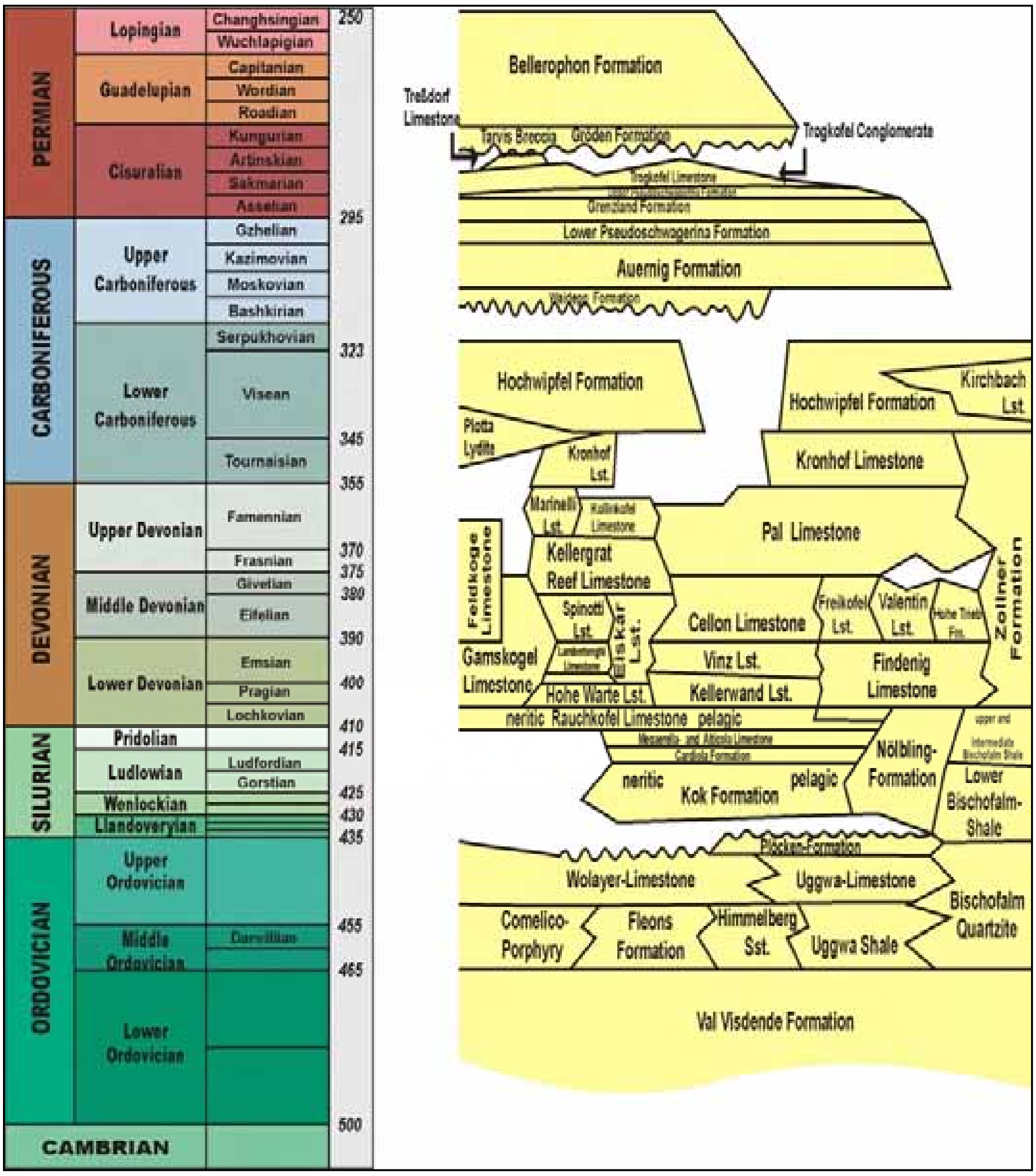
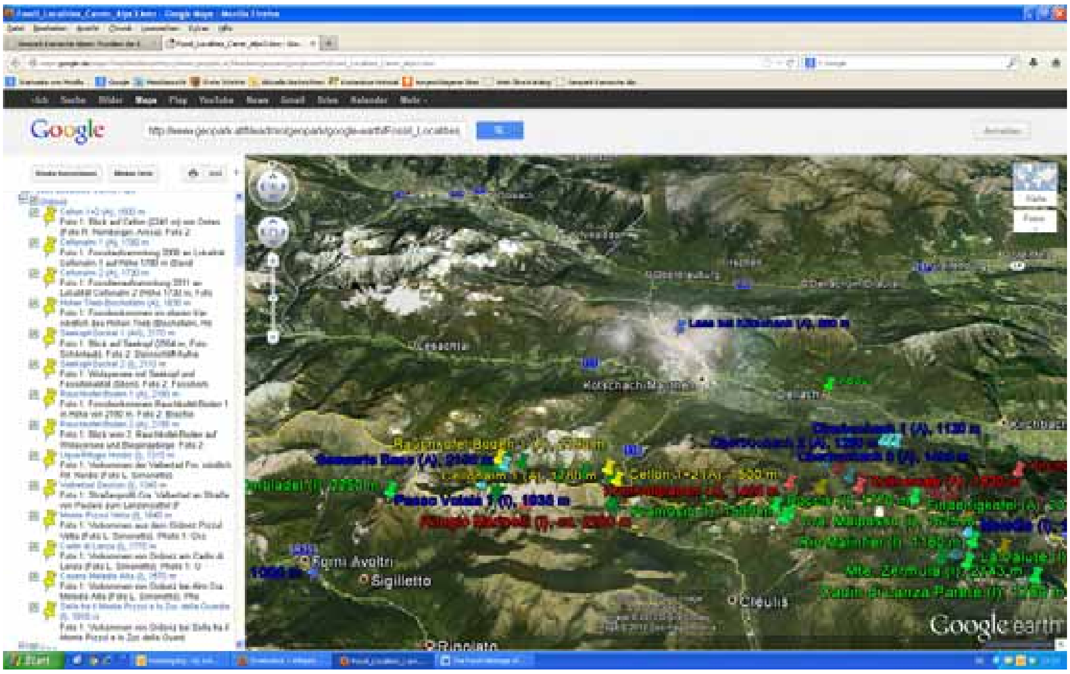


Fig. 1 – The Carnic and Karavanke Alps of southern Austria, northern Italy and Slovenia provide an almost continuous sequence of sedimentary rocks from the Ordovician to the Triassic, or almost 250 million years of Earth's history. The area's outstanding mountainous landscape and its fossiliferous sequences have contributed to the study of Earth sciences since the beginning of the 19th century.



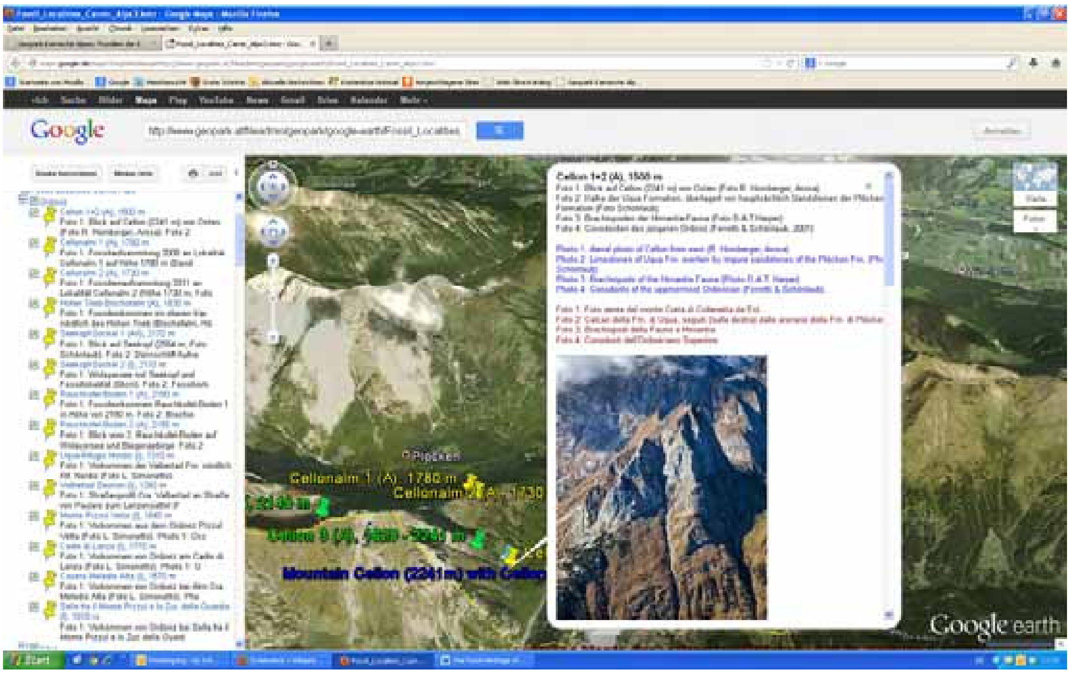


Fig. 2 – Screenshots of Ordovician to Permian fossil localities in the Carnic Alps (above) and Cellon section (below). Yellow caption: Ordovician, blue: Silurian, green: Devonian, red: Carboniferous.

ORDOVICIAN

No.	Name	UTM Coordinates	Lithostratigraphy	Dominating fossil groups	Environment	References
1	Cellon 1	33N E342436 N5163753	Uggwa Fm.	Conodonts	Open Pelagic	Walliser (1964), Ferretti & Schönlaub (2001)
2	Cellon 2	33N E342130 N5164241	Plöcken Fm.	Brachiopods (Hirnantia Fauna), Acritarcha, Chitinozoa, Graptolites	Pelagic	Gaertner, v. (1931), Jaeger et. al. (1975), Schönlaub et al. (2011), Priewalder (1987, 1997), Štorch & Schönlaub (2012)
3	Cellonalm 1	33N E342067 N5164296	Valbertad Fm.	Brachiopods, Bryozoa, Cystoidea	Pelagic	Hammann (unpubl.), Harper (unpubl.)
4	Cellonalm 2	33N E342130 N5164241	Valbertad Fm.	Brachiopods, Trilobites	Pelagic	Harper (unpubl.)
5	Hoher Trieb	33N E350970 N5162646	Valbertad Fm.	Brachiopods, Bryozoa, Trilobites, Gastropods, Cystoids	Pelagic	Schönlaub (1969a, 1971a), Jaeger et al. (1975), Havlicek et al. (1987), Jimenez-Sanchez (unpubl.)
6	Seekopf-Sockel 1	33N E336512 N5163827	Wolayer Fm.	Bryozoa, Cystoids	Shallow Pelagic	Jimenez-Sanchez (unpubl.)
7	Seekopf-Sockel 2	33N E336565 N5163782	Wolayer Fm.	Bryozoa, Cystoids	Shallow Pelagic	Jimenez-Sanchez (unpubl.)
8	Rauchkofel-Boden 1	33N E337424 N5164787	Valbertad Fm.	Brachiopods, Cystoids, Bryozoa, Hyoliths	Pelagic	Schönlaub (2000)
9	Rauchkofel-Boden 2	33N E337354 N5164573	Wolayer Fm.	Conodonts, Cystoids, Corals, Algae	Shallow Pelagic	Gaertner, v. (1931), Schönlaub et al. (1997), Schönlaub (unpubl.)
10	Uggwa-Rifugio Nordio	33N E383791 N5156718	Uggwa Fm. Valbertad Fm.	Conodonts, Brachiopods, Trilobites, Cystoids, Bryozoa	Pelagic	Serpagli (1967), Vai (1971), Vai & Spalletta (1980), Havlicek et al (1987)
11	Cra. Valbertad	33N E357807 N5159658	Valbertad Fm.	Conodonts, Brachiopods, Cystoids, Bryozoa	Pelagic	Bagnoli et al. (1998)
12	Monte Pizzul, vetta	33T E359982 N5157416	Valbertad Fm.	Brachiopods, Trilobites, Cystoids, Bryo-	Pelagic	Vinassa de Regny & Gortani, 1905a, Vinassa de Regny, 1910

Table 1 - Ordovician fossil localities listed in the database and in Google Earth

				zoa, Graptolites		
13	Cadin di Lanza	33T E359587 N5157806	Valbertad Fm.	Brachiopods, Bryozoa	Pelagic	Vinassa de Regny & Gortani, 1905a, Vinassa de Regny, 1910
14	Casera Meledis Alta	33T E356719 N5160932	Valbertad Fm.	Brachiopods, Trilobites, Cystoids, Bryozoa	Pelagic	Vinassa de Regny, 1910
15	Sella fra il Monte Pizzul e lo Zuc della Guardia	33T E360031 N5157692	Valbertad Fm.	Brachiopods, Bryozoa	Pelagic	Vinassa de Regny & Gortani, 1908

SILURIAN

16	Bischofalm Graben	33N E351522 N5164040	Bischofalm Fm.	Graptolites	Off shore basinal	Flügel et al. (1977), Jaeger & Schönlaub (1994)
17	Cellon Section	33N E342404 N5163776	Kok Fm. Cardiola Fm. Alticola Fm.	Conodonts	Pelagic	Walliser (1964)
				Graptolites	Pelagic	Jaeger (1975)
				Nautiloids	Pelagic	Gaertner (1930), Ristedt (1968), Gnoli & Histon (1998), Histon (1999b, 2002), Histon et al. (1999)
				Bivalves	Pelagic	Heritsch (1929), Kříž (1979, 1999, 2006)
				Brachiopods	Pelagic	Plodowski (1971, 1973)
				Acritarchs	Pelagic	Priewalder (1987)
				Chitinozoa	Pelagic	Priewalder (1997)
				Corals	Pelagic	Pickett (2007)
				Trilobites	Pelagic	Haas (1969), Santel (2001)
				Foraminifera	Pelagic	Kristan-Tollmann (1971)
18	Nölbling Graben	33N E352848 N5165472	Bischofalm Fm.	Graptolites	Off shore basinal	Jaeger & Schönlaub (1977)

Table 2 - Ordovician and Silurian fossil localities listed in the database in Google Earth.

Fig. 3 – Polished Orthoceras-bearing limestone slab from the Silurian of the central Carnic Alps.

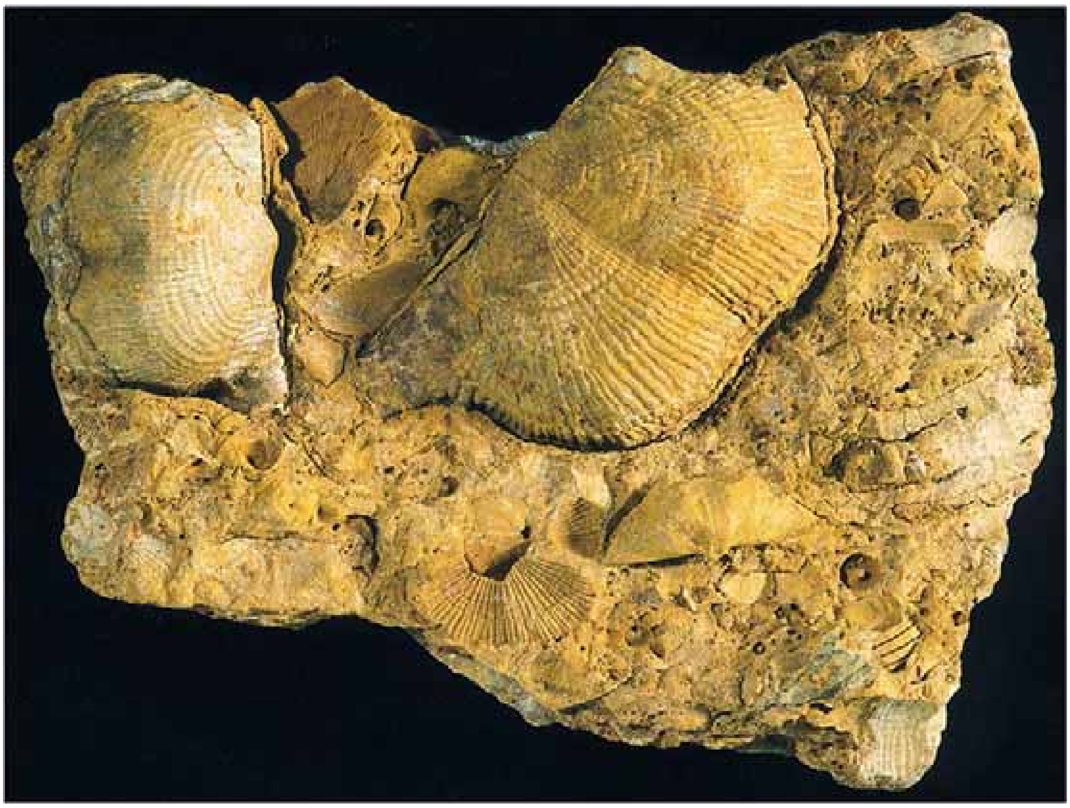


Fig4 – Productid brachiopods from the late Carboniferous Auernig Fm. of the Nassfeld area (eastern Carnic Alps).

12th European Geoparks Conference
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An Example of Geopark Management which Encouraged Local Residents' Voluntary Activities

Tadahiro S. ([a]), Kazuhiro Y. , ([a]) & Koji W. ([a])

(a) Muroto Geopark Promotion Committee, 25-1, Ukitsu, Muroto-shi, Kochi-ken, 781-7815, JAPAN. Email: shiba@muroto-geo.jp

ABSTRACT

Muroto Geopark Promotion Committee (MGPC) has created an Action Plan effective from April 2013 to March 2016. How MGPC members share their visions in order to make an effective Action Plan is an extremely significant issue for geopark management. One of the missions of GGN members is to practice bottom-up management, as mentioned in the GGN guidelines. However, it seems to be still difficult for new and aspiring geoparks to introduce such a management system, because each geopark has a different management platform.

For example, geopark management for Muroto Geopark is controlled mainly by the local government. MGPC was organized in 2008 by local groups such as the Association of Commerce and Industry and the Tourism Association; it also included research institutions such as Kochi University, Kochi University of Technology, and JAMSTEC (Japan Agency for Marine-Earth Science and Technology). Politicians, researchers, and local administration officials cooperated in organizing the Committee. However, the Committee members were not willing to work positively on the Geopark's development because the management plan was drawn up through closed discussions held by a selected group of people. The problem was that the plan and vision had not been shared by all of the Committee members.

MGPC has therefore changed the process of creating the Action Plan since 2012; active group discussion has been introduced into meetings. Politicians, local administration officials, guesthouse owners, and geopark guides sit around the same table and discuss shared topics. This generates lively discussion; a range of various opinions find expression in meetings. As a result, all of the Committee members have a sense of belonging to geopark management, so that a three-year Action Plan has been successfully created. This way of formulating the Action Plan has also influenced the policies of groups organizing the MGPC.

KEY WORDS: Geopark manargement, Workshop

INTRODUCTION

One of the responsibilities global and national geoparks should fulfill is to encourage local residents to use local resources effectively for the purpose of constructing a sustainable society. The terms 'local' and 'local people' are repeatedly used in the GGN guidelines. Section 2, "Management and local involvement" of the guidelines states that "the establishment of a Geopark should be based on strong community support and local involvement, developed through a 'bottom-up' process. It should demonstrate strong support from local political and community leaders, including in relation to the provision of necessary financial resources. The Geopark should have effective and professional management structures, and deliver policy and action for sustainable regional socio-economic and cultural development across the territory where it is located. Success can only be achieved through strong local involvement. The initiative to create a Geopark must therefore come from local communities with a strong commitment to developing and implementing a management plan that meets the community and economic needs of the local population whilst protecting the landscape in which they live." The 3rd JGN Conference, held in Muroto Global Geopark in November 2011, also discussed the issue of the relationship between the local community and geopark management, which issue was included in the conference declaration.

However, there is no fixed approach to cooperation with the local community. It depends on each geoparks' situation. Most geoparks across the world are now considering this issue. There are slight differences between Japan and Europe in terms of geopark management: in Japan, geoparks are managed by local governments; in Europe, by NPOs or regional organizations. In both cases, getting the community interested in geopark projects and getting people involved is the key for sustainable geopark management.

THE SITUATION OF GEOPARKS IN JAPAN

In 2012, JGN conducted a survey covering 50 topics; the groups surveyed included GGN and JGN members and aspiring geoparks in Japan, and the questionnaire gathered information on current situation. The results of the survey were reported under the title "Considerations on the Current Situation of JGN Members" in March 2013. The report details the current situation and management systems of JGN, and the issues JGN itself faces today. The following is an excerpt of some of the findings in the report:

[Reason for launching geopark project]
Expand visitor numbers and opportunities for inter-area exchange: 34%
Create a focal point for tourism in the region: 29%
Conserve geological heritage: 10%
Promote education on geology: 3%
Improve the system of cooperation between local government and local residents: 3%
Enhance awareness of disaster prevention: 2%

[Initial promoter of geopark project]
Researcher: 29%
City or village mayor: 19%
Individual or organization: 15%
Prefectural Governor: 11%
Assembly or assembly member: 6%
Local officials: 5%

[Promoting method]
According to the report, most geoparks in Japan are managed by local government. A few geoparks are managed by NPOs, regional organizations, or universities. It also states that local officials are too busy to commit themselves to geopark projects because of their other office duties. Another problem, the report pointed out, is information-sharing between local residents and local officials: even though there already information-sharing channels are in place on paper, the system does not seem to work well in a practical sense.

[Impact of the geopark project on the local economy and local residents' livelihoods]
E.g.) Q: Has the geopark project livened up the local shopping area?
A: The local economy has not changed from before: 58%
It has been deteriorating: 2%

Q: How has local residents' involvement changed after the geopark project was launched?
A: It has been changing drastically: 7%
It has been changing slightly: 46%
It has not changed at all: 38%

The report states that local residents' interest in geoparks has been increasing, but that local residents still need to understand more about the purpose and significance of the geopark project they are involved in. This will help local residents' voluntary action expand more than ever before. On the other hand the main tools for conveying information on geosites are websites, city public-relations magazines, and residents' association circulars. The report criticized this approach as one-sided and top-down.

WHAT EXACTLY IS COOPERATION BETWEEN LOCAL RESIDENTS AND LOCAL GOVERNMENT?

There are many examples of local residents and local government working together to construct a sustainable society. Each example is a story of local residents and local government or NPOs cooperating and making a plan as a foundation for their action. Geoparks also adopt the cooperative approach; it will never be a success if the geopark management process is decided by only a small inner circle of people. Haruo Yamaura reported in his book "Local Revitalization Promoted by Cooperation between Local Residents, Local government, and NPOs" that the workshop method helps to change local residents' and local officials' ways of thinking about a region's problems. Yamaura uses the word 'workshop' as meaning that "method of regional

Date	
Dec.19, 2012	Board of MGPC
Jan. 21,2013	1st Explanatory Committee for MGPC Action Plan; Holding a workshop with the topic of "Strengths, Weaknesses and Issues of Muroto Global Geopark"; Information Sharing (Explaining the GGN guideline and Declarations by past Geopark Conferences)
Feb. 21, 2013	2nd Explanatory Committee for MGPC Action Plan; Holding a workshop based on 3 topics emerging from the previous workshop
Mar.25, 2013	3rd Explanatory Committee for MGPC Action Plan Participants: 15 Review of 1st draft of Action Plan
Apr.23, 2013	Board of MGPC
May 10,2013	General assembly of MGPC

Table 1: Schedule for creating Action Planc workshop.

community-building carried out through local involvement," a method which is often adopted in the field of development studies. According to his definition, the workshop provides a space where local residents, local officials and NPOs can share problems and visions. MGPC is organized by local governments at two levels (Muroto City and Kochi Prefecture), private institutions, and regional organizations. Therefore it could be said that in this case, becoming involving in geopark management is, in a sense, of necessity taking part in a workshop. However, the actual management of MGPC has been far from balanced cooperation.

BACKGROUND OF MGPC'S ESTABLISHMENT AND PROBLEMS OF MANAGEMENT

MGPC was organized in 2008 by local groups such as the Association of Commerce and Industry and the Tourism Association; it also included research institutions such as Kochi University, Kochi University of Technology, and JAMSTEC (Japan Agency for Marine-Earth Science and Technology). Politicians, researchers, and local officials cooperated in organizing the Committee. However, it was not easy to make local residents understand the concept of a geopark and involve them in the project. This is because the Committee's time was entirely taken up with constructing a management body and making various funding and other applications. Muroto Geopark was designated as a Japanese Geopark in 2008, but was refused national government approval to apply for global geopark status in 2009 and 2010. The MGPC, therefore, reviewed its management system: 5 officials were newly assigned to geopark promotion activities in order to strengthen the management body. Increasing the number of staff brought favorable results: the quality of geo-tourism was improved in terms such as the organization of tour guides, and the geopark concept was introduced into the syllabus at local schools.

On the other hand, the degree of commitment to geopark projects among the Committee members and local residents had not developed very much. Geopark management was mainly controlled by the geopark administration office itself. This was why the Action Plan was not created by all of members of the Committee working together, but by only some. This meant that the vision and plans for geopark were not shared by all of the members. MGPC, then, introduced the workshop method (group discussion) into meetings for creating an Action Plan from 2013 to 2015. Local involvement was the most significant point in the.

REVIEW OF MGPC MANAGEMENT SYSTEM AND WORKSHOP

The activities of Muroto Global Geopark are determined based on a 10-year Master Plan (fiscal years 2010-2019) and a 3-year Action Plan. The Action Plan is renewed every 3 years and the first Plan was effective from fiscal year 2010 to 2012. The first Plan was mainly created by the geopark administration office; the aim of the first Action Plan was to achieve global status. However, the second Plan (fiscal 2013 to 2015) was created through discussions between all of the MGPC members. In order to listen to local residents' voices, the geopark administration office also made use of the city's

Fig. 1 – Meeting of MGPC

a: Meeting before introducing workshop method (April 2012: Only some board members speak out.)

b,c: Meeting after introducing workshop method (Feb 2013: All of the participants enjoy group discussion. People from different fields (politicians, local officials, owners of inns, etc.) sit around a small table and exchange their thoughts.

public-relations magazine, held several round-table talks in the city, and did a questionnaire surveying students in the city. “The Second Action Plan of Muroto Global Geopark” summarizes local residents’ opinions and ideas as raised through the above activities. The schedule for creating the Action Plan is shown in Table 1 and the results of the workshop are shown in Figure 1.

IMPACT OF THE WORKSHOPS

The new Action Plan more successfully reflects local residents’ thinking, compared with the previous one. Participants in workshops said that their sense of involvement in the geopark project had been enhanced and the workshops helped them to understand the situation facing the geopark. The workshop method is now being introduced into other voluntary groups in the city: the organization of tour guides and a range of different groups organized by board members are starting to hold workshops. Creating an Action Plan is not a goal but a start for achieving good local communication. Such an Action Plan, made through the above process, constitutes a major improvement of Muroto Geopark and a substantial contribution to its sustainable development.

ACKNOWLEDGMENTS

I would like to thank Muroto Geopark’s staff for organization of the meeting to make action plan. I am deeply grateful to Tonotani, A., and Ogasawara, T. They give insightful comments and suggestions.

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12th European Geoparks Conference
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Azores Geopark and the Regional Strategy for Environmental Education

Silva C. ([a]), Garcia P. ([b]) & Lima E. ([c])

([a]) Environmental Education Department, Environmental Management and Nature Conservation Society Azorina, S.A./ Azores Geopark, Portugal. Carla.SG.Silva@azores.gov.pt
(b) Ecoteca, São Miguel Natural Park, Environmental Management and Nature Conservation Society Azorina SA / Azores Geopark, Portugal. Paulo.RM.Garcia@azores.gov.pt
(c) Geosciences Department, Azores University / Azores Geopark, Portugal. E-mail: evalima@uac.pt; evalima@azoresgeopark.com

ABSTRACT

The Azores Geopark has three important pillars supporting its action: geoconservation, environmental education and sustainable regional development. In this article, we will talk about the relationship between the strategy of environmental education of the Azores Regional Government and the environmental education objective of the Azores Geopark.

KEY WORDS: Azores Geopark, children's guide, environmental education, Geopark educational programs.

INTRODUCTION

Environmental education in the Azores, like in the rest of the country, as well as many other countries, has always been the responsibility of the Environmental Department authorities instead of the Educational Department. This is due to the fact that it is a technical area, which is transversal and interdisciplinary, and addresses to people of all ages through all levels of formal and non-formal education.

Although certain subjects in schools and some school clubs tend to work more on the Environmental Education contents than others (such as Education for Citizenship, Geography, Natural Sciences, etc..), the need of interdisciplinarity in the school context is obvious, where each teacher must establish the link between the content of their discipline and environmental citizenship. For a community or region to implement environmental education is an enormous task, it cannot only be the responsibility of any single sector, therefore it cannot be left solely up to the public school system to foster environmental education. Fortunately, in addition to the formal education sector (schools), the informal education sector (as interpretation centers, non-governmental organizations, museums, science centers, etc.) and the social education sector (television, newspapers and magazines, radio, families and friends) work together to educate (not just environmental) all generations and social levels.

Because environmental education is a continuous process throughout life, the formal, informal and social sectors should continue to work together to reach local sustainability goals. The division and coordination of efforts have allowed a greater scope and prevent duplication of efforts and resources.

ENVIRONMENTAL EDUCATION IN THE AZORES

In the Azores, there have always been initiatives of environmental education and awareness, usually associated with the celebration of environmental dates, promoted by governmental and non-governmental organizations. However, in 1998 an agreement was formalized between the Regional Directorate of the Environment and the National Institute of Environmental Promotion with a commitment to establish cooperation in the field of environmental education, provide access to information, as well as citizen participation in the area of the Environment. Following this collaboration the Ecotecas Regional Network of the Azores was initiated, creating spaces of didactic and pedagogical content, focused on information, awareness and education regarding the environment and sustainable development of the Azores.

By 2010 there were 10 Ecotecas on all the islands with the exception of Corvo. Aside from the creation of some environmental interpretation centers and protected areas visitor's centers, these environmental education structures were under pedagogical coordination and financial management by the Environment Department through a protocol between the Government and local associations.

The Ecotecas targets are the municipality or island population where they operate, with particular attention to the school community.

With the implementation of new management structures for protected areas on each island (Island Natural Parks), the Azores Regional Government integrated the Ecotecas and the Environmental Centers in these Parks, in 2010, favouring the optimization of human and financial resources, sharing experiences and critical thinking to achieve common goals.

The Ecotecas network has a unified management system that promotes the regional coordination of environmental education campaigns, as well as international environmental education projects implemented in the region, which highlight the Eco-Schools program from the Foundation for Environmental Education (FEE).

These changes are intended to optimize the response to the population needs for environmental information, awareness, training and education, driving the implementation of the environmental policies and natural resources management based on the six pillars of the Azores Environment which includes: Waste Management, Renewable Energies, Water Resources, Territorial Planning, Air Quality and Nature Conservation. The latter, obviously includes, the Geoconservation, which stands out given the volcanic nature of the islands.

Following these reorganization, in late 2011, the Regional Plan for Environmental Education and Awareness of the Azores was launched by the Environment and Sea Secretariat. This Plan aims to define a transversal and coordinated strategy that support the actions, in order to achieve environmental education goals outlined in the medium and long term.

The Environmental Education Regional Meetings and Eco-Schools Seminars, promoted since 1998, have been the meeting place and training of the Environmental Education agents of the archipelago, contributing to the critical thinking, knowledge and new approaches of environmental education and sustainable development of the Azores. They include a very important component of training for teachers of all disciplines.

In 2012 the website Educating for the Environment (educarparaoambiente.azores.gov.pt) was created, aiming to promote and facilitate access to environmental education resources produced in the region, geared toward the Environmental Education agents of society. This website gives special emphasis to the regional themes and projects, but also includes global contents and campaigns (Fig.1).

Fig. 1 Regional environmental education website (educarparaoambiente.azores.gov.pt). The educational resources produced by the Geopark team are published here, as well as on the Geopark website.

One of the main components that have contributed to the major role of the Ecotecas in Environmental Education is the establishment of partnerships with several non-governmental entities, including parish councils, local authorities, scientific institutions, associations, non-governmental environmental organizations, schools, science centers, corporations, among others.

ENVIRONMENTAL EDUCATION IN THE AZORES GEOPARK

The Azores Geopark is an excellent example of coordination of instruction and partnerships for environmental education in the region, creating collaborations with people, financial resources and physical facilities. Since the creation of the Azores Geopark its group of environmental education is composed by members of the Ecotecas, working with elements of the Geopark in harmony with geo-education, particularly in the development of publications and educational resources, and its implementation in various educational contexts.

Since the inception of the Azores Geopark project, including the initial structure of the development of the educational programs content, sporadic actions were in place and implemented collaboratively with the Ecotecas (Fig. 2) and several schools (celebration of some geoenvironmental dates, classroom sessions and field trips).

Fig. 2 – A Geopark activity in “Ciência Viva” Summer Geology – Visit to the Furnas volcano.

The environmental education staff of the Azores Geopark produced Educational Programs to be used in a school context, including teacher guidelines for several educational levels (from the 1st grade until the high school) that have been experimental implemented in the schoolyard year 2011/2012, being oficially launched on february 2012 and implemented in the schools 2012/2013. The programs developed a dynamic approach to geo-education with an interdisciplinary perspective, focusing on geodiversity, geological heritage and geoconservation, and its integration in the sustainable development of the Azorean society.

The educational programs include:

- free online contents (*powerpoint* presentations and respective teachers guidelines) on the website (www.azoresgeopark.com) including topics “Azorean Volcanoes” and "Azorean Geolandscapes", differentiated by grade level (Fig. 3);
- Field trip programs and proposals for activities - "Geosites of My Island";
- Urban geology exploration "Geology in Our Town" to, enhance the characterization of ornamental rocks used in the regional architecture, the Portuguese stone sidewalks, etc.
- Training activities for teachers, Islands Natural Park technicians, tourist guides, and other professionals with interests in these themes.

The awareness actions of the geological diversity and heritage carried out by the Island Natural Parks are prepared with the Geopark environmental education staff. Geosites visits, lectures, exhibitions, celebration of environmental dates, among many others (Fig. 4).

In 2012 the Azores Geopark was present in the X Azores Regional Meeting on Environmental Education and Eco-Schools, with the presentation of its educational programs.

After the development of resources for the classroom context, the Azores Geopark educational staff has dedicated itself to the production of educational resources outside a formal education context: such as a board game "The volcanoes of the Azores" (Fig. 5); released in April 2013 the children’s guidebook "Volcanoes of the Azores", that has the main objective to awake their senses to issues such as Volcanology and Civil Protection, Earth sciences and the role of geologists, as well as aspects of the formation of the Azores Islands and its main volcanoes (Fig. 6), and the next children’s guidebook "Rocks of the Azores" is in development.

In the Decade of Education for Sustainable Development (2005-2014), proposed by UNESCO, the environmental education regional strategy (where the main work of the Azores Geopark environmental education staff is anchored), is still incipient, but it is intended as a contribution to the challenges and goals of the Decade in this region.

Taking part directly in the Azores Geopark, the Ecotecas and Environmental Centers from the Island Natural Parks, aim to contribute to the promotion and development of its mission, seeking to instill the citizens with knowledge and responsibility, both individually and collectively, to preserve the environment quality, now and for the future generations.

Fig. 3 – A Geopark hiking trail “Hiking in the eyes of a geologist”, in Faial Island.

Fig. 4 – A Geopark school session by Ecoteca de São Miguel.

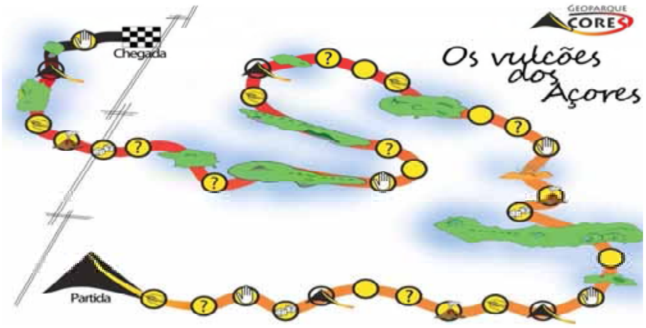

Fig. 5 – “The Azorean Volcanoes” board game.

Fig. 6 – One of the themes approached in the educational materials produced by the Azores Geopark is what to do in case of a geo-hazard such as a volcanic eruption.

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Communicating Geoparks at the Portuguese Parliament – Exhibition and Conference about the Portuguese Geoparks

Silva E. ([a]) & Sá A. A. ([b])

([a]) Portuguese National Commission for UNESCO. Palácio das Necessidades, Largo das Necessidades, s/n, 1350-215 Lisboa. Portugal. Portuguese National Committee for International Geoscience Programme (IGCP-UNESCO). Portuguese National Forum of Geoparks. E-mail: elizabeth.silva@mne.pt
([b]) Department of Geology, University of Trás-os-Montes e Alto Douro, 5001-801 Vila Real, Portugal. Portuguese National Committee for International Geoscience Programme (IGCP-UNESCO). Portuguese National Forum of Geoparks.

ABSTRACT

The Portuguese National Commission for UNESCO with the support of the Portuguese Parliament, the Portuguese National Committee for the International Geosciences Programme (IGCP) and the Portuguese National Forum of Geoparks organised an event at the National Parliament, in Lisbon, from 14^{th}-18^{th} January about the activities and objectives of the Portuguese Geoparks. This event had as main goals to promote these territories and their development strategies and to create awareness among decision makers about the Geoparks concept and also about the realities of the European Geoparks Network and the Global Geoparks Network.

KEY WORDS: Communication, Education, Geoparks, National Forum, Parliament, Portugal.

INTRODUCTION

The Portuguese National Forum of Geoparks was formalized on April 2011, at the Ministry of Foreign Affairs, in Lisbon. Since the beginning is coordinated by the Portuguese National Commission for UNESCO and is composed at the present by representatives of Naturtejo, Arouca and Azores Global Geoparks, as well as observers by the aspiring Geoparks *Terras de Cavaleiros* and *Costa da Laurissilva*. The main objectives of the Portuguese National Forum are to coordinate Portuguese Global Geoparks joint initiatives; to promote the development of new Geoparks projects in Portugal and to provide technical and scientific support to new applications to European and Global Geoparks Networks (EGN/GGN); to promote new projects for the valuation of the Geological Heritage at a national level; to outreach the EGN/GGN, using several communication tools (website, newsletter, newspapers, magazines, etc.); to promote several national activities related to the growing political impact of geological heritage and the Geotourism development; to organize an annual workshop to exchange experiences on good practices and to promote and stimulate several projects and activities of Geoparks; to promote close cooperation with other national forums and to promote cooperation initiatives under the principles of the EGN/GGN with the Portuguese Language Countries Community.

In consonance with other national forums already implemented under the EGN and UNESCO's auspices, this initiative provides a platform to increase knowledge among its members and also encourages experiences and exchange, as well as a definition of conditions, methods and goals of working together in the future, welcoming also new Portuguese Geoparks entries to the EGN/GGN. These goals must be developed and implemented according to the EGN/GGN founding principles under clarifications and advices from its Coordination and Advisory Committees.

INTERNATIONAL CONFERENCE AND EXHIBITATIONS ABOUT THE PORTUGUESE GEOPARKS AT THE PORTUGUESE PARLIAMENT

With the main goal to create awareness and knowledge about the existing Portuguese Geoparks and the sustainable management of these territories, the Portuguese National Commission for UNESCO (NatCom – Portugal), with the support the Portuguese National Committee for the International Geosciences Program of UNESCO (IGCP), the Portuguese National Forum of Geoparks and the Portuguese Parliament organised a major event at the Parliament, in Lisbon, during an entire week, from 14^{th}-18^{th} January 2013. This event promoted all type of activities and objectives of the Naturtejo, Arouca and Azores Global Geoparks and of the aspiring Geopark *Terras de Cavaleiros*. At the same time was a great opportunity to raise awareness about the aims and role of the European and Global Geoparks Networks. During this event each Geopark territory had the great opportunity to share with all parliamentarians their activities, their cultural and leisure events, gastronomy, videos and exhibitions, and each day was dedicated to a specific Geopark, giving growth visibility to the territory and everything that happens there. A special mention was due to the Educational Programs developed in the Portuguese Geoparks. During this week was promoted an International Conference, to create awareness among parliamentarians, scientists, researchers, teachers and journalists, about the Geopark concept and the importance of the Geoparks for the sustainable development of these territories. This Conference was opened by the Vice-President of the Portuguese Parliament, the President of the Educational, Scientific and Cultural Parliamentarian Commission, the President of the Portuguese National Commission for UNESCO and the Coordinator of the European Geoparks Network (Fig. 1). The last one emphasized, during the debate, the aims of the EGN/GGN and the guidelines to present further applications to Geoparks (Fig. 2).

Fig. 1 – Opening Session of the International Conference about Portuguese Geoparks, National Parliament, Lisbon

Fig. 2 – Intervention of Prof. Nikolas Zouros

During this event each representative of the four Portuguese Geoparks explain in a detailed way their objectives, activities, national and international projects, educational and cultural programmes, promotional videos and other issues about their territories. During these presentations was stated the strong and effective articulation and partnerships with the Portuguese National Commission for UNESCO, the Portuguese National Committee for IGCP, private and public sector, media, schools, universities, laboratories and NGO's, among others. This event was transmitted by the Parliamentary TV Channel publically. The media gave great visibility to this event, with special TV reports and TV Programs. This event also allowed the public presentation of the Portuguese National Committee for IGCP during which was emphasised the cooperation between this Committee and the Portuguese Geoparks Forum. During this event were presented the objectives and role of Portuguese National Forum of Geoparks and stressed the importance of these events specially dedicated to decision makers and politicians. It was also communicated the official inauguration of the Itinerary Exhibition about the Portuguese National Forum of Geoparks. During this event, the Portuguese National Committee for IGCP also took the opportunity to make a public recognition about the work done by Professor Emeritus António Galopim de Carvalho along his career in the area of Geosciences for Society in Portugal, paying him an official tribute (Fig. 3).

Fig. 3 – Tribute to Professor Emeritus António Galopim de Carvalho

CONCLUSIONS

This event about the Portuguese Geoparks and the role of the EGN and GGN carried out at the Portuguese Parliament got the attention of national policy makers on these issues. It also gave great visibility to the work done by the Geoparks staff and their specific projects focused in innovative and better solutions for challenges faced in these territories at economic, social, environmental and cultural level (Fig. 4). Taking into account these concerns, the Portuguese NatCom and the Portuguese National Forum of Geoparks encouraged the Parliamentarians belonging to the Commission of Educational, Scientific and Cultural issues to visit the Portuguese Geoparks.

In this sense, Geopark Naturtejo is going to receive the official visit of these Parliamentarians next 4th of June – Geopark Naturtejo Day – promoting a visit to the territory and to its most emblematic geosites, including a Conference at the Life Science Centre – Forest under the subject "*Geoparks and their role in Education and Science*".

Also during this event, the Portuguese Geoparks had the opportunity to discuss more about the development strategies to be implemented by the Portuguese National Forum of Geoparks, not only in Portugal, but also in close cooperation with the Portuguese Speaking Countries, such as Brazil, S, Tomé and Príncipe, Cape Vert, Mozambique and even East Timor. These strategies would include the creation of a website of the Portuguese National Forum of Geoparks, were the Geoparks could disseminate their activities and create links with other National Forum of Geoparks and also with the EGN/GGN. It was also decided to create a page in Facebook, so that all events promoted by the Portuguese Geoparks could be spread through different network connections. Besides given greater promotion about the Portuguese Geoparks among Civil Society, it was also considered very important to promote common events, particularly at an educational level, in partnership with the Portuguese National Committee for the International Program of Geosciences of UNESCO (IGCP), so it was decided to organize the second edition of a school contest entitled "*The water that unites us*", focusing the objectives of the *International Year of Water Cooperation*, proclaimed by the United Nations. This school contest will be promoted not only among the schools situated in the Portuguese Geoparks territories, but also in other territories from the Portuguese Speaking Countries were the creation of new Geoparks will count with the strong collaboration and support of the Portuguese National Forum of Geoparks.

The event at the Portuguese Parliament had as major goal to give stronger visibility to the work done by the Portuguese Geoparks, including the aspiring Geoparks among the Parliamentarians, and to reinforce such goal, it was also established official visits by the Parliamentarians to these territories will take place during 2013/2014, so that these policy makers, can continue to follow and support the work done by all the Portuguese Geoparks and recognize their value in the promotion of a sustainable development of these territories, working with and for the population belonging to the Geoparks., so a new reality and new opportunities were open for the Portuguese Geoparks. The increasing sensitization among the national policy makers will definitely help to reinforce their objectives and the development of these territories.

Fig. 4 – Stands of the Portuguese Geoparks

ACKNOWLEDGMENTS

We wish to thank all the staff involved in the organization of the event and especially to all members of the Portuguese Geoparks. Also a special thanks to Prof. Nikolas Zouros and to the Parliamentarians who participated in the Conference.

School Contest “Water that unites us”: an example of cooperation between Geoparks and Biosphere Reserves of UNESCO”

Silva E. ([a]), Ribeiro R., Pereira F. ([b]), Costa M. P., Lima E. A. ([c]) & Lopes P. ([d])

([a]) Portuguese National Commission for UNESCO. Palácio das Necessidades, Largo das Necessidades, s/n, 1350-215 Lisboa. Portugal. Portuguese National Committee for International Geoscience Programme (IGCP-UNESCO). Portuguese National Forum of Geoparks. E-mail: elizabeth.silva@mne.pt
([b]) Santana Biosphere Reserve, Madeira, Empresa Terra Cidade, Santana, Portugal; E-mail:rribeiro@terracidade.com; fpereira@terracidade.com
([c]) Azores Geopark Association, Centro Empresas da Horta, Rua do Pasteleiro s/n, 9900-069 Horta. Portugal. Email: manuel.ps.costa@azores.gov.pt; evalima@uac.pt
([d]) Príncipe Biosphere Reserve, S. Tomé e Príncipe, E-mail: placidaunb@gmail.com

ABSTRACT

Taking into account the main objectives of the *United Nations Decade of Education for Sustainable Development* (2005-2014), the *United Nations Decade for Action “Water for life”* (2005-2015) and the *International Year for Water Cooperation* (2013), promoted by UNESCO, the Portuguese National Commission for UNESCO invited the Azores Geopark and the Portuguese Biosphere Reserve of Santana, in Madeira, as well as the Biosphere Reserve of Príncipe Island to participate as a team in the school contest (2012/2013), entitled “Water that unites us”.
The main goal of this school contest was to promote the objectives of the *International Year for Water Cooperation* based also in the main line of the strategy implemented by the referred Decade (CNU, 2005).
In order to involve all Portuguese Geoparks, this educational project also involved the Portuguese Global Geoparks Naturtejo and Arouca, and also the aspiring Geoparks of *Terras de Cavaleiros* and *Costa da Laurissilva*, with the support of the Portuguese National Forum of Geoparks and the National Committee for the International Geosciences Program of UNESCO.

KEY WORDS: Education, Geoparks, Cooperation between Countries, Biosphere Reserves.

INTRODUCTION

In the framework of the *United Nations Decade of Education for Sustainable Development* (2005-2014) which UNESCO is the leading agency (CNU, 2005) and in the framework of *United Nations Action “Water for Life”* (2005-2015) and the *International Year of Water Cooperation* (2013) with the main goal to create awareness on water management cooperation and safeguard of this precious natural resource and its sustainable management, the Portuguese National Commission for UNESCO (NatCom – Portugal), the Azores Geopark and the Portuguese Biosphere Reserve of UNESCO, Santana, Madeira and the Biosphere Reserve of UNESCO of Príncipe Island, in S. Tomé and Príncipe, in Africa, developed a school contest (edition 2012/2013) entitled “Water that unites us” (Fig. 1). This school contest had two main objectives: to create awareness among students, teachers and school and local communities about the importance of water as a very important natural resource for our survival in Planet Earth and to increase the knowledge about the concept of Geopark and Biosphere Reserve of UNESCO (including their role to contribute to the development of knowledge about the European and Global Geoparks Network and the World Biosphere Reserves Network of UNESCO / Man and Biosphere Programme of UNESCO). This school contest was developed between different school levels, namely Preschool, Primary and Secondary level and the award ceremonies will take place during the celebration of the *World Day of Environment* (5th June, 2013). This activity was promoted in Geopark Azores and also in the Biosphere Reserve of Santana, Madeira and Biosphere Reserve of Principe Island with the aim also to clarify these different classifications of UNESCO. This school contest was also promoted in Geopark Naturtejo and Geopark Arouca.

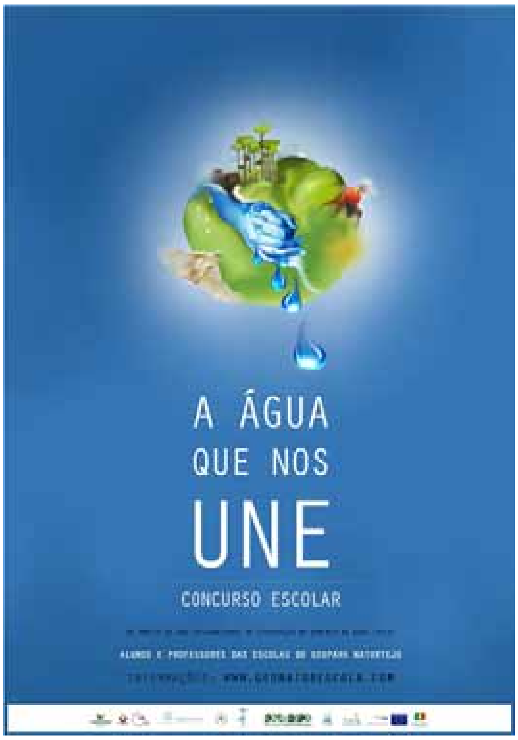

Fig. 1 – Poster of promotion of the School Contest “Water that unites us”

COOPERATION BETWEEN GEOPARKS AND BIOSPHERE RESERVES THROUGH A SCHOOL CONTEST

With the aim to promote the main goals of the *International Year of Water Cooperation*, in the framework of the strategies of the *United Nations Decade of Education for Sustainable Development* and the *United Nations Action "Water for life"*, focusing also the Geoparks and Biosphere Reserves concept towards a sustainable development of these territories, the referred school contest was promoted among all the nine islands of Azores Geopark, with the participation of 3 schools, involving 150 students and 15 teachers and with the development of 8 school projects (Fig. 2 and 3).

In the Biosphere Reserve of Santana (also an aspiring Geopark), Madeira, 7 schools participated, presenting 23 school projects (Fig. 4), involving 240 students and 11 teachers. In the Biosphere Reserve of Príncipe, 5 schools participated with a total of 11 school projects and involving 150 students (Fig. 5). This cooperation will continue in 2013/2014, reinforcing the cooperation between Geoparks and Biosphere Reserves.

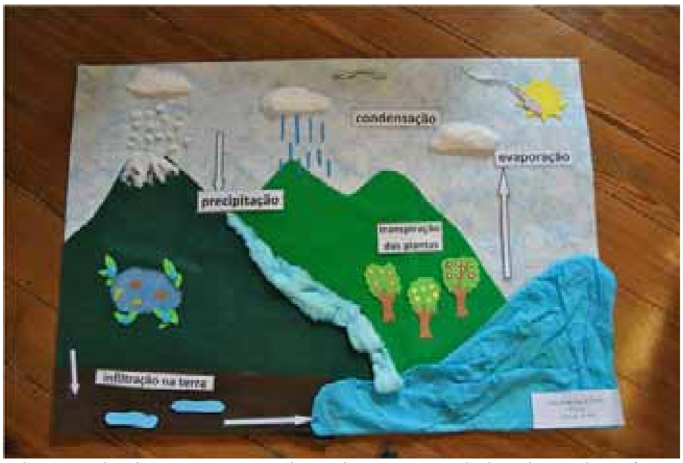

Fig. 2 – School Contest "Water that unites us" – Work done by students from the Azores Geopark, Santa Maria Island.

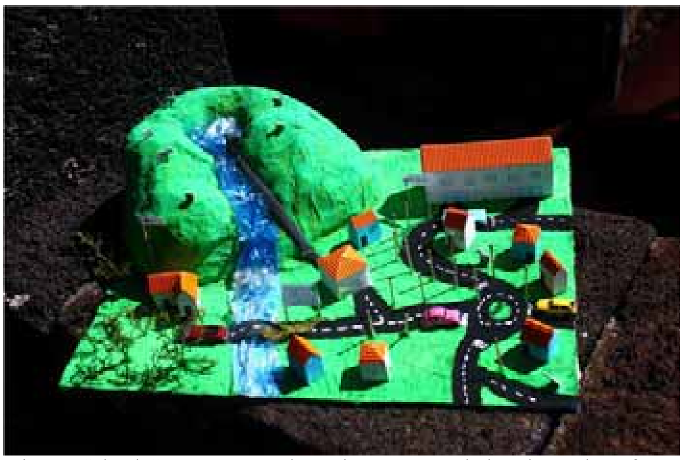

Fig. 3 – School Contest "Water that unites us" – Work done by students from the Azores Geopark, Pico Island.

Fig. 4 – School Contest "Water that unites us" – Work done by students from the Biosphere Reserve of Santana, Madeira

Fig. 5 – School Contest "Water that unites us" – Work done by students from the Biosphere Reserve of Príncipe, S. Tomé and Príncipe ("Rua Feliz" school")

CONCLUSIONS

In 2013 special attention is given to the objectives of the *International Year of Water Cooperation,* raising awareness also about the importance of increasing cooperation between nations on this issue. On another hand, this year it was also celebrated the *International Day for Biological Diversity* under the motto "Water and Biodiversity". In view of the importance of water in a Sustainable Development and pressing problems with water availability and quality, these type of celebrations focus on the solutions provided by biodiversity to meet water-related challenges. In fact, it was chosen to coincide with the *International Year of Water Cooperation* (UNESCO, 2013). Water is required to support biodiversity. Without sufficient water, stresses on species increase global biodiversity losses. In turn, biodiversity is critical to the maintenance of both the

quality and quantity of water supplies and plays a vital but often under-acknowledged role in the water cycle (*ibid*).
Taking into account these concerns, the NatCom-Portugal encouraged Azores Geopark and the Portuguese Biosphere Reserves, as well as the Biosphere Reserve of Príncipe Island, to collaborate in a common school contest, due to the importance that Geoparks and Biospheres Reserves give to water issues and to the use of this natural resource in these territories with a view to a sustainable consumption. Promoting both concepts and putting students from different regions working together with the same objective was the main challenge, reinforcing also the common approach about sustainable development of both Geoparks and Biosphere Reserves.
Due to the major success of this initiative, the Portuguese National Commission for UNESCO will promote and collaborate with the Portuguese Geoparks and the Biosphere Reserves from Portugal and S. Tomé and Príncipe to continue this effort, mobilizing both school and local communities in the development of concrete strategies to a sustainable use of water along with a project involving the reduction of water plastic bottles by using metal bottles with potable water and other solutions that can bring positive changes in water consumption and reduction and recycle of plastic bottles, both projects with the official support of the Portuguese Committee for the International Geosciences Program of UNESCO and the Portuguese National Forum of Geoparks.

ACKNOWLEDGMENTS

We wish to thank to all the people involved in the development of this school contest, specially teachers and students and the Geoparks and Biosphere Reserves staff and also the support of local communities, including municipalities, and also a special thank to the Portuguese teachers working at Príncipe Island and the Embassy of Portugal in S. Tomé e Príncipe and the Government and the President of Príncipe. Also a warm thank you to the Portuguese Committee for the International Geosciences Programme for its official support and for promoting the school contest in its website as well as the Portuguese National Forum of Geoparks.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

The school contests promoted by the Portuguese National Forum of Geoparks: a reality with increasing impact in the school community

Silva E. ([a]), Rocha D. ([b]), Catana M. M. ([c]) & Sá A. A. ([d])

([a]) Portuguese National Commission for UNESCO. Palácio das Necessidades, Largo das Necessidades, s/n, 1350-215 Lisboa. Portugal. Portuguese National Committee for International Geoscience Programme (IGCP-UNESCO). Portuguese National Forum of Geoparks. E-mail: elizabeth.silva@mne.pt
([b]) AGA-Arouca Geopark Association, Rua Alfredo Vaz Pinto – Apt. 20, 4540-118 Arouca, Portugal
([c]) Naturtejo Global Geopark, Educational Office of the Municipality of Idanha-a-Nova, Centro Cultural Raiano, Av. Joaquim Morão, 6060-101 Idanha-a-Nova, Portugal
([d]) Department of Geology, University of Trás-os-Montes e Alto Douro, 5001-801 Vila Real, Portugal. Portuguese National Committee for International Geoscience Programme (IGCP-UNESCO). Portuguese National Forum of Geoparks.

ABSTRACT

In the framework of the *United Nations Decade of Education for Sustainable Development* (2005-2014), the *United Nations Decade for Action "Water for life"* (2005-2015) and the *International Year for Water Cooperation* (2013), promoted by UNESCO, the Portuguese National Commission for UNESCO invited the Portuguese Global Geoparks – Naturtejo, Arouca and Azores – to develop a new school contest for 2012/2013, entitled "The water that unites us".
The main goal of this school contest was to promote the objectives of the *International Year for Water Cooperation* (United Nations General Assembly, Resolution A/RES/65/154 of 2010) based also in the main line of the strategy implemented by the referred Decade (CNU, 2005).
Therefore, teachers and students had to explore these issues in the Geoparks territories, focusing on the need to use this vital natural resource – water – in a sustainable manner.
In order to reach as much as possible all communities of teachers all students, this educational project also involved Geopark Azores and the aspiring Geoparks of *Terras de Cavaleiros* and *Costa da Laurissilva*, and also include the Portuguese Biosphere Reserves of UNESCO, namely Santana (Madeira island) and also the Biosphere Reserve of Príncipe Island, in S. Tomé and Príncipe, in Africa.

KEY WORDS: Education, National Geoparks Forum, Portugal, school contest.

INTRODUCTION

The Portuguese National Commission for UNESCO (Portugal NatCom) has been cooperating very closely with the Portuguese Global Geoparks. The maximum example of such cooperation was the initiative of creating the Portuguese Geoparks Forum, currently coordinated by Portugal NatCom. However, the recognition by this entity of the importance of Geoparks, while areas of excellence for the development of initiatives in the areas of education, science and culture, is a reality in Portugal since the development of the application of the first Portuguese Geopark – Naturtejo Geopark– to the European Geoparks Network, in 2005. It was based on this reality that since the school year 2008/2009 the Portugal NatCom and the Portuguese Geoparks initiated the development of joint initiatives in the area of education that passed by holding thematic-based school contests (Fig. 1 to Fig. 5) related with geosciences, biodiversity and the environment (Silva *et al.*, 2010; Silva *et al.*, 2012).

Fig. 1 – Poster about the School Contest "Water and Energy", 2008/2009

Fig. 2 – Poster about the School Contest "Climatic Changes & Biodiversity", 2009/2010

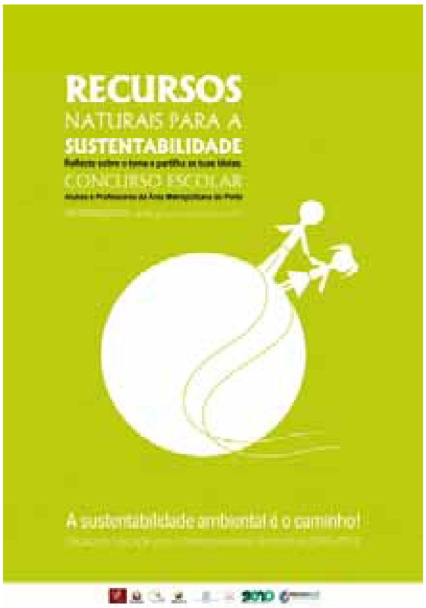

Fig. 3 – Poster about the School Contest “Natural Resources for Sustainability”, 2010/2011

Fig. 4 – School Contest “How to improve the environmental quality of my community?”, 2011/2012

The success of this initiative and the growing of its implementation led to the development of another school contest "The water that unites us" (Fig. 5), edition 2012/2013, extend to the Portuguese global Geoparks –Naturtejo, Arouca and Azores – and to the aspiring Geoparks, *Terras de Cavaleiros* and *Costa da Laurissilva*. This initiative was also extended to the Portuguese Biosphere Reserve of Santana (Madeira) and also reinforcing the cooperation with Africa, involving the Biosphere Reserve of Príncipe (S. Tomé and Príncipe). It was also extended to the schools of the Oporto metropolitan area and in the schools located in the territories of the Municipality of Cascais (Lisbon) and in the Municipality of Torres Vedras (northern Lisbon area).

All the work done within the school contest and further exhibitions of the students projects, in several official events, was also based in the themes of the Portuguese educational curricula, established from the primary level, including pre-school, until the secondary level, functioning has an important tool for teachers and students (Amador *et al.*, 2012). Since the theme of the contest fit in the thematic of the *International Year of Water Cooperation*, the Portuguese Committee for the International Geoscience Programme (IGCP-UNESCO) also joined and supported this initiative, revealing the growing collaboration and cooperation by the entities with responsibilities in education for sustainable development in Portugal.

"THE WATER THAT UNITES US" CONTEST

With the aim to promote the main goals of the *International Year of Water Cooperation*, in the framework of the strategy of the *United Nations Decade of Education for Sustainable Development*, but also promoting once again the Geoparks concept and the role of Geosciences in the dissemination of Environmental best practises and of a more active and socially responsible citizenship (Silva, 2012), the school contest focused on the sustainable use of water (Fig. 5), specially in the Geoparks and Biosphere Reserves territories, allowing students to explore this theme with field trips to rivers, collecting samples and study them and creating awareness about water consumption, working as a team in the classroom (Lopes, 2009) and involving their parents and the local communities, with exhibitions of their work, promoting also conferences and seminars about this issue.

Fig. 5 - School Contest “Water that unites us”, 2012/2013

The referred school contest implemented in the Geopark Naturtejo territory, involved 195 students and 11 teachers (from different Municipalities such as Idanha-a-Nova, Castelo Branco, Vila Velha de Ródão and Proença-a-Nova), with 20 school candidatures, in different categories, namely 6 videos, 5 drawings, 4 models, 3 posters and 2 publicity spots, from pre-school to secondary level (Fig. 6 and 7).

Fig. 6 – Example of a Poster produced by students from a pre-school located in Naturtejo Geopark

Fig. 7 – Drawing produced by students from a pre-school located in Naturtejo Geopark

In the Arouca Geopark and also in several municipalities belonging to the Metropolitan area of Oporto (Vila Nova de Gaia, Porto, Espinho, Oliveira de Azeméis, Matosinhos and Maia), the school contest involved 710 students and 34 teachers, with 59 candidatures (Fig. 8), namely 16 videos, 12 drawings (Fig. 9), 12 models, 12 posters and 7 publicity spots), from all levels, including professional courses.

Fig. 8 – Example of the projects presented within the School Contest, from Arouca Geopark

Fig. 9 – Example of the drawings presented within the School Contest from Arouca Geopark

CONCLUSIONS

The main objective of the *International Year of Water Cooperation* is to raise awareness, both on the potential for increased cooperation and on the challenges facing water management in light of the increase in demand for water access, allocation and services. Taking into account that also intends to highlight the history of successful water cooperation initiatives, as well as identify burning issues such as on water education, cross-border water management, financing cooperation and the linkages with the *Millennium Development Goals* (United Nations, 2013), the school contest "Water that unites us" is a project that contributed to these goals. It also allowed to unite all Portuguese Geoparks and also some of the Portuguese Biosphere Reserves, including an African Biosphere Reserve in a common objective to provide an opportunity to capitalize on the momentum created at the United Nations Conference on Sustainable Development (Rio+20) and to support the formulation of new objectives that will contribute towards developing water resources that are truly sustainable (United Nations, 2013). By creating awareness and looking for possible solutions, teachers and students were all involved in projects that reinforce the need to spare the water available in our planet and to highlight that this natural resource can be used in a sustainable and equitable way, among nations.

Putting different concepts based on the European and Global Geoparks Network, the Program "Man and Biosphere", and the International Geoscience Program proofs to be a very successful cooperation between different programs and networks, collaborating in a same theme, with different but common approaches.

In order to give more visibility to the European Geoparks Network and to the Portuguese Geoparks among the Portuguese society and especially between students and teachers, this educational project also promoted the exchange of students within the Geoparks territories. In this sense they could also experience other realities and new and innovative ways to spare and use a natural resource that allows life in this planet – the water that unites us all through Planet Earth.

ACKNOWLEDGMENTS

We wish to thank to all dedicated teachers, students, school staff and all the municipalities who participated in a very active way in this project. Also a special thanks to the Portuguese Committee for the International Geosciences Programme for its official support and for promoting the school contest in its website as well as the Portuguese National Forum of Geoparks.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

Kras-Carso, aspiring cross-border Geopark between Slovenia and Italy

Stupar M. ([a]), Ravalli R. ([b]), Fedrigo K. & Kljun M.([c])

([a]) Institute of the Republic of Slovenia for Nature Conservation, Regional Unit of Nova Gorica, Delpinova 16 , 5000 Nova Gorica, Slovenia. E-mail: martina.stupar@zrsvn.si
([b]) Province of Trieste, Piazza Vittorio Veneto, 4 34132 Trieste, Italy
([c]) Municipality of Sežana, Partizanska cesta 4, 6210 Sežana, Slovenia

ABSTRACT

The plateau named Kras in Slovene and Carso in Italian language is located in the western Slovenia and in the inland of the Gulf of Trieste on the eastern border of Italy and it forms the area of Classical Karst. Due to its overall value on the one hand, and risks and threats to the karst systems on the other, an effective protection of the karst areas as well as economic development is required. The karst features, karst landforms and geological phenomena in the Classical Karst on Italian and Slovenian territory are presented as follows.

KEY WORDS: karst features, geosite, karst landscape and cultural heritage, biodiversity.

INTRODUCTION

The Kras-Carso aspiring to geopark's administrative borders may be connected to the municipal boundaries of five municipalities in Slovenia (Miren - Kostanjevica, Komen, Sežana, Divača, Hrpelje – Kozina) and ten in Italy (Trieste, Sgonico (Zgonik), Monrupino (Repen), Duino – Aurisina (Devin – Nabrežina), Doberdò del Lago (Doberdob), Monfalcone, Sagrado, Ronchi dei Legionari, Fogliano-Redipuglia, Savogna d'Isonzo (Sovodnje ob Soči) (Fig.1).

The area is predominantly formed in carbonate rocks and it is a part of Dinaric Karst. Numerous surface and underground karst features formed, giving the landscape a distinctive and typical morphology. It has long been known as a unique natural feature which contains rare geological, geomorphological features, cultural heritage and landscapes, as well as represents a "hot point area" for biodiversity. One of the most key characteristics of the Karst is its rich subterranean fauna. Due to its geographic position numerous groups of plant species typical of the Mediterranean, continental and Alpine climates came into contact throughout and after glacial periods. There are traces of human settlements from all prehistoric periods. Special importance is attributed to cave archaeological sites, e.g. Palaeolithic sites (Riparo di Visogliano cave, Mušja jamacave,…). Caves as Vilenica, Škocjanske jame caves, Grotta Gigante cave (Velika jama v Briščikih) are also the cradle of cave tourism worldwide.

The strategic project KRAS-CARSO, with the full name of Sustainable Management of Natural Resources and Territorial Cohesion, is co-financed within the frame of the Cross-border Co-operation Programme Slovenia - Italy 2007-2013 from the European Regional Development Fund and national resources. It is being carried out within the territory of Karst and promotes sustainable territorial integration of an homogenous Karst area, as one of the most important cross-border areas between Slovenia and Italy. The project aims to carry out activities providing sustainable management of natural resources and territorial cohesion with joint strategies at transnational level. One of the main activity is the **"Assessment of the potential implementation of geopark in Karst"**. The objective is to find out whether the establishment of a geopark in Karst would represent a solution for keeping the natural characteristics of the area and promoting socio-economic development. For this purpose the activity foresees the elaboration of the Feasibility Study on Establishing a Kras-Carso Geopark.

In this paper the natural and cultural aspects of the area have been reviewed in specific chapters.

Fig.1-Aspiring Geopark Kras – Carso (map prepared by M. Vertovec)

GEOLOGY

Karst plateau is predominantly composed of Cretaceous and Palaeogene carbonate rocks and lies in the Komen upthrust horst that was pushed against the same carbonate rocks and Eocene flysch beds of Istria. The development of the Karst plateau is peculiar due to an unique combination of lithology and thrust and strike-slip tectonics. Geological evolution of the Karst is closely associated with dynamic activities on the carbonate platform and intensive tectonic processes that influenced the development of landscape. The latest researches have even shown that individual types of karst geomorphology are linked to a particular type of tectonics (Placer, 2012; Jurkovšek et al., 2012 and Carulli, 2006).

Fig 2 – Profile of the Raša fault, geosite (photo M.S.)

GEOMORPHOLOGY AND SPELEOLOGY

The Karst common characteristic is generally a level of surface with some rounded peaks with no surface-running river network and fluvial landscape. The Karst features various surface and subterranean geomorphologic landforms, such as dissolution dolines, collapse dolines, micro-forms on rocks created during karstification, and numerous karst caves rich in flowstone. On the west side of the Karst plateau borders the Adriatic sea (Fig.3). The longest cave complex is that of Škocjanske jame caves and Kačna jama cave (together, they are more than 20 km long) with the deepest caves reaching down to 330 m and featuring a connection to the underground Reka River, which appears as Timavo in the spring near Trieste (Otoničar,2012). The total number of caves, registered in Slovene and in Italian Cave Cadastre is over 4000 and is increasing with the discovery of new caves (as the recent “Impossible cave”). Most of the caves are rich in speleothems. Karst caves are indeed unique in both type (dry caves, water caves, cave systems, shafts, spring caves, etc.), dimensions and their great spatial frequency. A great numbers of cave channels covered in dripstone and its forms (stalactites, stalagmite, curtains, cave pearls, etc.).

The Karst plateau is extremely important for the history of research on karst landscape and karst phenomena, i.e. the development of karstology and speleology (Bertarelli et al., 1926). Pioneering speleological and spelaeo-biological as well as – later on – scientific research began in the Classical Karst. The term ‘karst’ is now established and globally accepted by scientists worldwide.

Fig.3 – Typical surface relief on carbonate rocks (photo R.R)

BIODIVERSITY

As a result of natural conditions (geographic location, carbonate bedrock, climate) and the century-old traditional human activities (cutting, mowing, grazing, burning, editing sinkholes, construction drywalls), Karst shows a wide variety of landscapes and diverse habitat mosaic with an extreme richness in flora and fauna. Karst is the habitat of many endangered plants and animals including many rare and endemic species.

Numerous endemic plants and animal species are located in these key-areas (type localities), whereas specialized, subterranean animal species (troglobionts) in the area are mainly strictly endemic. The fauna found in the Karst caves is diverse. The most important specialized cave animals include among others the cave salamander (Proteus anguinus), living in caves with the groundwater flow of the Reka River and some other active caves (Stupar, 2012).

NATURE PROTECTED AREAS

As far as the legislation in Italy and Slovenia is concerned, there are some differences in the system of nature protection.

In Slovenia the nature protection activities started a few decades ago. The Karst has extremely high nature significance, specially dominated by the caves. In Slovenia all caves are protected by the specific Cave Protection Act (2004) as the nature heritage objects of national importance. Among geological features with the status of nature heritage, the location of fossils, such as Cretaceous fossils of fish, dinosaurs and diverse fossil mollusc are the most important. The profile of Raša fault (Fig 2) and some other significant features affected by intense tectonics, such as roofless caves, sinkholes, dry valleys,… have a status of geological nature heritage, as well as some stratigraphic outcrops with important scientific value (Stupar, 2012).

On the Slovene part of Karst are located;

- The Regional park Škocjanske Jame, also put on the UNESCO's world heritage list in 1986,
- 72 natural monuments,
- 164 sites with status of nature heritage (81 of national and 83 of local importance),
- 1052 caves, all with status of nature haritage of national importance,
- 7 Ecologically important areas,
- 5 Special protection areas (Natura 2000),

Protected areas sometimes overlap rules of conduct and protection regimes, being these appropriately complementary.

On the Italian side of Karst almost half of the area is covered by nature protected areas:

- 5 nature protected areas on regional level,
- 2 Special protection areas (Natura 2000),
- 25 caves with status of nature heritage

Among them the geosites of international importance (specified by the Geological Survey of Friuli Venezia Giulia) such as Doberdò (Doberdob) Lake, Timavo (Timav) river spring, fossils of dinosaurs in the Villagio del Pescatore (Ribiška vas), Karen - Campi solcati near Grotta Gigante cave village, cliff of Duino (Devin) and the Rosandra (Glinšèica) Valley are the most important (Cucchi et al., 2009 and Gerdol, 2012).

CULTURAL HERITAGE AND LANDSCAPE

The man-made environment is adapted to the use of limestone as the basic building material as well as to the shortage of water. Stone has left its mark on the karst architecture and has been used to decorate and mark the karstic home and villages as well as their entire surroundings. The natural conditions in the karst landscape significantly affected the use of space and man's adaptation to the conditions. Over the centuries land areas in the Karst region have been acquired by deforestation, land transfer as well as by removing excess and smashing rocks. In the Karst region, the first settlements were established in prehistoric times. Archaeological evidences in karst caves are invaluable proofs of ancient settlement of the area. As an exception to the favorable climate found in the Karst breeding noble Lipizzaner horses, bred in the state stud farm, were established in 1580 by the Austrian Archduke Karel (Belingar, 2012).

In addition to stone, the Karst is characterised by Teran, the best known wine of the region. Cave tourism began developing in the Classical Karst as early as in the 17th century. Vilenica is mentioned as the oldest tourist cave (since 1633), while cave tourism began developing more intensively in the 19th century.

CONCLUSION

Many of the resources that exist within the Karst region suggest the notion of a »geopark« as method to collectively implement the components of nature conservation. It is crucial to understand the concept of geoparks. These natural and cultural features could easily be placed in the context defined Geopark Kras. The karst and the Karst region also achieved its reputation through the fact, that the Slovene word kras-karst has had an international meaning for a region possessing the same features. The big frequency and diversity of karst features and a huge amount of scientific researches carried out in the Slovenian karst phenomena, outlines its importance for the karst science. The amount and variety of natural and cultural sites recognized by the existing systems and programs may well support themselves in the efforts of the formal recognition as European and Global Geopark.

In fact, if a geopark is defined in the International Network of Geoparks program by UNESCO as "a territory encompassing one or more sites of scientific importance, not only for geological reasons but also by virtue of its archaeological, ecological or cultural value", the Karst area will have undoubtedly sufficient standards to be established as GEOPARK.

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

The genesis of "Cyprus-Type" sulphide deposits, their occurrences around the Troodos mountain and its exploitation since antiquity played a significant role to the mining heritage of Cyprus.

Tsiolakis E. ([a]), Morisseau E. ([a]), Zomeni Z. ([a]) & Kassianidou V. ([b])

([a]) Cyprus Geological Survey Department, Lefkonos, 1, 1415, Nicosia, Cyprus.E-mail: etsiolakis@gsd.moa.gov.cy
([b]) Department of History and Archaeology, University of Cyprus, Gladstonos, 12, 1678, Nicosia, Cyprus.

ABSTRACT

The Troodos ophiolite complex dominates the central part of the island and is the geological backbone of Cyprus. It is well known in the scientific community that Cyprus hosts a piece of fully developed oceanic crust that makes it unique worldwide. The rocks of the Troodos ophiolite record all the processes that took place during spreading in the Tethys Ocean, 92 million years ago. One of these processes takes place in mid-ocean ridge hydrothermal systems, the well-known black smokers, resulting in the creation of Cyprus-type sulphide ore bodies. These sulphide deposits became known in antiquity and played a significant role in the mining activity and heritage on the island.

KEY WORDS: Cyprus, Massive sulphide deposits, Sea-floor Spreading, Slag, Troodos ophiolite.

INTRODUCTION

Cyprus is a small island of the Eastern Mediterranean with spectacular geology concerning plate tectonic activity and especially the formation of oceanic crust and its subsequent uplift. It continues to attract attention not only for geologists but the general public considering the depth and processes that took place for the formation of the Troodos ophiolite complex and the degree of uplift that followed. The densely forested summit of Troodos is the deepest layer of a slice of oceanic crust correlated to the upper mantle of the earth (Constantinou et al., 1997), found today 2.000 meters above sea level.

The geological evolution of Cyprus is directly related to the genesis and uplift of the Troodos ophiolite complex, which dominates the central part of the island and is the geological backbone of Cyprus. It is a fully developed piece of oceanic crust that was formed some 92 million years ago along a small part of a spreading seafloor above a subduction zone (Moores et al., 1984; Edwards et al., 2010) on the Tethyan Ocean which used to extend from the Pyrenees in the west and through the Alps and Pindos, and reached the Himalayas in the east

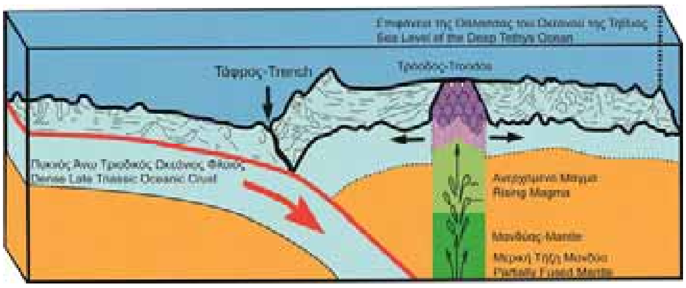

Fig. 1 – Graphical representation of the Supra-Subduction Zone and the formation of new oceanic crust of the Troodos 92 million years ago (Modified from Constantinou et al., 1997).

(Constantinou et al., 1997). Because of its stratigraphic completeness, excellent exposures and accessibility, it is the most studied ophiolite worldwide and has made a significant contribution in the development of the theory of seafloor spreading and the genesis of ophiolites the last 40 years.

Closely associated with the Troodos ophiolite are mineral deposits such as chromite, asbestos, massive sulphide deposits, ochre and umber (Constantinou et al., 1997) which have played a significant role through the centuries not only for the economic and social development of the island but also for the cultural and archaeological heritage of Cyprus.

GEOLOGICAL SETTING

The genesis of the sulphide deposits of Cyprus is an integral part of the dynamic process for the birth of the Troodos ophiolite. The Troodos ophiolite complex was formed some 92 million years ago at the bottom of the Tethys Ocean in a Supra-Subduction Zone (SSZ), along a spreading centre, close to the subduction zone of the African Plate beneath the Eurasian (Moores et al., 1984). In this Supra-Subduction Zone (SSZ) a slab of dense Late Triassic Tethyan oceanic crust was subducting beneath another oceanic slab which, spread and formed new oceanic crust above the subduction zone (Fig. 1) (Constantinou et al., 1997). Approximately 60 km beneath the axis of seafloor spreading partial melting of the upwelling

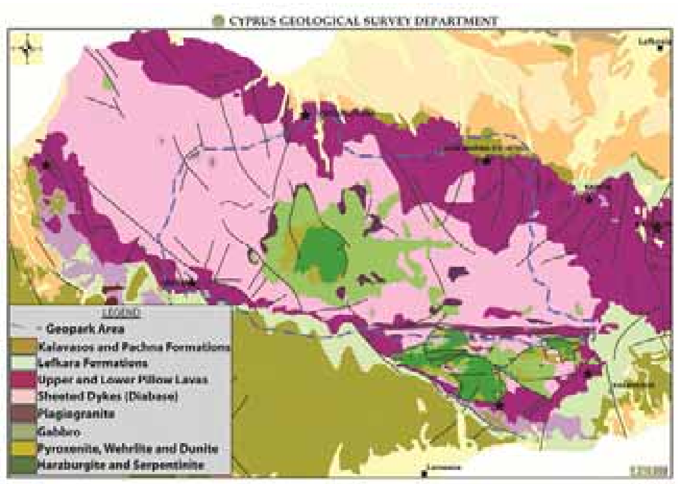

Fig.2 – Geological map of the proposed Troodos Geopark with the location of the copper mines and the ancient slag heaps (Cyprus Geological Survey Department).

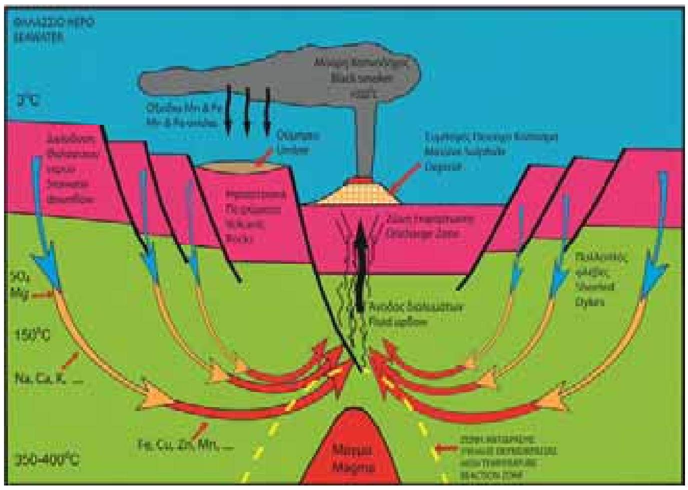

Fig.3 – Volcanic heat at the mid-ocean ridge axis drives hydrothermal circulation and chemical exchange between the ocean crust and seawater. A mid-ocean ridge hydrothermal system, black smoker, and resulting deposits are featured. Some metals represented: Mn = Manganese, Mg = Magnesium, Cu = Copper, Zn = Zinc, Fe = Iron. (Modified from Massoth et al., 1988; Humphris& McCollum,1998; Edwards et al., 2010).

mantle was producing melts of basaltic composition at temperatures of 1.000 – 1.200^{o}C, which gave birth to the different types of ophiolitic rocks (Constantinou et al., 1997). From the upper to the lower members the Troodos ophiolite consists of: the chemical sediments, the volcanic rocks, the sheeted dyke complex, the cumulate rocks and the rocks of the mantle sequence (Constantinou et al., 1997).

The iron, copper and zinc sulphide deposits of Cyprus (in the form of pyrite, chalcopyrite and sphalerite respectively) are associated with the Troodos Lower Pillow Lavas and have been formed on the Tethys sea floor along a mid-ocean ridge (sea floor spreading) (Constantinou, et al., 1997). These deposits are located on the foothills of the Troodos mountain in six mining areas: Limni, Skouriotissa-Mavrovouni, Agrokipia-Mitsero, Kalavasos, Kambia and Sia-Mathiatis (Fig. 2) (Constantinou, et al., 1997; Edwards et al., 2010).

Detailed studies show that Cyprus sulphide deposits have many features in common with black-smoker hot springs forming today at seafloor spreading centres such as in the Pacific and Indian Oceans (Constantinou et al., 1997; Edwards et al., 2010). Therefore, the Cyprus deposits have contributed significantly to the understanding of the processes of genesis of such deposits, known today as “Cyprus-type” deposits (Edwards et al., 2010). A general model for the genesis of the Cyprus sulphide deposits is given in Figure 3. These deposits are formed by the circulation of metal-rich hydrothermal fluids. The source of sulphur is seawater, which flows down into the newly formed oceanic crust through pores in rocks and via a network of fissures that are formed in the zone of spreading. At depth, the percolating seawater is gradually heated and washes out metallic elements from the surrounding rocks (Constantinou et al., 1997). In the reaction zone of a magma chamber or newly crystallized plutonic rocks, the sea water becomes very heated and chemically modified to hydrothermal fluids (Edwards et al., 2010). These hydrothermal fluids rise rapidly through a narrow zone along structural conduits, such as the major faults that are found close to the sulphide deposits and discharged through “black-smoker” hot springs on the sea floor at 350^{o}C (Edwards et al., 2010). The precipitation of sulphide minerals such as pyrite and chalcopyrite occurs due to the rapid decrease of the temperature of the hydrothermal fluids and other physicochemical conditions (e.g. pH, Eh) (Constantinou et al., 1997; Morisseau, 2005).

These deposits due to the submarine oxidation that followed after their deposition were covered by a thin layer of ochre approximately 50 cm thick (Constantinou & Govett, 1972; Constantinou et al., 1997). Due to continuous submarine volcanic activity these deposits were covered by a sequence of olivine-phyric pillow lavas of the Upper Pillow Lavas which top the extrusive series of the Troodos ophiolite complex (Constantinou, 1972; Constantinou et al., 1997).

The differential uplift of Troodos in conjunction with the erosion that followed when the Troodos was uplifted above sea level, exposed these deposits to the surface (Constantinou et al., 1997). Once exposed to subaerial climatic conditions, microbial oxidation converted them to a mixture of iron oxides and hydroxides forming gossans (iron caps) with spectacular red, yellow, orange and brown colours, which attracted the ancient inhabitants resulting in their discovery (Constantinou et al., 1997; Morisseau, 2005; Edwards et al., 2010).

CYPRUS COPPER MINING HERITAGE

The geology of Cyprus contributed significantly to the historical and cultural development of the island (Constantinou, 2004). The natural resources of the island, which have been exploited since antiquity as the cupriferous deposits, are directly related with the geological structure and evolution of the Troodos mountain (Constantinou, 2004; Morisseau, 2005).

The history of copper mining in Cyprus goes back at least to the third millennium BC (Constantinou, et al., 1997; Kassianidou, 2004; Morisseau, 2005; Edwards et al., 2010) and it is an important part of the island's history and cultural heritage. Cyprus was probably one of the earliest producers of copper derived from the smelting of sulphide ore. Cypriot smiths managed to produce copper from sulphide deposits using extractive metallurgy and Cyprus rapidly became one of the biggest copper producers and exporters in antiquity (Kassianidou, 2004; Morisseau, 2005). Eventually, its name became synonymous with copper (Constantinou, et al., 1997). The 100 ancient slag deposits (mapped and archived by the Cyprus Geological Survey Department) found scattered throughout the island constitute the most convincing evidence for the extent and duration of ancient mining in Cyprus. Slag was the waste product of the smelting furnaces, which was discarded (Kassianidou, 2004). Thus large slag heaps were formed in the vicinity of the copper mines where the smelting workshops operated. During the smelting operation and because of the high temperatures (which reached 1.300^{o}C), both the slag which consists mainly of iron and silica, and the copper metal were in liquid state (Kassianidou, 2004). As the two liquids are immiscible and copper is heavier, the metal would settle at the bottom of the furnace while the slag floated on top (Kassianidou, 2004). Slag was removed from the furnace, by opening a hole in the front part of the furnace and allowing it to run on a prefabricated cavity. That is why slag contains flow shapes and resembles lava flows. From the above, it is easily concluded that each piece of slag is proof for an independent smelting event for the production of copper metal (Kassianidou, 2004). The biggest slag deposit is found at Skouriotissa near the Phoenix Mine and is approximately 2 million tones (Fig. 4). According to new radiocarbon (^{14}C) dating on charcoal samples that were collected from the stratified layers reveals that this particular slag heap dates to the Early Byzantine Period, namely from the 4th to the 7th centuries AD (Kassianidou, 2011).

Other important evidence for ancient mining activity in Cyprus apart from the 100 scattered ancient copper slag heaps are the remains of ancient galleries and tools found in all the mines, references to historical sources and ancient shipwrecks loaded with Cypriot copper ingots (Constantinou, 1992; Morisseau, 2005, Kassianidou, 2011). Among the ancient mining tools discovered are ladders, ropes, wedges, nails, shovels, baskets and oil lamps (Constantinou, et al., 1997; Kassianidou, 2004).

Archaelogical research carried out both on the island and the neighboring countries indicate the importance of Cyprus as a copper producing and exporting center, while archaeometallurgical research has revealed details about the technology of copper production from sulphide ores (Kassianidou, 2004).

Closely related to sulphide deposits are the ochre and umber occurrences used as color pigments in antiquity, with umber also being used in the metallurgy process (Kassianidou, 2004). During the Late Bronze Age the metallurgy developed significantly. During that period apart from the improvement of the furnace shape and the discovery and use of blowers and nozzles, the Cypriot smiths mixed the sulphide ore with silica and manganese-bearing rocks (Constantinou, 1992; Kassianidou, 2004). The function of silica and manganese oxide in metallurgical operations is to lower the melting point and regulate the viscosity of the melt resulting in the better separation between the copper and the slag. The most probable source of manganese oxide were the numbers that have a high manganese and iron oxi-hydroxide content (Constantinou, 1992).

Fig.4 – A large slag deposit (2 Mt) at Skouriotissa.

Today the Phoenix mine in Skouriotissa is the only active mine in Cyprus and the oldest mine still in operation in Europe. The exploitation commenced in 1996, when for the first time since antiquity metallic copper was produced, with the application of bioleaching and hydrometallurgy. The ore is pilled in heaps and sprinkled with acidic solution rich in chemolithotrophic bacteria. The collected solution is then treated in a solvent extraction plant. The electrolysis of the solution leads to the production of pure metallic copper (Constantinou et al., 1997; Morisseau, 2005).

GEOPARK PROJECT

The ongoing European – funded project titled "Geotourism and local development: Itanos Mount (Crete) and Mount Troodos (Cyprus)" will provide the basic infrastructure in the two mountainous areas of Crete and Cyprus aiming to make known and protect the unique geotopes of the two areas and finally implementing the actions that are necessary in nominating the two geosites for membership to the European Geopark Network.

The ultimate aim is to ensure and promote sustainable use, education and protection of the target geosites, contributing to the enhancement of geotourism with special concern to rural economy.

In the area of the proposed geopark numerous spectacular geosites occur where the rocks of the Troodos ophiolite are well preserved and exposed. Every year many universities from all over the world organize educational fieldtrips around the Troodos mountain for the training of their students. Their basic aim is to create the prospective experts to continue the study for decoding the processes that took place at the bottom of the Tethyan Ocean. In this way they will try to constrain the earth processes that are taking place today during the formation of new oceanic crust.

Scattered sulphide deposits and abandoned mines around the foothills of the Troodos Mountain attracted the attention of many geologists and archeologists. Besides the geological value of these deposits their discovery and exploitation since antiquity left behind scattered all over the island many artifacts which reveal that copper and its alloys played an important role for the economic and technological development of the island that is apparent from the Bronze Age (Kassianidou, 2004).

CONCLUSIONS

The scattered occurrences of the abandoned mines and slag heaps around the foothills of the Troodos mountain are important remnants of Cyprus mining heritage which must be preserved for future generations. For that reason, it is strongly believed that joining the European Geoparks Network, will ensure the protection and sustainable use of the mining heritage with prospects for geotourism and for educational purposes for the scientific community such as training of the future scientists and for further research work.

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12th European Geoparks Conference
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Italy, 4th-6th September 2013

Aspiring Geopark Costões and Lagunas of Rio de Janeiro a potencial area to promote a sustainability model proposed by UNESCO

Vasconcelos G.([a]), Mansur K ([b]), Vasconcelos C.([a]) & dos Anjos S..([c]) -

([a]) Geological Institute ETHZ Switzerland: Email gisele.ferolla-vasconcelos@erdw.ethz.ch.; cris.vasconcelos@erdw.ethz.ch
([b]) UFRJ University of Rio de Janeiro: katia@geologia.ufrj.br
([c]) Petrobras E&P, Rio de Janeiro Brazil: sanjos@petrobras.com.br

ABSTRACT

The region of the "Costões and Lagunas of Rio de Janeiro Geopark", comprises an area with unique geological evolution, involving more than 2 billion years of geological history, and has examples of different typologies such as igneous formations, marine and submarine environments, mineralogical aggregates, tectonic evolution, geomorphologic, archaeological traces and sites of historical / cultural interest, that need to be protected. The existence of several educational programs in environmental and heritage preservation in a territory where the municipalities have different development levels offers great potential for sustainable development geoconservation and geodiversity. There will be new job opportunities for the poorest communities, open-air school activities, a place where the people can enjoy themselves while learning, discovering and helping the people and the environment at the same time.

KEY WORDS: Costões and Lagunas Geopark, Educational programs, Geological heritage.

INTRODUCTION

The Aspirant "Geopark Costões and Lagunas of the Rio de Janeiro" is situated in southeastern Brazil on the northern Rio de Janeiro coast. This region is called "Região dos Lagos" and also "Costa do Sol". The name "Costões" comes from the unusual cliffs existing in the region that represent amazing outcrops of Cambrian gnaisses that register the latest orogeny related to Gondwana amalgamation. The name "Lagunas" (lagoons) is due to the large number of lagoons, many of them hypersaline. In Some of these lagoons occur modern stromatolites – so-called "living fossils"- and Modern dolomite, which are of great scientific interest.

Brazil is a country of huge dimensions and it is easy to see that the proposed Geopark involves a very large territory with a large population and many very interesting sites (281 sites have already been mapped), perfect for Geotourism and Geoconservation.

GEOLOGICAL SETTING

The region comprises an area with unique geological evolution (Mansur et al., 2010) involving more than 2 billion years of geological history, and has examples of different typologies such as igneous formations, marine and submarine environments, mineralogical aggregates, tectonic structures, geomorphological, archaeological traces and sites of historical/cultural interest (Fig. 1).

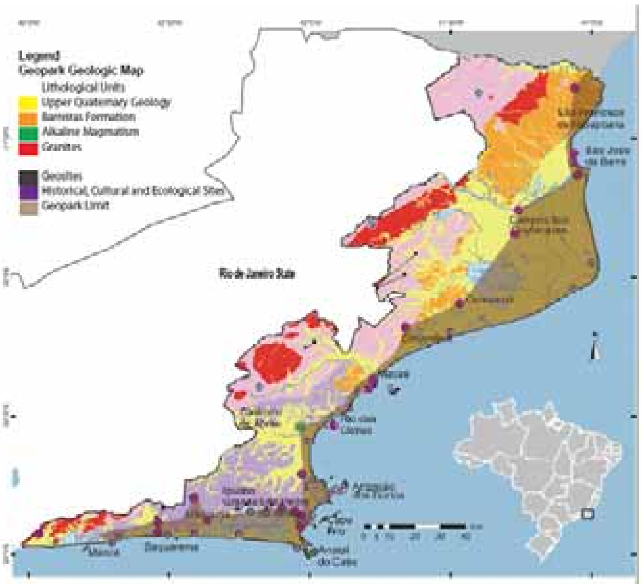

Fig.1: Location of Geopark geosites.

Metamorphic rocks predominate in the Costões region, they record the tectonic evolution from the Paleoproterozoic to the Buzios Orogeny in the Cambrian Ordovician granite. This involves the continental area adjacent to the sedimentary basins of the Campos and the Santos, including the high structures of Cabo Frio that separate them, and geological structures such as faults and grabens. In addition, there are Mesozoic tholeiitic dikes and plutonic alkaline bodies as well as Paleocene sub volcanic rocks. This area also has mineralogical rarities. Concerning the Cliffs, the sediments have different origins, age and compositions.

The region also has a semi-arid microclimate generated by seasonal upwelling of cold waters, called the South

Atlantic Central Water (ACAS), and by NE winds semipermanent anticyclone of the South Atlantic (Turcq et al., 1999), which create a natural air conditioning system, which favors the development of an unusual endemic flora and fauna. This microclimate also furthers the development of hypersaline lagoons with interesting physical-chemical characteristics, sedimentologic and biologic. The presence of recently formed stromatolites and dolomite arising from microbial action renders them natural laboratories of international importance. Stromatolites are the oldest life evidences on Earth dating back over 3.5 billion years (Awramik et al., 1983). They are organic mineral structures formed at the time by a microbial symbiotic association. The modern stromatolites living in Lagoa Salgada and Lagoa Vermelha, are rare examples of "living fossils". The presence of recent stromatolites and dolomite originating from microbial action transforms these lagoons into natural laboratories.

Some geosites are still not being protected, such as Mangue de Pedra (mangrove stones) in Armação de Búzios, and the beachrocks Jaconé/Costão Rochosos Ponta Negra.

Furthermore, in other regions in the proposed Geopark, the high humidity favors the Atlantic Forest and consequently, a rich biodiversity of endemic fauna and vegetation developed, which led the WWF/IUCN to select the area as a Center of Plant Diversity (Dantas et al., 2001).

GEOPARK SITES

281 sites have already been inventoried in this area, 37 interpretive panels from Geological and Darwin's Pathways that have already been implemented in the area, and archaeological sites, which the most important been the "Sambaquis". Also, the historical sites relating to the first colonial settlements in Brazil, where Pau Brazil (brazilwood) were explored, sites related with the French invasion in Cabo Frio and the Jesuit pathways (Mansur et al., 2012).

RESUME OF SOME GEOLOGICAL SITES:

Lagoa Vermelha, Brejo do Espinho & Lagoa Salgada: occurrence of modern stromatolites and dolomite precipitation, which are rare examples of "living fossils" (Vasconcelos & McKenzie, 1997). There exist only a few modern environments where stromatolite together with the mineral dolomite precipitates under Earth's surface conditions are rare. Due the fact that stromatolite and microbial dolomite are widespread in ancient sedimentary rocks, these sites may provide a window into the microbial ecology of the past.

Bechrocks de Darwin: sedimentary rock indicative of marine paleo-level.

Costão Ponta Negra: orthognaisse with pegmatitic intrusion intensely folded. Among the magmatic and pegmatites, dated at 500 Ma and diabase dike (130 Ma). These phenomena can clearly serve as excellent teaching examples. Faults and fractures can also be observed on site.

Serra da Sapiatiba & Sapiatiba Mirim: rocks derived from the formation of Gondwana.

Praia do Forno: the sand beach is formed by garnet minerals.

Ilha do Cabo Frio: alkaline occurrence with beachrock, dunes and archaeological site.

Parque Boca da Barra: igneous and metamorphic rocks – breaking up and formation of Gondwana.

Paleo-cliffs da Praia Rasa: sedimentary deposits, paleo-layers marine ecosystem and conditioned by hydrogeology.

Reserva do Tauá Reserve: paleo-lagoon indicator paleolevel marine.

SOME NON GEOLOGICAL SITES

Fauna and flora are protected in some areas designated Parks, APAs (area of environmental protection) and particular reserves. Coral reefs are also an important ecosystem in Armação dos Búzios where the Coral Park has been created.

Preserved cores of the restinga vegetation conserve information about one of the most threatened biomes in the country. Fauna and flora from this region are recognized for their rarity. Therefore, conservation units have been created in order to provide full protection and restrict development in the area. The locations of many endemic organisms have been mapped in the area. For example, the vegetation classified as open tree steppe in the region between Arraial do Cabo and Armação dos Búzios, as well as the mico-leão- dourado (golden lion tamarin), the restinga antwren (Formicivora littoralis) and the discovery of a new species of mammals in the territory of the National Park of Restinga de Jurubatiba in 2011, called ratinho-goytacá (Cerradomys goytaca).

Darwin's Pathways – Maricá: historical farm with occurrence of beachrock, granite and other sites. Description of Darwin in 1832.

Araruama's Archeological Museum: records of prehistoric occupation.

Archaeological Museum of Sambaqui Tarioba: records of prehistoric human occupation, Sambaqui da Beirada.

IMPORTANCE OF EDUCATIONAL PROJECTS

These cases demonstrate the importance of programs, projects and activities with an educational and historical propose to promote geo-conservation. Allied to this, there is the importance of geotourism, which encourages both the visitor and the resident to understand the evolution of the landscape and geological processes associated with it. These are powerful tools in the protection of the local heritage. Therefore it is essential and necessary to place emphasis on the geological sites. This role is being assumed by many scientists who support the project "Costões and Lagunas Geopark". The geopark mascots: have been created, an important step which in submitting the dossier to UNESCO, called "Os Super Feras" (Super Spheres) the mascots will be used for educational activities, displayed in books, theatres and cinemas, produced as toys, etc.

Super Spheres are presented as the super-heroes (Atmo Sphere, Hydro Sphere, Litho Sphere, Bio Sphere) that have built the wonderful planet Earth, but because of the incorrect man

Homo incorrectus, they are now in danger and need our help to save themselves. Based on this story the children start projects to help protect water, air, rocks, biosphere (Vasconcelos, 2011).

Some additional characters have also been created to publicize and help protect some assets whose importance is often not recognized by most local communities, such as stromatolites, dolomite, and *sambaquis* (shell-mounds).

Geological Pathways: the project seeks to bring together professors, teachers and students in order to encourage community involvement in geology and Geological Heritage. It describes the rock types and geological structures that can be seen by panels written in both English and Portuguese. There are 5 geological and historic cultural itineraries indicated in the map (Fig. 2).

Fig 2: Itineraries Geopark Map

Darwin Pathways: this project is valuable for the country as it speaks of scientific discoveries in Brazil as early as 1832. It is of fundamental importance that the Darwin Pathways project encourage local governments to enlarge on the project, developing their own activities for their schools and discovering ways to introduce these innovations to their cities.

There are open-air classes on the Geological Pathways, Darwin Pathways and Jesuits Pathways sites for both public and private schools**.**

São Pedro da Aldeia Horto School: there are several projects, Horto school, it houses gardens, where teachers from regional schools are taught how care for the soil, to plant and harvest crops etc. The programme also serves the teachers' local communities when they pass on what they've learned to the residents.

PROJECTS FOR THE COMUNITIES

There are some projects for the communities, for example: Clay Pathways - Campos dos Goytacazes is home to the bulk of the ceramic industry of Rio de Janeiro. The project directed by UENF, a partner of the Geopark in Rio de Janeiro, is an ideal example which values and expresses the identity of the local people, whose employment has been predominantly in the regional brick and ceramic factories. The Geopark approach combines an appreciation for conserving, protecting and celebrating the geology of this area with responsible economic de development.

Pacientes na Ativa: handcrafted products made by people with osteomuscular and neurological diseases is a therapeutic action that encourages work and income generation, promoted Municipal Rehabilitation Center of Cabo Frio municipality.

ECONOMIC ASPECTS

The economy depends on oil & gas, tourism and fishing, agriculture, extraction of salt, besides the production of cheese, fresh milk and bananas. Citrus fruits are still grown in the area and banana and coconut cultivation has been developed.

Other activities are dairy farming, horse breeding, handicrafts (clay, baskets, shells, wood, embroidery, sand, etc).

POTENTIAL FOR THE DEVELOPMENT OF GEOTOURISM

The region is of impressive and breathtaking beauty, especially due to the presence of several geological, archeological, ecological, historical and cultural sites. It has a good infrastructure for tourism, hotels and restaurants with prices that attractive to different wishes, from small and innexpensive to the most expensive and refined. The area can be reached by plane, automobile, bus or van. There are many places to visit, many things to do and to discover: rocks from the Paleoproterozoic period to the Holocene are present in the region. Though aproximatelly 280 significant sites have been described in the region.

The geosites also exhibit material that is crucial to understanding the evolution of the planet, such as the closure and final evolution of Gondwana registered in the cliffs, the Holocene stromatolites in the hypersaline lagoons, and the alteration of dolomite caused by microbial action.

The museums made up of the heritage sites, as well as the extensive biotic and geological mapping are represented in the whole area. The well-developed touristic infrastructure with pleasant hotels and restaurants, good connections, hospitals, a convention center and museums enhance the touristic potential of the area.

The lagoons are used as open-air laboratories, where the samples of stromatolites, dolomites and microbial mats are collected for study.

The lagoons and geological sites with explanatory panels of the Geological Pathways are used for geology classes and courses for students and for teacher or professional training.

MANAGEMENT STRUCTURE

The organizational management structure of "Costões and Lagunas of Rio de Janeiro Geopark" is presented in Figure 3.

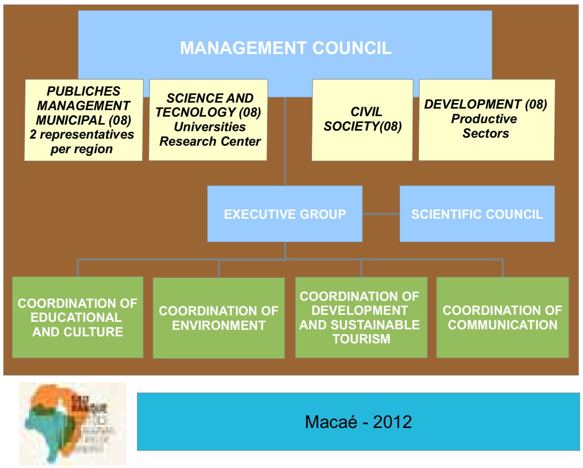

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Fig.3. Flow chart of Geopark management structure

CONCLUSION

It is believe that the Costões and Lagunas of Rio de Janeiro, has the potential to be approved by UNESCO as part of the Global Geopark Network, because it is inserted on the model grounded in the relationship between geological heritage, community and environmental sustainability.

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The map of the marine landscapes and habitats of Cilento, Vallo di Diano and Alburni Geopark. Linking geo- and bio- diversity with a multiscalar approach

D'Angelo S. ([a]), Di Stefano F. ([b]), Fiorentino A. ([a]), Lettieri M. T. ([a]), Russo G. F. ([b]) & Violante C. ([c])

([a]) Geological Survey of Italy/Land Protection and Georesources Department – ISPRA, Via Brancati, 48, 00144 Roma, Italy – silvana.dangelo@isprambiente.it
([b]) Department of Environmental Science (DISAM), "Parthenope" University of Naples, Centro Direzionale, Isola C4, 80143 Napoli, Italy
([c]) Insitute for Coastal and Marine Environment (IAMC), National Research Council (CNR). Calata Porta di Massa, 80133 Napoli, Italy

INTRODUCTION

The Geological Map of the Cilento, Vallo di Diano and Alburni Geopark includes, for the first time in Italy, marine areas. The work was carried out by the Geological Survey of Italy (ISPRA), in collaboration with the Italian National Research Council (CNR) and the University "Parthenope" of Naples (DISAM). The map was realized at 1:110,000 scale for the entire Geopark, covering a marine area of 460 square kilometers, until a depth of -100 m. A detailed map of the Marine Protected Area "Santa Maria di Castellabate" was produced at 1:30,000 scale. The seafloor was described according to a classification based on geomorphology, geological composition and dominant organisms.

The cartographic representation is largely based on the morphological features derived by a detailed bathymetry, completed by geological seabed data resulting from the Italian Geological Mapping Project at 1:50,000 scale (CARG Project). Biological data have been complemented by ROV inspections.

MAP DESCRIPTION

The attention has been focused on the relationship between the seafloor geology and morphology and the flora and fauna assemblages that live therein. All of these components contribute to characterize the diversity and complexity of the submerged landscape.

Information has been adjusted to the scale of representation. The main map scale (1:110,000) allows for a general overview of the submerged landscape of the Cilento coast. Many geological structures described in the emerged areas of the Park continue under the sea surface, particularly in the mountain areas of Mount Stella, Mount Bulgheria and the Gelbison-Castelluccio ridge, whereas in the coastal plains facing the rivers (Alento, Lambro, Mingardo and Bussento) sediments coming from land are reworked by the wave action and redistributed according to the dynamics of the coastal currents, originating extended submerged plains. Rock buttresses lean forward offshore and are massively covered by calcareous bioconstructions, interrupted and locally half buried by sands and gravels deriving from their dismantling. Benthic assemblages, highly diversified depending on the type of substrate (rock, bioconstructions or different kinds of sediments), are associated to each morphology (Tab.1). The Punta Licosa area, which is part of one of the two Marine Protected Areas included in the Park, has been mapped at a more detailed scale (1:30,000) as well, in order to evidence its great habitat richness.

MAP OF SUBMERGED LANDSCAPES AT 1:110,000 SCALE

Approximately 30% of the submerged areas of the Cilento coast is constituted by hard bottoms. Banks have been mapped distinguishing them according to the grain size of their sediment covers. Hard substrates are seldom represented by rocks directly exposed in the water, since they are covered everywhere by calcareous bioconstructions (coralligenous). Such constructions form also on sandy seafloors where algae with calcareous thalli produce lumps of cemented grains (melobesias). On top of them organisms with calcareous skeletons, such as madrepores, serpulids, bryozoans, molluscs, etc., settle. Seagrasses, like *Posidonia oceanica* and *Cymodocea nodosa*, form extended meadows colonizing sandy bottoms down to more than -30 m depth. Deeper than the lower boundary of these extended meadows, sediments are organogenic sands and gravels, characterized by calcareous shell fragments of the numerous and abundant species of foraminifers, molluscs, bryozoans and serpulids, which inhabit the *Posidonia* meadows. Wherever the sediments covering the rocky substrate are muddier, soft corals (Pennatulacea and Alcyonacea) prevail.

Terraces downstepping offshore are covered by sediments of mixed grain size, colonized by *Posidonia* meadows or incrusted by coralligenous organisms.

Submerged plains form in the center of bays bordered by promontories and at river mouths. In these areas sediments are generally fine (sands, muddy sands and silts) and the organisms are mainly fossorious, which actively dig sediments aiming at sheltering (burrows) and feeding (organic debris).

Morphology	Geological composition	Dominant organisms
Rocky bank	Rocky substrate covered by coralligenous bioconstructions	Calcareous algae, animals with calcareous skeleton (sponges, corals, serpulids, bryozoans, molluscs)
Bank with mixed organogenic sediments	Rocky substrate covered by sediments varying from organogenic sands to gravels, locally muds	Buttresses of shelf coralligenous and dense populations of echiurid species.
Bank with coarse organogenic cover	Rocky substrate covered by biogenic gravels and coarse sands.	Phanerogam meadows (*Posidonia oceanica* and *Cymodocea nodosa*).
Bank with sandy organogenic cover	Rocky substrate covered by biodetrital sands.	*Posidonia oceanica* patches or meadows
Bank with muddy cover	Rocky substrate mainly covered by terrigenous muds anf intermittently by biodetrital sands.	Soft corals (Alcyonacea)
Relict beach ridge	Sands formed in subaerial environment	Fossorious organisms, mainly sospensivorous mollusks and peracarid crustaceans.
Fan delta	Fluvial mixed sediments	Fossorious organisms, mainly depositivorous molluscs and polychaetes.
Shallow sandy plain	Sands characterized by ripple marks; muddy component increases seaward.	Fossorious organisms resistant to wave perturbation. Cockles worms and crustaceans in the muddy part. Phanerogam meadows in patches.
Shelf muddy plain	Muds with varying percentages of sands.	Fossorious organisms, including echinoderms, worms, molluscs and crustaceans. Locally “fields” of soft pivoting corals (Pennatulacea).
Ledge	Rocky layers covered by bioturbated mud.	Polychaetes and crustaceans burrows and very muddied shelf coralligenous
Deep terrace with muddy bioclastic cover	Terrigenous muds mixed with bioclasts.	Fossorious organisms, such as polychaetes and crustaceans.
Rock	Rocky outcrop constituted by arenaceous rocks.	Hydroids and stoloniferous Alcyonacea

Tab. 1 – Synthetic description of the features represented on the map at 1:110,000 scale

Sands accumulate in the submerged area exposed to wave action. They are locally characterized by current ripple marks and are colonized by fossorious organisms able to resist to wave perturbation, like cockles (*Donax spp.* and *Chamelea gallina*). The muddy fractions increase offshore and the submerged plains host fossorious “pipebuilders” organisms, such as worms and crustaceans. The plains can be locally covered by *Posidonia oceanica* meadows or, in case of finer sediments, by *Cymodocea nodosa*. Sands can be locally found at greater depths, beyond the muddy plains. In these cases they are the remnants of ancient relict beaches, which had formed during previous sea level low stands.

MAP OF THE MARINE PROTECTED AREA “SANTA MARIA DI CASTELLABATE” AT 1:30,000 SCALE

This area has been chosen to elaborate an experimental map in order to verify how much detail can be obtained in the description of marine landscapes by increasing the scale of representation. For example, the area, which in the 1:110,000 scale map is represented as a single bank in continuity with the Punta Licosa promontory, covered by mixed sediments, in the 1:30,000 scale map becomes a very diverse zone, with minor banks surrounded by irregular slopes and a variety of biological assemblages adapted to live in the different types of habitats (Fig. 1).

The bank appears therefore constituted by several sub-planar terraces slightly elongated in the direction of Punta Licosa. The less deep terrace is first covered by extended *Posidonia* meadows and by populations of photophilous algae (*Cystoseira* spp.) and, downward, by sand ripples and megaripples which alternate with shelf coralligenous banks hosting populations of hemiphotophilous algae (*Halimeda tuna*). The deepest bank is covered by coarse sands and sometimes by fine gravels, deriving from the dismantling of coralligenous bioconstructions, locally covered by remnants of *Posidonia oceanica* meadows.

The slope which surrounds and separates the terraces is slightly inclined. It is characterized by coralligenous structures more or less covered by organogenic sands. The southern side of the area is more heterogeneous, interrupted by channels of organogenic sands flows and buttresses of shelf coralligenous. In its upper part, the slope is characterized by marked megaripples and dunes and is colonized by ascidians (*Rhopalaea neapolitana*) and by hoary urchins (*Sphaerechinus granularis*), whereas in its lower part “praline” fields of melobesia are common. They alternate with shelf coralligenous banks, which are densely populated by echiurids (*Bonellia viridis*). Along the northern side of the area, the slope is enriched in the muddy component and is characterized by dense populations of pencil urchins (*Stylocidaris affinis*).

The deep terrace forms a sub-horizontal structure at the foot of the slope, covered by terrigenous muds mixed with bioclasts, colonized by bioturbating organisms, particularly fossorious polychaetes and crustaceans.

The submerged beach environment can be subdivided into a submerged beach and a beach foot. This latter is a gentle slope constituted by muddy sands, colonized by fauna living both at the surface and inside the sediment (molluscs, polychaetes, isopods, anisopods, amphipods, decapods, echinoderms), which constitutes the main food for sea turtles (*Caretta caretta*) and for juvenile specimens of numerous fish species.

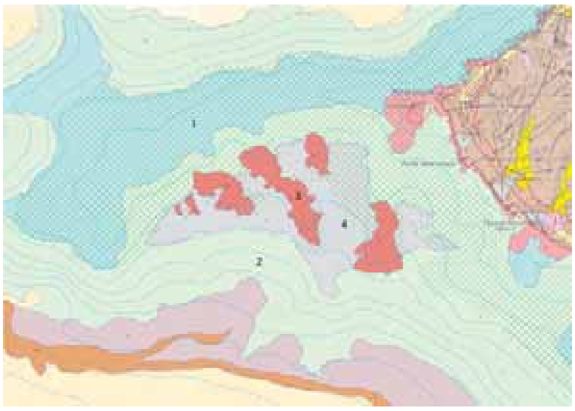

Fig. 1 – Detail of the map at 1:30,000 scale. 1 – Bank; 2 - Slope; 3 – Coralligenous buttresses; 4 – Terrace.

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

On communication strategies of Shennongjia Geopark in tourism destination competitiveness domain

Yu J.[(a)], Li J. [(b)], Liao M. [(c)] & Li L.[(c)]

(a) School of Arts and communication, China University of Geosciences (Wuhan), 430074, Wuhan, China. Email: jijunyu@126.com

(b) School of Public Administration, China University of Geosciences (Wuhan), 430074, Wuhan, China.
(c) Administration Bureau of Shennongjia National Geopark, Shennongjia, China.

ABSTRACT

Shennongjia Geopark is located in the southwest of Shennongjia Forestry District, Hubei Province, the People's Republic of China. Shennongjia Geopark was approved by China’s Ministry of Land and Resources in 2005 as a typical example of tectonic geomorphology within an upland geopark, and officially opened in 2008. Based on the concepts of geo-tourism and competitiveness theory, this paper aims to clarify the concept of geopark as tourist destination, to define tourism destination competitiveness from the perspective of the operational efficiency of tourism destinations, and to select corresponding indicators, to use operational efficiency of tourism destination to evaluate the tourist destination competitiveness of Shennongjia Geopark. Based on some communication theories, corresponding upgrading strategies are proposed to enrich and develop the theoretical research and method of a geopark as a tourist destination. The paper firstly highlights the features of Shennongjia Geopark. With our constructed evaluation indicator system of tourism destination competitiveness, after analyzing the tourist data of Shennongjia, the paper takes Shennongjia Geopark as an example and analyzes the application of tourism destination competitiveness theory in sustainable development of ecotourism. Finally, based on two-step flow theory and agenda-setting theory, the paper provides some suggestions on Shennongjia Geopark’s communication strategies.

KEY WORDS: Communication strategy, competitiveness, geopark, Shennongjia, tourism destination.

INTRODUCTION

Shennongjia Geopark is located in the southwest of Shennongjia Forestry District, Hubei Province, the People's Republic of China. Its geographical location is 109°56'02’’ to 110°36’55'' E and 31°21'56’’ to 31°43’13’'N. As a typical tectonic geomorphology integrated upland geopark, the total administrative area of the Geopark of 1022.72 km^2 is divided into five regions: Shennongding region, Guanmenshan region, Tianyan region, Dajiuhu region and Laojunshan region.

The territory is situated in China’s subtropical region and has significant variations in altitude. In ancient times, Shennongjia area was a vast ocean which was uplifted during the Yanshan orogeny and Himalayan orogeny to develop as an extension of east Daba Mountain. Shennong Peak, 3106.2 meters above sea level, is the "the highest peak in central China ". The southwest Shizhu River is the lowest point in Shennongjia, at 398 meters above sea level. The relative elevation difference is 2707.4 meters.

The topography in Shennongjia Geopark is generally higher in the southwest, and lower in the northeast of the territory. Mountains with an EW orientation traverse the southwestern part of the park.

Shennongjia is located within the subtropical zone of the eastern coast. The climate in the park is zoned both vertically and horizontally. It has a relatively large variation in local temperature. In the park, the average annual rainfall is 800-2,500mm. Mean annual evaporation is 500-800mm and drought index is 0.50-0.53. Southeast winds prevail throughout the year.

The river system is well developed. Shennongjia is the watershed of the Yangtze River and Hanjiang River. The river valleys show apparent young stage geomorphological features. They are steep and narrow and most of their cross-sections have a “V” shape. The total runoff of the surface water within the Geopark is 3.8711 billion cubic meters a year.

Shennongjia Forestry District, where Shennongjia Geopark is located, was approved by the State Council of China to establish a national forest and wildlife protected area in 1986, and joined the UNESCO “Man and Biosphere” world biosphere reserve network in 1990. In 1995, the World Nature Foundation listed Shennongjia as a “biodiversity conservation demonstration site”. Among the global 193 biogeographical provinces, Shennongjia represents the most typical and most well-preserved mid-latitude ecosystem.

Shennongjia has a vegetation coverage of 96%. There are 3,239 species of higher plants recorded within the park. It has a relatively large proportion of endemic plants, and a large area of world famous primary forest. It is a relatively well preserved area in China for north Asian tropical plants and species, and is one of the most completely reserved areas for vegetation in the world’s mid-latitude area.

Shennongjia Geopark has 493 species of vertebrates, including 75 species of mammals, 308 species of birds, 40 species of reptiles, 23 species of amphibians and 47 species of fish. Some are nationally rare and endangered species.

Shennongjia has national intangible cultural heritages including the legend that Shennong, an ancestor of Chinese nation, tasted hundreds of herbs, and started the Chinese agricultural civilization, and the Han ethnic myth epic Darkness Legend; and other intangible cultural heritages include 1,000 years old Hubei-Sichuan ancient Salt Road, the ancient army station sites and folk customs with strong local characteristics.

Recently, significant funding has been invested in infrastructure, public transportation, tourism, education on information and the environment, and especially on the protection of the geological heritages.

Based on the concepts of geo-tourism and competitiveness theory, this paper aims to clarify the concept of a geopark as tourist destination, to define tourism destination competitiveness from the angle of operation efficiency of tourism destinations, and to select corresponding indicators, striving to use operation efficiency of tourism destination to evaluate the tourist destination competitiveness of Shennongjia Geopark, and with the two-step flow theory and agenda-setting theory, corresponding upgrading strategies are proposed for enriching and developing the theoretical research and a method for defining a geopark as a tourist destination.

TOURISM DESTINATION COMPETITIVENESS OF SHENNONGJIA GEOPARK

The success of tourism destinations in global markets depends on their corresponding competitiveness. Tourism destination competitiveness becomes the main concern amongst tourism researchers (Crouch & Richie, 1999).

Literatures about tourism destination competitiveness have offered several general principles to guide the development of comprehensive tourism models in which tourism resources, attractors, destination management and macro and micro environment were important factors. Crouch and Ritchie (1999), Dwyer and Kim (2003), Enright and Newton (2004), Ritchie and Crouch (1993) and Ritchie & Crouch (2001) provided significant references.

National geoparks play a decisive role in China's tourism industry. Previous research on geoparks focused mainly on the following aspects: resource evaluation, planning, development and protection, it is less common to carry out systematic research on geoparks as tourist destinations by applying competitiveness theory.

The tourism competitive characteristics illustrate: firstly, that tourism competition is the first competition between destinations, thus the research on the competition between tourism destinations is more meaningful than the research on competition within the tourism industry. Secondly, tourism resources, the government and the infrastructure play important roles in enhancing the tourism destination competitiveness. So, in the tourism destination competitiveness evaluation system, the tourist market is the dominant factor, and its competitiveness index is defined as 0.0828 (Fangyan, 2012). Therefore, attention should be paid to enhance the tourist market, to constantly improve the quality of the tourism destination resources.

TOURISM RESOURCES

Shennongjia not only possesses cosmopolitan species, but also includes tropical, subtropical elements, together with warm temperate elements and the north temperate components. According to as yet incomplete statistics, there are 944 cosmopolitan species, 546 tropical and subtropical species, 466 tropical and temperate zone species, 489 temperate species, and 309 north temperate species.

TOURISM MARKET

In recent years, with the rapid development of tourism, the total number of visitors to Shennongjia soared to 949,027 in 2011 from 911,800 in 2007. The total revenues from tourism was 75,089,756 RMB in 2011, including ticket sales 41,931,898 RMB, with an increase of 22%; operating income 14,490,073 RMB, with an increase of 68%; and transfer ticket income 18,667,785 RMB, with an increase of 36%.

From the statistical data, 70.6% of the visitors are from Hubei Province, and come mainly from Wuhan (32.11%), Yichang (23.54%) and Shiyan (18.4%). A proportion of the visitors come from neighboring regions outside Hubei Province and some come from the remote Zhejiang, Jiangsu, Guangdong, Fujian, Shandong and other coastal areas. Only very few are overseas tourists.

TOURISM MARKET TIME STRUCTURE

According to surveys and related to climate conditions, Shennongjia's tourist season extends from April to October. November to March represent the off-season period.

TOURIST MARKET STRUCTURE

When gender is concerned, males constitute 66% and females 34% of tourists. These percentages are basically consistent with the tourism market gender structure in Hubei Province (65.52% male, 34.48% female). The predominant age range consists of visitors between 15-44 years old (76.62%). Fewer tourists are under 14 years or over the age of 65.

The range of tourist occupations include 46% for enterprises management personnel, 20% for professional and technical personnel, 10% for government officials, 10% for workers, 6% for teachers, 4% for employees of public institutions, 2% for self-employed, another 2% of the other employees, few farmers, soldiers, students, retirees, and other types of tourists.

Most tourists have a college or technical secondary school educational background, followed by bachelor degree, the sum of these three categories share 79% of total visitors.

Visitors who fall within the medium income level constitute the majority of tourists, low-income groups also comprise a large share of the tourists, high income level tourists are in the minority.

TOURIST BEHAVIOR STRUCTURE

Most tourists go to travel for sightseeing, some tourists travel for conferences or business.

Shennongjia's domestic tourists mainly travel with colleagues, relatives and friends, respectively, 44.55% and 28.57%. Tourists with travel agencies constitute only 4.38%.

For domestic tourists, the average stay time is 2 nights, 70% of them stay 1 ~ 2 days, 25% tourists stay for 3 ~ 4 days. All visitors are lodged in hotels, hostels or family inns for the night.

The main travel information source of Shennongjia's tourists is the introduction by friends or colleagues, suggesting that the tourism image and reputation of Shennongjia play an important role in the development of its tourist market.

TOURISTS' CONSUMER BEHAVIORS

The survey shows that visitors generally will not or only occasionally buy drinks or meals, accounting for 89.9% of tourists. Most visitors will choose to visit a large city and have dinner there, some tourists prefer tasting snacks in the street or eat in the hotels, and few tourists have dinner at the scenic spots.

As for accommodation, visitors mainly choose hotels, hostels, few choose camping or lodging in the farmhouses.

Visitors travel to Shennongjia mainly by automobile; few go by plane or train.

Visitors mainly go traveling individually or with relatives or friends, touring with colleagues, through travel agencies or clubs. Sightseeing and business are the main purposes of travel. Most visitors choose summer and winter vacations, weekends or use the three national vacations.

Statistics show that 70.6% of the visitors won't or rarely go shopping in the scenic sites. Tourists generally believe that the shopping environment is preferable in the main attraction sites. Souvenir/handicraft products, clothing/silk/cotton jersey fabrics, tea/drink/food, and wine/cigarettes are favorite items for purchase.

CURRENT SITUATION OF TOURISM MARKET

In recent years, the tourism development of Shennongjia Geopark has mainly focused on the physical construction of the infrastructure. Elements like service quality, popular science programs, and the development of human resources, stimulation of innovation and formation of fresh new tourism products were relatively weak.

All the management activities or actions could be considered as destination competitive measures that will help Shennongjia Geopark as a tourist destination to enhance its competitiveness. Creating and integrating value in the tourism products and resources should be taken care of so that Shennongjia Geopark as a tourist destination could sustain a better competitive position in the market. Therefore, the priority should be given to developing and promoting the unique image of Shennongjia Geopark as a destination to compete effectively in the market. There is much work to do to connect destination products with tourists' preferences.

GEOTOURISM POTENTIAL OF SHENNONGJIA GEOPARK

The transportation in Shennongjia Geopark includes integrated sets of roads, waterways and flights. Roads are currently the main way to enter into Shennongjia. The land-and-water coordinated transport through the Yangtze River Three Gorges has been opened. A new airport in Shennongjia will be built on the big lawn, 16 km away from Muyu Town, in the northwest of Shennongjia Forestry District. The direct flight of design planning generally can be controlled in about 1 hour. The flight distance to Beijing is 1,385 km, with distances of 1,119 km to Guangzhou, 1,137 km to Shanghai and 450 km to Wuhan respectively. The initial design of annual passenger throughput is 210,000 passengers, possibly increasing to 1.2 million people by 2040. The construction of the airport will bring a greater advantage for the tourism development of the Geopark.

The Geopark has a readily accessible tourism traffic network system. The inner parts (Guanmenshan, Shennongding) with the popular scenic sites are equipped with environment-friendly cars. A special Geopark tourism bus between the scenic sites or the parks will be opened during the peak tourist season.

The statistical data for 2011 shows that there are 127 family inns, 18 three-star and other hotels, 10 four-star hotels and 1 five-star hotel in Shennongjia. Muyu Town in the Geopark provides a center for shopping, dining and accommodation. It provides convenient, clean and comfortable restful environment for the visitors. The tourism information system of the Geopark is adequate, the service network is developing and improving, and the creation of a sign system integrating four languages including Chinese, English, Japanese and Korean, will enhance the visitors' enjoyment of geological tourism.

The convenient transportation network and adequate service facilities make visitors feel accessible and comfortable in Shennongjia Geopark, and provide a better opportunity for the tourism development of the Geopark.

COMMUNICATION STRATEGY ON SUSTAINABLE DEVELOPMENT OF SHENNONGJIA GEOPARK

The geopark network undertakes the dual task of protection of geological heritage and economic development, and the main function is the protection and utilization of geological heritages and natural environment, promotion of scientific research, promoting science and environmental education and development of tourism.

As a high-level and high-grade tourism destination, Shennongjia should follow the "protection-based moderate development" principle, its value is mainly defined as the ecological aesthetic and ornamental value, scientific research and science value, and the value of scientific research and scientific tourism is dominant. Shennongjia’s tourism development should equally emphasize the popularization of ecological and geological sciences. This role is suitable for a geopark characterized by excellent natural landscapes, no damage to geological formations and other features in the landscapes, a special geological environment with unique geological features which is of high scientific value. In addition the geopark’s resources are of high quality and are comparable with the characteristics of national geological parks, nature reserves and sites of world natural and cultural heritages. Understanding tourism and the ecological and scientific value of Shennongjia Geopark are still in a preliminary stage of investigation, however both aspects are in urgent need of development. All potentially destructive construction projects and activities should be prohibited; all possible facilities should undergo a rigorous feasibility study.

Shennongjia Geopark has adopted varieties of public relation strategies to improve the park’s tourism promotion through the media, actively organized a variety of large-scale expositions of geological tourism souvenirs and actively taken part in the official tourism fairs and tourism festivals to advertise the geological tourism services of Shennongjia.

Shennongjia Geopark attaches great importance to talent cultivating and training and has organized over 300 people to undertake the training in professional knowledge including basic concepts involving the geological heritages, the construction and development of the Geopark, basic geological science, the landscapes and geological heritages, and the function of tour guides about geological landscapes and so on. A number of tour guides have been sent to participate in three phases of geopark training courses for tour guides jointly held by the Chinese Ministry of Land and Resources and the China National Tourism Administration.

To emphasize the Geopark’s concept of regional participation and sustainable community, Shennongjia Geopark has built a tourist transfer center and a nature museum to provide services for the Geopark’s visitors. In addition, the authority of Shennongjia Geopark, together with operators of the center, has trained and selected excellent tour guides to make every effort for the development of the Geopark.

To achieve the educational function of the Geopark, three sites of science popularization have been established outdoors. Geological summer camps and other activities for large numbers of teenagers will be provided and practice bases for field studies by colleges will be established.

Shennongjia Geopark has published many books involving research and popular science and a collection of Shennongjia’s folk songs. It also has published many audiovisual products including an informative video about the Geopark, postcards, a stamp album, a commemorative envelope, calendars, VCD \DVD \CD introducing Shennongjia’s customs. In addition, it provides tourist maps, brochures of the geopark’s activities, publicity leaflets, and memorable tickets for tourists for free.

Shennongjia Geopark will invite experts to design a professional website to introduce digitally the variety of its provision. Travel services through the Internet will be developed. The geological heritage database and the retrieval system of the geopark will be built.

Shennongjia Geopark will edit and publish audiovisual products as follows recently: (1) treatises; (2) album; (3) video products; (4) popular science books.

The Geopark network is quite new. By Harold Lasswell’s propaganda theory, people need to be slowly prepared to accept radically different ideas and actions. Communicators need a well-developed, long-term campaign strategy in which new ideas and images are carefully introduced and then cultivated (Lasswell, 1935). Two-step flow theory tells that messages pass from the media, through opinion leaders, to opinion followers. Katz and Lazarsfeld (1955) reported that opinion leaders exist at all levels of society and that the flow of their influence tends to be horizontal rather than vertical. Opinion leaders influence people like themselves rather than those above or below them in the social status. As to agenda setting theory, in choosing and displaying news, editors, newsroom staff, and broadcasters play an important part in shaping political reality. Readers learn not only about a given issue, but how much importance to attach to that issue from the amount of information in a news story and its position.... The mass media may well determine the important issues- that is, the media may set the 'agenda' of the campaign (McCombs & Shaw, 1972). All these communication theories show that more clear communication strategies should be developed to promote Shennongjia Geopark. Firstly, Shennongjia Geopark should design a unique well-developed long-term campaign strategy for itself. Secondly, it should make a distinction between opinion leaders and opinion followers based on the results of research. Thirdly, the Geopark must know how to make good use of the media for Geopark network purpose. Finally, it is the right time for Shennongjia Geopark to adapt an environmental communication strategy for its dual task for both the protection of the geological heritages and economic development.

ACKNOWLEDGMENTS

We want to offer our thanks to Shennongjia Tourism Administration for their kindly permission to offer their data for our market research. We also want to offer our thanks to our team members for their hard work in this program.

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A “fossil free” Park

Cunaccia V. ([a])

([a]) Adamello Brenta Nature Geopark,via Nazionale 24, 38080, Strembo (TN), Italy. E-mail: vajolet.mase@pnab.it

KEY WORDS: renewable resources, innovative technologies, energy, climate change.

A “FOSSIL FREE” PARK

The idea behind the “fossil-free” project is that of a protected area which, besides fulfilling the primary function of nature conservation, scientific research and environmental education, also functions as a “sustainable development laboratory”. In line with the objectives established by legislation with respect to protected areas and promoting the development of a new global environmental awareness, the Park aims at experimenting an innovative way of managing environmental resources, energy saving and the reduction of carbon dioxide emissions into the atmosphere.

In order to pursue these objectives, the Park has identified three areas of action that meet precise goals:

1. USE OF RENEWABLE RESOURCES: the objective is to reduce the consumption of non-renewable resources. With regards to energy resources, the focus has been on the identification of actions aimed at a more efficient use of resources. Specifically, the project involves the installation photovoltaic systems on a number of structures. The project also involves collaboration with “Park Quality” certified hotels and schools in the design of the photovoltaic systems.

2. ENERGY FROM THE TERRITORY, FOR THE TERRITORY: the objective is to restore areas of particular value from a naturalistic and environmental point of view situated inside the Park territory. In the past, some of these areas have suffered excessive exploitation of the natural resources of which they were particularly endowed, especially water and timber resources.

3. SUSTAINABLE ARCHITECTURE: The third area of action relates to the promotion of a new building culture based on a sustainable form of architecture. The restoration of Villa Santi, converting it into an environmental education centre following a design based on low energy consumption, is a prime example.

With regards to the use of renewable resources, with the aim of contributing to the promotion of greater awareness on this theme among the population resident in the Municipalities in the protected area, the Park has set up a programme for the installation of a number of systems for the production of alternative electrical energy using photovoltaic panels, for the administrative office of Strembo and for Park Centres situated in a number of municipalities in the Park.

Fig. 1: Photovoltaic panels – guest house S. Antonio di Mavignola

These systems, besides being in line with the values of the Park concerning the development a sustainable economy respectful of both the environment and the local population, are also of great interest at a national and international level regarding problems associated with the high consumption of fossil fuels which pollute the environment, fine particles, global warming etc..

The table below shows data relating to the electrical energy produced by the photovoltaic panels installed on various structures in the Park.

Park Structure	Date of installation	Installed power [KWp]	Production			
			Year 2009 [KWh]	Year 2010 [KWh]	Year 2011 [KWh]	Year 2012 [KWh]
Strembo Offices	April 2008	5.58	6,625	5,781	6,810	6,184
Guest House S. A. Mavignola	End of 2008	3	2,030	3,503	3,596	3,539
Park Centre La flora - Rio Bianco Stenico	End of 2009	3	74	1,475	2,881	2,963
Carpenter's workshop Pesort Spormaggiore	End of 2009	3	43	2,685	3,222	2,864
	June 2012	48	---	---	---	20,678
Park Centre Parco Orso - Spormaggiore	Beginning of 2010	3	0	2,879	3,112	2,882
Villa Santi – Montagne	End of 2010	2.78	---	9	4,150	3,820
Park Centre Parco Geopark	May 2011	5.50	---	---	3,406	5,790
Wildlife Learning centre in Spiazzo	July 2011	6	---	---	890	6,446
Man & Environment Park Centre in Tuenno	Under construction	Around 6	---	---	---	4,480
Garage of the Park offices in Strembo	In the design phase	25	---	---	---	---
TOTAL AT FULL CAPACITY		110.86	8,772	16,289	28,132	59,646

Table 1: figures of completion dates and consumption of photovoltaic systems installed on structures in the Park - Years 2009, 2010, 2011 e 2012

The park has also drawn up an energy and water plan for the purpose of identifying the critical areas (both in structural and management terms) of a number of structures used as Park Centres. Specifically, the actions involve the replacement of the old boilers with new, high efficiency condensing boilers, the installation of solar systems for the production of hot water for bathrooms, etc.

With regards to the territory, the Park intends to develop a number of valleys rich in naturalistic elements, but which are, at the same time, fragile. The need today is to rationally combine the energy requirements of the area with the delicate natural equilibrium following the motto "Energy from the territory, for the territory". Specifically, attention will be focused on Val Nambrone and Val d'Algone.

The first has been the site of important hydro-electric exploitation work started in the 1950s by what was then SISM (Società Idroelettrica Sarca di Molveno), subsequently merged into ENEL. A number of significant restoration works have been carried out of the valley, but there are still many constructions in Val Nambrone which have remained unused, including the cable car arrival and departure station, MT line pylons and pylons supporting the cableway installed to transport materials. The Park has started negotiations with ENEL and Hydro Dolomiti ENEL and proprietary municipalities in the territory, which involves a number of important dismantlement operations and at the same time, site development. A part of the projects also provides for a recuperation of the area's didactic value, in particular the plan is for signs of past exploitation to become "cultural energy monuments" and for Cornisello in Val Nambrone to serve as a laboratory demonstrating the efficiency of techniques for obtaining energy from renewable sources (wind and solar generators).

The plan is to develop Val Algone, to produce energy through a centralised system of photovoltaic panels linked to a small hydroelectric station; besides this project, others are planned, such as, for example, anemometric surveys for wind energy and the design of a structure on the Algone river with energy/didactic objectives.

With regards, finally, to sustainable architecture, the Park has increased its efforts in the last few years aimed at implementing the concept of sustainability in many fields, from mobility to tourism to the experimentation of new, low impact, technologies. An example is the “Villa Santi” Nature Centre; it has been renovated with a restoration project that conserves its traditional appearance while adopting innovative technologies attentive to the sober nature of the materials, to energy efficiency and water saving.

An educational tool for guiding earth-science teachers on the field in the Bauges Geopark, France

Renau P. ([a]), Peisser C. ([a]), Lansigu C. ([b]) & Higel J. ([c])

(a) CalcEre, Geology & environmental education association, Arith, France. E-mail: pierre@calcere.fr
([b]) GEOLOGgrafis – La Terre En Dessin, Cournols, France
([c]) Bauges Geopark, Le Châtelard, France

KEY WORDS: educational program, illustrations, outings, pedagogy.

CONTEXT

The Bauges Geopark supports a strong environmental education sector, employing a full-time project manager in this specific field. A broad range of activities are developed for the scholars of the territory, from primary school boys and girls to students. In particular, specific geological outings are regularly offered by local specialized guides for classes on the field. The relative simplicity of the geological patterns of this homogeneous limestone massif turns out to be an advantage: the landscapes can be clearly interpreted, the different stages of the geological history are easy to differentiate and explain, making geology an understandable and attractive topic. In a word, it is extremely suitable for pedagogical purpose, for primary schools as well as for middle schools, high schools and universities.

In France, the national educational program concerning geology includes, during the second year of secondary school, an outing on the field. In fact, this outing only rarely takes place, mainly because the earth-sciences teachers are not aware of the geoheritage they can visit close to their schools. Based on this statement, the Bauges Geopark decided to develop a tool which could help the teachers organize the outing on its territory.

The tool: an interactive booklet

The tool was developed through a geo-partnership between 2 consulting firms: CalcEre, a specialist in scientific mediation on the field which has been developing geoeducation and geotourism activities in the Bauges Geopark for 10 years, and GEOLOGrafis, specialised in pedagogical drawings explaining geology (Fig.1).

The tool is an interactive notebook, which presents the geology of the Bauges Geopark in a simple way, based on CalcEre's knowledge of the local geosites, its pedagogical experience and the illustration enhancement of GEOLOGrafis.

Intended to the life-and-earth-science teachers, this tool can be used either as simple course-support to illustrate the program, or more specifically to effectively organize the field trip. The tool is not intended as a geology course, but as an illustration of the various points of the program, based on geosites from the territory.

In order to fit the National Education program as well as possible, a group of teachers has been closely associated to the conception. Finally, the tool was validated by National Education administration, in order to guarantee its pedagogical value.

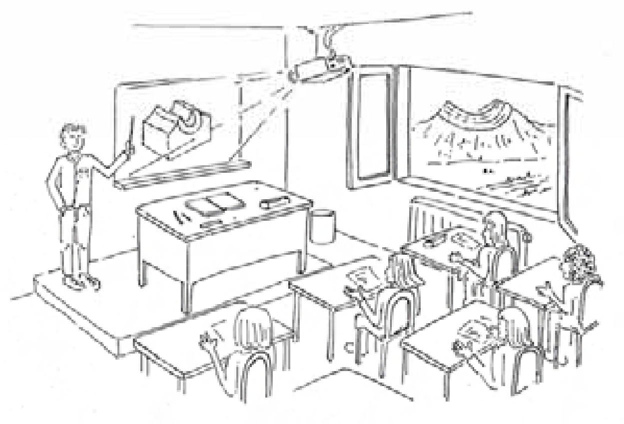

Fig. 1 – Sketch by GEOLOGrafis illustrating the first page of the booklet: the teacher uses the local geoheritage for its courses.

Content

As an introduction, a general presentation of the territory of the Bauges Geopark and its geology allows to place the geosites in their general context. Strictly based on the program of the Department of Education, this application approaches 6 big themes distributed into 3 parts:

1- The effect of water on rocks

1.a. Erosions: mechanical erosion and chemical erosion.

1.b. Transport and deposit phenomena.

2- Archival rocks
  2.a. Sedimentation.
  2.b. Fossils: identification and location.
3- The human action on the landscape
  3.a. Geological resources their exploitation; impacts and solutions.
  3.b. The natural phenomena: natural risks, prevention and mitigation.

Because of the geology of the massif, the information concentrates exclusively on calcareous rocks; eruptive rocks are also part of school programs but are not present on the massif, therefore they are not addressed by our tool.

Each of the themes is declined in details on a key geosite, which lends itself particularly well to the illustration of the relevant issues both for its geological wealth and for its accessibility. However, in order to take travel constraints into account, secondary sites are proposed: spread over three different geographical areas, they are suitable for treating the same theme and can be more appropriate for local outings, depending on the location of the school.

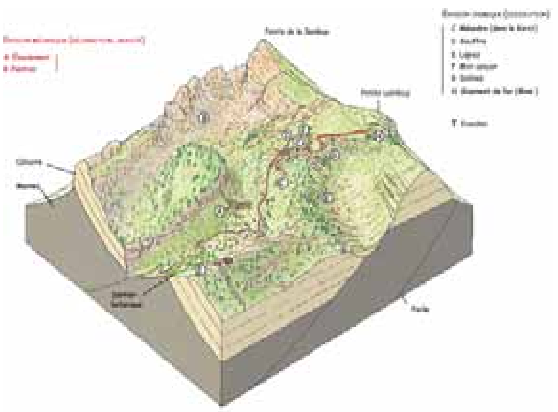

Fig. 2 – Example of the illustration of a key-site: the route is indicated in red; each letter on the sketch can be clicked and refers to a specific topic or activity.

In order not to overload the descriptions of routes nor the plans of illustrations, many additional elements are to be opened by clicking their link (Fig.2). They include maps, photos, plans and complements to text but also animated sketches. For each geosite an extract of topographic map indicates bus parking lots and recommended routes. The map is sometimes completed by an air photo which allows visualizing landscape elements. Activities that can be undertaken by the students, on-site or in class before or after the visit, are also proposed (Fig.3).

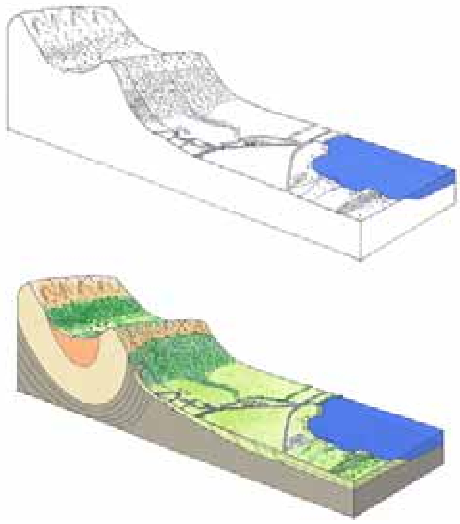

Fig. 3 – Example of proposed activity: the pupils have to fill-in the sketch of the geosite they visit (up); the teachers can correct (down).

Uses

The notebook application is free and can be downloaded on the Geopark’s website. All the files included in the application are pdf files or Flash objects, reducing compatibility problems to a minimum.

Teachers can use the tool as a support for guiding their own field-visits or request an extra specialized guide: nature guides from the environmental education network of the Geopark (RePERE) can attend a training course about the geosites which are described in the booklet.

The middle schools from the territory can benefit from a logistic and financial support in organizing their outings.

Conclusion

The educational notebook application dedicated to earth-sciences teachers is a rich and useful tool for experiencing “living geology”: teaching on the field in an attractive way, discovering the local geoheritage while fitting the National Education program. Conceiving this tool was an extremely enriching opportunity for CalcEre and Geolografis to combine their specific know-how. The concept, developed in the Bauges Geopark, can now be exported on other territories and used as a basis for educational tools in other geoparks.

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

The environmental education project "Save the energy": example from Adamello Brenta Geopark

Scalfi A. ([a]), Beltrami V. ([a]) & Masè V. ([a])

([a]) Adamello Brenta Nature Geopark,via Nazionale 24, 38080, Strembo (TN), Italy. E-mail: vajolet.mase@pnab.it

KEY WORDS: Environmental education, energy, climate change.

THE ENVIRONMENTAL EDUCATION PROJECT "SAVE THE ENERGY"

Adamello Brenta Nature Park has been dealing with the environmental education since several years and it is committed to raise awareness on environmental issues of local schools students. Every year the Park offers a range of environmental projects organized according to a vertical curriculum. The 2012 was decreed by ONU the "International Year of Sustainable Energy for All" and the Park included in its proposal the new project "Save the energy" addressed to the fifth grade of the primary school.

The aim of the project is to learn the history of energy and its evolution, to know renewable and limited (non-renewable) energy sources, to make students aware of the negative effects associated with the use of non-renewable resources, and especially to invite them to a rational and sustainable use of energy.

This environmental interpretation activity reveals meanings and relationships through the use of original arguments, direct experiences, illustrations and multimedia. Each student receives some teaching tabs as a support for the activity and further studies.

The project takes place in two meetings of two hours in the classroom and a full day visit to "Villa Santi", a Park House recently restored following the principles of energy conservation.

During the first meeting students discover the theme of the project, completing a crossword puzzle, learn the meaning of the terms "energy source" and "energy form", understand that energy is in continuous transformation and know the history of energy and its evolution through the activity of the energetic boxes.

Students interact actively with the boxes and receive a lot of information about the energy history, such as the periods of energy discoveries by human beings, the energy power of the different sources, the increasing energy consumption per person and the trend of world population growth. The purpose of this "hand-on" activity is to explain that during the evolution, people discovered and exploited progressively and faster and faster new sources of increasing power to meet the energy growing needs. Students receive current images to understand that all sources discovered during the evolution are still used **nowadays, and build an aerogramme showing that** non-renewable sources are now the most used in the world.

During the second meeting students discover which are the negative effects associated with the use of non-renewable resources, and in particular they explore the topics of climate changes (ice caps and glaciers melting, desertification, sea and ocean raising level) and of air, water (including the North Pacific Subtropical Gyre) and radioactive pollution. Various teaching methods are used to fix these key-concepts, and students are encouraged to watch a video, to play with didactic games, and to listen to the story of Rapa Nui Island.

Fig. 1 – Example of didactic tool.

Then students, stimulated to find solutions to the world's energy problems, address the issues of renewable energy watching some thematic videos about solar, wind power, hydropower, geothermal and biomass energy. Eventually they understand that the best "energy source" is its saving and its rational use.

During the full day visit to “Villa Santi”, students participate in various fun activities about the theme of energy

Fig. 2 – Villa Santi, Park house restored following principle of energy conservation.

efficiency and relevant good practices. In particular the three main topics are related to children's everyday lives and are “How do we move?” (transportation), “What do we eat” (food energy) and “How can we intelligently use the energy in our home?” (energy efficiency in buildings).

At the end of the activity students visit "Villa Santi", focusing in particular at the corner of energy, a hands-on exhibit that explains through short videos the technologies in the home.

Through this corner the Park should indicate a way of improving the conditions of our planet, that the students learn and bring at home, more aware of what we and they can do for the environment.

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

Visibility of Idrija Geopark

Kavčič M. G. ([a]), Režun B. ([b]), Peljhan M. ([c]) & Stupar M. ([d])

([a]) Geopark Idrija (IHC), Ulica IX korpusa 17, 5280 Idrija; mojca.gorjup-kavcic@geopark-idrija.si
([b]) Idrija Geopark (head of expert group); bojan.rezun@gmail.com
([c]) Idrija Mercury Mine Ltd., Bazoviška 2, 5280 Idrija; martina.rzs.idrija@s5.net
([d]) Institute of the Republic of Slovenia for Nature Conservation, Regional Unit Nova Gorica; martina.stupar@zrsvn.si

ABSTRACT

The Idrija Geopark from Slovenia with the total area of 297 square kilometres covers the entire Idrija Municipality. The Idrija Geopark began preparations for the inclusion in the European Geoparks Network (EGN) in 2008. In November 2011, the Geopark provided a file and membership application. In June 2012, two evaluators from the EGN came to evaluate the Geopark. On the basis of their evaluation report, the EGN formulated proposals and gave recommendations for the improvements of the file. The Geopark focused on these recommendations, especially on the ones that had to do with the visibility of the Geopark and the realisation of its management plans. The Geopark found new partners, increased its visibility and developed a strategy for its development. These tasks were mainly fulfilled by two projects: the first one was called Geopark - plan and establishment of geopark of regional importance and was partly financed by the EU and the European Regional Development Fund; the second one was called Geopark - opportunity for Idrija countryside and was partly financed by the European Agricultural Fund for Rural Development.

VISIBILITY OF IDRIJA GEOPARK

Through two projects that were partly financed by the EU, the Idrija Geopark has made its effort to improve the organisation and increase the visibility. The projects are based on the awareness of rich geological and natural heritage, and the unique legacy of knowledge and creativity that makes the Idrija region so special. We do not want to wait for visitors to find the heritage and knowledge themselves - we want to present it to the world in an interesting and clever way. Another essence of the project is raising the awareness that this heritage has to be respected and preserved for future generations by means of sustainable development. Thus the common goal has been pursued, which is to form a scientific basis, prepare programmes and promotional materials as well as to provide the organisation and operation of the Idrija Geopark. By doing so, the development of geotourism is encouraged.

The project has been carried out in cooperation with the Idrija Municipality, which provides financial resources, and its partners: Idrija Heritage Centre, Idrija Mercury Mine, Idrija-Cerkno Development Agency and other institutions, local communities, societies, groups and individuals that help develop initiatives.

The foundation was the development of the Idrija Geopark Programme, which defines activities and the financial plan. The Programme is quite comprehensive as it includes ways of management and coordination in the Geopark, its development, improvement of its trademark and products, organisation of educational and promotional activities, tourist promotion of the Idrija municipality, maintenance and marking of theme trails, promotion, production and reprinting of Geopark brochures, and development projects at suggestion of our partners. Activities are financed by the Idrija Municipality and partly financed by the EU.

The visibility of the Idrija Geopark is our most important task. We strive for a new system of marking theme trails that also involves interpretation boards, information pales and the information on important geological sites and the integration into the existing system of interpretation boards in the Idrija Municipality. The production of the map of the Geopark is in progress. On 22 cycle and walking trails, it will present the natural and cultural heritage of the Geopark, local offer, the most important geological sites and will be equipped with brochures. Five brochures have already been produced (Zgornja Idrijca Natural Park, Vojsko, the Črni Vrh Plateau, Kanomlja and Krnice, Spodnja Idrija), the others are still in production. The map will be free of charge and will be available on information points in the Geopark and in neighbouring unicipalities.

The main attraction of the Idrija Geopark - the Anthony Shaft - has been upgraded. The introductory multimedia presentation of the history of the Idrija mercury mine and miners has been changed; an interactive board with the geological profile of the ore deposit in Idrija and a geological column have been set up. For children we made a mysterious programme with a mythological cave dwarf that includes a video presentation and a visit to the mine together with the "Bergmandlc" dwarf.

Complex geological and natural processes have been interpreted in such a way that we put ourselves in visitors' shoes. The interpretation points for the Idrija fault in Kanomlja, stratigraphic columns, a viewpoint and a simple weather house in Vojsko, the explanation of gravel deposits at the confluence of the Idrijca and Belca Rivers, and the dinosaur's footprints (Figure 1,2) and the contact of tectonic plates in Črni Vrh have proven especially difficult. Two of these interpretation points are now open to the public.

Fig. 1- Dinosaurs footprints geo-site today.

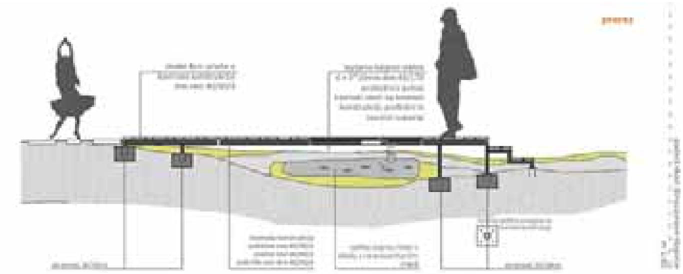

Fig. 2- Part of plans for arrangement of Dinosaurs footprints geo-site interpretation.

NETWORK OF SCHOOLS, EDUCATION AND CURRICULA, WORKSHOPS

A lot of attention has been paid to the education of different groups. In schools, education is provided through curriculum; for other groups, workshops and other activities are organised. There is also the *Idrija Geopark Network of Schools* that includes four primary schools: from Idrija, Spodnja Idrija, Črni Vrh nad Idrijo and Cerkno. Throughout a school year, each school prepares a one-day programme for the other three. This way, pupils get to know their home environment and the environments of the other three schools. This autumn, the first theme day will be organised on the Črni Vrh Plateau and two theme trails of the Idrija Geopark, including the demonstration of some local crafts. New marking of trails according to the system of the Geopark is planned as well. Schools, cyclists, hikers and guests of the Geopark will be able to take advantage of the two trails.

The curricula of the above-mentioned schools provide programmes for certain classes that include visits to our partners and exercises that were made compatible and were tested with one of our partners, the primary school in Idrija. A wide range of activities for schools throughout Slovenia should contribute to a greater number of tourists in the Idrija Geopark.

Workshops for children and adults are organised on a regular basis as well, like for example the making of Christmas cards with cinnabar patterns (Figure 3) in December 2012 or the making of flowers from crepe paper. For the second year in a row, there will be summer workshops organised for children that spend their summer holidays at home, which were heavily visited last year.

Fig. 3- Christmtas card with cinnabar patterns with the short explanation of cinnabar synsediment ore.

PROMOTION

A lot of attention has recently been paid to the promotion of the Geopark and the increase in its visibility. A promotional video has been shot, which shows the beginnings of the town of Idrija - mercury ore deposits - and summarises the 500-year old tradition of mercury extraction. The following scene shows white Idrija lace that complemented the hard work in the underground. Then the viewer is presented with beautiful scenes of the natural and cultural heritage, and landscape features. The video also offers ways of spending leisure time (cycling, hiking, tourist farms) and shows what is worth sightseeing in the area. And after an interesting and active day, there is no better way of ending it by tasting the local cuisine and music. Nearly 100 participants took part in the video.

The Idrija Geopark is introduced, together with the Idrija Tourist Information Centre, in different public events in Idrija, such as the *Opening of the European Cultural Heritage Days* and the Ecoday 2013 (Figure 4).

Fig. 4- Geopark Idrija was present at the Ecoday 2013 in Idrija.

The results of the project *Geopark - plan and establishment of geopark of regional importance* provide a basis for the idea of the Idrija Geopark to become an integral part of everyday life of the local people, who will also help to develop it further. Visitors, hikers, cyclists, fishermen, pupils, students, explorers and amateur or professional enthusiasts are also expected to actively participate. This way, the Idrija Geopark will become a place of nature's beauties, historical and cultural heritage, of the innovation and creativity of local residents now and in the future, where new opportunities for development can always be found.

CONCLUSION

There are other projects besides these two as well: the SyCULTour project, partly financed by the *South East Europe Programme*, is being carried out on the Črni Vrh Plateau, where the production of new brochures are planned. The HOMAI Project, partly financed by the *Lifelong Learning Programme*, offers its partners - in this case the towns of Idrija and Almaden, both nominated as UNESCO heritage - to get to know each other, especially through education. These are just some activities that increase the visibility of the Geopark and bring visitors to the town.

With these improvements, especially in terms of the organisation of the Geopark, we got closer to the goals which are achieved by the members of the *European Geoparks Network* and *Global Network of National Geoparks*.

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

iBeigua: innovative interactive tool to promote Beigua Geopark

Queirolo C. ([a]), Burlando M.([b]), Firpo M. ([c]), Galassi U. ([d]) & Mazzeo A.([e])

([a]) Beigua Geopark – Educational Service, Italy. E-mail: CEparcobeigua@parcobeigua.it
([b]) Beigua Geopark, Italy. E-mail: direttore@parcobeigua.it
([c]) Earth Sciences Department, University of Genoa, Italy. E-mail: firpo@dipteris.unige.it
([d]) ETT srl, Genoa, Italy. E-mail: ugo.galassi@ettsolutions.com
([e]) ETT srl, Genoa, Italy. E-mail: antonio.mazzeo@ettsolutions.com

ABSTRACT

At the present tourists ask for personalized routes to make their experiences more and more attractive and diversified through the use of interactive devices (smartphone and tablet). They have a more active attitude towards the offered services and opportunities and they look for up-to-date and friendly way to get information.
With this new perspective to promote in a better way geodiversity, biodiversity and the historical and cultural heritage of the Beigua's territory, a project to use an innovative high-tech tool has been launched.
It is a smartphone and tablet app created on the basis of iOS Apple and Android operating systems to describe and to make more catching the different sites and touristic attractions in Beigua Geopark's area.

KEYWORDS: Geopark, geotourism, high-tech devices, interpretation, communication.

iBeigua APP: THE FUNCTIONING

The application centres on the geo-position of the sites of most interesting values in order to provide exhaustive and interactive information about thematic trails, visitor centres, tourism facilities with the opportunity to organize personalized routes.
Two different ways of use has been prepared: off-line mode and on-line mode.

OFF-LINE MODE

In the off-line mode, without any internet connection, the user has the opportunity to consult a series of essential information regarding different items and aspects about Beigua Geopark.
Each site of interest has special information units which functions as a proper itemized and detailed guide. Each route proposed by the the application is interactive, full of information about the geological, biological, landscape, historical and cultural features the visitor is able to meet during his way. Each descriptive unit is fully equipped with a photogallery and videos.
This section of the application is a nice showcase to present in a very detailed way all the most important features and sites to be visited and to get well informed notes, also including time schedules, contacts and all the useful information to visit museums, monumental historical buildings and visitor centres.

Fig. 1- off- line mode to consult information about Geopark

ON-LINE MODE

In the on-line mode some additional functionalities are available if an internet connection is working.
These additional functionalities allow to the user to have real time news and up-to-date information directly by the Beigua Geopark's office, also through the "push notification". The up-to-date info news are uploaded using the CMS (Content Management System) web based system.

Following the main functioning structure of the application.

<u>Highlights</u>
· Geosites: list of the most important geosites with attached unit and pictures for each site
· Fauna: list of the most important animals with attached unit and pictures for each animal

· Flora: list of the most important animals with attached unit and pictures for each flower
· Vegetation: list of the most important animals with attached unit and pictures for each plant
· History, Archaelogy and Cultural Heritage: list of the most important sites to be visited with attached unit, pictures and geo-positioned map for each site.

Visitor Centres - Info Points

· Palazzo Gervino Visitor Centre · Villa Bagnara Visitor Centre · Vaccà Visitor Centre : detailed units about the different rooms which are open to be visited, with pictures, video, audioguide and geo-positioned map to reach the centres
· Prariondo Info Point · Banilla Info Point · Deiva Info Point: detailed unit with pictures, video and geo-positioned map to reach the info points
· Museums (7 different buildings): detailed units with pictures, video and geo-positioned map to reach them.

Fig. 2- on- line mode to consult real time news about Geopark

Weather conditions and WebCams

· Connection to the weather conditions forecast about the ten municipalities territories in the Beigua Geopark
· Webcam Beigua: connection with the two webcams installed in the Alta Via dei Monti Liguri – Monte Beigua site.

Trails

· Thematic Trails: list of all the best equipped trails about geology, forest, ornithology, botany, history and culture, with dedicated units, pictures, audioguide and geo-positioned map for each trail
· Trekking Trails: list of all the best trails available for trekking, with dedicated explanation units, pictures, and geo-positioned map for each trail

Sport outdoor facilities

· Nordic Walking · Canyoning · Orienteering · Mountain Bike · Climbing · Horse Trekking · Geo Snorkeling and Geo Diving:
list of all the best sites for sport outdoor activities, with dedicated explanation units, pictures, videos and geo-positioned map for each site.

News and Information

· News: up-to-date news and information (on-line mode) provided in real time through the CMS platform and the "push notification" system
· Events: list of events (on-line mode) provided in real time through the CMS platform and the "push notification" system.

Tourist facilities

· List of the suggested tourist facilities with dedicated explanation units, pictures, and geo-positioned map for each facility

Local products

· List of the local products from the Beigua Geopark's territory with dedicated explanation units, pictures, and geo-positioned map

Useful contacts and Geopark rules

· Contacts, useful links, social networks profiles connections, etc.

My Beigua

· Equipped picnic areas and parkings: useful info to reach them with geo-positioned maps
· Newsletters archives (dowloadable)
· Around here: maps with information about the activities available in the neighbourhood
· Track Me: this functionality allows to record the trails the visitors walked along his stay in the Beigua geopark's area.

INTERACTIVE VISITS THROUGH QR CODE

The application project also introduced a new communication tool using the QR code system. The QR codes are two-dimensional codes, installed in strategic sites of the territory (on interpretative panels, noticeboards, small columns, etc.), readable through several kind of free applications which give the opportunity to decipher the visual tag and to create direct connections with web sites or to multimedia contents or to videos and pictures.
These QR codes are able to be read through iBeigua app so that the visitor who downloaded the app before can provide information or special detailed units or video or pictures simply framing the QR code, also without any internet connection.

CONCLUSION

The iBeigua app is an important technological contribution to support the geotourism in the geopark's territory. A very good opportunity to enhance not only the several values of the area (geodiversity, biodiversity, historical and cultural heritage, ect.) but also the different offers from a touristic point of view through an innovative platform able to provide information and data in a proper way and exhaustive term.

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

Activities to increase public awareness about geohazards in Beigua Geopark

Burlando M.([a]), Castello G. ([b]), Firpo M. ([c]), Mangini I. ([b]), Queirolo C. ([b]) & Saettone M. ([b])

([a]) Beigua Geopark, Italy. E-mail: direttore@parcobeigua.it
([b]) Beigua Geopark – Educational Service, Italy. E-mail: CEparcobeigua@parcobeigua.it
([c]) Earth Sciences Department, University of Genoa, Italy. E-mail: firpo@dipteris.unige.it

ABSTRACT

In the recent past the Liguria Region and also the Beigua Geopark's area was affected by natural hazards, especially floods, inundations and landslides. In order to carry out new strategies to increase public awareness and background about geohazards, during the last three years Beigua Geopark educational staff presented several activities directed towards local communities and schools.

The project has been developed in collaboration and with a strong support by the Liguria Regional Department of Civil Protection and the CIMA Foundation, a scientific international centre on environment monitoring in Savona.

KEYWORDS: Geopark, geohazards, educational programmes, communication, civil protection, local governance.

THE AIMS OF THE PROJECT

In order to avoid that the concept of natural hazards is interpreted as inevitable disaster the project developed different items starting from the explanation of the territory from a geological and geomorphplogical point of view and finishing with special initiatives to awaken people to the local safety rules and plans.

The main activities of the project was:

- riconstructioning of the knowledge framework about natural hazards (especially geohazards) in Liguria Region and in the Beigua Geopark's area (Fig. 1);

Fig. 1- Activity in the field to explain the local geological and geomorphological characteristics

broadening the knowledge of the causes of geohazards (especially floods, inundations, landslides), the criticality and vulnerability of the territory;

- making aware local communities of the existence of available documents and know-how about civil protection role and actions on natural hazards (Fig. 2);

Fig. 2 -Workshop with local community about civil protection rules

- sensitizing local schools and community to the hazards by natural and anthropic factors, paying particular attention to geological hazards;
- spreading information about the existing territorial action plans (Civil Protection, Hydrogeological Basin, etc.);
- popularizing the communication channels about alerting and the possible expected scenarios;
- popularizing the self-protection rules to apply according to the various conditions due to the different kinds of hazard;
- spuring people to create stronger and stronger links with local civil protection services.

WORKING WITH LOCAL PEOPLE

The project has been developed in collaboration and with a strong support by the Liguria Regional Department of Civil

Protection and the CIMA Foundation, a scientific international centre on environment monitoring which works in Savona.
Several meetings and workshops was organized in the Beigua Geopark's Municipalities, explaining the local rules and organization to face emergency situations and hazard's conditions.
The Liguria Regional Department of Civil Protection participated in local initiatives showing their proper rules, activities and equipments.
Also all the School Departments of the Beigua Geopark's area has been involved too (*Fig. 3*).

Fig. 3 - Educational programmes has been developed to increase local schools awareness about geohazards

A specific game about Geohazards and Civil Protection has been created by the local students under the supervision of the Geopark's educational staff and experts from the Liguria Region Civil Protection staff.
This game is now travelling through all the Educational Centres of Liguria as a good practice to share at a regional level.
Some students participated also in the preparation of a leaflet (*Fig. 4*) about self-protection rules, with very friendly and easy information to understand.

Fig. 4 - Leaflet dedicated to self-protection rules

CONCLUSION

The good results obtained during the project have been considered only the first step of a continuous learning route the Beigua Geopark (*Fig.5*) is going to consolidate at a local level, also cementing the alliance with the Liguria Regional Department of Civil Protection, the CIMA Foundation, the local Municipalities, the local Volunteer Associations and local School Departments.

Fig. 5 Beigua Geopark southern slope

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12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-Italy, 4th-6th September 2013

EGN Homepage Review – A Comparative Approach

Schönlaub H. P. ([a])

([a]) Geopark Carnic Alps, A-9640 Dellach/Gailtal (hp.schoenlaub@aon.at)

ABSTRACT

A homepage is intended as a Geopark's window to attract visitors not familiar with the region. As far as the homepages of the EGN member countries are concerned, they reflect different philosophies. Based on the personal review of a non-professional in communication and marketing, the main differences between the various Geoparks to approach visitors is briefly summarized.

Key words: European Geopark Network, Homepage, Information technology.

A user of a specific homepage is (1) interested to learn more about a specific region and what it has to offer; (2) requires easy access to the main content of a homepage and, (3) responds positively to an inviting and appealing layout which arouse his/her curiosity. Based on the comparative analysis shown in the presentation and in the table below, these three criteria are only partly fulfilled in the EGN homepages. Moreover, less than half of the EGN Geoparks have a link to a homepage in another language.

In addition, a well-designed ranking of categories depends on the length of the text, its subdivision and the choice of complementary photos. The majority of the EGN Geoparks choose between two possible alternatives for presenting their data, namely either the horizontal subdivision of icons into four or more categories and sub-categories or vertically subdivided icons on the left side of the computer screen for the user's selection. However, these two options can be combined. The preferred option for displaying a Geopark's data depends on individual taste and bias.

A horizontal bar showing several categories and subcategories, however, has some advantages, as it is clearer and more up to date and provides more space for the main message including animations. Also, it fits much better the full screen. Presumably, children prefer this kind of presentation.

Attached is an Excel spread-sheet showing all data from February 2013, the author's personal comments together with some examples of, in the author's opinion, very well designed homepages and some which are considered to be less. In general, red lettering indicates positive examples, while those with bold letters seem to reflect appealing homepages.

Geopark	Name	Country	Web address	Other Language(s)	Horizontal subdivision	Vertical subdivision	Comments
1	Reserve Geologique de Haute Provence	F	www.resgeol04.org/	no	5	many	**well done**
2	Vulkaneifel	D	www.geopark-vulkaneifel.de/	no	Photos	14	clearly arranged
3	Lesvos	GR	www.petrifiedforest.gr/	gr., engl.	6	9	unclear
4	Parque Cultural del Maestrazgo	E	www.maestrazgo.org/	no	-	-	bad
5	Psiloritis Natural Park	GR	www.psiloritis-natural-park.gr/	gr., engl.	9	4 (incl. Photos)	well done but not informative
6	Geo and Nature Park TERRA.vita	D	www.naturpark-terravita.de/	engl.	7	up to 11	**very good**
7	Copper Coast	IRL	www.coppercoastgeopark.com/	engl.	up to 8	8	innovative headline
8	Marble Arch Caves	IRL	www.marblearchcavesgeopark.com/	engl.	8	7	good overview
9	Madonie	I	http://www.parcodellemadonie.it/	it., engl.?	?	?	unclear
10	Rocca di Cerere	I	www.roccadicerere.eu	no			
11	Naturpark Steirische Eisenwurzen	A	www.geoline.at/	no	5	7	unclear
12	Bergstraßse Odenwald	D	www.geo-naturpark.net	no	8	up to 9	very good, however, only in German
13	North Pennines AONB	UK	www.northpennines.org.uk	engl.	-	7	tedious
14	Luberon Parc Naturel Régional	F	www.parcduluberon.fr	no.	4	6	unexiting
15	North West Highlands	UK	www.northwest-highlands-geopark.org.uk/	engl., Google transl.	7	8	**interesting; Google translator works well; horizontal line offers possibility to access different categories**
16	Swabian Alps	D	www.geopark-alb.de/	no	-	9	**clear - pleasing - userfriendly**
17	Harz-Braunschweiger Land. Ostfalen	D	www.geopark-harz.de/	engl.	-	13	**informative, raises so.'s curiosity**
18	Hateg Country Dinosaurs	RO	www.hateggeoparc.ro/	no	4		difficult to evaluate, little information
19	Parco del Beigua	I	www.parcobeigua.it/	it., ger., engl.	-	15	too much text

20	Fforest Fwar	UK	www.fforestfawrgeopark.org.uk/	no			left column interesting, design less appealing
21	Bohemian Paradise	CZ	www.geopark-ceskyraj.cz/	cz, engl.	10	up to 8	**Google Earth well placed on start page; animations well done; clear statements; upper horizontal bar enables further subdivision and more space for text on right and left sides**
22	Cabo de Gata - Nijar Natural Park	E	www.juntadeandalucia.es	esp.	17		very unclear
23	Naturtejo	P	www.naturtejo.com/	pt, engl., esp.	4	7	much information, unclear
24	Subbeticas	E	www.juntadeandalucia.es	esp.			very unclear, overloaden
25	Sobrarbe	E	www.geoparquepirineos.com/	cast., engl., fr.	7	7	very appealing, excellent photos
26	Gea Norvegica	N	www.geoparken.no/	norks, ger., engl.	6	8	little information
27	Geol. Mining Park of Sardinia	I	www.parcogeominerario.eu/	it, engl.,ger., fr.,esp.	6	10	foreign languages are not working
28	Papuk	CRO	www.papukgeopark.com/	cro., engl., ger.	4	15	**well subdivided, appealing design**
29	English Riviera	UK	www.englishrivierageopark.org.uk/	engl.	4	17	**very appealing layout, clear categories, short text, very understandable**
30	Parco Naturale Adamello-Brenta	I	www.pnab.it/	it., engl.	6	6	little information, Geopark was imposed on Nature Park
31	GeoMôn, Wales	UK	www.geomon.co.uk/	engl.	6	9	unclear
32	Arouca	P	www.geoparquearouca.com/	pt., engl. (ger., esp.)	6	12	appealing
33	Shetland	UK	www.shetlandamenity.org/geopark-shetland	engl.	10	22	rather conservative, however, much information
34	Chelmos-Varaikos	GR	www.fdchelmos.gr/el/	gr. (engl.)			insufficient
35	Novohrad - Nograd	HU-SL	www.nogradgeopark.eu/	hung., slov., engl.	5		much information, for potential visitors not very clear
36	Magma	N	www.magmageopark.com/	nor, ger., engl.	8		insufficient, no description of geosites

37	Basque Coast	E	www.geoparkea.com/	bas., esp.	7		unclear, old fashioned
38	Parco Nationale del Cilento e Vallo di Diano	I	www.parks.it/parco.nazionale.cilento/	it., ger.	3	15	**very appealing, good subdivision into important categories**
39	Rokua	FI	www.rokuageopark.fi/	fin, ger., engl.	6	-10	too many graphics embedded in text - unclear
40	Tuscan Mining	I	www.parcocollinemetallifere.it/	no			website under construction
41	Vikos-Aoos	GR	old.igme.gr/Vikos_Aoos_Geopark	gr.?	6		no website available (?)
42	Muskau Arch	D, PO		no			no website available (?)
43	Sierra Norte del Sevilla	E	www.juntadeandalucia.es	esp.	too many	too many	old fashioned, unclear, bad
44	Burren and Cliffs of Moher	IRL	www.burrenconnect.ie/geopark/	engl.	7	15	much information about tourism, environment, communities and about the Geopark
45	Katla	IS	www.katlageopark.is/	engl.	9	8	little information about geology, unexited
46	Massif des Bauges	F	www.parcdesbauges.com/	engl., ne.	4	15	more Nature Park than Geopark, unclear subdivision
47	Apuan Alps	I	www.apuanegeopark.it/	it., engl.	13		very extensive, much text and many photos
48	Villuercaas-Ibores-Jara	E	www.villuercasgeopark.com	(engl., ger., it.), esp.	6	13	unclear subdivision
49	Carnic Alps	A	www.karnische-alpen-geopark.at	ger., engl., it.		7 and 27, resp.	in comparison with other Geoparks appealing, however need for shortening number of categories
50	Chablais	F	www.geopark-chablais.org	fr.	6		appealing website with horizontal bar subdivided into 6 categories; on left and right sides much place for description of Geopark; geology is treated rather short

51	Central Catalunyia	E	www.geoparc.cat/	cat., esp., engl.	4		appealing website ; upper bar enables enough space for descriptions, categories on left side are not needed
52	Bakony-Balaton	HU	www.bakony-balaton-geopark.hu/	hung., engl.	5		horizontal bar subdivided into categories offers much space for etxt and photos, good example for clearness
53	Azores	P	www.azoresgeopark.com	pt., engl.	4		**modern and informative, user friendly**
54	Karavanke Alps	A	www.geopark.si/ www.geopark-karawanken.at	ger., sl., engl.	8		**modern appealing, much information**

Aspiring Saarte Geopark – a candidate to become the first egn/ggn member eopark in Estonia

Bubukin V. ([a])

([a]) Project Manager, NGO Saarte Geopark, Lossi Street 1, 93819 Kuressaare town, Saare County, Estonia. E-mail: info@saartegeopark.ee

KEY WORDS: Aspiring Geopark, Estonia, Silurian age, history, activities

THE FOUNDATION OF SAARTE GEOPARK

Couple of years ago the local conditions of founding the Saarte Geopark were very good. Their targeted implementation allows the Saarte Geopark to become a member of the European Geoparks Network. Since the Saarte Geopark embraces entirely local nature and includes also heritage sites by not merely focusing on geological natural resources, the impact of the geopark to the economic and social development of Saare County is much broader than only focusing on its geological resources.

The following conditions supported the creation of an actively functioning and sustainable geopark in the Saare County:

- Internationally important natural and cultural monuments in the territory of the geopark – globally important Kaali Meteorite Crater Field, Bishop´s Castle in Kuressaare;
- A number of important regional geological natural monuments such as coastal banks, glacier landforms, alvars, etc;
- Rich natural landscape and biological diversity;
- The oldest national park in the Baltics – Vilsandi National Park with its set of Silurian outcrops;
- The existence of a number of regionally important heritage sites – Kuressaare town center, churches, museums, peasant's museums, windmills, estates, country fortresses, lighthouses, etc;
- Administrative compactness since the area remains within the borders of one single county and is demarcated by maritime borders;
- Access to islands from national and international areas, multi-modal transport – air or water;
- Offers a rich variety of accommodation and catering possibilities – spa-hotels, tourist cottages, B & B-style lodgings, restaurants, bars, etc.;
- Rich cultural events in the summer period – including internationally known events such as the Saaremaa Opera Days;
- Tourist information centers – in Kuressaare, Loona Manor, Kaali Visitor Center, etc. – tourist information available on paper and in electronic media;
- Long-standing tradition of environmental education;
- Local interest and willingness to set up the geopark and contribute to the initial financing.

Therefore, taking into consideration the conditions, the Saarte Geopark, which was called Saarte Silurimaa Geopark (in translation Silurian Islands Geopark) until June 2013, was founded in December 2010 by 9 local municipalities of the Saare County.

INFORMATION ABOUT THE TERRITORY OF THE SAARTE GEOPARK

Saare County is the most western county in Estonia – its area is 2922 sq. km, representing 6.5% of Estonia´s territory. In September 2012, 35,408 inhabitants lived in the County, which is 2.6% of the population of Estonia. The centre of the island and also the only city in the county is Kuressaare, where 14,588 people live.

In addition the island of Saaremaa, there are smaller islands such as Muhu, Ruhnu, Abruka and Vilsandi and a lot of small islands in the county. All are well-known destinations among tourists. Saaremaa is unique because of its location and its isolation – a unique atmosphere and architecture have been conserved (reed roof buildings, stone fences), the inhabitants of island have its own style of speaking and beautiful traditional costumes.

The Saare County is rich in natural monuments. The most important aspect for the creation of the geopark is an internationally well-known geological monument – the Kaali meteorite crater. The main pillar of Saarte Geopark is based on the presentation of the Silurian era. The outcrops of Silurian that are located all over the island of Saaremaa allow presenting almost ¾ of the Silurian era. Most of them are located on the seashore and form high or low cliffs. Due to thin subsoil there are a lot of old limestone fields and several limestone quarrys are currently in use. To have an overview of the Silurian bedding over the time, visitors have to travel through the island of Saaremaa from north towards south. The outcrop on the north coast is older or in other words, of Lower Silurian rocks. Towards the south there are gradually younger rocks, up to the Upper Silurian, under the surface by ending at the latest horizon in Sõrve peninsula.

By the creation of the Saarte Geopark the following objectives have been set:

- Saarte Geopark is recognized as an educational visiting site for learning geological and natural monuments, and it functions in international network.
- Saarte Geopark is the destination for acquiring education in the field of nature – from theoretical perspective to the acquisition of practical skills.
- Saarte Geopark is sustainably managed and socially coherent area.

The plan for the Saarte Geopark in terms of international Geopark status is to apply for admission to the European Geoparks Network and Global Geoparks Network in 2013 and hopefully in 2014 be acknowledged as a European Geopark.

INFORMATION ABOUT THE ACTIVITIES OF THE SAARTE GEOPARK

Even before the foundation of the Saarte Geopark at the end of 2010, the Strategy of the Saare County Geopark was developed for the period of years 2011-2015. This document is the main source of the planned activities in the Geopark.

At year 2011 an information brochure with the hiking tracks and routes of the Geopark was compiled and printed in Estonian, English and German languages. At the same time website www.saartegeopark.ee was started to develop.

Saarte Geopark has 3 routes: from East to West, from North to South and Southern-Saaremaa route. The routes involve all the main sites of Saare County.

Most important of those sites got labeled with road signs and information boards in 2012. In addition 6 large maps of the Saare County and routes of the Geopark were installed.

Every year in August the Saarte Geopark organizes a major conference at Kaali Visiting Centre located near the Kaali Meteorite Crater about geology, nature and tourism. Local students are involved in organizing the week of geology and several excursions are conducted to get familiarized with local geological heritage. Most of the excursions take place in Spring.

During 2012 Saarte Geopark took part in the Nordplus Horizontal project "Treasure Hunt Games – New way of Active Learning I". This was the project where we made in cooperation with Locatify (Iceland), Katla Geopark (Iceland) and Magma Geopark (Norway) educational games downloadable for smart phones that could be connected to the national and local curricula or for visiting tourists. One of the games is the game of Saarte Geopark, where the participants have to visit all the localities, which were labeled during year 2012, answer questions and perform different tasks.

In April to May 2013 Saarte Geopark arranged local geoguide courses where 39 new guides from Saare County got educated about all aspects of the Saarte Geopark territory, flora, fauna etc. This was done under the Nordplus project "Nordic Geoguide School" in cooperation with Katla and Magma Geoparks.

Various projects and activities have been started, so that Saare Geopark could reach the goals set on foundation of the organization.

Fig. 1. Excursion for the participants of the Geoguide course. Information map at Loona Manor, installed by Saarte Geopark at 2012.

Fig. 2. Excursion for the students. Information board at Panga Cliff, installed by Saarte Geopark at 2012.

Abstract

Development of PPF concept in hateg country dinosaurs geopark

Andrasanu A. ([a]), Ciobanu C. ([a]) & Savulescu I. ([a])

([a]) University of Bucharest, 1, N. Balcescu, urban district 1, 010041, Bucharest, Romania, mesajalex@yahoo.com

A place is not only a geographical or a geological or a historical context, but it`s also a subject to be interpreted and used in education, a subject of stories. A geopark is not just presenting or teaching about geology to visitors, Geoparks have to offer a time dimension and a dynamic vision of a specific place.

The PPF Concept (Past – Present – Future) developed by Guy Martini (2012) is based on the systematic use in Geoparks of interpretative supports for each site of three superimposed images of place evolution in time. This approach is a necessity in order to differentiate a geopark from other types of protected areas reserves and to comeback to the constitutive aim of a geopark: to educate, share and inspire through an another vision of time. Suggested categories of interpretative supports are: (i) classic interpretative static panels composed by three time segmentation; (ii) dynamic interpretative panels; virtual interactive panels.

Haţeg Country Dinosaurs Geopark started to apply the concept on its territory and the first step was to select a specific place and to open a time window, based on interpretative panels of landscape and its evolution in three time segments. The selected place is well defined form the geo-tectonic and geomorphologic point of view. Time segmentation will stop in the following points: 10000 years ago at the end of Ice Age when melting glaciers shaped the morphology of the foot hills of Retezat Mountains, specific flora association developed, and some of the plant species are still present. One hundred years ago the area was a key point in the local battlefields during the First World War. Going forward, in one hundred years human activities, erosion and climatic change will generate landscape changes, and in 10000 years the morphology and plant association could be different. Geological, botanical and morphological studies and simulations will document the evolution of the area.

The interpretation will focus in presenting the components of 3D piece of Earth`s crust that could be divided into separate components: living things, buildings, roads, pounds, lakes, rivers, soil, relief, rocks, wood etc. In a second phase we will imagine our place as part of a time evolving landscape. In this way a time dimension is introduced helping us to imagine processes and their results going foreback and foreward.

KEY WORDS**:** PPF concept, time dimension, geopark

Linking geoparks to education and research at university of Bucharest

Andrasanu A. ([a])

([a]) University of Bucharest, 1, N. Balcescu, urban district 1, 010041, Bucharest, Romania, mesajalex@yahoo.com

Promote geosciences, raise public awareness, educate decision-makers, made children to discover the Earth, and young people to pursue a career in geosciences are continuous objectives of geoscientists, universities and institutions.

Development of geoeducation was a response to the need of practical use in education and public awareness of all geological assets identified and classified by different professional geological associations, ProGEO, specialists from geoparks, natural parks, museums and other working groups. Three events could be considered as milestone for the process: (i) the *1st International Symposium on the Conservation of our Geological Heritage*, Digne, France, in 1991; (ii) creation of the European Geoparks Network (EGN), in 2000; (iii) creation of the Global Geoparks Network (GGN), in 2004 (UNESCO, 2004).

The geopark concept, as we know today, is the result of continuous efforts of dedicated specialists and innovative approaches in using local geological heritage as main resource for socio-economic development with geoeducation playing a key role (Martini, 2003; Zouros, 2004). The geoparks are places of practical use in geotourism, education and public awareness of all geological assets and for an integrated approach and a better understanding of the close connection of natural environment and socio-economic needs for sustainable development plans.

In different countries, over the last years partnerships of universities and geoparks developed interdisciplinary research projects, new MSc curriculum or intensive courses in geoconservation to form professionals able to provide a holistic view of nature and to work for promotion of geoscience, raise public awareness, educate decision-makers.

University of Bucharest was involved in development of two geoparks and now is managing Hateg Country Dinosaurs Geopark. During these processes developed research and educational projects (Erasmus, Leonardo da Vinci) both for geological heritage conservation and also in fostering geoparks development in Romania. The paper presents geoeducation as part of the geoconservation activities, and the role teaching staff and students are playing in geopark management, curriculum design, research and educational activities, sustained or developed by University of Bucharest. Two examples were selected to be detailed: (i) a new MSc program *Applied Geo-biology in natural and cultural heritage conservation*, and (ii) Geoconservation as a case study in the frame of the *European Virtual Seminar in Sustainable Development* (http://www.openuniversiteit.nl)

KEY WORDS: geoparks, geoconservation, geoeducation, university curriculum

The Geopark and Geotourism Potential of Levent valley (Malatya/Turkey)

Akbulut G. & Ünsal O.

The main aim of this paper is to determine “The potential of the geopark and geotourism of Levent Valley Geopark in Malatya city of Turkey. Geopark is defined as a geographical area where geological and geomorphological heritage sites are part of a holistic concept involving conservation all of the natural and cultural heritages, to be aim socio-economic development, education, sustainable and sites of ecological, archaeological, historical and/or cultural value are included.

As far as we know, there isn’t geopark in Turkey, but there are a few suggested geopark sites such as Kızılcahamam-Çamlıdere Geopark, Kapadokya, Van ve Tuz lakes, Nemrut Caldera ve Tortum –Narman Geopark and Levent Valley Geopark in Turkey..Turkey has rich geological and geomorphological heritage, however this resources is not completely used. In this study have tried to explanation The potential of the geopark and geotourism of Levent Valley Geopark in Malatya city of Turkey. submitted some suggested as related to future plan and applications for developing Levent Valley Geopark in Turkey. It was used ArcGIS 10 ve Special Analysis Module and prepared maps.

KEY WORDS: Geoheritage, Geopark, Geotourism, Levent Valley and Turkey

Preliminary proposal of the geopark network in Serbia: strategic and rationale approach

Belij S. ([a]), Mladenović M. ([a]), Marković S. B. ([b]), Vasiljević D. A. ([b]) & Timotić D. ([c])

([a]) Ministry of Natural Resources, Mining and Spatial Planning of Republic of Serbia
([b]) Loess and Geoheritage Research Center, Faculty of Sciences, University of Novi Sad, Serbia
([c])Institute for Nature Conservation of Vojvodina Province, Serbia

Serbia has long and successful tradition regarding nature conservation, including geodiversity. In Serbia, on relatively small area there are five National parks, 16 Nature Parks and more than 400 other nature protected areas and localities. Additionally, today, on its territory, there are 80 protected geosites and areas and more than 600 proposed ones. This all indicate great variety and quantity of potential areas for geoparks. In spite of rich and diverse geo-resources, there are no geoparks on its territory. Even worse, no particular or practical conservation, promotion interpretation has been conducted on these sites.

This study aims to present the new project entitled “The geopark network in Serbia” initiated by nature conservation experts from Ministry of Natural Resources, Mining and Spatial Planning of Republic of Serbia in collaboration with Loess and Geoheritage Research Center, University of Novi Sad and Institute for Nature Conservation of Vojvodina Province. This project should provide the platform and application for several geoparks for the EGN and GGN that would form the network of Serbian geoparks.

The project team will provide research, mapping and field work in order to identify all representative localities. Afterwards, the team will prepare and submit the application for the acceptance into EGN and GGN. During the application and preparation period, all project institutes and experts will work on (general and touristic) infrastructure, interpretation and other activities towards modern and functional geopark management.

Dark circles and recent discoveries in Fengshan, Leye-Fengshan Global Geopark

Bottazzi J.

([a]) Leye-Fengshan Global Geopark, Tourism Office, Balie, Fengcheng Town, Fengshan County, Hechi City, Guangxi Province, China. E-mail: jean.bottazzi@gmail.com

Document type: Powerpoint supported oral presentation

This is the story of a surprising discovery of a very newly described feature in Fengshan county.

From the beginning of our geopark's adventure, karst cave exploration never stopped.

The geopark created a local exploration team who know have the capacity of extending of the length and number of described and mapped caves.

In connection with external teams, we access to new technologies such as 3D laser to record complex and big volumes, such as the Nantianmen chamber and its famous inside natural bridge.

But the most surprising discovery was not what we were looking for: It was the presence of dark circles with some strange features, a kind of speleothem we never mentioned before.

The explanation came to us by a fortuitous chat during a work meeting at the French Federation of Speleology. A caving team discovered in Laos the same kind of dark circles and studied their formation. It was a very new speleothem formation process created by the air moved by drops fall.

We then measured these circles and put the results in a table to check their fitting to the theory: The correlation between the height of the drop fall and the diameter of the circle perfectly respect the mathematical model.

Doing this, we improved our acuity and recently discovered the first of these dark circle reaching an over 5 m diameter. Now this new geo-heritage feature is known, we work at protecting it and showing it to our geopark's visitors as well.

Space and time perception and the Geopark communities

Ciobanu C. ([a]) & Andrasanu A. ([a])

([a]) University of Bucharest, 1, N. Balcescu, urban district 1, 010041, Bucharest, Romania, ciobanu.cristian@yahoo.com

Space perception (or mental geography) appears at the contact between geography and psychology and deals with the human perception of space.

There are four levels of space perception:

1. Locational level – is the basic spatial problem solving, the mental map of an individual used to getting around in day to day life;
2. Attributive level – when space comes with an attached information/value – good or bad, beautiful or ugly etc;
3. Affective level – the spatial information is dominated by emotion, like the place of our childhood;
4. Imaginative level – deals with the mental construction of imagined spaces, either physical places we have never visited or fictional/mythical areas.

These levels are not firmly separated; they can come across each other making it difficult to draw a line, for example, between the affective and the attributive levels.

Spatial perception is a probabilistic science and works with sums of individual perceptions. When **time** comes into the equation, we separate four layers of space perception:

1. Perception of spaces in the past – people tend to remember spaces and places that existed someday and that today are transformed and destroyed. These glimpses of past are called paleoimages;
2. Perception of the present;
3. Perception of the future – vision – is the capability of people to see what it is not there but what they think or wish it would be there.

The subject of time perception is very sensitive and there is a need to distinguish between situational or individual type of interest and the focus of interest that could be for the entire subject or just a topic within it.

A Geopark is a place where interpretation of Earth's components and history is integrating and using the local communities` space and history. But how does the community relate to Earth, to time and to the local space – the place? Every single community that existed had its own theory of space, explaining, mostly in an egocentric way, WHERE they are, WHY and how they got there.

A study developed in the Hateg Country Dinosaurs Geopark communities using tools developed by Intangible Heritage Working Group of EGN and our own methodology we are studying not only the real, factual history of Earth and its places, but also the perceived space and time, the mythological history of Earth. The study is trying to identify the community perspective. There are present, real and often used spaces; lost places; mythical worlds; future plans etc. All this forms the mental maps of the communities, and the Geopark should focus on it in order to better understand the people and to enrich the heritage.

Knowing and representing knowledges networks:analysis and methodological proposals for heritage

Converti F. ([a])

(a) Second University of Naples, Department of Architecture "Luigi Vanvitelli"

The complexity of territory and its extraordinary ability to interact with human being require a basic knowledge of each element, but also, and above all, of its potentiality; knowledge is one of activities in which man experimented with, combining pre-existing and innovation, through knowledges considered as guarantors of territory development. Spatial dimensions overlap, occuring in relationships among several components of same territory and relationships among objects belonging to varied sizes, but relating to a different area, are the basis of diatopic and sintopic dynamics. So preconditions for effectiveness and durability of Regional and Local policies pass through four main steps: analysis, knowledge, integration, reporting and effective awareness of participatory planning.

KEYWORDS: Heritage, Networks, Subsoil.

Educational Games in geoparks: a case from Gea Norvegica Geopark (Norway)

Dolven J. K. ([a]), Johansen O. R. ([b]) & Aamundsen A. ([a])

([a]) Gea Norvegica Geopark, Kjølnes ring 30, 3918 Porsgrunn, Norway E-mail: jane.dolven@geanor.no
([b]) Brunla secondary school, Vardev. 34, 3292 Stavern, Norway

Children are curios by nature and love to discover and learn new things. Unfortunately, some of this enthusiasm disappears when growing older. One way to re-spike interest and make learning engaging and fun, is to combine learning with something that most children and young adults enjoy doing: playing games. Through games one gets challenged in a positive way; gets encouraged to become better and push boundaries; receives immediate feedback; and experiences that learning is rewarding and fun. Gamification is a growing trend in shaping the learning experience for a new generation of children and students (e.g. Khan Academy).

Today's technology of mobile devices adds another dimension to the learning experience. Students with smartphones and tablets can play and learn with their fellow students not only in the classroom but also in the field. An example of such a system is the application called TurfHunt, made by the Icelandic company Locatify (www.locatify.com).

A TurfHunt is a game with a set of geographic locations, created by a "game owner". People are invited to join the game, and must physically reach the locations in the game in order to score points. For additional points there may be a set of multiple-choice questions on each location that must be answered. A scoreboard is continually updated to reflect the score of each team. The game ends when all players/teams have completed the course.

Gea Norvegica Geopark has recently started using the TurfHunt app as an educational game. In cooperation with local schools our goal is to provide TurfHunt games at all of our main geological localities and let the schools use them free of charge. Each game will be designed through Locatify's platform and technology, and customized for each locality with regards to theme and level of difficulty.

This coming school year, 2013/2014, Gea Norvegica Geopark will cooperate with teachers at Brunla secondary school to make TurfHunt games at two of our localities, Rakke and

Mølen. The project is interdisciplinary and aims e.g. to show how local geology is linked with fields like biology, society and cultural history. The project will be partly funded by "Den naturlige skolesekken" a national effort initiated by the "Ministry of education and research" and the "Ministry of the environment".

Gea Norvegica Geopark will soon start using another educational app called SmartGuide. This is a guided audio tour including pictures and maps, and can be enjoyed on location using GPS activation or from anywhere else by browsing the pictures, maps and listening to the guides. Our first SmartGuide tour will be released in June 2013 at Århus Farm in the northern part of the geopark.

KEY WORDS: Apps, educational games, Geoparks, Locatify, TurfHunt

GEOSCIENCES project - the way to rebirth geology at the Czech elementary and high schools

Doucek M. J. ([a])

(a) Vodní zdroje Chrudim, spol. s r. o., U Vodárny 137, 53701 Chrudim, Czech Republic. E-mail: doucek@vz.cz

The Iron Mountains Geopark was from its beginning concentrated on the educational activities - not only for children and students but also for teachers. This is thanks to the complex geological conditions in the region. The Iron Mountains Geopark area is something like a geological textbook with a wide range of geological and geomorphological phenomena. There is possible to get known geology in two or three days so you can touch the history of the Earth in a short time.

But there is a huge problem. A situation in geology at the Czech elementary and high schools is horrible. Geology is nowadays taught only half of the year in the ninth grade. Thanks to the EU projects has the Iron Mountains Geopark chance to change this situation in the Pardubice region. More than hundred teachers from 56 elementary and high schools are learning in many geological topics like petrology, mineralogy, paleontology, history of nomenclature, hydrogeology and others. Two days courses have a theoretical part (first day) and practical part (second day) that is the excursion to the geopark area. There is also new website (www.geovedy.cz) not only for „project" teachers but also for other teachers who need the geological IT support. On this website there are many materials to download like thematic geological vocabularies, excursion guides, posters, thematic textbooks, worksheets and others.

With a bad knowledge background is also connected a bad material background of the Czech schools. Collections of rocks, minerals and fossils do not exist in many schools or they are too old and small and they do not have any localization. Why small? An effective geological education needs a type material in bigger sizes (min. 10 x 10 x 5 centimetres). On this size is a teacher able to show typical features. But reality at the Czech schools is mostly different. Samples are old, dirty and in small sizes.

Thanks to the GEOSCIENCES project are 56 elementary and high schools equipped with the collections of 24 rocks, 40 minerals and 24 fossils. Almost all samples are from the Czech Republic, some of them directly from the Iron Mountains Geopark.

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

TERRA.bikE: E-bike charging stations as a new element in the geotouristic infrastructure of TERRA.vita

Escher H. ([a]), Fisse N. ([a]) & Kluttig T. ([a])

([a]) Geopark TERRA.vita, Am Schölerberg 1, 49082 Osnabrück, Germany. E-mail: Escherh@LKOS.de

Cycling is one of the most important touristic activities in the Geopark TERRA.vita. Because of its smooth and varied landscape all different types of cyclists are exploring the area on roads and trails.

Already in 2004 a set of 17 cycling routes was implemented in the Geopark area. The so-called TERRA.trails offer signposted circuit tracks accompanied by informative booklets and maps. All 17 trails lead the cyclists to sights dealing either with earth history, archeology, mining or architecture. The routing chooses trails with little traffic through sound and silent landscapes.

Since a few years the bicycle market in Germany is undergoing a big change: Electric bicycles are reaching enormous sales figures. In 2012 bicycles with an electric auxiliary engine had a market share of already 10 %, with a growing tendency. Most of these bicycles are pedelecs, that add their electric power to the pedaling power of the cyclist only during pedaling action. Pedelecs include an electronic controller which stops the motor producing power when the rider is not pedaling or when a certain speed – usually 25 km/h – has been reached. For this reason, pedelecs are classified as normal bicycles, meaning that there is no requirement to wear a helmet or to have a special insurance.

The new development on the bicycle market is of importance for the Geopark, as it widens the target group for the Geoparks´ bicycle routes. In the past, for a certain group of cyclists the TERRA.trails were problematic, because the concept of the routing in most cases includes several inclines. For people with a limited endurance these segments of the routes sometimes were too hard to ride. Pedelecs open these segments to a wider group of cyclists.

Being aware of this development, TERRA.vita decided to push it by adding a new element to the existing infrastructure. Usually pedelecs have an average range of 40 to 70 kilometers, depending very much on the intensity of using the electric support and on the difference in altitudes on the route. For cyclists starting with a fully loaded accumulator usually riding a complete TERRA.trail will be no problem. But in case the battery needs to be recharged, in the past the cyclists had very little chance to find a place to recharge their bicycles.

The new project “TERRA.bikE” offers a network of 12 recharging stations all over the Geopark. The stations are located either next to important sights of the Geopark or at restaurants alongside the TERRA.trails. The idea behind this is to give cyclists the chance to recharge their batteries during their visit for at least half an hour to have a state of charge of at least 50 % again to be reassured for the way back to the starting point.

The recharging stations have a size of approximately 4 x 10 m and offer recharging plugs for eight pedelecs. The construction resembles an oversize carport equipped with a number of bicycle-stands. The plugs are installed in lockers, so cyclists can use their own charger. The roof is equipped with solar panels, feeding energy into the electric grid. So recharging is climate-neutral as well. The feed-in compensation is kept by the operator of the station that usually is not the Geopark itself. In return the operator is responsible for maintaining the station. For the cyclists using the station is free.

Another positive aspect of the project was the planning and construction process. It was done by a social association helping unemployed young people to finish their apprenticeship or their school graduation.

In the future additional recharging stations will be implemented depending on the financial capabilities of the Geopark.

KEY WORDS: cycling, geotourism, pedelecs, recharging stations

A step forward to a new geopark

Golež M. ([a]) & Majcen T ([b])

(a) ZAG, Slovenian National Building and Civil Engineering Institute Ljubljana, Slovenia, mateja.golez@zag.si
(b) STIK, Sport, Tourism, Information and Culture Centre Laško, Slovenia,tomaz@stik-lasko.si

Based on a web encyclopaedia of natural and cultural heritage in Slovenia (DEDI II) in 2011 an idea for creation of a new Slovene geopark was born. After preliminary contemplations, stemed on geological natural values, cultural and historical significances, ethnographic peculiarities and tourist sights of Kozjansko narrow area, a region in eastern Slovenia, during a previous year new steps were made towards a realization of tasks set.

Following the examination of geological features, the original scheme consisting of a pattern project concerning the village called Padež pri Laškem was expanded to a Posavje hills area comprised of carbon dating rock. Besides numerous ancient lead, zinc and silver mines a rich fossilized fauna of former extensive swamp woods can be found in carbon flint conglomerates, sandstones and clays, speeded out here more than 300 million years back.

Connective element of the whole Posavje wrinkles area are also thermal and mineral water springs, used for its healing effects as early as in antique Roman times, nowadays dwelling with modern spa resorts and wellness parks.

In addition to geological characteristics and features a shared factor to a geopark in the making is presented in a rich cultural legacy, predominantly material and immaterial ethnological heritage, linked to local life in and around mines. Life stories of their grandfathers are still retold by rough and vigorous but kind villagers; they still remember and can readily revive skills and crafts of the olden days and conjure up the good time like their ancestors did way back. Carefully preserved culinary specialities distinctive for these mine sites are described in well-worn cookery books and skilful housewives can still prepare them to the delight of guests.

More and more tourists each year make use of our countless mountain and hiking trails, educational paths, take cycling trips into unspoilt and varied landscape, visit our cultural and historical destinations, marvel at the natural beauty, exchange worldly wisdoms through talks with natives and let themselves be pampered with local cuisine.

We intend to add to all this splendour of Kozjansko and Zasavje some of the enthraling geological contents and perhaps one day a real carbon forest will grow tall here again.

Tourism developmental project in the Novohrad – Nógrád Geopark – based on the Hungarian Goverment's decision

Lóska J.([a]) & Kéri I ([a])

([a]) Novohrad – Nógrád Geopark Nonprofit Ltd., Museum square 1., 3100, Salgótarján, Hungary. E-mail: first.author@gmail.com

The Novohrad – Nógrád Geopark's governer Nonprofit Ltd., and the geopark's biggest city, City of Salgótarján Council's common project has 614 million Forints to develop the areas tourism. Due to the volume of the support, the Hungarian Governments decision was needed, especially with two ministries, Ministry of Economics and Ministry of Developement. The „GeoTur", the „ Novohrad – Nógrád Geopark ecotourism development" supporting contract was signed 30.11.2012 by the contracting partners, the expected date of completion is 30.06.2014.

With the help of the project, the Novohrad – Nógrád Geopark will have it's own centre, just one kilometer away of it's symbol, the Castle of Somoskő. The centre will govern the park, will control the educating, and will be responsible research/exploration duties.

The City of Salgótarján will save a more than 100 years old bulding from devastation, with the help of the project. As a recent mining activity's symbol, the ex-headquarters of the mining facility will be the visitor center after the reconstruction was done.

As a result, we establish, or renew 9 study trails on the Hungarian side of the geopark, according to our image. We make accessible an old mine's entrance close to a little mining settlement within the geopark's territory.

Additionally we get all the equipment and tools are needed for our programs and tasks, and of course do marketing activities as well. Related to marketing, we will create a website, and a mobile application, later on would be as a complex system.

So far the greatest support what the Novohrad – Nógrád Geopark got, we could be proud in both Hungarian and European relations. Our presentation will show our current project in details.

KEY WORDS: Novohrad – Nógrád, tourism development, visitor center, study trail.

North America's First Geopark – Education & Communication in the Geopark

Merrifield B. ([a]), Fullerton J. ([b]), Logan A. ([c]) & Bremner G.([d])

(a) Chair, Stonehammer Geopark, Stonehammer Geopark, New Brunswick, Canada
(b) Board Member, Stonehammer & CEO, New Brunswick Museum
(c) Chair, 2014 International Conference on Global Geoparks
(d) Executive Director, Stonehammer Geopark

Since designation in October 2010, Stonehammer Geopark, located in Southern New Brunswick, Canada has been piloting projects within select schools in the geopark to determine the needs of students and educators as it relates to enhancing earth science literacy. It is important to note that within the footprint of the geopark there are over 35 schools, over 25,000 students and over 150 educators, therefore, delivery needs to be sustainable. A comprehensive and diverse education committee was established prior to designation and it was through their dedication the pilot projects were established and needs determined with keen educators.

Establishing partnerships is the cornerstone of Stonehammer's model and once the needs were known the perfect partner was found. *Mining Matters*, a charitable organization dedicated to bringing knowledge and awareness about Canada's geology and mineral resources to students, educators and the general public will be collaborating with Stonehammer Geopark to bring three deliverables to the education sector during the 2013-2014 school year. The three deliverables include; a train the trainer session to build local capacity for in-classroom delivery beyond the partnership, a two day teacher's workshop focusing on classroom activities and field visits, and finally, two weeks of in-classroom activities for students and teachers hosted by Mining Matters and Stonehammer Geopark. This partnership also provides a great opportunity for local awareness building of the geopark and its commitments to our communities. Due to the large number of schools it will be impossible to reach every school during the first year and thus a competition will be launched in September 2013 which will have schools competing for the opportunity to win the in-classroom activities with Mining Mattes and Stonehammer in March 2014.

Through this partnership Stonehammer Geopark will; elevate awareness about in classroom offerings, build capacity for public programming, showcase the abundant opportunities for field trips to explore earth science outdoors, promote the geopark to local communities through a diverse communication plan, and promote earth science literacy in the classroom and beyond.

Nature, geological and mining reserves of Jebel Zaghouan: potential of recovery a geopark

Mohsen H. ([a])

(a) Office National des Mines, 24 Rue de l'énergie – 2035 La Charguia – Tunisia E-mail: mohsen.hassine@onm.nat.tn

A Geopark is a territory that includes a geological heritage notable in terms of its scientific quality, its rarity, its aesthetic appeal or its educational value. Sites valued in the territory of a Geopark belong to the geological heritage which are combined interests of archaeological, ecological, historical or cultural sites.

To know the situation and the importance of the elements of geological heritage, the future Geopark of Jebel Zaghouan present a wide variety of geological areas.

Jebel Zaghouan is located at 50 km south of Tunis. It is a massif composed of Jurassic formations, oriented northwest southeast, nine kilometers long and three wide . As evidence of the impressive géo-diversity of this site, we mention some of geological interest:

- stratigraphy and study of sedimentary rocks (optical station in which all configurations of the Jurassic)
- Tectonics (Zaghouan fault)
- Mining heritage (mining village of Sidi Median)
- Geological Landscape
- Karst Caves (the mountain of Zaghouan is one of the ''speleological hopes'' in Tunisia)

Human activities threaten the diversity of rocks, soils and landforms as well as animals and plants living on Earth. However, unlike biological species, geological or geomorphologic objects do not occur and the deterioration of an object or site often leads to its permanent loss. This kind of project is an opportunity for socio-economic development.

Developing Compelling Visitor Experiences in Geoparks Example of the Burren & Cliffs of Moher Food Experience

O'Dwyer T. ([a])

([a]) Sustainable Tourism Co-ordinator, Burren and Cliffs of Moher Geopark, Clare County Council, Ennistymon, Co. Clare, Ireland. todwyer@burren.ie

The Burren & Cliffs of Moher Geopark provides a case study of the the product development process for new visitor experiences to Geopark destinations. The Burren Food Experience project exemplifies how the Geopark can lead and manage this process, and also provide the necessary framework within which enterprises can come together to give new visitor meaning to the destination.

In the context of Geoparks' role in supporting the economic advancement of a region, Geoparks must focus resources on the development of a general visitor image linked to the geological heritage. In the Burren & Cliffs of Moher Geopark, a pioneering network of ecotourism businesses in the region is working collaboratively with the Geopark with a view to making the region an exciting, sustainable and world-class tourism destination.

If the Geopark is to become a compelling 'destination' in the mind of the visitor, it must draw together all the elements of traditional tourism destinations. What we promote to the visitor must therefore be about much more than the place, more than the landscape and natural heritage, more than the individual products or experiences, more than the people and the culture – to create a true destination in the mind of the visitor, **all** of these elements must be combined in an organizing framework that allows visitors to easily understand the products that different places have to offer.

The Burren & Cliffs of Moher Food Experience 2013 is an example of this type of framework. The overall aim of this project is to create a strong relationship in the mind of the visitor between high quality, sustainable food and the karst limestone landscape and hinterland. Our objective is to make the Geopark region synonymous with great food and great food experiences in the hearts and minds of key audiences. Food presents a way of linking the rocky, maybe barren-looking landscape with fertility, growth and production. We sought to link the landscape with its food and cultural heritage and, through this, enable visitors to interact with the landscape on a personal level.

The anticipated benefits of doing this were to:

- Provide an added attraction to visitors to the area
- Attract media attention and raise the profile of the area
- Create a 'package' that could be presented to the national tourism agency to help promote the area internationally
- Provide a framework for allowing businesses within the Network to work together
- create new visitor experiences that would endure into the future.

The approach of the Geopark was to seek to collate the existing experiences being offered by food producers, food growers and restaurants in the Geopark region and to translate them into one large destination-level product. This was achieved through completing the **Burren Food Trail** (including map) and also through creating '**The Burren Weekly Food Series**', a range of food and culture events taking place every single Monday between April and October. The Burren Weekly Food Series allowed even non-food businesses to participate by co-operating with their food colleagues in the Network to create new visitor packages. Examples include a sea kayaking trip that concludes at a local ice-cream factory and a wine and cheese evening with storytelling. In addition, a number of the weekly events centre around one of the 9 geosites in the region, while the Geopark is also supporting two food festivals, both emphasizing the slow food and sustainable food concepts.

The outcome of the initiative to date has been a range of communications and promotional tools that can be leveraged by media and individual enterprises. More than 25 new visitor experiences were created by member businesses. We have learned lessons regarding project management and implementation and the best ways to co-ordinate the efforts of a wide number of businesses. The Burren Food Trail and the Burren Weekly Food Series have attracted significant local and national media attention, and have proven to be particularly suitable for use in social media promotional campaigns.

Internationally, Tourism Ireland, the state body responsible for marketing Ireland abroad, has supported international media visits and is promoting the food events in is international communications.

Importantly, the brand and logo of the Burren & Cliffs of Moher Geopark is prominent in all communications and supporting material. In this way, the Geopark itself is invested with additional meaning in the minds of visitors. By using existing visitor experiences and businesses, we were able to create a completely new visitor proposition for the area. The Burren & Cliffs of Moher Geopark was able to co-ordinate and shape products and experiences that existed already into a new, overarching destination-level product that can compete with other national and international destinations.

KEY WORDS: Sustainable tourism; visitor experience; food tourism, networking; enterprise support; marketing and promotion

Collecting the memories of fluorspar miners in the North Pennines Area of Oustanding Natural Beauty & Geopark, England

Pickett E. ([a]), Forbes I. ([b]), Forbes P. ([b]) & Diment N. ([c])

([a]) North Pennines AONB Partnership, Weardale Business Centre, The Old Co-op Building, 1 Martin Street, Stanhope, DL13 2UY, England, UK. E-mail: elizabeth@northpenninesaonb.org.uk
([b]) Friends of Killhope, c/o Killhope Museum, Nr Cowshill, Upper Weardale, DL13 1AR, England, UK
([c]) Heritage Interpretation Services, 22 Wilson Street, Barnard Castle, DL12 8JU, England, UK

Memories and stories from the men and women whe worked in the once-flourishing fluorspar mining industry have been captured for posterity as part of an oral history project in the North Pennines AONB and Geopark in northern England.

The North Pennines has a rich mining heritage stretching back 2,000 years and there are evocative reminders of past mining dotted all over the landscape. For centuries the most important industry was lead mining, but other minerals have also been mined at different times. Lead mining, which ceased around 100 years ago, has been well researched and celebrated at Killhope Lead Mining Museum in the Geopark. However, very little has been recorded about more recent fluorspar mining, an industry that has had a major impact on the communities and landscape of the North Pennines within living memory.

Fluorspar is the commercial name for fluorite, one of the most beautiful and iconic minerals of the North Pennines. In the 20th century it became valuable for the steel and chemical industries and many old lead mines were reworked for fluorspar. Many local people still vividly remember fluorspar mining, which only finally ceased in 1999. However, as the miners become older the memories and stories associated with the industry are being lost.

In an attempt to do something before it is too late, the North Pennines AONB Partnership and a local group, the Friends of Killhope, ran a project to record the stories of former miners, mine managers, geologists, surface processors and their families. As part of the project we have also uncovered a wealth of information, photographs and films. The recordings will be stored locally at Killhope Museum and also at Beamish Museum, a famous museum and archive in north-east England.

This pilot project has been very successful and although it is now finished local people are still coming forward with their stories. We are now looking to find further funding to expand this project into a wider celebration of this once-important industry.

KEY WORDS: North Pennines, fluorspar, mining, heritage, oral history.

The analysis on classification of China national geoparks and probe into the information construction

Qian L. ([a]) & Mingzhong T. ([a])

(a) School of the Geosciences and Resources, China University of Geosciences Beijing, China

In order to protect the geological heritages, UNESCO raised the plan of Global Geopark Network. Since Ministry of land and resources of China established system of project application and review of geoparks in 2000, the national geoparks in the country has been planed, managed and developed for 13 years, and all regions gained obvious construction achievement. As a member of Global Geopark Network and the works which has been done, 201 country-grade and world-class famous geological scenic heritages has been discovered. The paper researched on geoparks classification and regularities of distribution in China according to analysis on the national geoparks. Combining with the statistics of the facilities and effect in geopark information construction, the paper proposed sustainable development advices for China participation in Global Geopark Network.

Geodiversity the National Park Iron Gates serve to form the Geopark

Rabrenović D. ([a]), Mojsić I. ([b]), Bejli S. ([c]), Mladenović M. ([c]) & Doslic A. ([c])

(a) Geological Institute of Serbia, 12, Rovinjska Street, 11000 Belgrade, E-mail: d.rabrenovic@gmail.com
(b) FacultyMining and Geologic, University of Belgrade
(c) Ministry of Natural Resources, Mining and Spatial Planning of Republic of Serbia

National Park Đerdap was declared as a natural heritage in 1974. Since 2001. has been a member of Europarc Federation. The National Park and its surroundings is a large number of geological structures, fosilonosnih sites of various categories from European to national importance, many-gorge geomorphological structures, gazebo. They are very significant and very attractive karst forms, such as caves and grow. A significant part of Đerdap makes the Danube, the largest and longest gorge in Europe, referred to as the Iron Gates for cultural and historical significance. Cultural and historical monuments and archaeological sites are in the top Europian and national heritage. Here is the oldest mine in Europe. The National Park has significant natural ecosystems, the composition of great value and rarity, objects of flora and fauna and the well-preserved natural forest composition and great looks.

KEY WORDS: Đerdap, geological structures

"On the trail of the Mouflon": an example of how to promote nature tourism in the Apuan Alps Geopark.

Raffaelli N. ([a]), Viviani F. ([a]) & Guazzi E. ([a])

([a]) Apuan Alps Geopark, "Research and conservation" Service – via Simon Musico, 8, 54100 Massa, Italy. E-mail: eguazzi@parcapuane.it

The Apuan Alps Geopark, in its limited surface, has got an extraordinary variety of landscape and environment. These natural treasures, both of geological and geomorphological interest, host a large biodiversity. The Geopark Rangers have set up educational panels about geosites, flora and fauna, along a few trails signposted by the Club Alpino Italiano (Italian Alpine Club), with the aim of promoting these great natural treasures. This in order to increase the number of potential tourists in the Geopark area. Paths wind upwards from valley level through different vegetation belts and reach up to the summit meadows and rocky peaks. Visitors are able to spot the typical wildlife and plants, in addition to some of the most important geosites in the Apuan Alps Geopark. The Mouflon trail has a total length of approx 15 km and criss-crosses an area where these wild ungulates are widespread and the common thread in all the trekking trails.

About Tills and erratics in the Aspiring geopark Hondsrug (the Netherlands)

Roelfs G. ([a])

([a]) Provincie Drenthe, The Netherlands, (g.roelfs@drenthe.nl)

The Hondsrug area (the Netherlands) is a unique remnant of an old Saalian glacial lineation, a NNW-SSE orientated complex of till covered megaflutes (e.g. Bennet and Glasser, 2009). Recent study of erratics, clayminerology, sedimentological structures and groundpenetrating radar gives insight in the forming-conditions of these till-ridges and contributes to a new glacial model of the onland Hondsrug-Hümmling Ice Stream (fig. 1). The model implicates the source area of the ice stream in present North Sea area, the Hondsrug area, as well as the area where clasts and sediments were dumped in the Münster Basin in Germany (Bregman & Smit, 2013)

Since till deposits reflect glacial history this is one of the aspects in the study.

In general, two groups of till are found in the Hondsrug area, which can be dinstinguished on flint-content and colour: ‘grey’Assen-group rich in flint, and ‘red’ Emmen-group poor in flint. The boulder configurations of the tills are almost identical and are classified as East Baltic.

In general, the Emmen-type lies over the Assen-type. The Emmen-type gets its colour from Devonian old red sandstone and iron-rich regional deposits, whereas the Assen-type contains German pleistocene clays. Oxidized Assen-type till can have the same colour as Emmen-type.

Therefore flint-content is used as criterion for distinction of the two tills.

So, color, flint content and boulder configuration give in addition to other observations insight in the unigue now well known glacial history of the Hondsrug-area.

Boulders are rewarding not only for research reasons, but also for educational purposes. Since the start of the Geopark de Hondsrug-initiative several courses on recognizing boulders have been given. The participants were surprised by the variety, composition and colours. They also are taught on the way rocks are formed and how the pebbles and boulders came to the geopark area. In an easily accessible way people get familiar with different geological processes and the history of an area. Many of the students follow continuation-courses and attend excursions.

The main characteristic for both tills of the Hondsrug is the presence of rapakivi. On the Hondsrug these reddish boulders are considered “house sparrows” under the boulders, because they are so numerous.

KEYWORDS*:* Saalian Ice age, megaflutes, tills, erratics, geo-education

12th European Geoparks Conference
National Park of Cilento, Vallo di Diano and Alburni Geopark-
Italy, 4th-6th September 2013

Ruyang Gooup Geological Heritage Characteristics and Geopark Construction in the South Rim of North China Platform

Xuejun C. ([a, b]), Zhonghui Z. ([a, b]) & Fengjun D. ([a])

([a]) Henan Institute of Geology Survey, Zhengzhou, Henan Province 450001

([b]) Henan Shanshui Geological Tourism Resources Development Ltd., Co, Zhengzhou, Henan Province 45000

Ruyang Group is the first set of terrigenous elastic after the formation of North China Plate crystalline basement, which is the key area in the comparative study between Mesoproterozoic and Neoproterozoic of North China Plate and Sinian Period of Yangtze Plate. Complex paleogeographic environment during the period made rich and typical geological heritages occur in the set of strata. Moreover, specific combination with red quartzose sandstone and mudstone bring us the landform scenery in the area where Ruyang Group distributes as the perfect place to build a geopark. As we know, Ruyang Group is one of the most important geological heritages and geological sceneries in Yuntaishan Global Geopark, Songshan Global Geopark and Wangwushan-Daimeishan Global Geopark and the research on the distribution rule and sedimentary evolution characteristics of Ruyang Group is conducive for the tourists to improve the cognition of Ruyang Group geological heritages and is conducive to protect the typical and systematic geological heritages of Ruyang Group and achieve the geological tourism sustainable development of the type of geoparks. This article presents the thought of development of the type of geoparks and the orientation of geopark further construction on based on the discussion of distribution characteristics, evolutionary history, geological heritages and the geopark construction situations of in Ruyang Group distribution area

KEY WORDS: Ruyang Group, lithofacies palaeogeography, geological heritages, sustainable development

The longevity, an immaterial geo-heritage in Fengshan, Leye-Fengshan Global Geopark

WEI Y. ([a])

([a]) Leye-Fengshan Global Geopark, Tourism Office, Balie, Fengcheng Town, Fengshan County, Hechi City, Guangxi Province, China. E-mail: weiyelie@163.com

Leye-Fengshan Geopark is located in Leye County and Fengshan County in northwest Guangxi, China. It has 132 geosites distributed in eight scenic areas, including cone karst, poljes, tiankengs (great dolines), caves, karst windows and large subterranean river systems. The Geopark has developed geotourism routes, which include general sightseeing, eco-experience tours, adventure experience tours and professional adventure tours.

1 Longevity survey :

- At the end of 2012, the county census registered 70 centenarians for a population of 208 889， that means 3.3/10000 of the total population, the highest percentage of centenarians in the world.
- The life expectancy is 78.2 years, higher than the national level of 74.8 years.
- In 2012, Fengshan had a population of 26872 people who aged over 60. - Among them, 4039 people who aged over 80 (15.03%).

2 Main reason for the longevity:

- The quality of the environment: High forest coverage, ambient air and water quality.
- The organic and ecological food herited from local traditions.
- The practice of physical activities : lifelong diligent work and exercise
- The style of life : eat well, keep calm and happy.
- The harmonious society.

The longevity is an important part of our geo-heritage and a powerfull factor of attractivity : our local products and the time spent to visit our geopark can claim the virtue of increasing our visitor’s life! For this reason, to record and protect this particular feature is one of our goals.

CONTENTS KEY NOTES

CONTENTS SHORT PAPER

CONTENTS ABSTRACT

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ISBN 978-88-907281-4-3
9 788890 728143