

Proceedings

of the

11TH **EUROPEAN GEOPARKS CONFERENCE**

19 > 21 September 2012
Arouca Geopark
Portugal

smart

inclusive

sustainable

growth

EDITORS

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References to this volume

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11th European Geoparks Conference 2012
Arouca Geopark, Portugal, 19-21 September 2012

Organized on behalf of the European Geoparks Network by the Arouca Geopark and the Municipality of Arouca

Under the auspices of



United Nations
Educational, Scientific and
Cultural Organization



Foreword

In less than two years, we wrote two pages in the history of our territory, a land of heritage: the Arouca Geopark. In November 2011, we discussed and clarified the innovative concept of geotourism, in an International Congress that brought to Arouca the most renowned world experts on this matter. Here we shared ideas and good practices, enhancing our action carried out with know-how and excellence, so that we can continue to be a reference, either as a touristic destination, either by promoting culture and science.

We welcome now the 11th European Geoparks Conference, that brings to Arouca Geopark representatives from all the Geoparks of the Networks (European and Global), with the support of UNESCO. During these days, we may consider Arouca the world's «geo-capital», where territories with those characteristics share knowledge about smart, inclusive and sustainable growth. Here, we will discuss the importance of education and pedagogic projects, the geoconservation and geotourism, the economic potential and the sustainable and distinctive character of our territories. We also welcome the new classified territories, especially Azores, as intended to be the third national geopark.

During this event, you'll get to know our dynamic and the true pulse of the territory. You'll get to know our story, you'll see as we look at heritage, as we preserve it, as we have turned our geosites visitable, subject of study and real testimonies of Earth History.

Your presence, your experience and the exchange of ideas are of great importance for us. On behalf of the municipality of Arouca and all the Arouca Geopark inhabitants, I give you a warm welcome, certain that we will come out of this conference and from Arouca Geopark more lucid and aware of the sustainable and distinctive character of these territories, and of the need to enhance their specificities and their resources.

19th september of 2012
José Artur Neves
Mayor of Arouca Municipality

Foreword

Welcome to the 11th European Geoparks Conference!

Today, it is our great pleasure to welcome you with the same dignity with we face the mission to preserve for the future the memories, experiences, natural resources, Nature, geological heritage, monuments, traditions, history and cultural diversity of the different territories that compose the European and Global Geoparks Networks.

Arouca has witnessed over the last years the consolidation of a strategy for social-economic development designed primarily for the tourism sector, namely the Cultural Tourism, Nature and Adventure Sports, creating the necessary condition to enjoy the beauty, and diversity of our "habitat" and implementing works of construction of infrastructure and equipments.

Being the host of the 11th European Geoparks Conference, it is our responsibility to pursuit the outlined objectives for this international meeting. After giving some thought to the "smart, sustainable and inclusive growth in Geoparks", new ideas and strategies will certainly be defined.

AGA - Arouca Geopark Association - is, since the beginning, partner and developer of this policy of sustained and inclusive growth, promoting environmental education actions, respecting life experiences, many of them ancient, and bringing to action those who really know, feel and protect heritage, which is legacy of no one but surely of us.

I wish all the participants of this meeting and future members of the Network the necessary wisdom and courage to reach the message that sustainable development is a compulsory subject for reflection nowadays, being an important, complex, as well as urgent issue and enhancing of positive results, thanks to the contributions of all of us.

19th september of 2012

Margarida Belém

President of the Board of Directors of Arouca Geopark Association

Foreword

"From dream to reality" could be the right phrase to use to help illustrate the existence of the Arouca Global Geopark. A multifaceted territory, where a set of geological features, linked to our historical and cultural heritage, allowed its recognition as a member of the European and Global Geoparks Networks, under the auspices of UNESCO, in April 2009.

This serious commitment was assumed right at the beginning by the Arouca Global Geopark, to be a territory which contributes effectively to the consolidation and affirmation of the Geopark movement, which here at this meeting will reach its highest point. When assuming the responsibility for the organization of the 11th European Geoparks Conference, the territorial management organisation (AGA-Arouca Geopark Association) elected as the Conference theme "Geoparks: territories with smart, inclusive and sustainable growth", in line with the "Europe 2020" strategy of the European Union. In fact, the territorial dynamics developed by the current 50 Geoparks of the European Network, the regional branch of UNESCO's Global Geoparks Network, has shown the ability of these territories to meet and enhance significantly all territorial synergies, based on its geological heritage, placing them at the service of local people and visitors. It is this reality that will lead us during this Conference to share and discuss the realities of our territories with 325 delegates, representing 43 countries of 5 continents. The abstracts present in this volume are the best witnesses to this growing reality. Through them it is possible to evaluate how important Geoparks are within territories for the development of Science and Education, or for the implementation of activities related to Geotourism, where we have many examples of good practices which, in turn, leads to an increasing process of certification of the quality of products and services in these areas. And the best example of this is a strong movement, is the fact that the largest number of papers submitted to this Conference cover the territories who aspire to become members of the Global Geoparks Network. In this sense, there is an imperative the need for policy makers from all countries with Geoparks, or with projects under development, to understand the need to support unconditionally the aspirations of this global network, to obtaining the formal designation "UNESCO Geoparks". This will bring a huge visibility to these territories, allowing to the different territorial management structures develop partnerships and projects of greater magnitude targeting a real smart, inclusive and sustainable growth of their territories.

19th september of 2012

Artur Abreu Sá

Scientific Coordinator of Arouca Geopark

Chair of the 11th European Geoparks Conference



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The 11th European Geoparks Conference will be organized by AGA – Arouca Geopark Association in cooperation with the Arouca Municipality.

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- Margarida Belém, Arouca Municipality and AGA – Arouca Geopark Association
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Adília Cruz, President of the Secondary School of Arouca



Keynotes

José Manuel Durão Barroso, President of the European Commission

- Key priorities of Europe 2020 Strategy: application to the European Geoparks

Nickolas Zouros, Coordinator of the European Geoparks Network

- Measuring progress in European Geoparks: a contribution for a smart, sustainable and inclusive growth of Europe

Hervé Passamar, Director of the Agency for the Development and the Enhancement of Heritage

- Analysis and studies of the social and economic impact of heritage



aims

- To reflect about the European Geoparks Network progress;
- To contribute for the smart, sustainable and inclusive growth of the European Geoparks;
- To share good experiences on Education Programs and Projects;
- To consolidate the European Geoparks as territories of excellence for Geotourism;
- To exchange new trends on geoconservation strategies;
- To present new public and private investments in Geoparks;
- To certificate Geoparks: a strong tool to foster European Geoparks.



presentation and topics

Oral and poster presentations will be planned on the following topics:

1. Smart, Inclusive, and Sustainable growth in Geoparks
2. Geoparks, Geotourism and Territorial Management
3. Education in Geoparks
4. Science and Research in Geoparks
5. Geoconservation: new challenges for Geoparks
6. Geoparks good practice projects
7. Labels, Certifications and Quality in Geoparks
8. Aspiring Geoparks



partners

- European Geoparks Network
- Global Geoparks Network
- ADRIMAG – Local Action Group
- Secondary School of Arouca
- University of Trás-os-Montes e Alto Douro
- Geosciences Centre of University of Coimbra
- Earth Sciences Centre of University of Minho

- Portuguese National Commission for UNESCO
- Portuguese National Committee for the International Geoscience Programme (IGCP-UNESCO)
- IUGS – International Union of Geological Sciences – Geoheritage Task Group
- ProGEO Portugal
- Portuguese Geoparks Forum
- Porto and North of Portugal Tourism Entity
- ISLA - Higher Institute of Languages and Administration
- Portuguese Mines and Geological Sites Route
- Centenary of Tourism in Portugal (1911 - 2011)
- Geological Interpretative Centre of Canelas

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Comissão Nacional da UNESCO - Portugal
Portuguese National Commission for UNESCO



Comité Nacional para o Programa Internacional de Geociências (IGCP) Portugal





11th European Geoparks Conference - Programme

September 19th - Wednesday

08h30 Opening of the Secretariat at the Secondary School of Arouca

ROOM: HALL 1

10h00 Official opening of the Conference

11h15 Inauguration of GeoExpo'12

11h30 Coffee-break

ROOM: HALL 1 – Keynotes

12h00 *Key priorities of Europe 2020 Strategy: application to the European Geoparks*
José Manuel Durão Barroso (President of the European Commission)

12h30 *Measuring progress in European Geoparks: a contribution for a smart, sustainable and inclusive growth of Europe*
Nickolas Zouros (Coordinator of the European Geoparks Network - Greece)

13h00 *Analysis and studies of the social and economic impact of heritage*
Hervé Passamar (Director of the Agency for the Development and the Enhancement of Heritage - France)

13h30 Lunch at Secondary School canteen

Parallel sessions of oral communications

15h00	ROOM: HALL 2	ROOM: HALL 3	ROOM: HALL 4	ROOM: HALL 5
	Panel 1	Panel 2	Panel 3	Panel 4
	Science and Research in Geoparks	Geoconservation: new challenges for Geoparks	Labels, Certifications and Quality in Geoparks	Education in Geoparks
	<i>Chairpersons</i> Marie-Luise Frey João Carlos Nunes	<i>Chairpersons</i> José Brilha Patrick McKeever	<i>Chairpersons</i> Vesa Krökki Stéphane Légal	<i>Chairpersons</i> Elizabeth Silva Wesley Hill
15h00	"PECULIAR TAFONI STRUCTURES AT SITIA NATURE PARK: A PRELIMINARY STUDY" (C. Fassoulas & S. Staridas)	"EXPANDING THE GEOCONSERVATION TOOLBOX: DIGITAL DOCUMENTATION FOR INTEGRATED HAZARD ASSESSMENT AT THE GIANT'S CAUSEWAY WORLD HERITAGE SITE" (A. Bratton, B. Smith, J. McKinley & K. Lilley)	"VALORISING PALAEOLOGICAL HERITAGE THROUGH THE DESIGN OF GEOPARK PRODUCTS" (B. Moreno & A. Serna)	"TERRA.GENESIS – A 3D-VIDEO-ANIMATION EXPLAINING THE LOCAL EARTH HISTORY TO A WIDE PUBLIC" (T. Kluttig & H. Escher)
15h15	"EVAPORITES IN SICILY: GEOLOGICAL AND KARST FEATURES" (G. Madonia, M. Vattano & F. Chiaramonte)	PPF CONCEPT: CREATING A NEW STRONG GEOPARK IDENTITY IN FRONT OF OTHER WORLD UNESCO TERRITORIES (G. Martini)	"THE GREEN MARKET IN GEOPARKS THROUGH ECO-LABELS" (N.T. Farsani, C. Coelho & C. Costa)	"THE GLOBAL WATER CRISIS: AN EDUCATIONAL ROLE FOR GEOPARKS" (T. Ramsay)
15h30	" <i>Cloudina</i> IN THE VILLUERCAS-IBORES-JARA GEOPARK (EXTREMADURA, SPAIN): SOME OF THE OLDEST SHELLED ANIMALS" (I. Cortijo, M. Martí Mus, S. Jensen & T. Palacios)	"KENTS CAVERN JAWBONE THE OLDEST HUMAN FOSSIL IN NW EUROPE DISCOVERED IN THE ENGLISH RIVIERA GLOBAL GEOPARK" (N. Powe)	"LABELS, CERTIFICATIONS AND QUALITY IN GEOPARKS – THE BURREN & CLIFFS OF MOHER EXPERIENCE" (C. Gleeson, K. Webster & T. O'Dwyer)	"ANALYSIS AND CONCLUSIONS FROM A STRUCTURED GEOSCIENCE TEACHING METHODOLOGY, CHABLAIS GEOPARK" (A. Guyomard, J.-P. Fillion, S. Justice & N. Kramer)
15h45	"INVESTIGATING DINOSAURS IN MAESTRAZGO CULTURAL GEOPARK (TERUEL, SPAIN)" (L. Alcalá, A. Cobos, E. Espílez, F. Gascó, A. González, L. Mampel, M.D. Pesquero & R. Royo-Torres)	"THE PROTECTED EVAPORITE AREAS NETWORK OF SICILY" (M. Panzica La Manna & F. Chiaramonte)	"INTEGRATION OF COMMUNITY PARTICIPATION IN GEOPARK KEY MANAGEMENT PROCESSES – ENHANCEMENT OF ACCOUNTABILITY FOR SUSTAINABLE DEVELOPMENT" (C. Eckhardt)	"ENVIRONMENTAL EDUCATION IN ADAMELLO BRENTA" (R. Zoanetti, V. Masè & G. Bazzoli)
16h00	"SEISMOLOGY IN GEOPARKS – AN IRISH PERSPECTIVE" (T. Blake, P. J. O'Connor & K. Webster)	"GEOHERITAGE AND GEOPARKS: A TOOL FOR LOCAL SUSTAINABLE SOCIO-ECONOMICAL DEVELOPMENT IN DIFFERENT REGION OF MOROCCO" (E. Errami, N. Ennih, M.	"AROUCA GEOPARK: A TERRITORY WITH QUALITY MANAGEMENT ISO 9001:2008 AND A BRAND'S CERTIFICATION" (A. Duarte, R. Neves & D. Rocha)	TEACHER AND MANAGERS TRAINING IN ARARIPE GEOPARK" (M. Galvão & N. Almeida)

16h30 Coffee-break				
17h15	ROOM: HALL 2	ROOM: HALL 3	ROOM: HALL 4	ROOM: HALL 5
	Panel 1	Panel 2	Panel 8a	Panel 4
	Science and Research in Geoparks	Geoconservation: new challenges for Geoparks	Aspiring Geoparks	Education in Geoparks
	Chairpersons Nickolas Zouros Manuela Catana	Chairpersons Guy Martini Martina Stupar	Chairpersons Ánchel Belmonte Ribas Andreas Schuller	Chairpersons Flávia Lima Alexia Amorfini
17h15	"SCIENTIFIC RESEARCH IN THE GEOPARK CARNIC ALPS – A NEVER ENDING STORY" (H. P. Schönlaub)	"GEOHERITAGE OF TERRAS DE CAVALEIROS ASPIRING GEOPARK (NE PORTUGAL): INVENTORY AND ASSESSMENT" (D. Pereira, J. Brilha & P. Pereira)	"THE TROODOS MOUNTAIN, A UNIQUE GEOSITE OF GEOLOGICAL HERITAGE IN CYPRUS AND A PROPOSED GEOPARK" (E. Tsiolakis, E. Morisseau, T. Tsintides, T. Papachristoforou & K. Vasilou)	"AZORES GEOPARK PROJECT: INTERPRETING THE AZOREAN GEOLANDSCAPES" (E. Lima, P. Garcia & C. Viveiros)
17h30	"ASSESSMENT OF GEOSITES TOURISTIC VALUE IN GEOPARKS: THE EXAMPLE OF AROUCA GEOPARK (PORTUGAL)" (P. Pereira & D. Pereira)	CHALLENGES FOR A GEOCONSERVATION STRATEGY OF THE PALAEOONTOLOGICAL HERITAGE IN ARARIPE GEOPARK (CEARÁ, NE BRAZIL) (M. Vilas-Boas, F. Lima & J. Brilha)	"METEORUM GEOPARK PROJECT, SWEDEN" (T. Jacobs & S. Johansson)	"COURSES FOR GEOTOUR-GUIDES AND A NEW GEOLOGICAL VISITOR CENTRE IN THE ASPIRING BAKONY–BALATON GEOPARK, HUNGARY" (B. Korbély & A. Knauer)
17h45		"CULTURAL AND ARCHAEOLOGICAL HERITAGE OF THE PARYS COPPER MINE, ANGESLEY, NORTH WALES" (M. Wood & J. Conway)	"THE OLDER THE VOLCANIC ISLANDS, THE RICHER THEIR GEODIVERSITY. THE CASE OF PORTO SANTO (MADEIRA ARCHIPELAGO, PORTUGAL) AND ITS POTENTIAL FOR GEOPARK" (M. Ferreira, M. Cachão, J. Silva & F. Rocha)	"ARARIPE GEOPARK AND THE SUMMER CAMP IN THE GEOSITES" (M. Galvão, L. Macedo & M. Holanda)

18h00 Poster session in the GEOEXPO'12 ROOM

"A FANTASTIC LANDSCAPE FORMED FROM ERUPTIVE PRODUCTS OF BATUR VOLCANO; A CHARACTERISTIC FOR GEOPARKS IN BALI, INDONESIA" (H. Samodra, Achyaruddin, S. Permanadewi, D. Rahadian & Herlina)

"CONTRIBUTION TO SUSTAINABLE AND INCLUSIVE DEVELOPMENT IN THE ARARIPE BASIN" (I. F. Freitas, J. V. Monteiro & F.F. Lima)

"GEOCONSERVATION IN THE ORDOVICIAN OF PORTUGAL: THE VALONGO PALAEOZOIC PARK, THE GEOLOGICAL INTERPRETATION CENTER OF CANELAS AND THE PENHA GARCIA ICHNOLOGICAL PARK" (H. Couto, M. Valério & C. N. Carvalho)

"ASPIRING GEOPARK OF MENORCA ISLAND: GEODIVERSITY AND GEOLOGICAL HERITAGE IN A BIOSPHERE RESERVE" (R. Quintana, D. Carreras, S. Mari & J. Orfila)

"GEO-TRAILS IN THE ORDOVICIAN OF PORTUGAL" (M. Valério, C. N. Carvalho & H. Couto)

"INTEGRATED CULTURAL LANDSCAPES: A CONCEPTUAL FRAMEWORK OF HERITAGE AND GEO(CULTURAL)TOURISM IN TERRITORY ENHANCEMENT (SERRA DA ABOBOREIRA, BAIÃO)" (J. Lucas, L. Soares & E. Pacheco)

"IVALOJOKI PLACER GOLD AREA IN FINNISH LAPLAND, WORTHY CANDIDATE OF THE EGN" (P. Johansson, K. Launonen & J. Seurujärvi)

"PERCEPTIONS AND IDEAS ABOUT GEOPARKS EXPRESSED BY STUDENTS OF A SECONDARY SCHOOL OF PORTUGAL" (C. Tomaz, M. H. Henriques & A. A. Sá)

"PROTECTING AND USING GEOSITES: A PROJECT TO ESTABLISH GEOHERITAGE MANAGEMENT PROCEDURES" (A. Carvalho, P. Pereira & J. Brilha)

"THE TRILOBITES TOUR ROUTE IN PORTUGAL – DEVELOPING THE FIRST GEOTOURISM ITINERARY DEDICATED TO ORDOVICIAN PALAEOBIODIVERSITY" (C. N. Carvalho, H. Couto, M. Valério & T. Oliveira)

"TUNGSTEN LEGACY IN AROUCA GEOPARK" (G. Brandão & V. Magalhães)

"THE LOCAL NETWORK OF TRAILS IN BEIGUA GEOPARK: RAISING GEOTOURISM, SUPPORTING LOCAL ECONOMY" (M. Burlando, M. Firpo, C. Queirolo, M. Vacchi & M. Moretti)

"BUILDING A GEOPARK WITH A BRIGHT FUTURE: CASE STUDY OF THE OKI ISLANDS GEOPARK" (K. Nobe & M. Hirata)

"LANDSLIDE MORPHOLOGY AT BATUR VOLCANO AREA" (S. Hadian, Z. Zakaria & S. Suwardi)

"THE SESIA SUPERVOLCANO: A PROPOSAL TO CREATE A NEW GEOPARK UNDER THE AUSPICES OF UNESCO" (A. Freschi, J.E. Quick & S. Sinigoi)

19h00 End of the Scientific Sessions of Day #1.

Cultural Programme in the Arouca Monastery and in the Centre of town.
Guided visit of the Arouca historical centre
Venue: Church and Monastery

19h30 Dinner at local restaurants (vouchers).

22h00 Folklore Workshop
Venue: Brandão de Vasconcelos Square

September 20th - Thursday

Parallel sessions of oral communications				
09h30	ROOM: HALL 2	ROOM: HALL 3	ROOM: HALL 4	ROOM: HALL 5
	Panel 5	Panel 6	Panel 7	Panel 4
	Inclusive, Smart and Sustainable growth in Geoparks	Geoparks, Geotourism and Territorial Management	Geoparks good practice projects	Education in Geoparks
	<i>Chairpersons</i> Nick Powe Pablo Rivas	<i>Chairpersons</i> Luis Alcalá Claudia Eckardt	<i>Chairpersons</i> Kristin Rangnes Ronaldo Gabriel	<i>Chairpersons</i> Ingeborg Klepp Maria Helena Henriques
09h30	"PRECIOUS TIMES: HAPPY SPENDING IN THE GEOPARK" (I.Auer & H.A.Kollmann)	"THE DEVELOPING PARTNERSHIP BETWEEN THE PORTES DU SOLEIL AND THE CHABLAIS GEOPARK, FRANCE" (B. Cherblanc, C. Mutillod, A.Guyomard & J.P. Fillon)	"GEO-WINE-TOURISM PROJECT" (Y. Menet, L. Reynaud & C. Balme)	"ECOLOGICAL EDUCATIVE CAMPUS OF SEIXOSO" (M. J. Castelo Branco)
09h45	"ARARIPE GEOPARK, SOCIAL INCLUSION AND ART PROJECTS" (T. Riedl)	"GUIDING GEOTOURS ON THE FIELD IN MOUNTAIN AREAS: THE ROLE OF MOUNTAIN LAEDERS IN THE BAUGES GEOPARK, FRANCE" (C. Peisser, P. Renau, J. Desbois & E. David)	"RAISING PUBLIC AWARENESS ON NATURAL DISASTERS AND THE ROLE OF GEOPARKS" (C. Fassoulas, N. Zouros & G. Martini)	"PREADAPTION OF THE EDUCATIONAL PROGRAMME ROCHA AMIGA (FRIENDLY ROCK) TO GEOPARKS" (M. Cachão, M. Ferreira, U. R. Azevedo & M. Machado)
10h00	"FOLLOWING THE TRAIL OF THE MEDIEVAL IRON INDUSTRY IN THE BASQUE COAST GEOPARK (GIPUZKOA, BASQUE COUNTRY, W PYRENEES)" (J. Poch, X. Orue-Etxebarria & J. Castro)	"GEOWORLD TRAVEL: A BUSINESS PROPOSAL FOR SUSTAINABLE GEOTOURISM IN GEOPARKS" (J. Cresswell & T. Ramsay)	"ALTOGETHER ARCHAEOLOGY: A COMMUNITY PROJECT IN THE NORTH PENNINES AONB & GEOPARK" (P. Frodsham & E. Pickett)	"PROVIDING A LINK BETWEEN THIRD LEVEL EDUCATION AND THE LOCAL COMMUNITY IN THE BURREN & CLIFFS OF MOHER GEOPARK" (E.Doyle)
10h15	"ACCESSIBLE GEOPARKS, GEOPARKS FOR ALL" (J.M. Barrera & J.M. Corrales)	"GEOTOURISM AND THE DEVELOPMENT OF RURAL AREAS IN THE AZORES ISLANDS" (C. Viveiros, E.A. Lima & J.C. Nunes)	"BURREN ECOTOURISM: THE 'FACE' OF THE BURREN & CLIFFS OF MOHER GEOPARK" (T. O'Dwyer, C. Gleeson & K. Webster)	"AN INTERACTIVE GUIDE FOR SMARTPHONES AND TABLET-PCs TO DISCOVER MARSH PLANTS IN GLACIAL AND PERIGLACIAL GEOSITES IN THE APUAN ALPS" (A. Amorfini, A. Bartelletti, E. Guazzi & G. Ottria)
10h30	"THE VILLAGE OF MONTIROND, SUSTAINABLE DEVELOPMENT IN PARTNERSHIP WITH THE CHABLAIS GEOPARK, FRANCE" (A.Peersman, J.P.Fillion & A.Guyomard)	"DEVELOPMENT OF GEOTOURISM IN THE BOHEMIAN PARADISE GEOPARK" (T. Řídkošil & M. Pásková)	"COMMUNICATION TOOLS OF THE AZORES GEOPARK PROJECT" (E.A. Lima, J.C. Nunes, M.P. Costa, C. Viveiros & F. Gonçalves)	"MUSEUM NETWORK AS EDUCATIONAL AND DISSEMINATION TOOL IN CILENTO AND VALLO DI DIANO GEOPARK" (A. Aloia, N. Catino, A. de Vita, D. Guida, E. Pescatore & M P. Positano)

10h45	PROJECT YOUNG PALEONTOLOGISTS IN THE ARARIPE GEOPARK'S TERRITORY (Y. Felix, F. Freitas, F. Lima, F. Neres, F. Alencar & L. Freire)	"CONNECTING LOCAL GEOTOURISM INITIATIVES INTO WIDER TOURISM NETWORKS" (J. Karkut)	"AZORES ISLANDS AND QUATERNARY VOLCANOES GEOPARKS: A NETWORKING PROPOSAL" (J.C. Nunes, E.A. Lima, M.P. Costa & C. Viveiros)	"COPPER COAST GEOPARK - VISUALISING MOUNTAIN TO SEA IN 3D" (S. Gatley, J.H. Morris, E. McMonagle, R. Scanlon & K. Verbruggen)
11h00 Coffee-break				
11h45	ROOM: HALL 2	ROOM: HALL 3	ROOM: HALL 4	ROOM: HALL 5
	Panel 5	Panel 6	Panel 7	Panel 4
	Inclusive, Smart and Sustainable growth in Geoparks	Geoparks, Geotourism and Territorial Management	Geoparks good practice projects	Education in Geoparks
	Chairpersons: João Carlos Pinho Aniello Aloia	Chairpersons: Tony Ramsay Francesco Chiaramonte	Chairpersons: Jutta Weber John Conway	Chairpersons: Violette Masé Timo Kluttig
11h45	"GEODIVERSITY INTEGRATION AND RELIGION IN THE COLINA DO HORTO GEOSITE" (I. F. Freitas, J. V. Monteiro & F. F. Lima)	"NEW EQUIPMENTS FOR THE GEOPARK INTERPRETATION, INFORMATION AND TOURISM IN VILLUERCAS IBORES JARA" (J. M. Barrera, J. López & M.J Rosado)	"MONITORING GEOSITES: A GEOCONSERVATION TOLL AT AZORES GEOPARK" (A. Lima, J.C. Nunes & J. Brilha)	"AN OVERVIEW OF THE FIVE YEARS OF THE NATURTEJO GEOPARK (PORTUGAL) EDUCATIONAL PROGRAMMES AND THE NEXT CHALLENGES" (M. M. Catana)
12h00	"PAIGNTON GEOPLAY PARK, A COMMUNITY PROJECT IN THE ENGLISH RIVIERA GLOBAL GEOPARK" (M. Border)	"ROKUA GEOPARK OUTDOOR GUIDE" (J. Nenonen & T. Tervo)	"HERITAGE INTERPRETATION USING NEW TECHNOLOGIES" (R.Barton, D. Cooper, A.Guyomard, S.Justice, P.Samson, E. Pickett, C.Posthumus & Dirk Jan Lekkerkerker)	"THREE YEARS OF A SCHOOL CONTEST BETWEEN PORTUGUESE GEOPARKS ON EDUCATION FOR SUSTAINABLE DEVELOPMENT" (E. Silva, D. Rocha & M.M. Catana)
12h15	"COMMUNITY SUPPORT AND INVOLVEMENT: KEYS TO PROMOTE SUSTAINABLE DEVELOPMENT OF GEOPARKS" (Y. Zhu)	"SUSTAINABILITY AT A MASS TOURISM «HONEYPOT»" (K. Webster)	"NEW DEVELOPMENT STRATEGIES: I-PARKS PROJECT CABO DE GATA-NÍJAR GEOPARK AS AN EXPERIMENTAL TERRITORY" (J.M. Quero, P. Rivas, V. Vargas, J. Navarro & M.M. Molina)	"IN AND OUT – INTO THE OUTDOOR CLASSROOMS ADAPTION OF NEW SUBJECT-RELATED APPROACHES IN DIFFERENT LEARNING ENVIRONMENTS" (K. Barfod, A. Alesandru, M. Lindner, E. Kätting, K. Johansson, M. Skånstrøm, & R. Gräfe)

12h30	"SOCIAL VEGETABLE GARDEN # 3: HEALTHY, FAMILY, COMMUNITY AND SUSTAINABLE HORTICULTURE IN NATURTEJO GEOPARK (PORTUGAL)" (M. M. Catana & M. A. Catana)	"GEOTOURIST AND HIKING MAP OF THE APUAN ALPS: THE FINAL PROJECT" (G. Ottria, A. Amorfini, A. Bartelletti, E. Guazzi & S. Ravani)	"THE USE OF MODERN TECHNOLOGIES IN ASSESSING GEOTOPES AND DEVELOPING MANAGEMENT PLANS IN GEOPARKS: THE CASE OF SITIA NATURE PARK" (C. Fassoulas & S. Staridas)	"GEOLOGISTS MEET ARTISTS" – COMMUNICATING GEOLOGY THROUGH ART" (M. Holte & K. Rangnes)
12h45	"SMART & INCLUSIVE DEVELOPMENT IN LOCAL COMMUNITIES, AN ENTERPRISE IN QESHM GEOPARK" (A. Amrikazemi & N. Badri)	"AFRICAN GEOPARKS NETWORK: CHALLENGES AND PERSPECTIVES" (E. Errami, L. Andrianaivo & M. Gaulty)	"FLYSCH, THE WHISPER OF THE ROCKS": A SCIENTIFIC DOCUMENTARY FOR THE INTERNATIONAL PROMOTION OF THE BASQUE COAST GEOPARK" (A. Hilario)	"GEOMINING HERITAGE IN NATURTEJO GEOPARK (PORTUGAL) – THE ROLE OF TEMPORARY EXHIBITIONS FOR CONNECTING LOCAL COMMUNITIES WITH GEODIVERSITY" (C. N. Carvalho, J. Rodrigues & E. Chambino)
13h00	"PRELIMINARY DATA OF A PROPOSAL FOR A FUTURE AROUCA GEOPARK EXTENSION: THE "MONTEMURO AND GRALHEIRA" TERRITORY" (D. Rocha, A. Sá & J. Brilha)	"THE DREAM MIILE – EXAMPLE OF HOW TO IMPLEMENT GEOTOURISM IN AN ATTRACTION-CLUSTER IN GEA NORVEGICA GEOPARK" (A. Aasmundsen, K. Ragnes & K. Arvesen)	"THE FIRST YEAR OF ESTABLISHMENT: STONEHAMMER" (L. A. Best, D. N. Buhay, & N. Ramsay)	"NATURTEJO GEOPARK SCHOOL PROGRAMME ANIM'A ROCHA AT PORTAS DE ALMOURÃO GEOMONUMENT " (J. Rodrigues, C. N. Carvalho & B. Henriques)
13h15		"THE ICE AGE IN MAGMA GEOPARK" (J. Richard Wilson & Pål Thjømmøe)	"A NEW INTERACTIVE PANORAMIC MAP PRESENTING THE SITES AND SERVICES OF ROKUA GEOPARK" (V. Krökki)	"AN EXPEDITION IN GEOPARK THE HONDSRUG" (H. Wolters & C. Posthumus)
13h30 Lunch at Secondary School canteen				
15h00	ROOM: HALL 2 Panel 8b Aspiring Geoparks <i>Chairpersons:</i> Charalampos Fassoulas Sara Gentilini	ROOM: HALL 3 Panel 6 Geoparks, Geotourism and Territorial Management <i>Chairpersons</i> Melanie Border Jasmine Moreira	ROOM: HALL 4 Panel 7 Geoparks good practice projects <i>Chairpersons:</i> Pål Thjømmøe Alicia Serna Barquero	ROOM: HALL 5 Panel 9 Workshop In and Out <i>Chairpersons:</i> Karen Barfod Alexandru Andrassanu
15h00	"QUADRILÁTERO FERRÍFERO, MINAS GERAIS, BRASIL - ASPIRING GEOPARK: CULTURAL AND NATURAL HERITAGE, DEVELOPING ACTIONS" (U. Ruchkys; M. Machado &	"GLOBAL GEOPARKS IN CHINA" (Zhi-Zhong Zhaoa, Chang-Xing Long, Xiao-hong Yuanb & Yuan Zhengc)	"OUTCOMES FROM 5th INTERNATIONAL UNESCO CONFERENCE ON GEOPARKS AT UNZEN (JAPAN)" (S. Nakada & M. Watanabe)	Workshop "In and Out"

15h15	"CAMINHOS DOS CÂNIOS DO SUL, Aspiring Geopark, SANTA CATARINA AND RIO GRANDE DO SUL STATES – BRAZIL" (C. L. Sung, C. Biléssimo & F. F. Lima)	"REFLECTIONS ABOUT THE GEOTOURISM CONCEPT" (G. Martini, L. Alcalá, J. Brilha, L. Iantria, A. A. Sá & J. Tourtellot)	"WINDOWS INTO THE PAST AND MUCH MORE...THE GEOTOPES OF THE YEAR IN THE GLOBAL AND EUROPEAN GEOPARK BERGSTRASSE-ODENWALD" (J. Weber)
15h30	"DANISH POSSIBILITIES OF GEOPARKS" (A. Petersen)	"FROM A PIT TO A VISITOR CENTRE AS GEOTOURISM ATTRACTION AND LIGHTHOUSE OF THE TOURIST DESTINATION ODENWALD: BUILDING UP A SUSTAINABLE INFRASTRUCTURE AT THE MESSEL PIT WORLD HERITAGE SITE, GEONATUREPARK BERGSTRASSE-ODENWALD, GERMANY" (M.-L. Frey)	"RECOGNISING THE VALUE OF GEOPARKS IN PROMOTING HEALTH: AN INTERDISCIPLINARY APPROACH" (R. Gabriel, E. Gomes, A. Alençõo, L. Sousa, H. Moreira, E. Cabecinha, A. Faria & E. Rosa)
15h45	"GEOPARK ODSHERRED – BECOMING THE FIRST GEOPARK IN DENMARK" (H. Vejre & N. Lemkow)	"CONSERVATION TOOLS OF QESHM ISLAND GLOBAL GEOPARK" (M. Qaseminejad & A, E. Zobeiri)	"MY GEOPARK! HARNESSING THE RICH, NARRATIVE RESOURCES OF INTANGIBLE CULTURAL HERITAGE TO GENERATE ARTS WORKS FOR A POSITIVE REINFORCEMENT OF CIVIC AND INDIVIDUAL IDENTITY IN GEOPARKS" (S. Goldingay)
16h00	"THE IDRJA GEOPARK – FROM THE EXPERTS' IDEA TO FINAL REALISATION WITH PARTNERS" (B. Režun, M. Stupar, M. Peljhan & M. G. Kavčič)	"LESVOS PETRIFIED FOREST GEOPARK (GREECE): AN ATTEMPT TO EVALUATE 10 YEARS OF ACTIVITIES" (M. J. Picas de Carvalho, J. Brilha & N. Zouros)	"FACIES AND PALEO-ENVIRONMENT OF PERMIAN MENGKARANG FORMATION AND ITS IMPLICATION TO POTENTIAL OF PALEOBOTANY" (M. Nainggolan, N. Sulaksana & M. Hadian)
16h15	"GEOPARK'S PROJECT OF EL HIERRO ISLAND: CELEBRATING THE STRONG LINKS BETWEEN PEOPLE AND VOLCANIC HERITAGE" (V. Montero, A. J. Morales, C. Morales, J. R. Zamora, G. Álamo, A. González & J. Poch)	"GEOPARK AROUCA AND THE EUROPEAN CHARTER FOR SUSTAINABLE TOURISM, A LONG "JOURNEY" THAT HAVE JUST STARTED" (P. Castro & C. Gonçalves)	"DEVELOPING AN INTEGRATED GEO-CULTURAL TRAIL" (M. Wood & J. Conway)
16h30 Coffee-break			

	ROOM: HALL 2	ROOM: HALL 3	ROOM: HALL 4	ROOM: HALL 5
	Panel 8b	Panel 6	Panel 7	Panel 9
	Aspiring Geoparks	Geoparks, Geotourism and Territorial Management	Geoparks good practice projects	Workshop <i>In and Out</i>
	Chairpersons: Martina Pasková Eva Lima	Chairpersons Neda T. Farsani Paulo Pereira	Chairpersons: Hans-Peter Schönlaub Diamantino Pereira	Chairpersons: Karen Barfod Alexandru Andrassanu
17h15	"THE PROCESS OF THE MANAGEMENT AND ESTABLISHMENT OF THE BODOQUENA PANTANAL GEOPARK: ADAPTING THE METHOD TO THE CONTEXT" (A.J.S.Soriano, J.Rimoli, G. Brittes, M.A.Turine, N. Brun, F. N. Moura & A.L.Rachid)	"IT'S NOT ONLY GEOTOURISM ! TYPES OF TOURISM IN GEOPARKS, AN ANALYSIS BASED IN 37 GEOPARKS" (J.C. Moreira & G. Meléndez)	"PARTICIPATORY GEOSCIENCES EXPERIENCED IN THE BAUGES GEOPARK (FRANCE)" (F. Hoblea, N. Cayla, C. Peisser, P. Renau, S. Gallino-Josnín & J.L. Desbois)	Workshop "In and Out"
17h30	"THE KOREA DMZ PEACE GEOPARK PROJECT" (C.-H. Kim & S.-H. Jung)	"GEOPARK MANAGEMENT STRATEGY IN KOREA" (S.J. Lee S.W. Jeong, S.C. Jeong, J.H. Lee, M.G. Hwang & J.H. Kim)	"FREE FLIGHT MASTER PLAN PRESERVING ROCK BIRDS" (J-L. Desbois, J. Frachon & G. Richelot)	
17h45	"THE GEOPARK BODOQUENA-PANTANAL LIKE AN OPPORTUNITY OF REGIONAL DEVELOPING" (N. Almeida & S. Alonso)	"COMBINING GEOLOGY AND ARCHAEOLOGY IN IRELAND: A NEW GEOTOURISM RESOURCE" (I. G. Meighan, P. McKeever & M.R. Cooper)	"THE VALENTÍ MASACHS GEOLOGICAL MUSEUM. THE LINK BETWEEN MINERALS AND ROCKS AND THEIR EVERYDAY USE" (F. Climent, J. Biosca, F. Grandia, J.M. Mata-Perelló, D. Parcerisa & J. Sanz)	
18h00	"GEOPARK KARAVANKE/KARAWANKEN – GEO ADVENTURES IN THE CROSS- BORDER GEOPARK BETWEEN SLOVENIA AND AUSTRIA" (S. Fajmut Štručl , M. Bedjanič, L. Rojs, U. Herlec, W. Poltnig, G. Hartmann & P. Vodovnik)	"GEOPARKS PROGRESS IN KOREA AFTER JOINING GGN" (S.J. Lee , S.W. Jeong, S.C. Jeong & J.H. Lee)	"TRANSFER OF THE GRAND TRUNK FOSSIL FOUND IN THE SIERRA NORTE DE SEVILLA Geopark (SPAIN)" (A. Gil Toja & I. Cuenca Bonilla)	
18h15	"THE BEAUTY OF FAR EAST CRETE: SITIA NATURAL PARK" (C. Fassoulas, V. Perakis, C. Mavrokosta & S. Staridas)	"«CLIMATIC THINKING» AND GEOPARKS' ARCHITECTURE" (M. Q. Abdolmalaki, F. Momeni & M. Ziaee Torbati)	"SMARTGUIDES AND TURFHUNTS - APPS IN GEOPARKS" (S. A. Gunnlaugsdóttir & P. Thjømøe)	

18h30	"THE EMILIA ROMAGNA APENNINE GEOPARK PROJECT" (S. Gentilini & M. Panizza)	"AROUCA GEOPARK AND THE PROJECT ROUTES OF WOLFRAM IN EUROPE – MEMORY OF MEN AND INDUSTRIAL HERITAGE – "THE CASE OF "RIO DE FRADES" MINES" (A. Monteiro, A. Neves, L. Aguiar, L. Ferreira & C. Gonçalves)	"ARCHAEOLOGICAL POTENTIAL WITHIN AN INTEGRATED STRATEGY OF GEOPARKS MANAGEMENT: APPLICATION OF PREDICTIVE MODELS IN TERRITORY VALUATION" (L. Soares, A. Costa, E. Pacheco, A. Gomes, C. Ferreira & J. Lucas)	
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18h45 Poster Session in the GEOEXPO'12 ROOM

- "A NEW STRATEGY FOR GEOPARKS IN TUNISIA: GEOLOGY FOR DEVELOPMENT" (H. Mohsen)
- "GEOTOURISM POTENCIAL OF SEMNAN DESERT AND THE DEVELOPING AN ASPIRING GEOPARK (CENTRAL IRAN)" (M. Zandmoghaddam)
- "ASPIRING GEOPARK OF BATUR CALDERA" (H. Samodra, Achyaruddin, S. Permanadewi, D. Rahadian & Herlina)
- "ASPIRING GEOPARK TERRAS DE CAVALEIROS: A PROJECT TO PROMOTE SUSTAINABLE DEVELOPMENT IN NORTHEASTERN PORTUGAL" (B. Pinto, S. Marcos, P. Favas & A. A. Sá)
- "CAJÓN DEL MAIPO GEOPARK PROJECT: PRELIMINARY STUDY" (J. Benado, M. Schilling & J. Brilha)
- "ESTIMULATING A GEOPARK PROPOSAL IN FERNANDO DE NORONHA ARCHIPELAGO – BRAZIL" (J.C. Moreira)
- "FIROUZABAD, WHERE THE GREAT ANCIENT HISTORY ENGAGED WITH CULTUR, NATURE AND GEOLOGY" (A. Amrikazemi & N. Badri)
- "INFORMAL SCIENCE LEARNING IN GEOPARKS" (D. N. Buhay, L. Best & N. Ramsay)
- "MT ARARAT GEOPARK AS A SUGGESTED GEOPARK" (G. Akbulut, C. Sevindi & Y. Güngör)
- "SMALL IS BEAUTIFUL: SÃO PAIO (LABRUGE, NW PORTUGAL), AN EMBRYO TO A GEOPARK INSPIRED IN THE RELATION OF LAND AND SEA?" (M. Abrunhosa & M. A. Araújo)
- "THEMATIC CARTOGRAPHY AS AN INTERPRETATIVE TOOL IN THE NATURTEJO GLOBAL GEOPARK (PORTUGAL)" (S. Canilho, C. N. Carvalho & J. Rodrigues)
- "THE LNEG ATLANTERRA SOUTH PORTUGUESE ZONE GEOSITE CHARACTERIZATION PROGRAM" (J.X. Matos & Z. Pereira)
- "TRANSLATION AS A COMMUNICATION TOOL BETWEEN THE WORLD GEOPARKS" (T. Valero & F.F. Lima)
- "VALLE DEL CROCCHIO ASPIRING GEOPARK (CALABRIA-ITALY)" (F. Colosimo, F. Scarciglia & E. Infelise)

19h30 Closing Ceremony – Hall 1

20h00 Cultural entertainment
Venue: Arouca Monastery

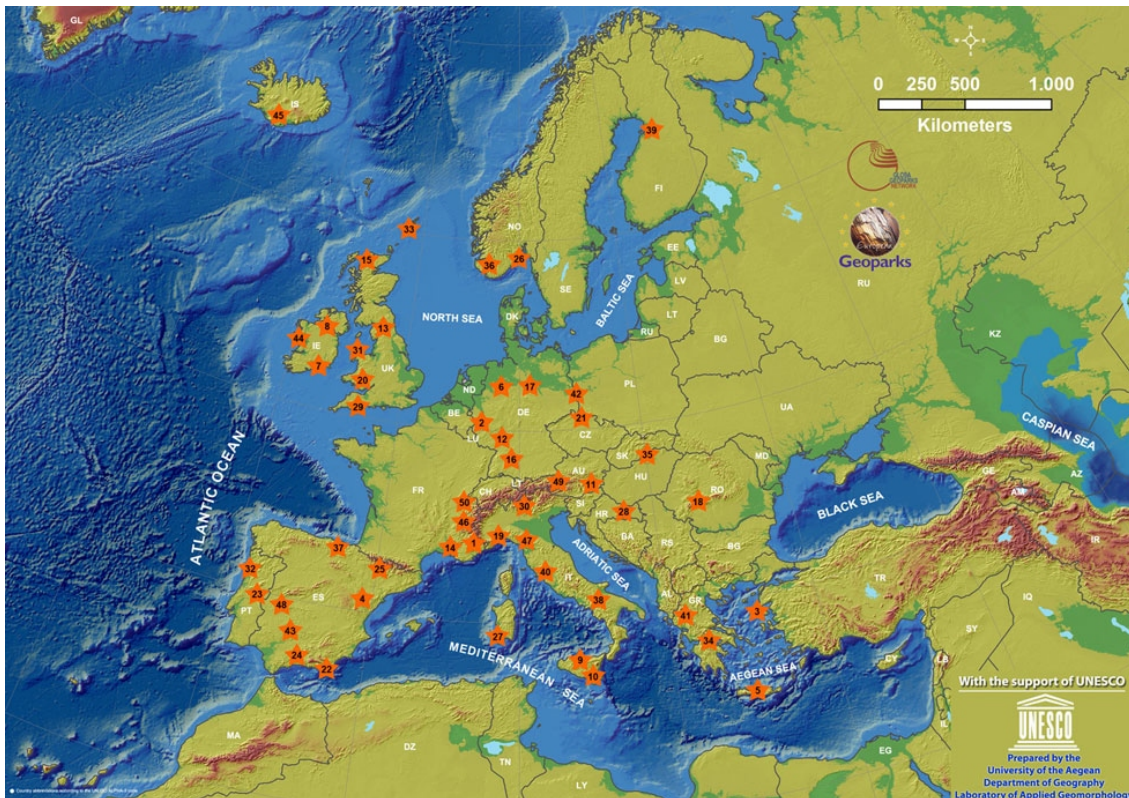
20.30h Congress Dinner at Arouca Monastery National Monument

September 21st – Friday

08h30 – 18h00

Conference Field-Trip: **“The Arouca Geopark”**





Map showing the location of the 50 members of the European Geoparks Network as of March 2012:

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 Eisenwurzten – 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, Toscana – ITALY
41. Vikos – Aaos 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

KEYNOTES

KEY PRIORITIES OF EUROPE 2020 STRATEGY: APPLICATION TO THE EUROPEAN GEOPARKS

José Manuel Durão Barroso
President of the European Commission

Ladies and gentlemen,

I am very pleased to address all of you on the occasion of the 11th European Geoparks Conference.

And I want to thank the coordinator of the European Geoparks Network, Nicolas Zouros, and the Director of the Agency for the development and Enhancement of Heritage, Hervé Passamar, for their leadership and their strong commitment to preserve and promote European geological and cultural heritage.

The successful dynamic of the European Geoparks Network is really impressive. From 4 territories in 2000, it now includes 43 territories across 17 European countries and attracts increased attention from communities across Europe as well as from the wider geological community.

In fact I am not surprised by such a success. Your active involvement in supporting sustainable economic development of Geopark territories has never been so crucial.

More than ever we need to pool efforts and work together to stimulate growth, to create jobs, to promote regional economic development and to strengthen social cohesion.

We do share the same objective. We want a better future for the young generations. That is a future where everyone will be given a chance to develop one's skills and where everyone will be more respectful of our fragile environment.

Building such a future is about capitalizing on our strengths to help tackle our current biggest problems.

And our geological and cultural heritage is certainly one of these strengths.

It has a positive spill-over effect on a wide range of businesses, as for example in the field of tourism – one of the sectors of the economy that has been performing well throughout the current economic crisis.

It also greatly contributes to the reinforcement of social and territorial cohesion, and the creation of jobs.

That is why the preservation and the promotion of such heritage is a sound investment in a more sustainable, fair and creative future, in line with the objectives of the Europe 2020 Strategy, our European blueprint to get the economy back on track over the course of the decade.

As you know very well, education, research and innovation are at the very heart of this strategy; which can only succeed if there is a strong sense of shared ownership and active involvement from all the stakeholders throughout Europe.

And the Arouca Geopark that hosts today conference is precisely a good illustration of such an active involvement. It shows how science, education and geotourism activities can improve local economy while reinforcing cultural identity.

Indeed, all of you here today, you represent the incredible variety and richness of our natural and cultural heritage.

But all of you here today, you are also demonstrating the solidarity of Europe's territories behind a common objective: to build together a stronger and more united Europe while respecting its diversity.

Your commitments will certainly enable Europe to have a more sustainable, smart and green growth.

And you can count, as always, on the European Commission's support- notably through our cohesion policy- to implement a wide range of projects from protecting cultural heritage and promoting tourism-related activities to protecting biodiversity and developing renewable energies.

Just to give you one example: for the period 2007-2013, the European Regional Development Fund has allocated €3 billion for the protection and preservation of cultural heritage, €2.2 billion for the development of cultural infrastructure and €775 million to support cultural services.

Ladies and gentlemen,

Let me conclude by sending you my best wishes for a very fruitful conference.

Such a gathering is always a good occasion for a reflection on the progress achieved so far, for exchange of experiences and best practices. But most importantly, it is an occasion to reflect on the way forward, on new ideas, new projects, new ways of organizing. And it is exactly what is most needed in these very challenging times: an entrepreneurial spirit, an openness to change while respecting our core values and heritage.

I thank you for your attention.

MEASURING PROGRESS IN EUROPEAN GEOPARKS: A CONTRIBUTION FOR A SMART, SUSTAINABLE AND INCLUSIVE GROWTH OF EUROPE

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Keywords: *European Geoparks Network, Earth heritage, sustainable development*

The European Union adopted a multifaceted strategy called “Europe 2020” for sustainable growth and jobs for the next decade, designed to help Europe come out stronger from the world's worst economic crisis since the 1930s. The objective of Europe 2020 is to develop:

- smart growth (education, knowledge and innovation)
- sustainable growth (a resource-efficient, greener and more competitive economy) and
- inclusive growth (high employment and economic, social and territorial cohesion)

This vision of Europe's social market economy for the 21st century is built on a partnership between the European Commission and the Member States.

Established in 2000 by four territories, with the support of E.U., the European Geoparks Network (EGN) has been expanded to include, as of April 2012, 50 territories across 18 European countries. EGN aims 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. Through Geoparks operation important geological sites gain worldwide recognition and benefit through the exchange of knowledge, expertise, experience and staff among Geoparks.

Since 2004, 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). 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.

After one decade of successful establishment, the European Geoparks Network (EGN) represents today a growing European network of excellence, including territories with significant geological heritage facing a series of new challenges towards their operation as effective tools for the implementation of the E.U. strategy for a smart, sustainable and inclusive growth leading to economic and social local development.

In order to measure the progress made in each territory and 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.

Applications after submission need to be checked and reviewed by the Network. IUGS is carrying out a desk top evaluation on value of geological heritage. Evaluation missions are undertaken by two Geopark experts who are sent to the applicant territory to evaluate the application and to discuss the application with the relevant national and local authorities as well as stakeholders and local communities. Furthermore, the evaluators are also requested to make comments on the integrity and future management of the proposed Geopark. These recommendations have been, in many cases, critical to strengthening the success of applications in the long run.

EGN/GGN membership review takes the form of a revalidation process involving the submission of a revalidation dossier and progress assessment document. An inspection visit is

carried out by two evaluators from two different countries from the revalidating Geopark, nominated by the GGN Bureau and UNESCO. The revalidation process involves an examination of progress in geological heritage protection and promotion within the geopark as well as the development of sustainable economic activity within the territory. However it will also take into account the geopark's degree of active participation in common activities with the network members. A quantitative assessment methodology is performed to assign a numerical value to the main elements in the operation of a Geopark.

As a result of this evaluation/revalidation process Geoparks can present concrete and measurable results in all EU strategy components.

Geoparks contribute significantly to smart growth by developing, experimenting and enhancing innovative methodologies for preserving the European geological heritage and supporting the development of scientific research in the various disciplines of Earth Sciences through the Geopark's management plan which is the main tool for the operation of a Geopark. Geoparks are operating 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 became also excellent environmental education destinations with efficient and well organized educational activities implemented in open air parks, thematic museums and interpretation centres.

Geoparks support sustainable growth through geotourism development based on Earth heritage resources that define the identity of each territory. Geoparks develop a range of tourist infrastructures to serve their visitors. A Natural History Museum or Interpretation Centre lies at the core of their infrastructures becoming a key factor in attracting visitors. Open air parks and interpreted geosites within the Geopark territories are attracting thousands of visitors each year. Another main infrastructure for each geopark is the network of pathways linking the different sites of interest. Equipped with information panels that explain the various geosites, 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.

Geoparks replay also to the request of an inclusive growth by creating new jobs directly and indirectly. But what is even more important for the employment in the area is the number of other job opportunities which are created in tourist enterprises, small hotels, guest houses, restaurants and other activities connected with the increase of tourist flow in the Geopark area. Several other local artisans, such as makers of handicrafts and ceramic fossil casts are permanent collaborators with the Geopark. 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. 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.

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ANALYSIS AND STUDIES OF SOCIAL AND ECONOMICA IMPACT OF HERITAGE

Hervé Passamar
Agency For The Development And Valorisation Of Patrimony

In the domain of patrimony, new territorial configurations together with a re-ordering of public and institutional missions and competences, themselves the result of decentralisation laws, have involved a revision of both the methods and traditional sites of collaboration and action. At the same time, greater public awareness of the economic, social and cultural roles played by patrimony, and the need for measuring its impact, has been re-enforced. The “strict” logic of the site, mainly focussed on monuments and buildings, is giving way to a new concept of integrated patrimony, which privileges inscription of a wider environment, thereby moving away from a curative approach to one concerned with the attractiveness and dynamism of the territories concerned. The various actors are thus confronted with new complexities and stakes: an increased need for information and different working methods; a widening of networks, expertise and knowledge; mediation; the sharing of various professional cultures; development of collective capacities for intervention and the recording of the actions taken within coherent, area-specific programmes.

Created in January 2001 on the initiative of the Provence-Alpes-Côte d’Azur region and the Ministry of Culture, the Agency for the Development and Valorisation of Patrimony aims at gaining greater knowledge about and control of the economic, social and cultural issues relating to inheritance at national level and within several international programs.

We are thus systematising a decompartmentalised and open approach to cultural problems, which takes into consideration the way the various patrimones (historical, cultural and natural) interact in order to offer sufficient support to the different actors (institutional, cultural and economic) dealing with the process management and valorisation programmes.

The actions of the Agency for the Development and Valorisation of Patrimony are guided by this logic of crossroads and diversifications: publications and co-ordination of studies related to patrimony; settlement and animation of a national observatory looking at the economic and social consequences of patrimony; expertise, knowledge and development assistance; diffusion of good practice and transfer of methodologies; networking and professional training for actors; strategies against exclusion; control of teaching methods, and mediation and participation in European programmes and international exchanges.

By apprehending patrimony within a wide arena, the Agency for the Development and Valorisation of Patrimony will achieve nothing more than to record a major, sustainable phenomenon. The agency’s intention is thus to contribute to the development of ambitious patrimonial policies in France as well as in the Mediterranean area.

The ADVP is chiefly engaged in the settlement and animation of observatories looking at the various economic and social consequences of patrimony : French Ministry of Cultural Affairs (General Direction of Architecture and Patrimony), Provence-Alpes-Côte d’Azur region, European network of Word Heritage Cities (Unesco).

ABSTRACTS

THE DREAM MILE – EXAMPLE OF HOW TO IMPLEMENT GEOTOURISM IN AN ATTRACTION-CLUSTER IN GEA NORVEGICA GEOPARK

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Keywords: *Gea Norvegica Geopark, cluster, innovation, geotourism, sustainable tourism*

Gea Norvegica Geopark is one of a total of seven attractions in the Dream-Mile project. The main goal is to make a stronger boundary between these attractions to promote natural and cultural attractions for tourists and develop local businesses. The project is located in the village Ulefoss in Nome municipality.

Nome municipality is one of the stakeholders of Gea Norvegica Geopark in Norway. The town of Ulefoss lies in picturesque surroundings, by Lake Norsjø and the tourist-magnet, Telemark Canal. Goods have been transported along the canal for 150 years, and the natural waterway was an important thoroughfare for an even longer period of time. Today, one can travel by boat or steamer from the coast 108 km inland, through 8 locks and up to 72 metres in elevation.

Ulefoss is situated close to the Fens Carbonatite Complex, the world's type locality for carbonate volcanic rocks ("carbonatites"), and is an important attraction for the Geopark. It was here that this rock type was first described, in 1921. Also the processes caused by a volcano spewing out carbonate-rich lava was of great interest, and still is. The volcano was active 580 million years ago. The only active carbonatite volcano today is in the African Rift Valley, Tanzania. The Ulefoss Iron Works was founded in 1657, based on the iron deposits in Fens Field, formed by those same volcanic processes. This industry continues to produce iron products and is still important for local development. The iron mines are no longer active, but the stories of the volcano and mines are exciting and part of the Dream Mile project.

There are many local participants in the "Dream Mile" project working together to increase possibilities for tourism and thereby strengthening local businesses. A total of seven attractions are included in the Dream-Mile project for development by the working group, all have the historical themes in common. The aim of the Dream Mile is that all who travel on the canal or pass through Ulefoss will have a visit to these attractions, get a bite to eat, experience the area, preferably stay overnight - and will want to return. The cultural offerings are many: geological excursions, an active Iron Works, Medieval Churches, boating on the canal, visit a Manor Farm, or have a culinary experience at the Artisans Courtyard. The Dream Mile project fosters close cooperation between participants, creating an arena for sustainable tourism, while at the same time strengthening local pride and commercial development. During the first project period 2011-2012 the project has acquired many experiences on how to manage and develop such an attraction – cluster, and Gea Norvegica Geopark has also had many good experiences by participating in the Dream Mile project.



Fig. 1. The seven attractions in The Dream Mile project

“CLIMATIC THINKING” AND GEOPARKS' ARCHITECTURE

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Keywords: *Qeshm Geopark, Responsible Design, Climatic, Visitors Centre*

Today the promotion of sustainable development is more than a necessity, consequently "climatic thinking" is one of its effective requirements. Climatic thinking is an important investment of the governments for the future of the planet too. It reduces the impacts of energy production as well as energy consumption. Climatic thinking should come from schools to projects and Geoparks are exceptional opportunities for such experiences.

New buildings do not provide quietness despite their adjusted temperature. Cold walls, wet windows, the lack of silence, sky views, moonlight views, and wind probably come from a wrong building pattern. While the new architecture is based on formal and pure business features, an architect's duty is to provide any space with appropriate climatic conditions.

Architects and planners should go to a place and be among the locals to get a clear picture of the ecological, social and cultural aspects of the community and its ethic codes. There are no irrelevant aspects in a site. However, the basis of any project has its own characteristics shown in a unique shape, slope, hierarchy, wind direction, coordination and so on.

We believe that the imitation of local engineering methods is a cheap shortcut to a perfect design. Traditional architecture in all regions has been formed for many centuries, therefore it has a small impact on the environment. We believe the traditional architecture, despite the forms and ornaments, is a pragmatic handbook for young architects.

The basis of the Qeshm Geopark Management Plan is to increase the building capacity for the locals, and therefore many solutions have been presented, from handicrafts to ecotourism development and geo-sites conservation.

We believe that creating small buildings and monuments is the synergizing booster of the local unaware entities. But Qeshm Geopark is very fragile due to its vast dry areas and very poor vegetation. We suppose the Qeshm Geopark is a mine field while designing.

We have already built a visitors centre with an area of 350 m² nearby one of our geo-sites following the idea above.

SÃO PAIO (LABRUGE, NW PORTUGAL), AN EMBRYO TO A COASTAL GEOPARK

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Keywords: *São Paio, Labruge, geosite, archaeosite, Centro Interpretativo do Castro de São Paio, Geopark*

São Paio (W 08° 43' 46,978", N 41° 16' 49,165", WGS84) is simultaneously a geosite, a geomorphosite, an archaeosite and a religious cult site. Its core has hardly 2 ha in area but holds outstanding relevance in scientific, cultural, educational, environmental and socio-economic terms. It is included in a Protected Landscape Area (Paisagem Protegida Regional do Litoral de Vila do Conde e Reserva Ornitológica de Mindelo) that was recently defined with a focus mostly in environmental coastal assets based on relevant supra-local landscape, geology, fauna, flora, cultural and conservation values and based in sustainable activities, with nature tourism having a bold place. São Paio is here a proposed focal point for the future evaluation of the feasibility of a coastal geopark within the vast Metropolitan Area of Porto.

São Paio is located in northern Portugal, 15.8 km north from the Douro river mouth and 6.7 km south from the mouth of the river Ave. It consists in an isolated rocky cliff on this stretch of low north-western Portuguese coast with its highest point ca. 23 m amsl over the often rough Atlantic Ocean. Its dominion over the coastal landscape is highlighted by Blue Flag sandy beaches of Labruge to the south, and Moreiró to the north. It takes position in front of an extensive low slope polycyclic littoral platform carved at least since late Cenozoic in a crystalline basement incised by small rivers, leaving remnants of a thin sedimentary cover up to the Holocene.

São Paio has probably the northernmost onshore outcrop of a segment of an old polymetamorphic continental crust integrated in the Ossa-Morena Zone of the Iberian Massif. The contact to the east is shown here and made through a major tectonic suture with Central Iberian Zone variscan granites and metamorphic rocks from late Proterozoic-Paleozoic. Swarms of deformed and undeformed felsic veins crisscross gneiss, migmatite and granite outcrops. Anorogenic basic dykes and faults affecting them probably relate to the opening of the Atlantic Ocean during Mesozoic or represent later deformation phases, some of them with seismogenic character.

Following exhumation, deep geology controlled quaternary geology and geomorphology, not only providing support and materials, but also contributing to its evolution in interplay with coastal processes, climate change and other external processes. In fact, tectonic features at São Paio emphatically constrain geomorphic features like linear cliffs. Neotectonic activity has been proposed as a cause for the unique and peculiar sequence in altimetry of several fossil notches typical of hard rock shores in mesotidal high energy environment. We find here in association with infrequent coeval marine deposits to be dated soon, suggesting standing water levels during the last interglacial period and its tectonic dislocation. Nearby, a small outcrop with a last interglacial marine layer, superposed by a solifluxive formation and aeolian sands TL dated of ca 84.k years BP demonstrates the complex evolution of the environmental conditions and climatic changes during the last 125.000 years. São Paio alone holds rock types of varied origin, evidence of folding, metamorphism, magmatism, and records a rich sequence of shear zones and ductile to fragile fractures, all demonstrating a vast sequence of geological events often discerning clear stratigraphic relations infrequent elsewhere, all with high earth science and educational relevance, whose study continues.

An archaeosite of international importance was discovered here in the decade of 1950. It is the only “*castro marítimo*” in Portuguese territory that is also the oldest and the southernmost of a series of 1st Iron Age walled settlements built in NW and N of Iberian Peninsula with round stone thatched houses and taking advantage from their hanging position over the ocean. Proto-historic peoples probably used a small beach protected by rock walls as a port. Rock engravings were inscribed in São Paio rock outcrops. Scattered around, several much older pre-historic stone tools were found. Much of this is yet to be studied by modern archaeological science. The outstanding importance of this rich prehistoric site and of the material remains set up the focal point for a long time project recently brought to light by the municipality of Vila do Conde: an onsite interpretation and museological centre aimed to demonstrate and support research and educational activities involving the Castro de São Paio, considering Geology, Geomorphology, Biology and Archaeology.

Along the coastal outcrops runs a centuries old footpath variant of the Way of St. James (“*Caminho de Santiago*”) leading to Santiago de Compostela, allowing pilgrims to pay a visit or give a prayer there at the old chapel of São Paio, also cherished by locals and foreigners.

It is clear to the authors a sustained crescendo in interest and effective actions taken by the regional authorities, the municipality and local authorities, local and regional cultural and environmental ONG, a broad scientific community, the local population and the economic players. However they are not yet coordinated. This first public proposal is hoped to raise a common conscience needed to integrate a concept and multiply efforts, plans, actions and success, setting his future based in geotourism as a littoral geopark.

With such assets, why not consider São Paio an embryo to a Geopark that values them all?



Fig.2. Left: fossil notch 9 mamsl. Right: marine sediments fossilizing the same notch.

MT ARARAT AS A SUGGESTED GEOPARK

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Key words: *Mount Ararat, geopark, geotourism, and sustainable development*

The aim of this paper is to propose the establishment of a new geopark in the area of Mt Ararat (Ağrı) in the Eastern Anatolia Region of Turkey. Mt Ararat and its surrounding area that is one of the most significant volcanic areas of Turkey provide the main subject for this investigation. This mountain located in Iğdır and Ağrı provinces. Mt Ararat, which is a young stratovolcano that formed in the Pliocene, is the highest mountain of Turkey with its peak of 5137 m. This volcanic mountain, which is situated on an area of large basin with its 130 km and with an area of 1200 km², has two cones named Great Ararat (5137m) and Little Ararat (3896). It has sharp summit from level of 4300 m. The area is famous for its well-known youthful volcanic features improving depend on andesitic and basaltic law flows. Mt Ararat and its arounds have many geology and geomorphology features such as Cehennem Valley, Lawrence Cave, Cow Valley, Ice Cave, meteor depression. Every year, hundreds of native and foreign mountaineers climb to the mountain's peak and visit to see these features. It has biodiversity. It can observe many animals such as *Ursus arctos*, *Canis lupus*, *Vulpes vulpes*, *Capra aegagrus*, *Sus scrofa* and *Lepus capensis*, *Allactaga williamsi*. At the same time, Mt Ararat has very important in terms of cultural. This mountain was sacred for some religions. Many people believed that there was Noah's ark. Ishak Paşa Palace and Bayazıt Mosque are important architecture buildings in terms of historical.

This area has all the necessary criteria including scientific value, geotourism appeal, educational, historical, cultural, spiritual, and social attributes, international significance, with links to biodiversity, aesthetic value and the potential for sustainable economic development to warrant its establishment as a geopark. Approximately 874 km² of Mt Ararat was created as National Park in 2004. The number of tourists increased. According to Iğdır and Ağrı Tourism Managers records, 265 711 tourists visited this area during 2011. The development of tourism has inevitably brought some environmental problems, pollution, and rubbish. Local people and tourists need to educate to protect and use in the land. Local people do not know how to use the natural and cultural heritages. When we thought the philosophy of geopark, it could be an opportunity for the protection and conversation of the region. Geopark ensure sustainable socio-economic and cultural development for local people who has restricted economic sources. We started to determine geosit, biodiversity ad geo-archaeological values in 2011. We prepared topography, geology, settlement and tourism maps. We submit preliminary results related authorized body. In this study, we suggest Mt Ararat and its around as a potential site for a geopark. Mt Ararat and its geological and cultural heritages introduced and it will be to offer suggestions for the protection of geoparks and geotourism approach.

INVESTIGATING DINOSAURS IN MAESTRAZGO CULTURAL GEOPARK (TERUEL, SPAIN)

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Keywords: *Dinosaurs, Jurassic-Cretaceous, Parque Cultural Maestrazgo*

The Maestrazgo Cultural Geopark is one of the four founding members of the *European Geoparks Network* and is composed by 43 villages from Teruel (Spain) which stretch a total surface of 2.622 km². Roughly speaking, the Maestrazgo Cultural Geopark is characterized by the set of Cretaceous sedimentary rocks outcrops along the river Guadalupe basin (tributary of the River Ebro on its right bank).

A distinct geological feature of the Geopark is its dinosaur sites, which have provided outstanding fossils to the Spanish Palaeontological Heritage. Thus, dinosaur remains have been cited since the beginning of the XX century in Cantavieja, Ejulve and Castellote. But from the mid-century, Galve became relevant within the Spanish dinosaur research studies, because the remains to establish the first new “Spanish” dinosaur: *Aragosaurus ischiaticus*, were found in that village. Also, in the XXI century, a new turiasaurian sauropod and a new iguanodontid were discovered. Even 5 dinosaur ichnites palaeontological sites from Galve have been protected according to the first-level figure in the Spanish Heritage Laws (as well as other in Abenfigo-Castellote and another in Miravete de la Sierra).

Apart from the research studies carried out on the fossils and stratigraphy of some of the already known sites, the Dinópolis palaeontologists team has intensified the search for dinosaurs over the Geopark along the last years. So, new sites with dinosaur fossils have been found in Galve (8 with bones and 2 with ichnites), Miravete de la Sierra (8 with bones), Aliaga (2 with bones), Mirambel (2 with bones) and 1 site with bones in Cantavieja and another in Villarluengo (Fig. 1).

The new finds are placed within the following geological formations (Fig. 2):

Jurassic- Cretaceous Transition: Villar del Arzobispo Formation (6 sites).

Lower Cretaceous: El Castellar Formation (6); Camarillas Formation (7); Mirambel Formation - local equivalent of the Camarillas Formation (3); Artoles Formation (1); Morella Formation (1).

Fossil remains belonging to the two main groups in which dinosaurs are divided: Saurischia and Ornithischia, have been found at the Geopark. Among the recent scientific findings we can highlight the possible presence of an ornithopod nursery from the lower Cretaceous in Galve, the identification of postcranial remains (in Aliaga) and of big sized tridactyl ichnites (in Galve) belonging to Ornithopoda from the lower Cretaceous, or the proposal to increase the age of the type locality of *Aragosaurus ischiaticus* in more than ten million years.

The new scientific data constitute an attractive element for the public diffusion of the Geopark, due to the great interest dinosaurs create among the people and the media, for example, in the Dinópolis palaeontological park-satellite museums in Galve, Castellote and Mas de las Matas (which is associated to Dinópolis).

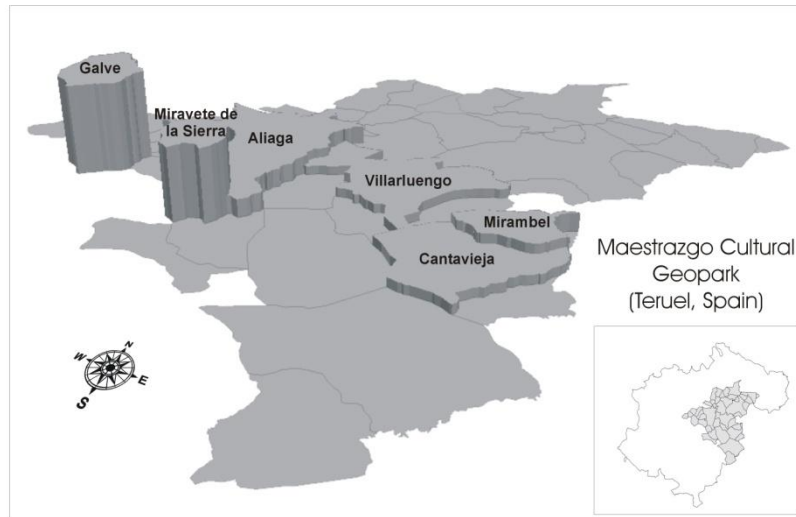


Fig. 1. Geographic distribution of the new dinosaur sites found in the Maestrazgo Cultural Geopark.

Age	Formation	Sites
Albian	Utrillas	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> Aliaga 2 🦕 Villarluengo 1 🦕 Galve 3 🦕 1 🦕 </div>
	Escucha	
Aptian	Villarroya de los Pinares (Oliete)	
	Forcall	
	Chert	
	Morella	
Barremian	Artoles (Alacon)	
	Camarillas Mirambel	
Hauterivian	El Castellar	
Valanginian	[Hatched Box]	
Berriasian	Villar del Arzobispo	
Tithonian	Higueruelas	
Kimmeridgian	Torrecilla Loriguilla	
	Pozuel	
	Sot de Chera	

Fig. 2. Geological distribution of the new dinosaur sites found in the Maestrazgo Cultural Geopark.

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THE GEOPARK BODOQUENA-PANTANAL LIKE AN OPPORTUNITY OF REGIONAL DEVELOPING

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KeyWords: *Geopark, Geotourism, Geoconservation, Susteinnability*

The Geopark Bodoquena-Pantanal, created through Mato Grosso do Sul Govern in December 22nd, 2009 through a state decree n 12897 is the second in Brazil with possibilities of being recognized for UNESCO - Organization of the United Kingdom for education, science and culture. For being an international seal of approval, we can't confuse with the categories of conservation units present in SNUC (National Systems of conservations Unities). The Geoparks needs studies and researches to know the area in question and all the possibilities of exploration and economical regional developing in a conservation politics of biodiversity. Intentionally, we use here the term Geopark in English to distinguish and not to confuse with "national park", and because the term was used in all the text of the state decree.

According to the Candidacy dossier elaborated through IPHAN-MS, Institute of Historical Patrimony and National Artistic, a Geopark is a composed of a group of interesting and important places, where we can understand the region's geologies evolutions. They are composed of aspects from ecologicals, paleontologicals, historicals, cultures and leisure values (IPHAN, 2010). These values are found too in manifestations and costumes of the social endogenous representativities manifestations. Its conceptions justify itself too like a positive factor toward the fomentation to the regional sustainable developing, with the divulgation about knowledge, preservations and publics policies that search and justify this purpose.

In despite of the diversity presented in Geopark Bodoquena-Pantanal it's presented the necessary of realization of a deep study about the use of these geodiversities to the rational explorations, conscious, sustainable of tourism to the development of the communities that are in the study area. The Geopark region, that is composed to 13 cities of Mato Grosso do Sul (Anastácio, Aquidauane, Bela Vista, Bodoquena, Bonito, Caracol, Corumbá, Guia Lopes da Laguna, Jardim, Ladário, Miranda, Nioaque e Porto Murtinho) there are in majority cities with low indices of developing and too with low population.

The Geopark's creation in the south-west region of Mato Grosso do Sul makes to be presented an opportunity to implantation of publics policies directed to the socioeconomic development of several cities that until this period presented a few growing perspectives, but through cattle breeding activity characteristic of the region. To a regional integrated developing and sustainable, the Geopark Bodoquena-Pantanal can be an excellent scenery, cause in its extension are found a big cultural diversity expressions, several family activities and important environmental interest sites. Promoting and encouraging is a sustainable way this region will provide the State in a new perspective to several cities that today are at doors of sustainable economical developing.

The purpose of this work is, to point the opportunities of regional developing that can appear hereafter the seal of approval from UNESCO. As the future actions can be substantiated in programs and projects on the stage of elaborations or being executed. It's observed, with some salvos, that the involved cities until now didn't have important and significant changes, like an example we can mention: PCBAP- Pano de Conservação da Bacia do Alto Paraguai, IIRSSA- Iniciativa para a Integração da Infraestrutura Regional Sul- Americana, Programa BIOTA,

Programa Monumenta, GEF- Pantanal, Cenários Estratégicos de Longo Prazo - MS 2020 e o Zoneamento Ecológico Econômico.

The Geoparks are on the stage of growing all over the world and today the Mundial Network Geopark count on seventy seven associated recognized through UNESCO in 25 different countries. The purpose of the Network is to conglomerate around five hundred Geoparks. The Geoparks Program from UNESCO was launched to promote the appreciation and the protections of the important geosites, contributing to a better observing of the earth's evolutions, its history and territorial occupation during the years. To understand the importance strategy that a Geopark can have to promote the regional development it's necessary to understand its conception and analyze its creations historical on the other countries.

To UNESCO (2004), the term Geopark is defined like a territory with limits well defined that has an area sufficiently big good for the economical local developing. This comprehends a certain number of associated sites to the geological heritage of special scientifically importance, beauty or rarity, representative of an area and its geological history, events or cultural value. The sustentation tripod is a Geopark passes through its ecological diversity, geoconservation and geotourism activities to be implanted and that justify the exploration of the locals by visits that generates jobs, rent and benefits to the local communities. For geodiversity is understood the variety of geological environments, phenomenon, and actives process that gives origins to the landscapes, rocks, minerals, fossils, ground and other superficial deposits that supports the life in earth. (STANLEY, 2000, in: NASCIMENTO, et al: 2008).

The geoconservation aims the preservation of natural diversity (or geodiversity) from significant aspects and geological process (substratum), geomorfolological ways if landscapes and the soil, through the natural evolution maintenance from these aspects and process. (SHARPLES, 1995; 2002. in: NASCIMENTO, *et al*: 2008).

The economical exploration in a harmonic way and consequently with a smaller impact possible in a determinate geosite is encouraged through a new segmentation of market that is geotourism. This new segment can be defined like a tourist activity that has the geological patrimony like its mainly attractive and reaches protection like a conservation way of its resources and sensibility of the tourist, utilizing for this, an interpretation of its patrimony becoming it accessible to the lay public, beyond promoting the divulgation and the developing of the earth's science. (HOSE, 2000, in: NASCIMENTO, *et al*: 2008).

The analysis that proposes this text and the Geopark Bodoquena-Pantanal can be an increment to the developing of projects and programs, as well as, can be a facilitator on picking up resources to develop these same programs and projects, it's made relating the existents actions with the concepts purposes and characteristics of a Geopark. It's required an analysis about the characteristics of the region "Serra da Bodoquena" and "Pantanal" too. But, we have the clarity that in spite of the dimension and complexity of the analysis that is proposed, this text will present only na initial outline from the presented purpose future papers Will be realized so that we can have a clear perspective that the Seal of approval from UNESCO Will bring na excellent opportunity to the improvement for the conditions of the local resident's life.

MUSEUM NETWORK AS EDUCATIONAL AND DISSEMINATION TOOL IN CILENTO AND VALLO DI DIANO GEOPARK

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Keywords: *Museums network, National Park, geosite,*

The Cilento, Vallo di Diano and Alburni National Park, located in Italy, is a territory with extraordinary natural, geological, historical and cultural heritage. In the Cilento area the main geologic features related to the polyphase geological history, which characterizes the Southern Apennine chain, are present. Infact, we can find, several, significant geological sites (geosites), with stratigraphical, structural, geomorphological and hydrogeological interest (Aloia et alii. 2006, 2010, 2012). One of the more important and useful tools to disseminate knowledge is through museums network. In the Cilento, Vallo di Diano and Alburni National Park 40 museums are present (archaeological, geologic, paleontological, of the country civilization, of the sea, an Antiquarium etc), three of which are geological: the Paleontological Museum in Magliano Vetere, the Open Space Museum in Caselle in Pittari and the MIDa in Pertosa.

The Paleontological Museum in Magliano Vetere was opened in 2009. It is an educational and scientific centre with an exhibition of fossils and rocks. The museum area is planned as a didactic tool, addressing issue from Universe, Solar System and Earth formation, through the life evolution and the fossils' deposits of Cilento. A big diorama shows, in full size, the fauna and flora of the Cretaceous. The Museum has also three laboratories and two didactic areas for more experiences and to simulate the work of a paleontologist.

The Open Space Museum, located in Caselle in Pittari, was opened in July 2012. It is an educational and scientific centre, where didactic materials (mainly concerning geology but also natural and cultural contents) are organized to be presented taking advantage of multi touch technology. The technological (or virtual) museum consist of: i) a Multi Touch Totem, located at the museum entrance, providing information about museums network of National Park, touristic pathways and facilities and geographical, geological and geomorphological contents; ii) an Holographic Table, located in the museum hall, showing the National Park of Cilento, Vallo di Diano and Alburni territory and providing geographical, geological and geomorphological information; iii) two Multi Touch Tables, located into the museum hall, with several didactic contents organized in folders and subfolders allowing the user to be able to manipulate, move and manage the contents, using touch technology; iv) a 3D room, where 3D images and videos create an optical illusion, changing the space around viewers to transport them into a 3D virtual dimension, composed by images, colors and sounds. In this room, the visitor seems to go in a karst cave, generally a place not easily accessible, and have a unique experience.

The MIDa in Pertosa is an integrated museum network where geological, botanical and cultural themes are developed and represented as multimedia cultural ways. It has a geological museum, opened in 2003, showing the karst phenomena and caves habitat, the bio-speleology and archeological motifs found inside the Grotte dell'Angelo. The botanical museum, opened in 2010, shows flora namely: edible plants, an actual and fossil herbarium, seeds, woods and bulbs collections from the Cilento, Vallo di Diano and Alburni National Park.

In order to make available and to improve the territorial culture, the National Park promotes innovative initiatives, involving the museums network, namely with the creation of : i) didactic geological collections; ii) new didactic approaches including museum supplied with multidisciplinary information; iii) scientific material for didactic use; iv) a virtual library that

will include publications about several aspects in the Cilento area. The main marks that are expected are the increase of local geological -awareness and the knowledge about biodiversity, in order to improve international development for natural and geotourism values.

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AN INTERACTIVE GUIDE FOR SMARTPHONES AND TABLET-PCS tO DISCOVER MARSH PLANTS IN GLACIAL AND PERIGLACIAL GEOSITES IN THE APUAN ALPS

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Keywords: *Apuan Alps, Last Glaciation, geosites, wetlands, dichotomic key*

Vegetal biodiversity in the Apuan Alps is remarkable both in terms of quantity and quality due to a very high floristic density, a large quantity of endemic and subendemic species and the significant presence of arctic-alpine and orophyle species.

This vegetal variability is strongly linked to the vast geodiversity of the Apuan Alps as it must be remembered that the majority of Apuan habitats greatly depend on the features of the substrate both in terms of rock and soil chemism and existing morphostructures and morphosculptures.

In the Apuan Alps, the Last Glacial Maximum (about 19.000 years BP) left clear and remarkable traces of widespread erosion and deposit landforms despite the moderate height of the mountain peaks and their vicinity to the sea.

The mountain range provided an obstacle to Atlantic humid currents and it is likely that during cold phases in the Last Glaciation it was responsible for heavy solid precipitation leading to the formation of perpetual snowfields. Since the glaciers were exposed to the north-east and located on a more gentle slope, they built up more and consequently survived longer compared to those on the opposite side which was hampered by the relief-energy and its exposure to southern quadrants.

Attempts to piece together the glacial extension of the Apuan Alps glacier led to the identification of twelve large valley glaciers on the inland side of the range, over a total area of about 77 km² and the low permanent snow line at about 1,250 m asl. These data, showing a slight importance compared to Alpine glaciers, assume a remarkable value in the Mediterranean area.

The inland side of the Apuan Alps houses typical U-shaped glacial valleys with a parabolic cross-section and overdeepened glacial basin which have often been characterized by peat bogs and wetlands. These particular habitats develop mostly in glacial and periglacial geomorphosites (glacial hollow, glacial cirque, periglacial orographical terrace, etc.) and their vegetal population from the Preglacial to the Postglacial period is strongly linked to the movement of the glaciers. Nowadays the Apuan wetlands have a very high environmental and landscape value because they are rare habitats and specific biotopes, preserving vegetal species of remarkable biogeographical value. Consequently, the Apuan wetlands, on glacial and periglacial geosites, have outstanding biodiversity and geodiversity value (Fig. 1).

The flora of the Apuan wetlands is rich and includes a lot of vegetal species of remarkable biogeographical and epiontological value such as *Menyanthes trifoliata* L., *Eriophorum latifolium* Hoppe, *Eriophorum angustifolium* Honck. and three rare orchids, *Dactylorhiza incarnata* (L.) Soð s.l., *Epipactis palustris* (L.) Crantz and *Herminium monorchis* (L.) R. Br..

These biotopes/geosites are of great value in terms of biodiversity because they host a significant number of vegetal species on a very small total area of about only 0,08 hectares.

In order to improve the knowledge of these particular plants and biotopes, the Apuan Alps Geopark has recently produced an interactive Guide for smartphones and tablet-PCs which allows for the easy identification of the Park's marsh plants. The guide is available online and downloadable free of charge in both Apple (iPhone, iPod touch, iPad) and Android versions.

By the use of some distinctive characteristics, the app aims to guide the user in identifying the scientific name of the 131 marsh plants living in the Park. Hence, its main purpose is to give the excursionist a better knowledge of these plants and biotopes (and geotopes also) and make him/her aware of the absolute necessity of their conservation.

The app starts with a splash screen that leads straight to the index page and from here the user can choose from the available functions. The most important is the digital key which guides the user in the identification of the plant. The key is dichotomic and at each stage it asks the user to make a choice between two options. The options are described with a simple text and illustrated, where possible, in order to facilitate the choice. After every step, and each choice, the user excludes certain plants, thereby reducing the number of the remaining plants. In the end only one species remains and the user can therefore identify it. For every plant the system shows a descriptive page together with one or more images and a textual description about the most important characteristics of the plant, the etymology of its name and some information about the distribution of the plant in the Park area.

The dichotomic key named "Guide to the marsh plants of the Apuan Alps Geopark" was produced together with the "Dryades Project", coordinated by the Department of Life Sciences at Trieste University. Its production was financed by the National Environment Department as part of a project for the biodiversity and geodiversity conservation in the Park wetlands.

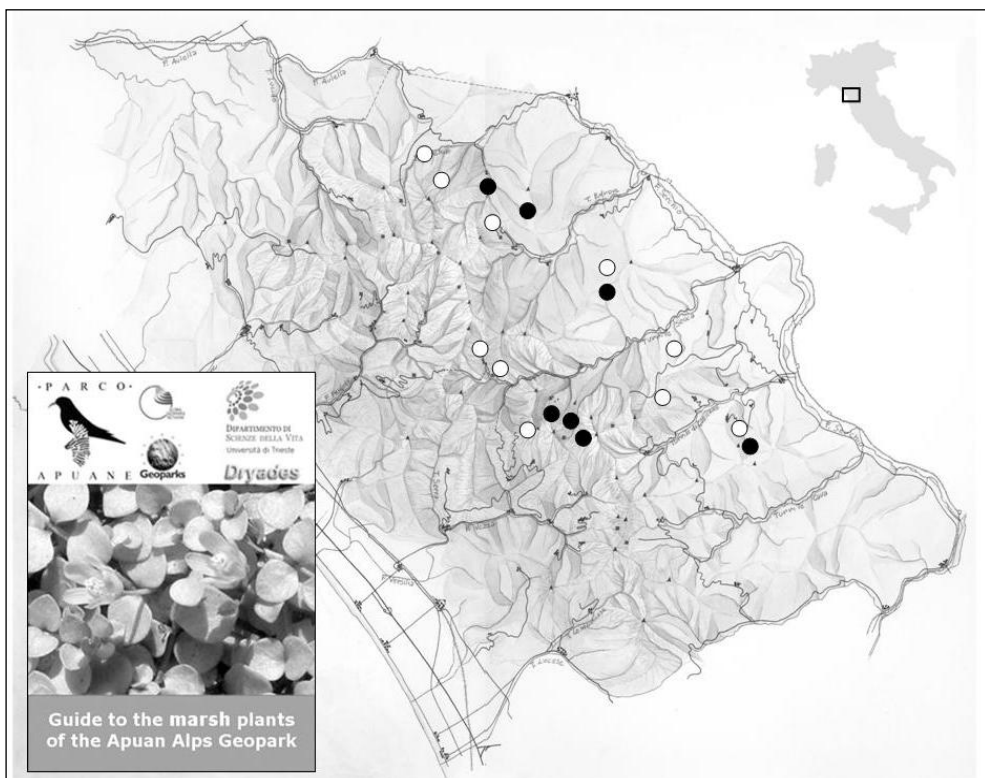


Fig.1. Active (full circles) and reclaimed/extinct (empty circles) wetlands on periglacial and glacial geosites of the Apuan Alps and the splash screen of the app.

SMART & INCLUSIVE DEVELOPMENT IN LOCAL COMMUNITIES, AN ENTERPRISE IN QESHM GEOPARK, IRAN

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Keywords: *Qeshm Geopark, Local Community, Development, Handy Craft*

Qeshm Geopark was among the first GGN Members recognized in 2006. For many years, Qeshm was famous just for its unique and exiting desert landscapes and geological features but nowadays, after a revolutionary change in management, a wide and inclusive involvement of local communities can be observed through geopark.

Qeshm society mostly includes traditional and devout people. Women always stay at home and rarely are seen outside. It is not usual for girls and women to communicate with strangers. Involving women -as a very important part of society- in geopark activities is really a challenge. Qeshm geopark management prepared some facilities for women to present their home made handy crafts to geopark visitors. At beginning it was just for their simple and traditional products and making them interested to be more active in society and having income to help their families. Hereafter geopark experts help women to use some simple sketches of surrounding landscape and nature into their products. In this way local people will have some awareness about their geological and natural features around. In addition, they learned simple and general stories and explanations about land formations around and try to transfer this information to visitors of their shops. With this simple strategy, Qeshm Geopark involved many girls and women in these activities and in result they made some effects on their children and husbands.

For men, fishing, transportation and small trade is the main job in island. After recognition of geopark and particularly during last year on, men living in villages inside geopark understood that visitors are a good source for their income. They attended in several workshops arranged by geopark in their villages, schools and mosques. During the workshops people learned how to host visitors and give them suitable services. They also found out they landscape, geology and nature are their most valuable wealth and protecting and preserving is necessary to keep this wealth. Nowadays there are many local guides to geosites, local accommodation and restaurants in villages inside the geopark.

High councils of villages as well as mosques are the main connection windows between local people and geopark experts. Most workshops and other related educational programs held in these places due to most relation and connection with locals. Schools are the main center for teach children about their landscape and nature value and necessity of protection. "Tabl" High school is like a portal for all schools inside geopark. In this school there are regular educational programs for school teachers also. They will talk about geopark and its basic concepts for their students in far villages. Geography and geology teachers always have specific section in their classes, talking about geopark and geotourism.

Geopark is a well known word in Qeshm Island now. It is rolling like a real brand between Qeshm habitants; they talk about their geopark with honor and always try to use this label in different ways. The next challenge for geopark management is controlling this growth in certain way and moving toward sustainability in local activities. Qeshm Geopark receives considerable amount of annual governmental budget for different projects including infra structure establishment. Qeshm is going to reduce the governmental budget to reliance to own geopark incomes. It forces local community to increase their level of attention to economical development and to follow geopark management solutions seriously.

FIROUZABAD, WHERE THE GREAT ANCIENT HISTORY ENGAGED WITH CULTURE, NATURE AND GEOLOGY

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Keywords: *Firouzabad, Local Community, Handy Craft, Tribe, Salt Dome, Nomad*

Firouzabad is a new city built over remnants of historical city of Gur (Gōr), capital of Sassanid Emperor (224-651 A.D.). In vicinity of this city, numerous historical monuments and buildings can be found. This city is located in Fars Province near Shiraz City. Fars Province was the center of powerful Achaemenid Persian Emperor (550-330 BC).

Firouzabad area is very divers in geology. Typical salt diapirs, deep canyons and huge anticlines are among the most important geological features in this area. Konar Siyah and Jahani Salt Diapirs are two important salt diapirs in this area. Hiqer and Tangaab Canyon are two deep valleys near the city.

Qashqaie Nomads are the oldest habitants of this area. They are community of people who move from one place to another regarding the seasons. They produce a very famous pile carpets and rugs named Qashqaie. Qashqaie culture is very interesting for tourists. Qashqaies always host many visitors from Iran and from outside country. Traditional foods, dance and music are among cultural attractions of this area. Qashqaies wear colorful and fantastic cloths designed with simple sketches of nature and environment. These sketches also can be found in their carpets.

Meymand City near Firouzabad is a historical center for herbal distillates productions. A wide variety of flowers and herbs are producing in this area and distillates export to other cities in Iran and other countries as well. This is one of the great sources for local communities' economic development.

In Firouzabad Area a collection of geological, cultural and natural features and attractions along with local communities are present to act as a successful geopark, in national and global level.



Fig 1. Hiqer Canyon in Southeast Firouzabad.



Fig 2. Jahani Salt diaper.



Fig 3. Ardeshir Palace (224 A.D.)



Fig 4. Ancient stone carving named: Victory Sign (224 A.D.)

PRECIOUS TIMES: HAPPY SPENDING IN THE GEOPARK

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Keywords: Tourism, marketing strategies, presentation policies

According to the European Geoparks Charter, geoparks are expected to play an active role in the economic development of their regions. It might therefore be useful to compare the activities of geoparks with the performances of enterprises which are dedicated exclusively to economic aims but take all efforts to make the selection of items a joyful experience. We therefore can learn from supermarkets how to present our “products” for the visitor.

By definition, a supermarket is a self-service store offering a wide variety of food and household merchandise, organized into departments. It is essential that the customer selects the desired objects free of any exterior pressure in a relaxed atmosphere.

In their core business, geoparks present a variety of geological, biological and cultural sites and exhibitions of various contents. What they offer to the visitor are intangible goods which physically cannot be delivered: Information, skills, social events, impressions, etc. The majority of goods in a supermarket can be replaced by other brands. They are “elastic” to use a commercial term. The goods offered by the geopark itself are “inelastic” because they are unique for each park and cannot be replaced. We therefore have to create a market with a product

Which cannot be replaced

Is not familiar to a majority

Which is connected with a comparatively high input of individual resources (financially, time, physically, psychologically ...)

This background and especially the unfamiliarity of most people with earth sciences require marketing strategies which communicate geology for different target groups through programmes and locations which are known for fun, surprise and adventure. The mysterious world of caves, the fascination of fossils and any activity using water, sand or even solid rocks attract families. White water rafting and mountaineering is a challenge for more sportive people geological and more mature semesters might react positively to hiking trails. Independently from these marketing initiatives the promise of individual comfort is essential for the decision to visit the geopark. It comprises a wide selection of housing, local food specialities, visits to geopark partners, etc.

Everybody feels satisfaction selecting items in the supermarket with the personal feeling he or she has made the best buy. Equally, the visit to the geopark is a joyful experience when the visitor can select among various attractions, restaurants, etc. It is this personal freedom which distinguishes the geopark from organisations where a definite goal for learning is given. Geoparks are not primary educating but offer education. That this also true for school groups becomes evident when individual students are asked about their experiences at their visit to the park.

In the supermarket you will notice at merchandises and their labels the messages which the consumer expects clearly written in large letters: The producing company, the net weight or the content. All other information on nutrients or preservatives is so small that you may need a hand lens to read them. There is often also a picture. It is called reminder advertising and is designed to keep a product in the mind of the consumer.

Looking at a bottle of Ketchup we know immediately what is in it because we have stored knowledge about it in our brain. This is the prerequisite of all communication: Written or oral

messages can only be understood when there is a previously achieved knowledge on the subject. It is recalled and processed by the brain together with the new information. It is therefore of fundamental importance to consider the knowledge of the audience when science is communicated. This does not only mean that we have to differentiate between the target groups in oral presentations but also that panels or explanations of objects have to be extremely simple like on the bottle of Ketchup without demanding much previous knowledge.

It is therefore essential to follow general rules and strategies of communication in marketing a geopark. In advertisements and in our home-pages we just can give a general outlook of what visitors are to expect. This may arouse their wish to visit the park but once they have decided to come it is essential to satisfy their expectations. Satisfaction is achieved when the expectation comply with the reality. Satisfaction is an important part of the biological, psychological and social well-being which is crucial for health and the quality of life. Only satisfied visitors recommend the park to others. To arouse satisfaction is therefore the psychological requirement for a sustainable development. It does, however, require the cooperation of the local population.



Fig. 1. Deep gorges and waterfalls are among the most fascinating destinations.

“IN AND OUT – INTO THE OUTDOOR CLASSROOMS ADAPTION OF NEW SUBJECT-RELATED APPROACHES IN DIFFERENT LEARNING ENVIRONMENTS”

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Keywords: *Education, Nonformal education, Cooperation, School programmes*

Using learning arenas outside the classroom is a well known pedagogical tool in building a varied and sustainable education. It is shown to enhance learning outcome, motivation, physical activity and social behavior among pupils and students (Fägerstam, 2012, Mygind 2007). Learning in different environments has many faces, from excursions to monuments and natural sites, over adventure trips to fieldwork and community based development projects (Rickinson et al, 2004). Most of the outdoor practice in the primary and lower secondary school systems tends to focus on environmental, social and personal development aspects in the pupils' general education, and is often limited to school subjects related logically to the outdoors, such as physical education and wild life nature activities in nature or natural environments. But going outside can offer possibilities in many aspects of the school-based curriculum, using the outside in a broad sense, as both natural settings and geoparks, museums, visitors centres etc. It is not only about changing the room and leaving the roofed settings – it also implies changes in teachers' role and learning styles.

As the teacher shifts the closed ceiling to the open air, he can also shift his mind and the biased expectations upon his role. The change of room can be liberation from sedentary school day, driven by its own inner scheduled logic, to a more flexible, purpose driven learning situation.

As the children in Europe use many hours and many years in the school, it is inevitably to use various and varied learning approaches to ensure an education for all kinds of children. In this light, getting the formal and the non-formal learning professionals to cooperate in developing learning activities show its importance. The non-formal environments offer expertise and well developed educational approaches connected to subjects. The teachers in the school must take the responsibility to let these non-formal educational activities fit into the curriculum and supplement the indoor lessons. In this field, it is of interest to let the two groups – the non-formal and the formal educators, meet to develop new insights and exchange knowledge, plans and goals. If we can encourage the schools to use frequent, curriculum based activities outside the classroom, and walk into the authentic settings with objects and artefacts connected to the subject in the non-formal museums, galleries, geoparks, educational centres, visiting trails etc., we can offer a much broader and more holistic learning environment for the children (Szczepanski, 2007). From the point of view of the non-formal educators, working closely together with the formal educational system can improve the educational offers and their learning environment.

Using geoparks as “places of learning” is more than experiencing outside the classroom, is discovering and understanding the connections between geodiversity, biodiversity and cultural identity in a historical evolution. A geopark offers students the possibility to integrate separate disciplines, contextualize knowledge to real life, develop the sense of responsibility and solidarity. Geopark's educators develop and operate educational programs at different levels not only as a prerequisite in order to spread awareness and preserve our geological heritage and it's links to our natural and cultural heritages but at the same time to reinforce community

involvement, pride, and strengthen of local identity (UNESCO Homepage). A geopark is a framework for close cooperation and partnership in order to foster a multi-stakeholder approach in developing educational activities and educational tools, supporting active participation and involvement of teachers, non-formal educators and children

Polishing the content of geopark educational offers to fit more precisely into the goals of the school can develop the usefulness and for example also the amount of visitors, and maybe open up for other ways of using the resource – e.g. working systematically with mathematics by using the time span in geology, understanding graphs and mapping, developing language in presentations, writing stories about the life of extinct animals, reading poems and listening to music – that is, using many subjects at the site visit.

In this project funded by the European committee under the Leonardo da Vinci Lifelong Learning Program, we focus on the cooperation between the formal and the non-formal professions to strengthen the educational value of field trips and learning outside the classroom. During the project period, the two main target groups, teachers from the formal sector as well as guides and youth workers from the non-formal sector, have been working together and developed a foundation course and a subject related course, using the authentic settings outside the classroom as learning arenas. In Denmark, Germany, Romania and Sweden the dual target group have been taking part at and evaluated two courses; one on the basic concepts of learning theories, and one on the practical development and presentation of subject related curriculum based courses in the non-formal learning environments.

This workshop will work within conference topics no 3: “Education in Geoparks”, and will be divided into parts: Initially, we will present our results, course aims, background, course schedule and target group at an indoor session. Secondly, we will take participants outside the conference room to demonstrate some of the practical activities developed during the project period. Last our external advisor Prof. Dr Martin Gröger will give a short presentation upon his work with science education outside the classroom.

- The idea and the theoretical background for the project (Senior Lecturer and Project Manager Karen Barfod, VIA University College, Denmark)
- The Course Content, practical activities outside the classroom (Martin Lindner, University of Marburg, Germany and Senior lecturer Eva Kätting, University of Linköping, Sweden), followed by discussions and questions

As some of the workshop will consist of practical activities outside, proper clothing and shoes are necessary. Project homepage: <http://viauc.com/projects/inandout/Pages/inandout.aspx>

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NEW EQUIPMENTS FOR THE GEOPARK INTERPRETATION, INFORMATION AND TOURISM IN VILLUERCAS IBORES JARA (SPAIN).

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Keywords: *Geotourism, interpretation, sustainable growth, Villuercas Geopark.*

The Action Plan of Villuercas-Ibores-Jara has, among other priorities, the construction of five new interpretation resources with different purposes. The main building is a restoration of the old primary school of Cañamero (fig.1). It will become the new visitors welcoming centre in September 2012. The building, freely given to the geopark service by the town hall, has a welcoming zone, the geoparks' corner, a 3D projection room, a large place for the interpretation of the geopark geological history, a zone for geological school games and another one for the commercialization of local products and geopark merchandising. Two new centres are in charge of the interpretation of the mining past of Villuercas: a little centre in La Calera represents the local lime kilns, which is useful to explain the calcareous strata of Villuercas and the lime historic use as building material (for example in the construction of the Royal Monastery of Guadalupe, UNESCO World Heritage). The other is the adaptation for visiting of the Phosphorite Mine of Logrosán. It represents a good opportunity to understand the geological concepts of fault, vein, igneous intrusions, contact aureole... as well as the important mining past of this area, which was in his time, the most important phosphate exploitation in Europe. Finally we have proposed two centres dedicated to the ethnological and cultural assets of the territory. First, the Archeological Center of Berzocana explains the painting that can be observed on the rock shelters all around the geopark below the quartzite hills. It represented also the ancient tools, objects and jewelry used by the first inhabitants of Las Villuercas. The Carnival of Souls Centre explains an original and historical carnival of Villar del Pedroso, in La Jara, as an example of the intangible heritage that accompany the geopark. Some of these centres (Logrosán and Villar del Pedroso) will be managed by the town which have an exceptional engagement in the geopark management. The others, included the main visitors center in Cañamero will be managed by the tourism companies associated to Geovilluercas, (local tourism companies association). Geovilluercas is an important geopark's partner. Its activities near the tourists, information, accommodation, guidance, etc., will be also presented in this communication.



Fig.1. The Geopark new visitors' center in Cañamero.

ACCESSIBLE GEOPARKS, GEOPARKS FOR ALL

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Keywords: *accessibility, interpretation, easy-to-read guide, Villuercas Geopark.*

We present, in our communication, the Villuercas-Ibores-Jara Geopark initiative to become a Geopark increasingly accessible to all citizens regardless of their potential limitations. We are aware that it is clear that the special landscape of our geopark, their geological and geomorphological features is, as well as many others in the network, a limiting factor for certain groups with some disability, visual or sensory or whatever other.

Working from the principle of universal accessibility is intended as a course of action in the Villuercas-Ibores-Jara Geopark.

We wanted to reflect on what it assumes the existence of sites, interpretive centers, gardens and pathways adapted or specially created for people with sensory disabilities. Also, we want to plan the design of circuits with special adjustments and support products performed inside or outside in locations of high scenic, geological and cultural interest.

We believe that Geoparks can and should enhance the relationship between disabled people and nature, and the need for a protocol to access to these spaces. There are previous experiences that allow visualizing the possibilities of people with disabilities to interact with nature under the philosophy of sustainable development written in the Earth Charter: respect for ecological integrity, social and economic justice, democracy and peace.

The universal accessibility must also be considered when we publish and disseminate texts. They must be adapted to easy-to-read guides, following the international guidelines of IFLA (International Federation of Library Associations and Institutions). In recent years we have published guides for two protected areas in Extremadura: Monfragüe National Park and the Natural park of Cornalvo. We are working on the easy-to-read guide of Villuercas-Ibores-Jara Geopark.

We would like to create a working group within the European network and the Global Network to work on a protocol of Geoparks accessibility and a catalog of best practices.

HERITAGE INTERPRETATION USING NEW TECHNOLOGIES

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Keywords: *Technology, Interpretation, Education, Tourism, Geoparks, Heritage*

The HINT Project is a four-country collective of Geoparks and aspiring Geoparks, each researching the uses and benefits of new technologies in heritage interpretation and sharing the findings.

This presentation, developed by the HINT partners, aims to give people an insight into the practical process of developing interpretive tools using new technologies. Some common problems are highlighted and some ways in which these can be addressed are shown.

HINT is a two year project part funded by the European Leader programme. The partners are Geopark Shetland (Scotland), Chablais Geopark (France), North Pennines AONB (England) and Aspiring Geopark de Hondsrug (The Netherlands).

Each Partner is developing a pilot project to investigate the practicalities of interpreting and communicating heritage, especially geological heritage, using a particular technology. An overview of each of the four pilot projects is given.

Geopark Shetland is developing a Google-maps based app for Android and Iphone that provides information about Shetland's geological sites and trails (see Fig.1). The app is linked to phone GPS systems to allow interpretive content to be triggered on-site, and makes use of augmented reality viewing to help users understand the landscape around them.

Chablais Geopark is developing a GeoRoute incorporating 23 sites of geological interest across the territory. The route combines 'traditional' on-site interpretation with flashcode technology that allows visitors to download interpretive information to their phone via a barcode. 'Virtual itineraries' are being created, for download by internet or Smartphone, to help visitors explore unmarked trails.

North Pennines AONB is testing the application and use of wifi and bluetooth technology to allow visitors to access heritage interpretation and tourist information at times when the local visitor centre is closed. Visitors will be able to download self-guide walks and audio-files to their phone via an information post and view information using an Iglass touchscreen.

Aspiring Geopark de Hondsrug is using a digital table to tell the story of the Hondsrug area. The digital table is touchscreen device which can be used by several people at once to obtain information and allows users to interact with one another. The table is linked to an app which is populated with storylines and information that can be downloaded via phone or computer.

The overall aim of the pilot projects is to develop best practice in using new technologies for heritage interpretation and to share information and ideas within the project partnership and with Geoparks across Europe.

An overview of what has been learned to date is given through practical examples that demonstrate what is involved when developing these kinds of projects, from the initial concept

through to the digital product. The huge range of digital possibilities available is shown along with some common stumbling blocks and how they can be overcome.

A short movie illustrates the work that has gone into each of the pilot projects to date and shows some of the results that have been achieved.

Further information about the progress of the pilot projects and the lessons learned can be found at www.hintproject.eu.



Fig.1. Geopark Shetland smartphone app screenshots.

CAJÓN DEL MAIPO GEOPARK PROJECT: PRELIMINARY STUDY

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Keywords: *Geopark, Chile, Cajón del Maipo*

The Cajón del Maipo is a well-known tourism destination located in Central Andes, 50 km from Santiago, the capital city of Chile (fig.1). This area is visited by national and foreign tourists and is part of the San José de Maipo county, which has an area of 4995 km² and about 13,500 inhabitants, contrasting with the nearly 6.5 million people living in the Metropolitan Region of Santiago. San José de Maipo is a semi-rural county with an unemployment rate of 9.7% (2009 data). With 11.1% of its population living below the poverty line, San José de Maipo is economically depressed compared to the neighbouring counties. The major economic activities of this area are mining, electrical energy production, livestock and agriculture. However, the Strategic Plan of the Province considers San José de Maipo a county with high potential for ecotourism, nature and environment and establishes tourism as the most promising development activity.

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 José. 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 Cajón del Maipo is the name given to this valley, which has been formed by the action of the Maipo River. With a hydrographical basin with an area of about 5,000 km², 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 Jurassic 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. Extensive research and investigation has been carried out on the geology of this area, especially since 1957, when the development of geology in Chile begins with the creation of the School of Geology at the Chile University and the Institute of Geological Research.

In terms of climate, the city of San José 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, so there are great efforts made for their conservation. The public-private initiative called "Santiago Andino" stands out as one of these conservation efforts covering 76% (3,779 km²) of San José de Maipo county and aiming to conserve, restore and protect ecosystems. This territory was declared a hunting-forbidden area.

There are two protected areas in the county. The first one is the "National Monument El Morado", a park under public administration with an area of about 30 km² located in altitudes of around 5,000 m. The main attractions are its high peaks, the San Francisco Glacier and its moraines, the San Francisco Lagoon, and its proximity to the Morales hot springs. It has a great diversity of flora and fauna, much of it native and some endangered species. The second protected area is the "Santuario de la naturaleza Cascada de las Animas", an area under private management with an area of about 36 km². It is known for its steep gorges and waterfalls, where thick and intensely folded Miocene volcanic successions can be observed. This area is also a shelter for flora and fauna.

Additionally, the county of San José de Maipo boasts great cultural and archaeological interest. To mention a few, we highlight two areas already included in the Tentative List for World Heritage of UNESCO. The first one is the "Qhapaq 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 José de Maipo county, which ends at the "Santuario de Altura del cerro El Plomo", the second area included on the list. This is the southernmost Incan ceremonial and religious site, located at 5,200 m height.

The aim of this study is to estimate the potential of Cajón del Maipo for an eventual creation of a geopark. As a first step, an inventory of the geological heritage of the county will be 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 "Cajón 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 common 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 (SERNATUR) declared in 2001 San José de Maipo county as a "National Zone of Tourism Interest". 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) 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. Thus, the establishment of a geopark near the capital, where about 40% of the population lives, could involve the community in educational activities related to the geosciences and encourage a more harmonious cohabitation with the environment.

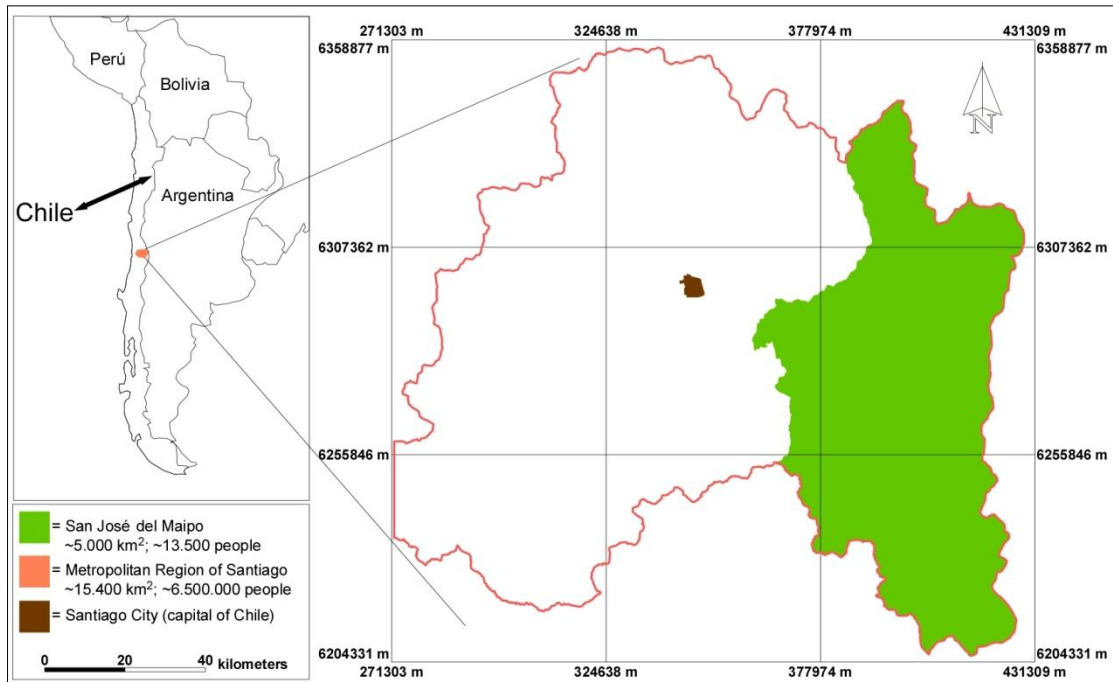


Figure 1. Location of San José del Maipo county (central Chile).

THE FIRST YEAR OF ESTABLISHMENT: STONEHAMMER

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Keywords: *information communication, earth science literacy, Stonehammer Global Geopark*

Geological education has been a part of the Saint John area since 1835 when Ebenezer Emmons and Albert Hopkins led the first college field trip (from Williams College in Massachusetts) to the region (Emmons, 1836; Falcon-Lang, 2009). Conference and university field trips continue in this area, and recently, a local teacher successfully integrated Stonehammer Global Geopark into the curriculum of her physical geography class (Saunders, 2011). Geological stories of this area include plate tectonics, mountain building, volcanism, earthquakes, sedimentology, mineralogy, and weather and also focus on geology-based industrial sites that provide educational opportunities to connect geology and society.

The overall goals of this project were twofold. First, we wanted to determine how geopark visitors and community members first became aware of Stonehammer and which information technologies were preferred for the conveyance of information. Second, we measured earth science literacy awareness to determine baseline awareness. Over the next five years, we plan to assess knowledge gains associated with the establishment of Stonehammer. In 2011 and 2012, two groups of participants (Stonehammer visitors and University students) completed a short survey (see Buhay, Best, & Miller, 2011) to assess these issues. In total, 617 participants completed the surveys ($N_{\text{community}} = 309$, average age 48.62 years; $N_{\text{university}} = 308$, average age 20.39 years). Of these participants, 382 (61.9%) were from greater Saint John, 53 (8.6%) were from other areas in New Brunswick, 82 (13.3%) were from other areas of Canada, and 99 (16%) were not from Canada.

Promoting Stonehammer to Potential Park Users

The information communication preferences of the participants differed. The community participants (52.92%) preferred to use the web as a source of information but, interestingly, university participants preferred to get in-person information (33.12%). Given that 82.57% of community and 98.70% of university participants had a handheld mobile device, information on the web and social networking sites was available to most participants and, thus, the university student preference for in-person information was not due to a lack of access to the Internet.

To determine the effectiveness of the advertising campaigns used to inform the public about the establishment of Stonehammer, we asked participants if they were aware that there was a Geopark in the Saint John area and, if so, how they first heard about the park. As can be seen in Figure 1a, community participants were more likely to be aware of Stonehammer; almost 70% of community participants from the Saint John area but only 23% of the university participants from the Saint John area were aware that a Geopark had been established. Figure 1b shows most participants first heard of the park through traditional media (print, radio, television). The community participants also reported hearing about the geopark through museum programmes/conferences and the university students reported hearing about the park from a teacher or professor. Both groups of participants reported that friends and other people gave them information about the park. Across all age groups, participants reported first hearing about Stonehammer through traditional media (print, radio, television). Younger participants were more likely to have heard about Stonehammer using websites or social media sites and older participants were more likely to have heard about the Geopark through a museum programme or public lecture. These differences illustrate the need to publicize Geopark information and programmes widely, using a variety of different methods.

Earth Science Literacy Rates

Nine questions were designed to represent concepts central to the Big Nine Ideas outlined by the Earth Science Literacy Initiative (Earth Science Literacy Principles, n.d.). Overall, the average awareness of the university students was higher than that of the community participants (90.31% vs. 85.22%), $F(1, 604) = 10.67, p=.001$. Figure 2 shows that, across most of the big ideas, the awareness of the groups was similar but university participants were more aware of Big Idea 2 (Earth is 4.6 billion years old; $p<.05$), Big Idea 3 (Earth is a complex interacting system of rock, air, water, and life; $p<.05$), and Big Idea 5 (Earth is the water planet; $p<.05$). Given the high awareness of the Big Ideas, programming in Stonehammer can focus on expanding both general and specific knowledge of relevant topics.

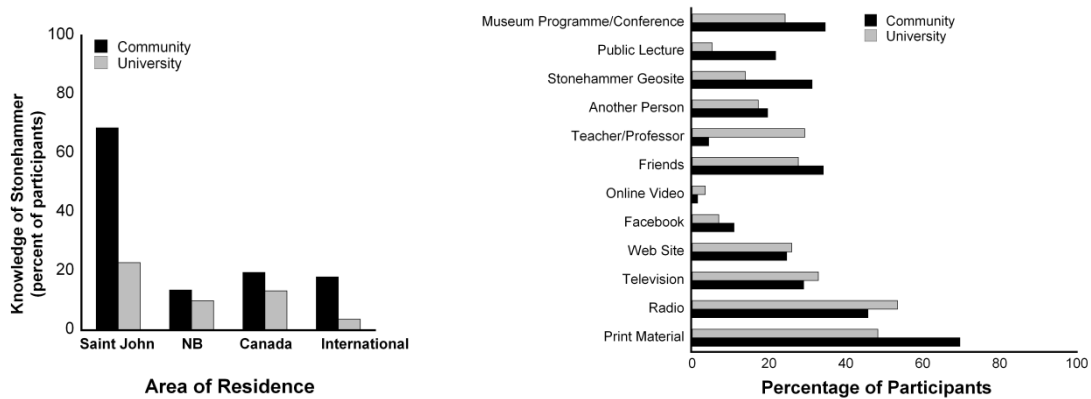


Fig.1. Participants' awareness of the establishment of the Stonehammer Geopark (1a) and how they first learned of the Geopark (1b).

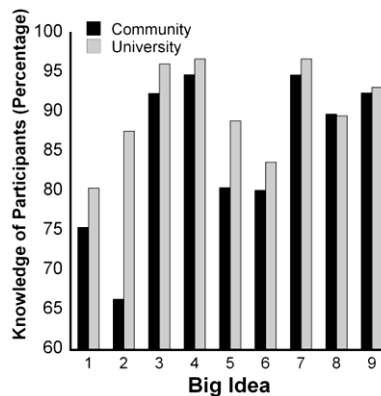


Fig.2. Earth Science Literacy Levels of University and Community Participants.

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SEISMOLOGY IN GEOPARKS – AN IRISH PERSPECTIVE

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Keywords: seismology, Irish geoparks, science communication, geoeducation

The work of the Irish geoscientist Robert Mallet (1810 - 1881) has earned him the title of father of controlled source seismology for his research into the mechanics of earthquakes and for coining the phrase seismology – the study of earthquakes. The Geophysics Section of the Dublin Institute for Advanced Studies (DIAS) has pioneered an innovative pilot geoeducation programme called Seismology in Schools in which seismometers were installed in 55 primary and secondary schools throughout Ireland (Fig. 1). The seismometers and supporting software allow students to record and study earthquakes worldwide and in real-time. The project has been very successful and has led to the inclusion of seismology on the new proposed Physics curriculum in Irish secondary schools. Moreover, the Irish schools network is linked to the growing international schools seismic network (<http://www.iris.edu/hq/ssn/schools>). Students upload the waveform data recorded by their seismometer for use by all participating schools in the project.

Building on this initiative, and recognising that Geoparks fulfill an increasingly important role in the communication of science to the public, DIAS and the Geological Surveys in Ireland and Northern Ireland have helped install seismometers at visitor centres in all 3 UNESCO-supported Geoparks in Ireland (Fig. 1). These instruments monitor real-time solid earth processes such as earthquakes and allow visitors and students to interact with their environment in an exciting and immediate way. This was shown rather dramatically on 6 June 2012 when a magnitude 4 earthquake struck some 60 km off the west coast of Ireland at a depth of 3 km. The quake was felt by many people in western counties and was graphically recorded by the seismometer at the Cliffs of Moher visitor centre in the Burren Geopark (Fig. 2) and reported in national and local media. The earthquakes in northern Italy and other more distant seismic events were also recorded by Irish Geoparks instruments.

The seismometers, together with a dedicated desktop computer, currently in use in Irish schools and in the Irish Global Geoparks are comparatively inexpensive (c. €2,000) and relatively easy to use once demonstrators have received some initial training. It has been our experience that having a working seismometer in Geopark visitor centres adds greatly to the visitor experience and stimulates a lot of discussion on earth processes. Other European Geoparks might consider the establishment of a seismic network perhaps affiliated to the IRIS network or to the EU-funded EPOS (European Plate Observing System) project.

The use of seismometer as a teaching tool, helps greatly to respond to the increased public awareness of destructive earthquakes and the ability to monitor these and other seismic events in real-time. Because seismological techniques are one of the four scientific disciplines specifically used to monitor violations of the Comprehensive Nuclear Test Ban Treaty, the incorporation of the seismometer into the school environment facilitates classroom discussion on disarmament and nonproliferation.

SIS Seismic Network 2012

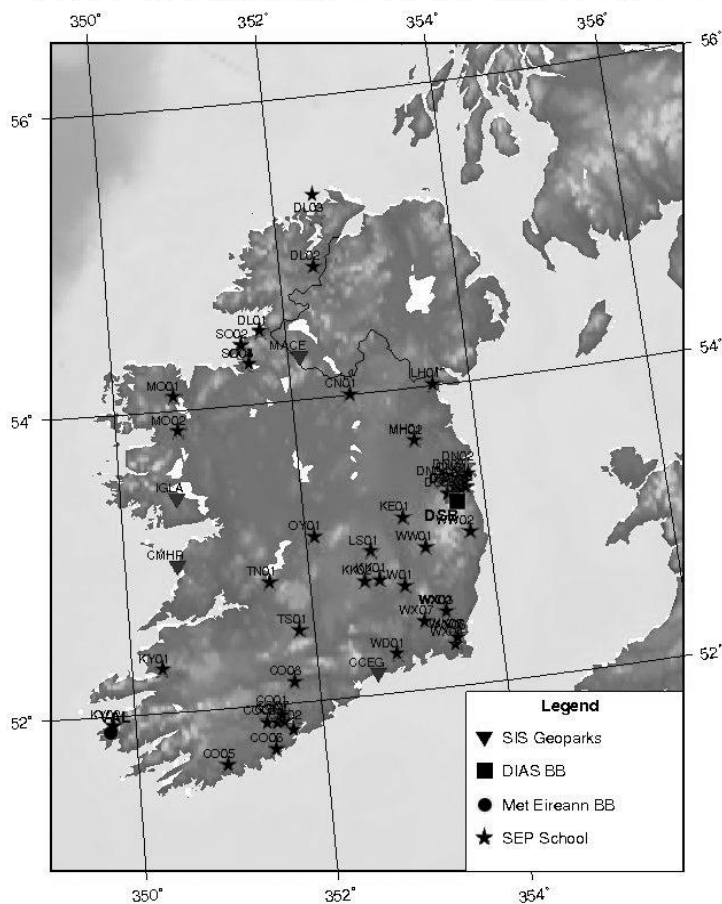


Fig.1. Irish seismic network showing participating UNESCO-supported Geoparks.

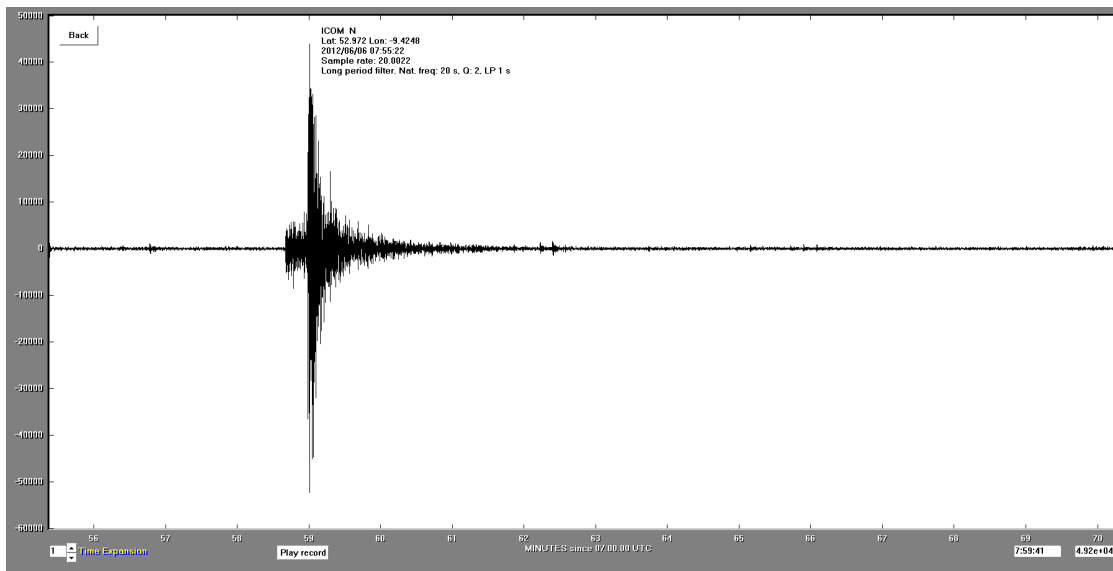


Fig.2. Magnitude 4 earthquake recorded at Cliffs of Moher visitor centre seismometer in Burren Global Geopark

PAIGNTON GEOPLAY PARK - A COMMUNITY PROJECT IN THE ENGLISH RIVIERA GLOBAL GEOPARK

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Keywords: *community, partnership, consultation, regeneration, best practice, play*

The English Riviera Geopark, situated in Torbay, South Devon, UK, joined the European and Global Geopark network in September 2007 and is active and dynamic in all areas of its work. The Geopark has a strong urban characteristic with a population of 134,000 in an area of 62km² and 42km² of sea.

Amongst other strategic plans the Geopark status is firmly embedded within the area's Community Plan which was developed with the full input of the Ward Partnerships. Operating at local level the Ward Partnerships enable people to engage with decision makers and ensure local opinion is taken fully into account at the strategic level. One such partnership is the Paignton Community Partnership. Despite its sunny seaside outward appearance Paignton was in steady economic decline long before the recent recession hit and is ranked as deprived in the following areas: income, employment, health, education, barriers to housing, living environment and crime.

However, Paignton's coastline and beach is beautiful. The residents are proud of it and their strength of support and belief in the Geopark, and determination to turn the situation around, led to £0.5 million National Lottery funded community project to create a Geopark themed play and adventure area in a central seafront location in the town of Paignton.

Working in partnership with the English Riviera Geopark and the local authority, the community has created a vibrant and diverse play space for all ages and abilities where it is now possible to swing over a Devonian sea, climb the Variscan Mountains, burrow with the giant Permian millipedes and roar with the Quaternary sabre-toothed tiger! This fantastic free facility now provides a place for all, from toddlers to grandparents, to connect with the stories of the rocks around them but it is also a new attraction that will draw in the wider community and visitors ultimately helping to sustain the seafront and town centre businesses.

The success of this project is a testament to the commitment and dedication of partnership involved and has proven that given the opportunity and support local communities can achieve great things and make a big difference.

TUNGSTEN LEGACY IN AROUCA GEOPARK

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Keywords: *Arouca Geopark, Tungsten, Heritage, Memories, Intergeneration Convey*

Located in the extreme North of Aveiro's district and inserted in Oporto's Metropolitan Area, Arouca Geopark corresponds to the administrative limits of Arouca's municipality, with approximately 328Km² and 20 parishes. During World War II (1939-1945), this region has lived a big apogee in the search for the so called «Black Gold». In this period of time Germans and English have lived, pacifically, side by side between the parishes of Rio de Frades and Regoufe, respectively, in tungsten exploitation to provide Europe with military supplies. This unchecked period in the quest for tungsten has left deep marks on the land and people, on culture and landscape which urges to be preserved in favour of future generations.

The project «Stories Told, Preserved Memories: the tungsten in Arouca Geopark» [Pinto *et al.*, 2011] has emerged in the ambit of a partnership between ADRIMAG, AGA and Arouca's City Hall, that consists of gathering of statements, documental information, photographic material, geological utensils/tools and samples, through the people that, directly or indirectly, have a connection with the tungsten exploitation. This collecting aimed not only the construction of social memory but also the preservation of the places, crafts and traditions reinforcing, like this, the territory identity and the communitarian empowering in Arouca Geopark's territory.

All of the gathering work realized, in this project's ambit, has been embodied in a set of actions, described below, that have allowed the intergenerational transmission through the preservation of material and immaterial heritage of a period with great importance for the region.

1. Exhibition «Told Stories, Preserved Memories: the Tungsten», in Arouca's Municipal Museum

This exhibition has opened on February 11th 2012 and it closed on March 25th of the same year, and has received around 900 visits. The temporary exhibitions' room of Arouca's Municipal Museum has accommodated a set of utensils, tools, photographs, statements and geological samples that have transported the visitors to the time of the «Black Gold Fever», intensely lived in Arouca Geopark during the World War II, and later on, in a not so active way, in Korea War.

2. Exhibition «Told Stories, Preserved Memories: the Tungsten», in ISCET

After the success and interest demonstrated in Arouca's Municipal Museum, the exhibition «Told Stories, Preserved Memories: the Tungsten» was held in ISCET [Higher Education Institution of Business Sciences and Tourism], from May 24th to May 31st 2012, at the time of the public presentation of the «Routes of Wolfram in Europe: Memories of Men and Industrial Heritage» project. This project consists of a partnership between ADRIMAG, AGA, Arouca's City Hall and ISCET and it has as objective the constitution of a tungsten mine's route that, starting in Rio de Frades, will extend itself to all of Europe, having as foundation the countries with tungsten mines. Notice that all collected memories and documental and photographic assets may result in strong evidences for the application of this project to the European Institute of Cultural Routes.



Fig. 1 - Exhibition «Told Stories, Preserved Memories:



the Tungsten», in Arouca's Municipal Museum
Fig. 2 - Exhibition «Told Stories, Preserved Memories:

3. Creation of a museological and interpretive nucleus of tungsten, in Arouca's Municipal Museum

As a consequence of the temporary exhibition «Told Stories, Preserved Memories: the Tungsten», Arouca's City Hall, together with ADRIMAG and AGA, is developing, in Arouca's Municipal Museum, a museological nucleus related with the thematic of tungsten in Arouca Geopark. This space has the objective of accommodating statements, documental information, photographic material, utensils/tools and geological samples that will allow visitor to learn a little about the time of the «Black Gold» exploitation, in this municipality.

4. Revitalization of traditional singings regarding miners, with a strong ethno-musicological potential

Guardians of an oral heritage, Arouca's singing groups, which are example Cabreiros' group and Santa Maria do Monte's group, as also the Órfeão de Arouca (choral society), portray, through their lyrics and musicality, an heritage with a strong ethno-musicological potential, concerning to everyday practices related to tungsten's exploitation in Arouca. The dynamics of the set of initiatives and events related to the tungsten has allowed the revitalization of the singing groups in the recovering of songs and in the active participation in local and regional initiatives.



Fig. 5 - Órfeão de Arouca (choral society) performing



Fig. 6 - Cabreiros' singing group performing

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LITHOPHONE: AN IDEIA OF EDUCATION FOR SUSTAINABILITY, *THROUGH MUSIC*

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Keywords: *Lithophone, Rock, Music, Geopark, Education*

The name of this instrument has Greek roots (lithos - stone). A Lithophone is a pitched percussion instrument, built using rocks of different sizes, providing in some cases, melody and harmony.

All orchestration books contain the same about the percussion instruments. What makes them work is the impact of an object over another. An instrument with pitched blades (cases of marimba, xylophone, vibraphone and glockenspiel), can provide melody and harmony, making these instruments similar to the piano, the organ or other keyboard instruments.

The rock is probably the material from which we wouldn't expect to pick a 'musical' sound. However, several investigations show us that rocks may well have been one of the first (if not the first) musical material, whether as a form of ceremonial ritual or a mean of communication.

Our goal is to promote the links between geology, industry, heritage and environment (adding, in this case, music), providing learning tools and an awareness of the sustainability of our planet, for a rational use of natural resources. Music may well be the 'cement' that binds all these issues together, being a privileged vehicle, through educational activities, to introduce, in practice, these issues to younger people.

By definition, a Geopark is not a confined space or a thematic park. It is a territory where people, their customs, traditions and culture are important, and where the activities are intended to involve everyone. On the other hand, the educational aspect is structural on the action of the entities most directly involved in conservation and promotion of these territories. So, the construction of this instrument, using materials from the region, may well be a creative and inclusive way to involve children, trough art, on the concept and importance of conservation and sustainable use of natural resources.

So far, a few experiments have been performed using polished granite and schist, the two predominant rocks in the territory, and it was possible to determine the material type, thickness, and some sizes.

We expect that any Geopark can accept this idea, finding here a way to combine education, music, geology, heritage and sustainability.



Fig. 1 - The first experiences with polished granite – seven pitched blades.

EXPANDING THE GEOCONSERVATION TOOLBOX: DIGITAL DOCUMENTATION FOR INTEGRATED HAZARD ASSESSMENT AT THE GIANT'S CAUSEWAY WORLD HERITAGE SITE

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Keywords: *Geoconservation, Digital Documentation, Remote Access, Hazard Assessment, Sustainable Access*

Point clouds derived from laser scanners, stereoscopic photographs and video, High-Dynamic Range photography and 5.1 Dolby Surround Sound; represent just some of the digital techniques used to document and disseminate natural heritage values. Whilst applauding the valuable contribution Digital Documentation makes to contemporary records of local, national and global heritage, a brief overview of the origin and evolution of conservation philosophies suggest Digital Documentation as an evolution of poetry, song and art, cannot act as a substitute for practical conservation of nature. As a tourism 'honeypot', the Giant's Causeway and Causeway Coast World Heritage Site is Northern Ireland's most significant heritage resource and represents a contested space where managers attempt to balance visitor requirements with safety considerations created by frequent rockfalls. Whilst the National Trust (site owners) recognise the potential for Digital Documentation to provide much safer remote access, they understand that virtual visits do not provide the stimuli required to ignite an interest in the natural world and our need to conserve it. This short article reports on a project designed to expand the geoconservation toolbox, not through remote access to natural heritage, but by facilitating physical access and practical conservation through an integrated approach to Digital Documentation and Hazard Assessment.

Poetry, song, art and other artificial representations of nature have historically failed to act as adequate substitutes for physical access to nature. It is worrying that increasingly artistic and visually impressive Digital Documentation techniques are proposed as a means of remote access to irreplaceable sites. Figure 1, a digital representation (3D point cloud) of the dynamic Causeway Coast, fails to fuel all five senses and removes elements of discovery, creativity and analytical thinking which are provided by immersion in the physical environment. Studies show that early personal experience with nature, initiated by an adult, continues to be the primary factor influencing a contemporary conservationists' relationship with nature. To foster a conservation ethic, geoconservationists must ensure Digital Documentation secures physical interaction and sharing of nature at an early age, across generations and at a local scale.

The National Trust insists technology must support rather than substitute geoconservation and physical access at dynamic natural sites. In response a new recipe for Digital Documentation has developed at the Giant's Causeway. First a database of natural heritage attributes is established and laser scanning combined with GPS surveys provide data required to build a 3-dimensional model upon which data is referenced. Information is integrated within a single Geographical Information System (GIS) and analysed to develop hazard assessment techniques. Figure 2 demonstrates how technologies regularly employed in Digital Documentation can provide data with potential far beyond artistic documentation. Application of off-the-shelf GIS software enables integration of previously isolated and consequently limited data sources. At the Giant's Causeway provision of integrated hazard assessment maps has been instrumental in providing site managers with information necessary to make decisions about visitor safety.

Informed decision making ensures managers work in tandem with the site's natural dynamics, significantly reducing risk for both visitors and staff.

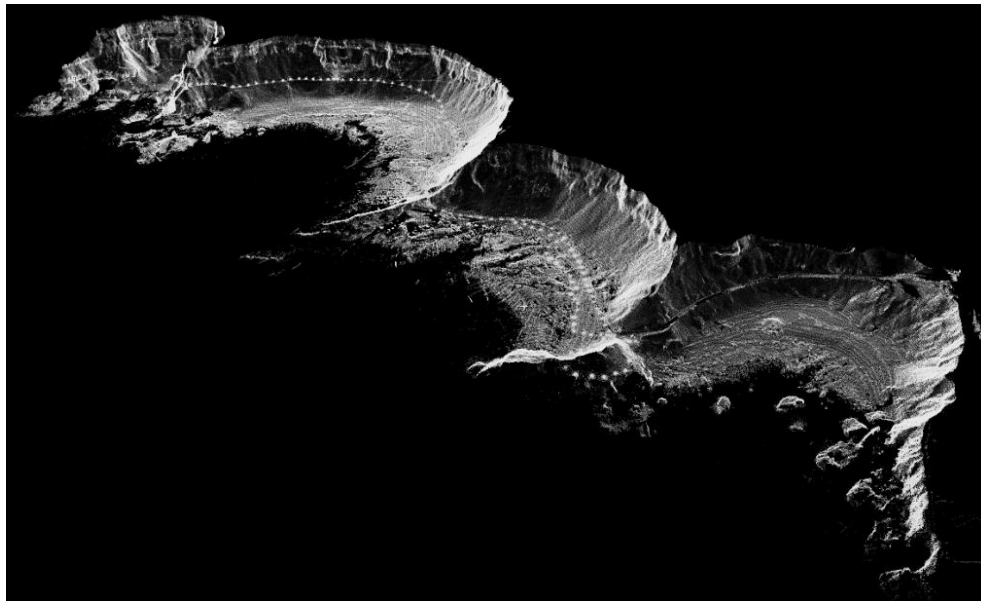


Fig. 1. 3-Dimensional point cloud showing the embayed giant's causeway and causeway coast world heritage site, Northern Ireland (55.23°N , -6.51°E)

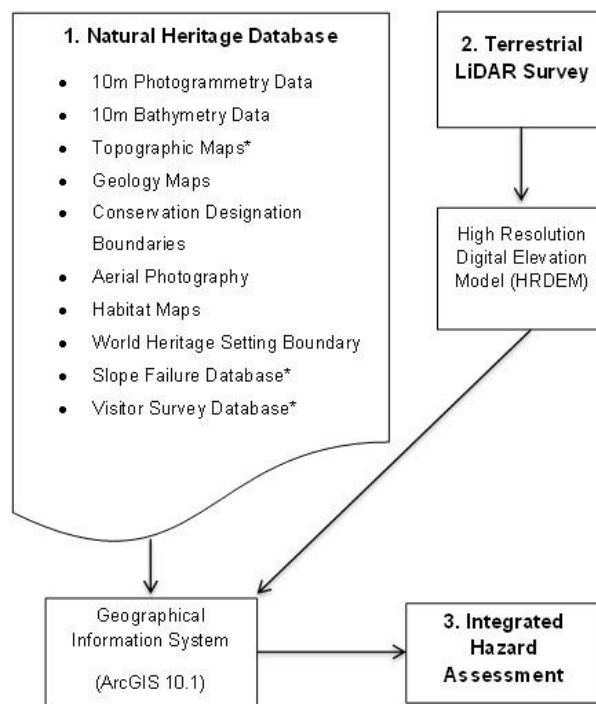


Fig. 2. New recipe for digital documentation and integrated hazard assessment

INFORMAL SCIENCE LEARNING IN GEOPARKS

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Keywords: *earth science literacy, geoeducation, informal learning*

Science learning takes place in the classroom, in the workplace and in everyday life. On a daily basis, we encounter public communication of science through sources such as the news media, television, community organizations, museums, science centres, and parks. We engage in learning through many of these sources and this is significant in our pursuit of lifelong learning (Falk, Storksdieck, & Dierking, 2007).

Public education is an integral component of geoparks (UNESCO, 2010). Through interpretive programmes, signage, tours, electronic media, etc. geoparks are able to tap into a person's curiosity and engage them with a geological "story" while providing them with a fun experience. Visitors are introduced to information about the Earth and its systems. Because of the many challenges that are facing us, whether it's climate change, nonrenewable natural resources, water shortages, or natural hazards, earth science literacy is a key component that enables us to make informed decisions about these things that affect our planet.

We are in a unique position to measure earth science literacy in an area where there is a newly established geopark, Stonehammer, the first in North America. We have the opportunity to collect earth science literacy base line levels. Our goal is to determine whether earth science literacy levels change because of the establishment of the park and the educational components that are offered. For example, a local teacher has already incorporated the geopark into the curriculum of her high school physical geography class (Saunders, 2011). Using the base line levels we will be able to compare knowledge gains over time.

Funded by the National Science Foundation, in 2008 the Earth Science Literacy Initiative (ESLI) developed a community-based document that depicts the nine major ideas and fundamental concepts that all people should understand to be earth science literate. According to the document, earth science literacy involves the ability to understand the fundamental concepts of Earth's many systems, to find and assess scientifically credible information about Earth, to communicate about earth science in a meaningful way, and to make informed and responsible decisions regarding Earth and its resources (Earth Science Literacy Principles, n.d.).

We developed two surveys to assess geopark knowledge and general earth science literacy. The Geopark Field Survey (GFS) assesses knowledge of Stonehammer Geopark visitors and was used in a field study during summer 2011 (Buhay, Best, & Miller, 2011). The Earth Science Literacy Survey (ESLS) was developed to assess general knowledge of concepts central to the earth sciences. This survey included 28 questions measuring concepts central to the nine Big Ideas outlined by the ESLI. We randomly selected three or four concepts from each Idea to be representative of the underlying concepts. The overall purpose of this study was to ensure that the GFS nine Big Idea questions adequately reflected the fundamental concepts underlying each idea.

A total of 219 university participants enrolled in first year biology and psychology courses at the University of New Brunswick, Canada completed two surveys. There were 150 females (Mean age = 21.19 years, SD=3.96) and 69 males (Mean age = 21.28, SD=3.90). The majority

(71.2%) of participants indicated that they were from the Saint John area, 9.1% indicated that they were from New Brunswick, and 10% indicated that they were from other areas in Canada.

We compared participants' knowledge of each Big Idea (Geopark Field Survey) with the knowledge of the underlying concepts (Earth Science Literacy Survey). Overall, the scores on the two surveys were positively correlated, $r(219)=.34$, $p=.0001$ and thus, when participants were aware of a Big Idea they were also aware of the concepts underlying that Idea.

The overall scores on both the field survey (GFS) and the literacy survey (ESLS) were high. On the GFS, accuracy ranged from 88.1% (Concept 6: *Life evolves on a dynamic Earth and continuously modifies Earth*) to 97.7% (Concept 7: *Humans depend on Earth for resources*). On the ESLS, overall knowledge of the Big Ideas was also high, ranging from 68.8% (Concept 5: *Earth is a water planet*) to 91.8% (Concept 1: *Earth scientists use repeatable observations and testable ideas to understand and explain our planet*). Participant responses for each concept were similar (with one exception). On the ESLS, participant accuracy was only 26.9% on Big Idea 5 Concept 2 (*Water is essential for life on Earth*). The lower accuracy on this Concept led to lower overall accuracy on ESLS Big Idea 5. Overall, if participants were aware of a Big Idea, they were also aware of the individual concepts underlying that idea.

Given these results we are confident that the GFS can be used to broadly assess earth science literacy in the field. An overall goal of our research programme is to evaluate if earth science literacy increases due to the establishment of a geopark and the construction of a valid instrument that can be used in field research is key to this goal.

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THE LOCAL NETWORK OF TRAILS IN BEIGUA GEOPARK: RAISING GEOTOURISM, SUPPORTING LOCAL ECONOMY

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Keywords: *geopark, geotrails, geotourism, sustainable development*

Beigua Park, the widest nature protected area in Liguria, spans across the Provinces of Genoa and of Savona and it represents an excellent cross section of the region's features. It can be defined as a spectacular balcony formed by mountains overlooking the sea. It stretches for twenty-six kilometres of mountain ridges, two steppes away from the Ligurian Riviera, that encompasses grassland and precious upper-level wetlands, thick woods of beeches, English oaks, and chestnut trees, maritime pinewoods and strips of Mediterranean vegetation. It is a real mosaic of environments, which makes it one of the richest areas in Liguria in relation to biodiversity and geodiversity.

In March 2005 a specific panel of international experts conferred upon the Beigua Park district the distinction of entry into the European and Global Geoparks Network, under the auspices of UNESCO.

The international recognition has been achieved due to the fact that the Beigua Geopark region:

- is characterised by a geological heritage of particular interest
- includes a certain number of valuable geological sites from a scientific, aesthetic, educational and public knowledge point of view
- makes use of facilities for information and dissemination on its territory (visitors centres, information points, museums, etc)
- is part of an area that adopts a territorial policy that has been negotiated with local administrations and that is focused on the development of natural resources and on planning a contextual strategy for a sustainable socio-economic development to benefit local communities.

The Beigua Geopark includes the territory classified as the “Beigua Regional Nature Park”, and a broad zone functionally connected to the Park itself. It covers an area of 39.230 hectares, and it comprises the Municipalities of Arenzano, Campo Ligure, Cogoleto, Genova, Masone, Rossiglione, Sassello, Stella, Tiglieto and Varazze.

In Geopark Beigua tourists can enjoy an extensive network of footpaths which stretches for about 500 km. giving the opportunities to admire and appreciate the natural beauty of the area and several historical and cultural sites.

Walking along the trails in the Geopark on both sides (Tyrrhenian or Po plan) or along the ridge marked by the Alta Via dei Monti Liguri (www.altaviadeimontiliguri.it) is like leafing through a wonderful book telling the history of man and nature in Beigua territory.

Several trails have been dedicated to geology and geomorphology to show the great value of the geological heritage in Beigua Geopark. Often the Geopark Authority has developed thematic equipped geo-trails, supported by interpretative panels and educational material.

The different geological trails allow the visitors to discover some of the best geosites in the territory of Beigua, such as the spectacular canyons modeled in the conglomeratic formation in the Gargassa Valley (Rossiglione) or the rich fossil flora, consisting of terrestrial higher plants with trunks and leaves, Stella Santa Giustina area Equally amazing is the fossil coral reef in Ponte Prina - La Maddalena (Sassello) characterized by showy coral colonies set directly on the

ophiolitic substratum or the curious ophiolitic lherzolite spheroids in the area of Lake Gulli (again in Sassello).

The ideal “geological” journey includes also the meanders in the plain of the Abbey of Tiglieto, where it is possible to visit the first Cistercian abbey built outside the borders of France (in 1120), or an excursion to discover the ophiolitic outcrops in Passo del Faiallo locality, very rich for the precious red crystals of garnet.

Further geo-trails show the fascinating blockstreams and blockfields on the top of the Beigua (in the localities of Torbiera of Laione, Prariondo and Pian Fretto) which testify ancient geomorphological processes occurring in periglacial environment or the marine terraces along the coast between Varazze, Cogoleto and Arenzano which recorded the fluctuations of the sea level.

In addition to the several trails to walk, the Beigua Geopark offers many other interesting opportunities to practice outdoor sports as mountain-bike, horse-trekking, orienteering, Nordic walking, canyoning, climbing and bouldering, paragliding.

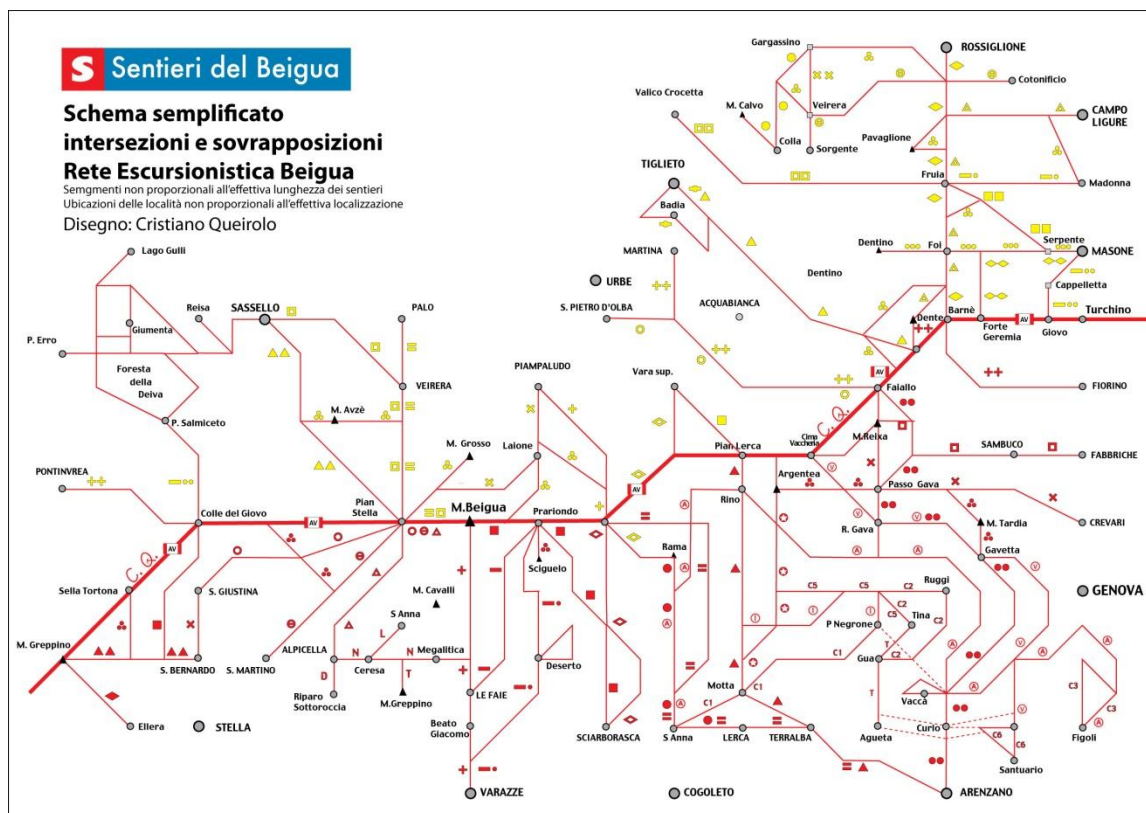


Fig. 1. The local network of trails in Beigua Geopark

The local network of thematic trails is an element of great attraction from a touristic point of view. It encourages the development of initiatives and activities to increase the tourism attendance in the district and to promote the Geopark territory as an extraordinary area for leisure and geology popularization

In the framework of those initiatives to support local community a new project about the “suggested lodging of Beigua Geopark” has been recently launched. It is a circuit of agritourism farms, bed & breakfasts, hotels and mountain huts which have agreed to collaborate with the Park Authority to promote sustainable tourism, which pays careful attention to local traditions and to environmental quality.

PREADAPTION OF THE EDUCATIONAL PROGRAMME ROCHA AMIGA (FRIENDLY ROCK) TO GEOPARKS

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Keywords: *Educational programme, Geopark, rock hand-specimens, pedagogical kits*

Rocha Amiga (Friendly Rock) born as a project sponsored by the Portuguese National Agency for Science education and popularization *Ciência Viva* (<http://www.cienciaviva.pt/>) was one of the initiatives promoted by the Portuguese Committee for UNESCOs International Year of Planet Earth (IYPE 2008; <http://www.progeo.pt/aipt/>). At the time its main goal was improve geosciences teaching capabilities through a rock hand-sample exchange network between Portuguese schools. It subsequently evolved to become an educational programme suitable to test innovative Geology-teaching strategies and promote an exchange of experiences between CPLP countries (Community of Portuguese Language Countries).

Rocha Amiga three-step strategy gradually gained form as an educational programme in itself. The *first-step* is an invitation to schools to be better acquainted to its geological background. Is still common to high school teachers (and obviously to their students and relatives) to be unfamiliar with the rock(s) that outcrop inside the recreational patios or in their vicinity (for schools located in strongly urbanized areas). Foreign and exotic examples from available manuals or web-search are often taught for geological settings or processes similar to those that may also characterize school foundations. Being one of the main goals of a Geopark to decode the geological heritage of its territory, the establishment of educational programmes to introduce and explain school's particular geological setting is clearly a priority.

The *second-step* derives from a chronic need of schools to have their own didactic collection of rock samples. To find a didactic hand-specimen of a certain rock type is harder than it looks since, for instance, weathering features tend to distract from diagnostic characteristics (unless weathering *is* the pertinent feature). On the other hand many available specimens do not have a proper location label or any additional information regarding its geological setting. After each school becomes aware of its geological inheritance and in cases geoconservation is not an issue, after collecting their own rock hand-specimens any surplus can be used to promote exchanges between schools. By establishing an exchange network across the territory that defines the geopark to obtain a representative collection of its most important rock-types suddenly becomes rather easy and immediately available for pedagogical purposes. Since Geoparks have an important role in what concerns geoconservation and awareness of damages to the geological natural heritage promoted by unregulated collection activities focus must shift from the rare and peculiar to the common and typical and from outcrops to quarries.

The *third-step* provides an answer to the question: we already identified rocks so, what then? In most cases geological practical activities inside classrooms end with the macroscopic identification of rocks. However, many other interesting geological aspects and processes can be taught with a well-selected set of rocks, what we called the "*Rocha Amiga* kit". For younger classes, multi-kits (i.e. 5-6 kits with similar contents; Fig. 1) allow to run a particular practical activity simultaneously by students arranged in working groups. For elder classes, pluri-kits, each exemplifying a particular geological process, can circulate throughout working clusters providing multiple and comprehensive practical interpretation exercises. This way, the geopark's geo-history can have an in-classroom first approach before fieldwork sessions, thus

facilitating student’s apprehension of the often not-so-easy geological interpretation of the landscape.



Fig. 1. Example of a multi-kit. Two of a five boxes-set on experimenting the usefulness of the common “test of the acid” (limestone identification through the spontaneous reaction of CaCO_3 to diluted HCl) with two whitish and two blackish rocks, some with positive and others with a negative reaction, independent of its color. Based on rocks typically used on Portuguese sideways.

Several examples will be presented during this short communication. One such example is the pedagogical kit (Porto Santo’s round-pebble game; Fig. 2) directly derived from the strategy delineated to promote the geological importance of the aspiring Porto Santo geopark (Eastern North Atlantic Madeira archipelago) printed as a small booklet entitled “The Ages of Porto Santo Island”. Others already integrate educational initiatives involving schools from the Brazilian *Minas Gerais* region as part of the aspiring *Quadrilátero Ferrífero* geopark-promoting program.



Fig. 2. Example of one of several pluri-kits used by the Rocha Amiga programme: the *Porto Santo Round Pebble Game* based on popularization activities promoted by the aspiring Porto Santo Geopark.

THEMATIC CARTOGRAPHY AS AN INTERPRETATIVE TOOL IN THE NATURTEJO GLOBAL GEOPARK (PORTUGAL)

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Keywords: *Naturtejo Geopark, GIS, thematic cartography, applications, interpretation*

The Naturtejo Geopark was the first Portuguese geopark to join the European and Global Geoparks Network, under the UNESCO auspices, in 2006. It is a 4617 km² territory which integrates 6 municipalities: Castelo Branco, Idanha-a-Nova, Nisa, Oleiros, Proença-a-Nova and Vila Velha de Ródão.

The goals of the Naturtejo Geopark are to investigate, protect, promote and disseminate the Geological Heritage through educational and tourism activities. Together with other scientific and cultural thematics, it also intends to manage the geodiversity, with the support of the public consciousness, such as the promotion of the science in the education. With such wide territory covered by Naturtejo, it is of the utmost importance to have not only strong scientific fundamentals, but also excellent interpretative and disseminative materials. Through the Geographic Information Systems (GIS), such as the ESRI ArcGIS software, digital thematic cartography material has been developed, based on the digital cartography available on the Environment Digital Atlas – Environment Institute (Portugal). This helped fulfilling the lack of support for territory interpretation, and can be used as a tool for educational programs and other science interpretation activities.

The work described in this paper is about the digital thematic cartography developed during an internship at Naturtejo Geopark, as a support tool for the formal and non-formal education in several thematics. When we are studying the thematic cartography, we are recurring to graphical representations of the distributions of features and properties of a particular area, which represent a tool that simplifies the interpretation, and if properly used can be excellent to better fit and explain the territory morphology. A thematic map is a map which represents the cartography of a particularly phenomenon (Leite *et al.*, 2010), such as the natural resources, protected areas, vegetation, soils, among others.

Based on the available digital information in the Environment Digital Atlas – Environment Institute, in Portugal, it was possible to build a cartographic database for the Naturtejo Geopark territory. Therefore, with the support of the EDRISI ArcGIS software, several thematic maps were developed, combining different information in several shapes: geological, tectonics, soils, hypsometric, hydrographic, geomonuments, protected areas and geomorphologic, the last was based on the Geomorphological Map of Portugal, in a 1:500 000 scale. This cartography was developed for all the Geopark territory, but also in particular for each one of the municipalities and some parish villages highlighting their Geological Heritage.

In the Educational Programs of the Geopark Naturtejo there are field trips to its geomonuments, which aims to use as educational tools the Geological Heritage and the geoconservation, performed by its specialized technicians. In these activities, didactic models are used to help to better understand the meaning of some features and processes. In this context, the use of thematic maps reveals itself as a favorable tool given all the didactic potential of using graphic representations of land surface.

To better fit any geosite, whether for a scholarly audience or for tourist one, with the appropriate approach, the analysis of thematic cartography helps reducing the level of abstraction inherent to geological themes, the reliefs according with the geodiversity, the landforms of the territory according with the geologic evolution, such as faults scarps or residual reliefs, the hydrographical net which carved the region and which respond to the geological discontinuities, or even the distribution of the classified areas through the Naturtejo Geopark, such as the

Protected Areas Network, Important Bird Areas (IBA's) or Natura 2000 sites. Specifically, in some levels of teaching, cartography integrates the programmatic contents, which means that the development of specific activities with cartography can be performed with specific material within the territory of the Naturtejo Geopark, including interpretation of topographic charts, scale exercises, making profiles, thematic maps interpretation, specifically reading geological maps and stratigraphic logs.

The geological cartography, although in a simplified scale, has an added importance due to its utility in the domains of the mining exploitation and other energy sources, aquifers, nature conservancy, and particularly of the Geological Heritage (Rebelo, 1999)

The utility of the thematic maps it is not only important to the educational programs of Primary, Elementary, Secondary, High School and University levels of the Naturtejo Geopark, but also to the scientific meetings, conferences and others, as a framework for the works in progress at the scientific or geotouristic levels.

Concerning the target audience, it is important to consider the sort of maps to use, based on the goals of the visit. The thematic cartography is also advantageous to include in leaflets (for instance "Geomining Heritage of Oleiros"), interpretative panels and field guides to contextualize the theme and the discussed area.

In the Educational Programs of Naturtejo Geopark interaction between the school groups and the Geological Heritage is highly important, and for this, it is important to have a good interpretation. This helps captivating and promoting the interests of all in the formal and non-formal education. One of the methods that can be used to explore the vast territory of geopark is through its thematic cartography, in the different scales, which comes to strengthen the diversity of supply issues for interpretation and territorial management. Posteriorly, and to get the most of the GIS, a more technical and detailed cartography can be developed, taking into account the fact that not all the territory the Naturtejo Geopark is charted in 1:50 000 scale, in particularly part of the regions of Castelo Branco, Idanha-a-Nova, Proença-a-Nova and all the Oleiros region; as well as 3D cartography, such as, Digital Elevation Models.

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PROTECTING AND USING GEOSITES: A PROJECT TO ESTABLISH GEOHERITAGE MANAGEMENT PROCEDURES

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Keywords: *geoconservation strategy; geoheritage; management*

A geoconservation strategy for a region or a country must be based on six main stages: inventory, quantification, classification, conservation, promotion and monitoring of geosites (Brilha, 2005). The first two steps constitute the geosites assessment and the following four are considered to be their management. Inventory methods and especially proposals for the quantification of different types of geodiversity values have been the subject of numerous studies, during the last years. This kind of methodological information is already sufficient to support assessment procedures at local, regional or national scales (Reynard *et al.*, 2009; Pereira & Pereira, 2010). However, there are few works supporting procedures related with geosites management. The scarce examples of methodological proposals in geosites classification, protection and monitoring do not justify the solutions presented (Mampel *et al.*, 2009, Puga *et al.*, 2009; Lipps, 2009). On the other hand, some works focus on geosites touristic or educational values, directed primarily to protected areas or geoparks in Portugal (Araújo 2005; Catana, 2008; Vasquez, 2010), Brazil (Moreira, 2008; Mansur, 2009) or in specific contexts such as mountain environments (Pralong, 2006; Cayla, 2009) without discussing the background, the feasibility and the effectiveness of these tools. Works specifically on these methods are scarce (Hose 2006; Carcavilla *et al.*, 2010) and much of the interpretation and dissemination of geosites is based on general principles of environmental interpretation.

Geoconservation research has been subject to substantial progress in recent years in Portugal, following a global trend. This is expressed by the multitude of scientific publications devoted to geosites inventory and quantification methods. However, there are still a significant number of difficulties linked with management, especially regarding legal classification and effective protection of geosites. The recently finished inventory of geosites with national and international relevance encloses 322 geosites spread over 27 thematic categories that were surveyed for more than 70 geoscientists (Brilha *et al.*, 2010). It is now important to ensure proper and effective management of these geosites and others of lesser importance by means of classification, conservation, promotion and monitoring.

The project here presented aims to lay the groundwork for a geoconservation strategy in Portugal, providing a methodological basis and technical support to these management procedures, which must be performed sequentially and concerted. The work aims to address issues for which there has been no objectivity such as: how to classify a geosite? What is the most appropriate legal figure in each case? How to delimit the area to be classified? How to solve issues of ownership of land? What are the appropriate techniques to protect and/or promote different types of geosites? Should some geosites be protected in situ or ex situ? Tools such as interpretative panels are functional in geological heritage? What kind of language should be used? What is the most appropriate type of illustration? What are the communication media best suited for each type of visitor (tourist, student, scientist)? How, when and who should perform the monitoring? What monitoring indicators should be used?

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THE TRILOBITES TOUR ROUTE IN PORTUGAL – DEVELOPING THE FIRST GEOTOURISM ITINERARY DEDICATED TO ORDOVICIAN PALAEOBIODIVERSITY

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Keywords: *Trilobites Route, Geotourism, organizing the offer, Ordovician, Centre and North of Portugal*

A thematic tour devoted to trilobites

Thematic routes, such as the most recognized gastronomical, architectonical or famous writer's tours, are tourism products organizing natural or manmade attractions accessible around a chosen theme. In recent years the number of thematic routes all over the world was multiplied following the trend for stronger networking cooperation among organizations or regions. With the advent of protected natural areas based on the Geological Heritage and the Geoparks in Portugal there is an increasing demand on Geotourism attractions that must be fulfilled by organizing the existing offer or utilizing almost unexploited tourism resources. A thematic route linking geotourism attractions is the way to diversify the tourism demand by improving quality and thus providing stronger arguments to enlarge the time of holidays and reduce seasonality, with a relatively small investment. For the general public, trilobites are the dinosaurs of the invertebrate animal world. Fossil diversity and abundance in the Ordovician rocks of Portugal, together with historical and well-established palaeontological research in internationally-well known or newly-discovered fossil sites, and interpretive facilities already available, makes trilobites a logical brand for a thematic geotour. Under the agreement between Naturtejo partnership managing Naturtejo Global Geopark, the Faculty of Science of the University of Porto and the Geological Interpretation Center of Canelas, the project "Trilobites Route" between Douro and Tejo rivers is being developed in the frame of the Centre of Portugal Tourism Region. This project unequivocally joins the three areas in Portugal where trilobites can be enjoyed on-site. Here we present the Trilobites Route highlights starting from Porto International Airport where most of the low-cost flight companies operating to Europe are based. Valongo Palaeozoic Park is just 20 km from Porto. As alternative, the Route may start in the Lisbon International Airport connected worldwide, with a 2 hour drive to Naturtejo Global Geopark where the Ichnological Park of Penha Garcia is part of.

Trilobites destinations in Portugal

Valongo Palaeozoic Park may be the first stop for discovering the ancient world of the trilobites. The Park opened in 1998 as a result of the partnership between the Municipality of Valongo and the Faculty of Science of the University of Porto aimed at priority to preserve and disclose the palaeontological heritage of Valongo area. Among the precious and diversified geological heritage existing in the Park, the internationally known Ordovician trilobites of Valongo are of particular interest owing to their scientific, didactic and aesthetical values. In the Park an Interpretative Circuit with three geo-trails is available to visitors. In one of them (green trail) a route 5 km-long signed along the right bank of Ferreira river follows the Ordovician sequence allowing to make a journey through geologic time since the beginning of Ordovician with the opening of Rheic passing through a sea with a great biodiversity dominated by trilobites till the ice age of Upper Ordovician that almost extinguished these marine

invertebrates. This trail ends in a small typical rural village called Couce. In the Park there is an Interpretative Center where, among other didactic materials, thematic posters and a permanent exhibition of fossils of the Palaeozoic of Valongo, namely trilobites, exemplify the forms of life that populated the seas of Valongo about 470 million years ago.

Canelas Fossil Site is remarkable for the reconstitution of the Ordovician ecosystem where different species of giant trilobites thrived. Another singular feature here is the occurrence of mono- or plurispecific congregations of trilobites evidencing gregarious behavior. The fossil site is actually an active quarry for fine slates. “Ardósias Valério & Figueiredo, Lda.” has been doing a meticulous work in the last two decades collecting the fossils as priority in the industrial activity, that otherwise would be almost impossible to achieve such important palaeontological collection. Nowadays recognized for the international importance, the former known “Slate Quarry of Canelas” is actually a well-established site for the geology of Portugal. This very original example of geoconservation, as result of the solid cooperation between the extractive industry and researchers from several universities, makes a collection of reference available for new advances in different palaeontological disciplines and life evolution. The Geological Interpretation Center of Canelas, also known as the “Museum of Trilobites” and unique in its kind, enables visitors to travel to the Dawn of metazoan life and to contact with the animals that lived in the Ordovician sea 465 million years ago. Open to the public since 2006, the Fossil Site of Canelas inspired the application of Arouca to the European and Global Geoparks and the trilobites are now an icon for the region. Born as a private family project and based on two decades of careful fossil collecting the giant trilobites of Canelas are now inspiring entrepreneurship, with the development of new handcraft approaches and the very special restaurant “Trilobite” at Canelas.

Ichnological Park of Penha Garcia immerses the visitor into the life modes of the long-extinct trilobites. Integrated in an outstanding scenario where vertical quartzite beds present fossil behavior like a gigantic art gallery, the Park symbiotically includes the classic *Cruziana* trace fossils in exquisite preservation with local rural life and heritage. The visitor discovers a new world of wonder by the Fossils Trail, 3 km-long signed trail surrounding the village of Penha Garcia. Guided tours and educational programs are provided by skilled rangers in the local tourism office and exhibit gallery. The tour includes the visit to the historical part of the village with the quartzite neighborhood and the Templar Castle, the viewpoint of the Mother Church with panel interpretation and the 5 centuries-old watermills recovered for use. Those who wish to find the Ponsul gorge in an alternative way may prefer the rock climbing school. The local Interpretive Center and the House of the Fossils provide information on the fossil site in place. Pego swimming area is a must stop during the hot summer. Alternatives provided by local companies include a donkey ride or 4x4 in the Smugglers paths, kayaking in the Penha Garcia reservoir or traditional baking. Trilobite.Aventura is an active tourism company providing activities in the Ichnological Park. Tourism facilities include a rural guest house – Casa de Santa Catarina, restaurants, bar and a traditional bakery for tasting local flavors, as well as the “Rancho das Casinhas” horse ranch and a tourism complex with swimming pool and multisport.

Work in Progress

After the “Trilobites Tour Route” presentation to Centre of Portugal Tourism, including a comprehensive description of the relevance of each of the fossil sites attractions and the roads signing plan, the next steps will be to improve the cooperation with Porto & Norte Tourism for the development of communication/interpretive tools for the new Trilobite-themed attractions, such as website, tourism brochures or information panels.

GEOMINING HERITAGE IN NATURTEJO GEOPARK (PORTUGAL) – THE ROLE OF TEMPORARY EXHIBITIONS FOR CONNECTING LOCAL COMMUNITIES WITH GEODIVERSITY

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Keywords: *Naturtejo Geopark, Geomining Heritage, local exhibitions, local communities, raising awareness*

Naturtejo Geopark has a wide geodiversity with recognized Geomining Heritage whose marks were left in the landscape for more than 3000 years without significant environmental impacts. In the last two centuries 110 mining concessions existed at the Geopark territory together with hundreds of non-formal explorations for cassiterite and wolframite during the Second World War and the beginning of the Cold War. Nowadays there are no active mines in Naturtejo Geopark. Geological resources contribution for economy was resumed to granites quarrying with secular tradition at Alcains (the land of stonemason workers) and at Alpalhão, bottled water at S. Vicente da Beira and thermal springs at Termas de Monfortinho and Fadagosa de Nisa, besides prospection of mineral resources, mostly gold.

The aim of Naturtejo Geopark is to disclose the wonders of mineralogy and mining geology providing at the same time information about the social and environmental impacts of mining activity, both positives and negatives, in order to prepare communities for important decisions regarding land management and sustainable local development. One of the recent approaches of Naturtejo Geopark is to revitalize old stories and techniques about mining, including the know-how of old miners told by them (Fig. 1a).

Segura Mining District was one of the most important districts of the region, where barium, tin, lead and wolfram were exploited during the first half of the 20th century. There are large areas of tailing piles, galleries and shafts still around, as well as the last remains of the machinery and the old washing factory. The exhibition “When we went for ore” (= “Quando a gente andava ao *menério*”) dedicated to Segura Mines is a part of a long term project that has been developed in Idanha-a-Nova municipality. For one year this exhibition was in Centro Cultural Raiano, the headquarters of Naturtejo Geopark at Idanha-a-Nova, and it is structured in two sections: formal and non-formal domains vs. history and memory. During this period there was an Educational Program, for the different schools levels, specially designed for interacting with the exhibition and mineral resources exploited in these mines. This educational program included a visit to a mine, recreational activities and workshops about minerals, mineral resources uses in the daily life and jewelry. All the students from kindergarten to primary schools from Idanha-a-Nova participated in this educational program (Fig. 1b), involving more than 600 pupils. The next stage for the exhibition is to become nomad. It is now travelling through the main mining contexts of Idanha-a-Nova. The core of the exhibition is the same only the contents are adapted to the geological and mining context and local specificities, involving local people. The end of the journey will be Segura where all the contexts will be joined and it will be presented a completed exhibition of Geomining Heritage in Idanha-a-Nova, including an oral archive of the memory and a collection made of offers and loans.

The exhibition “Geomining Heritage from Oleiros” was dedicated to Fragas do Cavalo wolfram mines that worked in the first half of the 20th century, with a small note about other mining in Oleiros since Roman times. Nowadays, in these mines we can see a wide and steep slope 150 m high full of pits and galleries, some collapsed, others with quartz veins full of wolframite crystals, wood shoring and tailing piles at the mouth of the mine. The documentary “Black gold – the other side” was prepared with a geological, historical and anthropological approach and

the testimony of former miners and workers of the mines. In parallel the catalog “Wolfram times in Oleiros” was released to present this unknown heritage to most of the people by showing the importance of the mine in this period when the region was tightly connected with the major world moments of contemporary history. During the European Geoparks Week additional activities were provided such as guided visits and workshops for local schools, guided visits with former miners and workers and a thematic visit to Fragas do Cavalo Mines, with the participation of former workers from the washing factory.

These two projects are linked by the theme of the rush for wolfram during the “black gold” periods, with the climax during the Second World War, that moved thousands of farmers-miners searching for cassiterite (tin) and wolframite (wolfram) in mining districts and illegally, creating parallel markets and contraband at the borderland. But they are also connected through the impact they are causing in local communities that remembered or known the importance that those mines had in the past, increasing their interest and the sense of belonging.



Fig. 1 – Exhibitions and exhibition activities involving local communities: a) educational program for local pupils (Centro Cultural Raiano); b) direct contact with locals’ know-how and discussion in the outcrop.

ECOLOGICAL EDUCATIVE CAMPUS OF SEIXOSOSO

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Keywords: *field work; environmental education; educative and ecological campus.*

I defend field work as an important method to promote an environmental education for sustainable growth, particularly for those who teach science groups.

I have been supporting an educational space network where education in the environment would give young people the necessary knowledge to understand and appreciate the local natural heritage transforming the environment into an important educational resource.

The creation of educational campus is one of the responsibilities of the Environment National Institute and the Education Ministry but local authorities, schools, tourism commissions, cultural associations, etc. have to involve all the community entities responsible for education, not only youth but all other society members as well.

According to the proposed model, with educational campus next to each school enumerating local natural issues, we might aspire to a growing network of educative spaces articulated with natural protected areas according to the defined educational targets. This objective will approach the community to its heritage

The educative areas would provide the opening of the school doors to the surrounding environment allowing an easier teaching process, specially designed for the youth of Science themes.

As I have been defending, there will be a place in each school, that will be a valuable study resource, providing the necessary help to the practical task, like a wall, an open abandoned space, a water line, a monument, etc.

In this study, we are focusing in the area of Seixoso, in Felgueiras, more specifically the hydrographic area of the Borba river, as it has a relevant potential in the creation of an Ecological Educative Campus.

Different tracks that we have already defined could be pointed out in this campus, and as an example, one of the farming buildings on the bank of the river could be adapted to become a supporting centre of the pedagogical activities. Some mining exploitations, could be adapted as centers for the study of the mining archeology.

The old *sanatorium* buildings can be used as an information center for some pedagogical seminars, working on different themes (geology, bird watching, plants, soil, etc.)

I studied the area on different perspectives: as far as geology is concerned, I started by analyzing the existing lithologies in the hydrographic basin of the Borba river, that will condition the relief, hydrology, human activity (farming, mining, forest, etc.), soil, vegetation, etc. Geomorphology, hydrographic and mineral resources are geological aspects that will be analyzed in the present study.

As far as biology is concerned, I tried to identify areas of spontaneous vegetation, classifying the forest and farming areas. In the animal species field, we found out different types: birds that are easily seen, but also the invertebrate, such as insects, that can be seen everywhere.

The human activity, and its effect on the landscape, was studied from a broad perspective, including farming, heritage, architecture and mining.

As a concluding remark, several tracks along the area of the hydrographic basin of the Borba river are proposed, aiming to stress the special points that have to do with the educational sciences, and can be discussed in the classroom or on visiting sessions, guided by leaflets designed for that purpose.

This work, showing some of the different material that we have already collected, which can always be improved, will be proposed to the Town Hall of Felgueiras, aiming at the creation of the Educative and Ecological Campus of Seixoso, an example of what can be done by community entities, supporting environmental education.

AROUCA GEOPARK AND THE EUROPEAN CHARTER FOR SUSTAINABLE TOURISM, A LONG “JOURNEY” THAT HAVE JUST STARTED

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The European Charter for Sustainable Tourism (ECST) is an award of the EUROPARC European Federation of National and Natural Parks that recognizes protected areas as a tourist destination with sustainable development, guarantee of respect for the natural values, safeguard of the local populations expectations, providing an opportunity to local stakeholders and offering visitors a quality experience. Geoparks have a similar approach, emphasizing concerns about heritage conservation and educational aspects as well as the well being of local populations.

In 2011 the ADRIMAG Associação de Desenvolvimento Rural Integrado das Serras de Montemuro, Arada e Gralheira with the support of other local stakeholders from the territory “Magic Mountains” has decided to apply to the ECST. At the present moment work is on progress preparing the application that has to be delivered in December and hopefully positively evaluated in 2013 at the same time that Arouca Geopark will be reevaluated.

The initiative European Charter for Sustainable Tourism in Protected Areas – ECST is a planning tool that encourages a territory to work as a unit, always based on a participatory process that promotes discussion/understanding between people/entities with different interests/perspectives around a common subject, the sustainable development of tourism based in natural values.

The ECST and the Geopark are similar planning methodologies that seek to promote sustainable development of a certain territory. Its added value is the conservation and protection of the natural values and resources existing in the territory. Essentially, the Geopark methodology is directed to the protection and conservation of geological heritage, promoting education for sustainable development and tourism activity in the territory. The ECST methodology promotes the sustainable development of tourism in sensitive areas, with the continuous support, agreement and monitoring of the local population and tourism business.

The ECST is more than an award, is a very precise methodology based in a participatory process, from the territory diagnosis to the definition of a strategy for sustainable tourism development and its Action Plan. This implies a commitment with the principles of the Charter by the institutions, businesses and local population.

The ECST is an award given by the EUROPARC Federation since 2001. To date, this award was assigned to 100 protected areas from which at least 5 are also geoparks. In Portugal there are five Charter Protected Areas, from which 4 are in North Portugal Region.

In spite the “Magic Mountains” are not a formal protected area, ADRIMAG took the decision to apply to the ECST based in the following facts:

i) the growing importance of Natura 2000 Network in the European Union context as the European network of nature conservation (giving greater visibility in the European tourism market to these destinations);

ii) growing demand for nature tourism destinations (constituting an unique opportunity);

iii) the specific characteristics of the larger territory (7 municipalities) of the “Magic Mountains” where the Arouca Geopark is included, being a nature tourism destination of high potential quality;

iv) the existence of a private entity (ADRIMAG) that houses all the public entities with direct competence in the management of the territory and with competence to lead a common project.

The territory of ADRIMAG, has a total of 169.000 hectares and 127.000 inhabitants (where the Arouca Geopark is included, besides 4 sites of Natura 2000 in a total of 79.182 hectares of non-overlapping areas of classified area of European and International level) focused on its natural spaces, has the necessary and sufficient conditions for a sustainable development, basing its tourism strategy on a modern image of European level, through ECST, consolidating the tourist offer next to the niche markets that value it. Besides the Geopark and the Natura2000 sites, the territory is in São Pedro do Sul the first Spa thermal tourism destiny in Portugal.

Being ECST a process of active participation of the several local partners in the definition of their future as a sustainable tourism destination, it was a key opportunity for all the interested parties to sit at the same table to discuss the same problems and to seek their solutions.

Since the beginning, the Project Team has developed already three major Forums of Sustainable Tourism (ECST presentation, territory diagnostic and strategy for sustainable tourism) with active participation of all kind of stakeholders. Besides the plenary sessions in the Forum meetings, the main type of stakeholders met in 4 thematic working group sessions (accommodation, restaurants and food services, tourism services and institutions). This way it was possible to start to develop a common perspective with participation from all territory. There have been also two rounds of municipal meetings gathering in each municipality the ensemble of stakeholders where they discuss the problems and solutions that affect directly their business at local level and have contribute for the SWOT analysis. In the meantime a blog <http://cetsmontanhasmagicas.blogspot.pt/> was created in order that all information could be available and people could participate electronically. Finally and by suggestion of a stakeholder it has been created a Facebook page <https://www.facebook.com/MontanhasMagicasCETS> for the “Magic Mountains”.

Participation is increasing and the work done by Geopark in the recent years has been point out as a good example how a territory can use positively their natural resources in a sustainable way and making of it a tourism activity.

The fact the “Magic Mountains” territory is rich in geological sites and long tradition of mining has highlighted the potential enlargement of the Arouca Geopark to a larger territory. For that reason, the Arouca Geopark Association is doing a technical survey evaluating the geological richness of the “Magic Mountains” territory which has been received and perceived very positively by all stakeholders.

The Charter has proved to be a useful tool in boosting the local development and in mobilizing institutional, social and economic stakeholders. A territory that organizes its offer and that integrates into a network of European spaces of quality and sustainability captures the growing interests from travel agents specialized in offering nature tourism, and thereby increase the future prospective of business.

AN OVERVIEW OF THE FIVE YEARS OF THE NATURTEJO GEOPARK (PORTUGAL) EDUCATIONAL PROGRAMMES AND THE NEXT CHALLENGES

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Keywords: *Educational Programme, geoeducation, environmental education, school public, education for sustainability, Naturtejo Geopark*

In 2006 Naturtejo Geopark became part of the European and Global Geoparks network under the auspices of the UNESCO. To achieve one of the most important missions of a geopark – promoting geo and environmental education – the educational programmes of the Naturtejo Geopark appeared in the school year of 2007/2008 and were addressed to students both from the school institutions of the geopark and from national and foreigner ones.

This educational Project was firstly drawn in three stages. The first one consisted on the creation and implementation of two educational programmes: “School goes to the Geopark” and “The Geopark goes to school” addressed mainly to students aged 12 to 15. The second stage included the elaboration of pedagogical resources and the augment of the number of field trips to increase the number of geosites included in the activities. The third stage would be to draw educational programmes and subsequent pedagogical resources addressed to pupils from the 1st grade to university students.

Five years after the implementation of the Project one can conclude that these 3 stages developed as predicted and the goals were achieved. However, the stage related to the elaboration of pedagogical resources is obviously in constant development. One then started with 2 educational programmes and the third one, called “Anim’ a rocha”, which consists of annual projects regarding geopark schools, was created in the school year of 2009/2010; the number of field trips and included geosites comprising the 6 municipalities of the Geopark Naturtejo increased and the addressees were now students aging 3 to 83 years old (from pre-schooling to senior universities).

A preliminary analysis of the statistic data collected all along five school years shows that 17, 892 students and teachers coming from Portugal and from other countries such as Spain, Germany, Brazil, the United States, England and Japan have participated in the programmes (Table 1). The number of participating institutions has been of 24-62, with the exceptional number of 162 during the school year of 2009/2010 due to “*DinoExpo*”. The number of participants had progressively increased between the school years of 2007/2008 and 2009/2010. The higher increase of 2009/2010 was due to “*DinoExpo*” which attracted many schools to the geopark. In 2010/2011 the number of participants continued to increase when compared to 2008/2009. The decrease in 2011/2012 is due to transportation costs and the economic difficulties endured by many families which are facing a time of severe austerity in Portugal and also due to the logistic reasons of the annual projects with geopark schools.

In 2010/2011 a new vision of school named *Geonatureschool* included the educational programmes as well as the new programmes to be created, the geofun addressed to families, companies, youth associations and others. The physical space of this school is the 4617 km² of the geopark territory. In February 2011 a microsite dedicated exclusively to the *Geonatureschool* was created – www.geonaturescola.com - also accessible through the homepage of the Naturtejo Geopark. Whereas the educational programmes have continued to expand and develop the geofun programmes are still waiting to be implemented. Two more staff monitors will be needed to extend and adapt the concept of the educational programmes to new publics.

The programmes addressed to the school public face several difficulties such as the reduced number of staff monitors; the time needed to develop educational resources is also insufficient because of the time spent in field trips, in exhibitions or in schools promoting activities or dealing with their bookings and logistics; there's also a lack of adequate facilities and conditions to develop lab activities or in the nature linked for instance with rural activities.

Here are some strategies to implement in the following five years so that the Educational Programme of the Naturtejo Geopark evolves and consolidates as a complement of the geosciences formal teaching institutions and as a vehicle of implementation of a true and practical Education to Sustainability (environmental, social and economical): to increase the number of staff monitors of the educational programmes which will allow us to welcome a larger number of students and spend more time creating new educational tools; to acquire materials for the lab activities; to establish partnerships in order to own a physical headquarters infrastructure for the Geonatureschool, where the educational resources can be stored and lab activities along with practical workshops can be developed in contact with nature and therefore learning by doing and experimenting; where there can be conditions to implement summer fields to school groups and others; to improve the channels of promotion of the activities both in Portugal and abroad, namely in Spain; to improve and translate the microsite and the new promotional booklet to English.

The Educational Services of the Global Geoparks Network under the auspices of the UNESCO should, more than ever, focus their joint efforts in the task of contributing to Earth's sustainability through the promotion of education to sustainability in general, paying particular attention to the role that Geoeducation must have based in the holistic vision of the natural and cultural heritage and in the interdisciplinary perspective underlying its activities. Only this way an integrated and balanced vision of this Planet with 4600 million years of history will be promoted in a global scale, contributing to the changing of attitudes and educating for the sustainable use of the natural resources.

School Year	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012
Number of school institutions	24	48	162	55	62
Number of countries	2 (Portugal and Spain)	2 (Portugal and Spain)	5 (Portugal, Spain, Germany, Brazil and U.S.A.)	3 (Portugal, Spain, U.S.A.)	5 (Portugal, Spain, England, Japan and U.S.A.)
Number of students	902	2517	6792	3420	2114
Number of teachers	81	295	644	787	462
Total of participants	938	2735	7436	4207	2576

Table 1. General statistic data of the Educational Programmes of the Naturtejo Geopark between the school years of 2007/2008 and 2011/2012.

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SOCIAL VEGETABLE GARDEN # 3: HEALTHY, FAMILY, COMMUNITY AND SUSTAINABLE HORTICULTURE IN NATURTEJO GEOPARK (PORTUGAL)

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Keywords: *Social Vegetable Gardens; Organic Farming; Education for sustainability; Municipality of Idanha-a-Nova; Naturtejo Geopark*

The Social and Health Action Office of the Municipality of Idanha-a-Nova has delivered a leaflet to the inhabitants of the parishes of Idanha-a-Nova, Ladoeiro and Zebreira in December 2011 promoting a Project called “Social Vegetable Gardens of Idanha-a-Nova”. That leaflet informed that the Municipality of Idanha-a-Nova would grant small lots of land with 100 m² of the *Couto da Várzea* Farm to those who wished to dedicate themselves to horticulture.

The *Couto da Várzea* Farm owns some of the most fertile lands of the *Beira Baixa* region and occupies an area of about 600 hectares in the plain of Idanha-a-Nova and it is crossed by the Ponsul River which flows near the foothill of the magnificent fault cliff of the Ponsul.

These Social Vegetable Gardens are located by the left bank of the Ponsul River which circumscribes them in the north. The place is most agreeable and relaxing because of the several species of dense trees such as poplars, willows, ashes and plane trees.

Many white storks build their nests in the poplars by the river (Fig. 1). While farming, one can hear the singing of the different bird species: nightingales, hoopoes, cuckoos, bee-eaters, magpies, goldfinches and sparrows. Moreover, one has a privileged sight of the scarp of the Ponsul’s Fault.

In March 2012 the 9 applicants to this Project were summoned for a meeting and the general regulation of the “Social Vegetable Gardens” was presented. Then the previously numbered lots of land with around 300 m² each were delivered by application order.

The municipality was in charge of plowing the land and installing several free of charge water points. Later other improvements were made such as the setting of a gate and the donation of the organic fertilizer, cow manure.

The vegetable gardens were cultivated at the beginning of April and at the end of June 2012, 13 small lots were effectively being cultivated.

This Project aims at contributing for the education for sustainability, good farming practices and for the implementation of the organic farming, encouraging the use of the land, the return to the rural world and the preservation and knowledge of nature.

In a planet where consumerism is ruling a change in people’s habits and lifestyle is needed and this is a small contribution so that people start producing their own food. This way they can save money and eat healthy food produced without chemical pesticides and fertilizers which cause many of today’s diseases. On the other hand, it is also a contribution for the maintenance of biodiversity, water and air and soil quality.

The food from these vegetable gardens is for family consumption or donated to friends and neighbours and the remainder products may be delivered at the Social Bank of Clothes and Goods of the municipality of Idanha-a-Nova.

As participants of the Project “Social Vegetable Gardens of Idanha” with land lot number 3 (Fig. 2.) the authors can share their experience and conclude that it is possible to produce tasty, sweet, healthy and good quality food using only biological farming methods.

Between April and June 2012 the authors have experimented growing potato, cucumber, lettuce, kale, tomato, courgette, chickpea, corn, eggplant, beetroot, cauliflower, cabbage, savoy cabbage,

runner beans, pumpkin, onion, carrot, pepper, broccoli, watermelon, strawberry and melon. Until now the most successful were the courgettes, the runner beans, the cucumbers and the watermelon.

The authors used cow and sheep manure as an organic fertilizer, natural pesticides made of an infusion of nettles in water to eliminate the lice which attacked the eggplants and French marigold were planted to repel plagues. No chemical fertilizer, pesticide or herbicides were used at all.

The quality and quantity of the vegetables already grown are exceeding all expectations, so the contract for the occupation of the Social Vegetable Garden is expected to be renewed next year. Throughout this experience one were able to verify that there was an increase of vegetable consumption per meal and there was also an increase of the number of vegetarian meals.

This Project is an important action which can be perfectly framed in the spirit of the celebration of “2014 – International Year of Family Farming” declared by the UN.



Fig. 1. Storks build their nests in the poplars by the river.



Fig.2. The Social Vegetal Garden number 3.

The DEVELOPING PARTNERSHIP BETWEEN THE “PORTES DU SOLEIL” AND THE CHABLAIS GEOPARK, FRANCE

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Keywords: *Tourism, Private Partnership, Geopark, Sustainable Development*

The “Portes du Soleil” covers a vast area made up of 12 village resorts, where the main activities are skiing during the winter, and hiking and biking during the summer. The “Portes du Soleil” is a unique tourist organisation whose territory lies in France and in Switzerland. It is the largest tourism stakeholder in the Chablais, both from the point of view of its economic success and its geographical extent.

For several years the “Portes du Soleil” has defined itself as a big natural “powder” reserve; a ski domain in a wild area where nature still has its place. This is thanks to the efforts made to manage the 197 ski lifts in a manner that respects the environment, and is what differentiates it from other large European ski areas.

The “Portes du Soleil” lies at the heart of the Chablais Geopark, which was awarded Geopark status in March 2012. The two entities are developing an effective working relationship. This began with the letter of endorsement featured in the membership application of the Chablais Geopark to the European Geopark Network.

Partnership with the Chablais Geopark offers the “Portes du Soleil” several notable areas for tourism development, (i) new types of tourism e.g. geotourism, (ii) the use of the “Geopark” quality label to reinforce its destination marketing and (iii) the extension of the tourist season into the Spring and Autumn.

For the Chablais Geopark, the partnership provides access to the clientele of an established tourist destination. It will enable dialogue with a new public, those who are not necessarily seeking the products of the Geopark. It will therefore significantly broaden the communication reach of the Geopark.

Initial tourist products developed include the publication of the summer “Portes du Soleil” map. The map of the domain, on sale in France and Switzerland, contains information on the village resorts, the lift infrastructure, numerous sporting activities as well as the geosites of the Chablais Geopark. It was branded with the both the “Portes du Soleil” and Chablais Geopark logos.

An example of a joint winter tourism initiative is the installation of two sets of information panels in the “Portes du Soleil” domain. These will be fixed to the pylons of two different chair lifts in the ski area. As skiers ascend the mountain they will be presented with a succession of six linked information panels. For the first ski lift, the panels explain the geological evolution of the landscape over 245 million years. The theme of the second chair lift is the geology behind the steep and gentle ski slopes. These panels are to be installed this autumn, ready for the 2012 winter season (Fillon et al., 2011).

To stay in the “Portes du Soleil, to ski in its resorts, to hike in its mountains, is to be in harmony with nature. The “Portes du Soleil” can only benefit from the new Geopark status through the ongoing development of joint tourism initiatives; the Chablais Geopark will also profit from the notoriety of the “Portes du Soleil”, and the communication links of our resorts that are internationally known, such as Morzine and Avoriaz.

Already working together for 40 years, the 12 Franco-Swiss resorts of the “Portes du Soleil” will join forces with the Chablais Geopark to achieve cross promotion, development of new products and to achieve sustainable territorial development.

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Fig. 1. A map showing the 650km of ski runs within the “Portes du Soleil” domain and its 12 village resorts, source: <http://www.avoriaz.com/station-alpes-france/modules/plan-des-pistes>.



Fig. 2. An interpretative panel to be attached to the pylons for selected ski lifts in the “Portes du Soleil”. source: Technical drawing, Chablais Geopark, SIAC.

THE VALENTÍ MASACHS GEOLOGICAL MUSEUM. THE LINK BETWEEN MINERALS AND ROCKS AND THEIR EVERYDAY USE

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Keywords: *Geological museum, uses of minerals, education*

The Geological and Mining Park of Central Catalonia is an aspiring Geopark located at the north-east of the Iberian Peninsula (Catalonia, Spain). This territory has a great geodiversity and international relevant geological and mining sites. Rocks formed in many different depositional environments, karstic formations, active geological processes, etc. shape the geological and cultural landscape of the Park which, combined with ancient mining and its related heritage, and the extraction of the huge salt deposit (halite and sylvite mainly) in the subsurface give the strong personality of the territory.

From all the visitor centres of the Park, the exciting and often unfamiliar link between geology, mining, their everyday uses and their environmental and social implications can be found in the Valentí Masachs Geological Museum. This museum belongs to the Technical University of Catalonia and is at the city of Manresa, inside the School of Engineering.

Nowadays it's a lot more than a classical geology museum where representative collections of minerals, rocks and fossils are exposed, as it has evolved considerably since it was founded under this point of view in 1980. In 1993 it made an important qualitative leap incorporating cabinets for applications of minerals, expanded in 1995 with the uses of rocks. It wasn't until 2007 that a new room called "The reflection room" was added to allow visitors to learn and think about topics like: "Earth is depleted"; Radioactivity: pros and cons"; "Minerals and people". The latest cabinet focuses on the "Minerals of the future" and completes the wide offer of the museum (Fig.1).

Thus, the museum aims:

- 1- To offer students, lecturers and the general public a frequently changing classroom that is open to all, where they can learn about the world of minerals, rocks and fossils, their applications, their formation and characteristics, teaching at the time how to make a sustainable use of non-renewable natural resources, with respect to the nature that provides them to us, to the environment that surrounds them and last but not least to the people who extract.
- 2- To maintain and extend the collection, to use it for research, and to publicise and facilitate access to it.
- 3- To be a useful tool for geologist and non-geologist alike. To this end, an online advisory service has been set up to answer queries regarding the best stones to use for a particular building and location or the characteristics of a mineral or fossils in the museum's collection. It can also be used to make individual queries and to request geological, environmental or gemmological studies.

4- To become a platform for the dissemination of the research that is carried out at the university on topics such as concrete to be produced without water on the moon, memory metals for dentistry, silicon microchips, gold and zirconium oxide as absorbents for environmental pollutants.

The museum has elaborated educational programs for all ages and is visited not only for a lot of scholars but also for the general public all over the year. A wheelchair system incorporating a camera (chaircam) adapted for disabled people allows the visit and learning suitable for everyone. More information can be found in Catalan, Spanish and English at the website of the museum (www.geomuseu.upc.edu).



VALLE DEL CROCCHIO ASPIRING GEOPARK (CALABRIA-ITALY)

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Keywords: *Valle del Crocchio Geopark, Calabria, Sila*

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 Crotona as for the coastal side and of Cosenza as for the internal one.

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 extension 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 Chestnut, 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 (Jonic Coast and Stretta of Catanzaro).

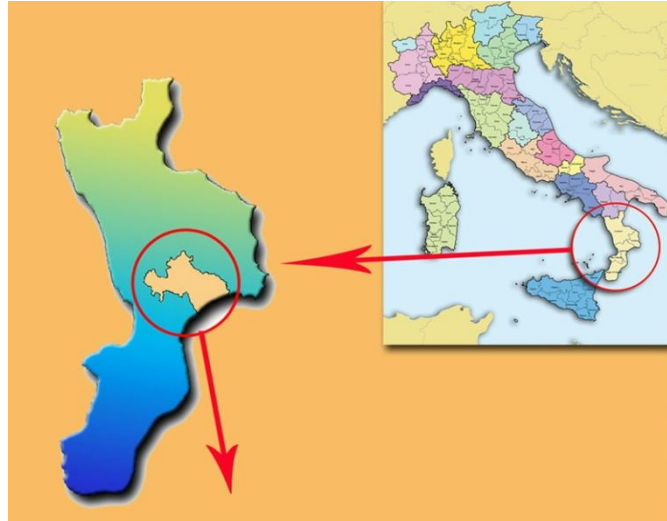


Fig 1: Territorial frame work of the “Valle del Crocchio Geopark”

Cloudina IN THE VILLUERCAS-IBORES-JARA GEOPARK (EXTREMADURA, SPAIN): SOME OF THE OLDEST SHELLED ANIMALS ON EARTH

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Keywords: *Cloudina*, Ediacaran, Extremadura, geopark, biomineralisation, Spain

Animals with mineralised skeletons appeared during the last 10 million years of the Ediacaran Period (ca 635-542 Ma). These animals may include the ancestors of the diverse biomineralising metazoa that emerged during the "Cambrian explosion" (ca. 530 Ma ago). Over the last decades several of these mineralised Ediacaran fossils have been described and interpreted as the first metazoans capable of secreting a mineralised skeleton, which makes them highly significant from the standpoint of biological evolution.

Usually interpreted as the external skeleton of a cnidarian-grade metazoan, *Cloudina* was the first described biomineralised Ediacaran fossil (Germs 1972) and it remains the best known. *Cloudina* consists of a small (commonly 1-4 mm wide) tube formed by a characteristic succession of stacked funnel-shaped elements. Because *Cloudina* has both a wide palaeogeographic distribution and a relatively short temporal range, it is considered an index fossil of the terminal Ediacaran (Grant 1990, Cortijo *et al.* 2010a). Therefore, in addition to its paleontological interest, it has a high biostratigraphic value. For these reasons, the *Cloudina* outcrops are of great importance on a global scale.

Several *Cloudina*-bearing outcrops are known in Spain, in the Central Iberian zone, and they represent the only occurrences of *Cloudina* in Europe. One of these outcrops is located close to Castañar de Ibor, Cáceres Province, within the Villuercas-Ibores-Jara Geopark, in the Geosite 40, called "Yacimiento paleontológico del Arroyo de las Fuentes". The *Cloudina* fossils in this geosite are found in platform carbonates of the Ibor Group, where they occur as storm-generated accumulations of skeletons. The quality of preservation of the specimens is affected by processes of dolomitisation and recrystallisation, although in general the material is relatively well preserved (Cortijo *et al.* 2010b; Fig. 1).

Exceptionally well-preserved *Cloudina*, including secondarily silicified three-dimensionally preserved specimens (Fig. 2) occur in carbonate blocks from the Ibor Group, incorporated in olistostromic deposits exposed in localities adjacent to the geopark. This material includes the new species *Cloudina carinata* (Cortijo *et al.* 2010b). This olistostrome can be examined in the northeastern part of the Villuercas-Ibores-Jara Geopark in the area of Arroyo del Pedroso, within the same area as Geosite 42. Although the sedimentary rocks are affected by a nearby granite intrusion and visibility is limited by soil and vegetation cover, the olistostrome can be readily observed here. Preliminary investigations have resulted in possible, but not confident, identification of *Cloudina*, but this olistostrome is nevertheless of interest for the geological diversity within the Villuercas-Ibores-Jara Geopark.

The Villuercas-Ibores-Jara Geopark is currently the only geopark worldwide with examples of these ancient shelled animals, and the presence of *Cloudina* represents a palaeontological heritage of singular importance.

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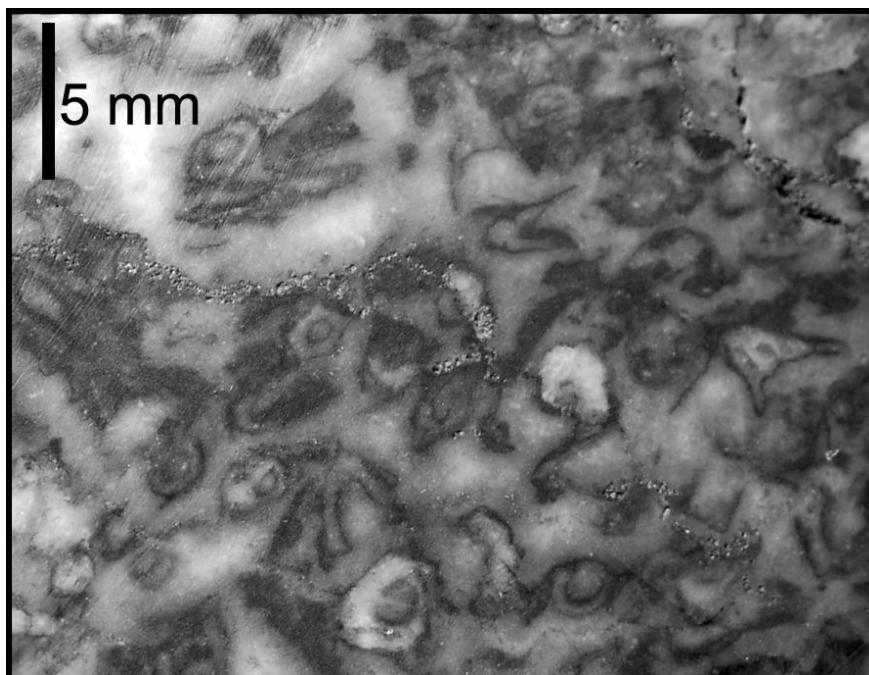


Fig.1. Cloudina fossils in a polished rock surface from the “Yacimiento paleontológico del Arroyo de las Fuentes” in the Villuercas-Ibores-Jara Geopark.

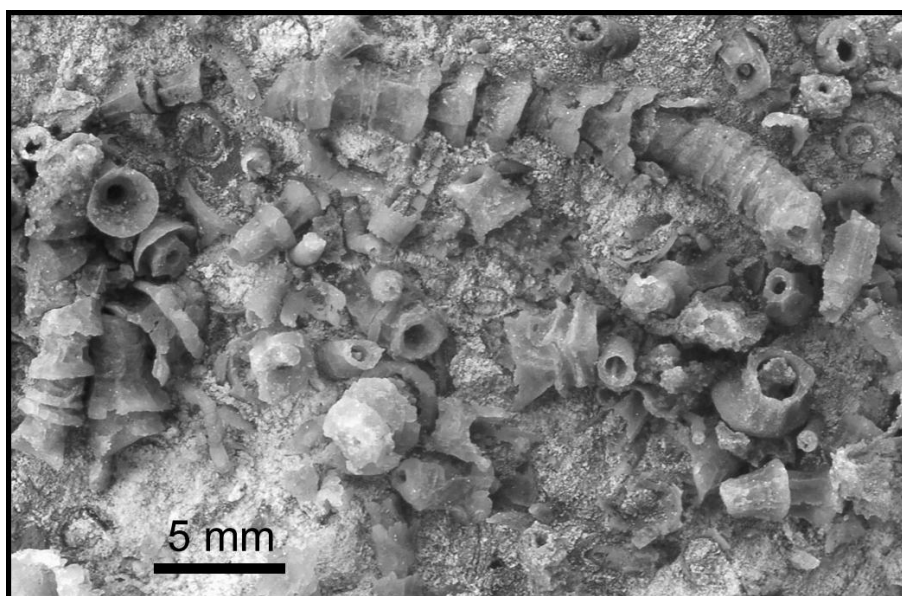


Fig.2. Three-dimensionally preserved specimens of the new species Cloudina carinata from a carbonate block in olistostromic deposits from the Membrillar locality, about 10 km south-east of the geopark.

GEOCONSERVATION IN THE ORDOVICIAN OF PORTUGAL: THE VALONGO PALAEOZOIC PARK, THE GEOLOGICAL INTERPRETATION CENTER OF CANELAS AND THE PENHA GARCIA ICHNOLOGICAL PARK

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The Valongo Palaeozoic Park, the Geological Interpretation Center of Canelas (Arouca Global Geopark) and the Penha Garcia Ichnological Park (Naturtejo Global Geopark) are three areas of Portugal where geoconservation strategies have been implemented. The two first examples are located in the Metropolitan Area of Porto in North-Western Portugal: the Valongo Palaeozoic Park is placed south of Valongo in the neighbourhood of Porto and the Geological Interpretation Center of Canelas is situated in the vicinities of Arouca; Penha Garcia Ichnological Park is positioned in the NE region of Naturtejo Geopark, in the Centre of Portugal, near the border with Spain. The international relevance of the geological heritage of these three areas provided the earliest approaches on the protection and management for the Ordovician of Portugal. The **Valongo Palaeozoic Park** created in 1998 was a pioneer example of geoconservation in Portugal resulting of the partnership between the Municipality of Valongo and the Faculty of Sciences of the University of Porto. The project started in 1995 and was founded by a European Community LIFE Programme. Since 2000 the Park has the assistance and scientific support of the Geology Centre of the University of Porto. **The geological heritage of Valongo Palaeozoic Park includes significant values with major focus on the Ordovician fossil sites including also ecological values protected under Natura 2000 Network. All this rich heritage have deserved the attention of scientists and** authorities that enthusiastically developed efforts to preserve and raise awareness about the Park (Couto & Lourenço 2005) and which led the Portuguese Group of ProGEO to assign to the Municipality of Valongo the Geoconservation Award 2005. The Palaeozoic Park, as a part of a greater area designated “Santa Justa and Pias Mountain”, was protected as Local Protected Landscape Area by the Municipal Assembly of Valongo in 2010. “Ordovician fossils from Valongo Anticline” was one of the fourteen frameworks proposed by the Portuguese Group of ProGEO to include the Portuguese Geological Frameworks of International Relevance published in Episodes by a working group from several universities and other institutions. In the Interpretative Environmental Centre there are permanent exhibitions, a small library provided with scientific and didactic papers, thematic posters explaining the most relevant geological events, a block-diagram representing the actual geology and geomorphology of the region and its evolution throughout 350 million of years after the structuring of Valongo Anticline. Among the educational activities, observation of fossils and minerals with identification cards is provided. There is also an exhibition of fossils from the region representing the forms of life that inhabited the Ordovician sea of Valongo. The interpretative circuit has three geo-trails (green, red and yellow trails) that show different aspects of the protected geodiversity. **Geological Interpretation Centre of Canelas** launched in 2006 is the most relevant site of Arouca Geopark. This infrastructure was fundamental for the starting up of the Arouca Geopark wich became included in the European Geoparks Network in 2009. The activity of the quarries is usually associated to the destruction of fossils, however in

Canelas, the operating company Ardósias Valério & Figueiredo Lda is protecting them carefully since the quarry reopened in 1988 (Sá et al. 2005). These fossils were exhibited in the most prestigious universities and museums since 1994. The Geological Interpretation Centre of Canelas was born as a private project owing to the necessity to create an on-site permanent exhibition. Some of the invertebrate fossils (in particular trilobites) were recovered since the rebirth of quarrying. The most significant fossil collection of the Geological Interpretation Centre of Canelas was the aim of several palaeontological studies. Despite these studies only in 2011 the inventorying of each specimen in a comprehensive database began to be developed with the support of experts and universities. An outdoor educational activity of Geological Interpretation Center of Canelas is the “Palaeozoic Geo-trail”. The **Penha Garcia Ichnological Park** was the birthplace of Naturtejo Global Geopark in 2003, the first Geopark of Portugal. In 2004 the Portuguese Group of ProGEO assigned to the Municipality of Idanha-a-Nova the Geoconservation Award and in 2007 the Geoconservation Award was assigned to the “Associação de Municípios Natureza e Tejo” for the work developed on preservation and raising awareness of geological heritage particularly in Penha Garcia. The Ordovician fossil sites are protected under the municipal frame, and the Ichnological Park is daily controlled by a vigilant. Several fossil sites and “House of fossils” are accessed by the Fossils Trail where visitors find easily beautiful examples of *Cruziana* beds in an outstanding geological setting (Neto de Carvalho, 2004). There are also several educational programs for the Portuguese school curricula where students and teachers can apply what they learn outside the classroom. In all three protected areas a great geodiversity is evident in the Ordovician sequences that show different and interesting values namely in palaeontology (a great palaeobiodiversity with trace fossils and marine invertebrates) and stratigraphy (complete sequences starting from Lower Ordovician, with evidences of the opening of Rheic Ocean, to the Upper Ordovician when these regions were next to an ice cap located in South Pole). Lower Ordovician rocks, namely those evidencing submarine volcanism, and the presence of algae sometimes forming stromatolites and other microbial-induced sedimentary structures, contributed for the concentration of gold that was exploited since Roman times contributing in these areas for a relevant geomining heritage. Geoconservation approaches include also guided visits for schools and to the general public, training for teachers, and national and international scientific meetings. Since 1998, in the frame of “Geologia no Verão” (“Geology in Summer”) an initiative of “Ciência Viva” program and more recently, since 2005, in the frame of “Universidade Júnior” (“Junior University”) an initiative of the University of Porto, several activities have been developed to rise awareness of the geological heritage of the Ordovician of Portugal.

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GEO-WORLD TRAVEL: A BUSINESS PROPOSAL FOR SUSTAINABLE GEOTOURISM IN GEOPARKS

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Keywords: *international geotourism, excursions within and between geoparks*

GeoWorld Travel is a recently established company specialising in geotourism with a view to extend its travel programme to include the network of Geoparks. The company was founded by James Cresswell, a geology tourism professional with a degrees in geology and oceanography, who has worked as an expedition guide and lecturer for Poseidon Expedition and as assistant expedition leader and guide for Oceanwide Expedition. He uses his experience as an expedition guide in the Canadian Arctic, Greenland, Svalbard, Antarctica and the South Atlantic Islands to influence and inform the general public on issues of climate change.

GeoWorld Travel is aware that the global network of Geoparks offers an opportunity to promote education on the environment and its preservation with links to sustainable economic development. The company wishes to develop with Geoparks a programme for international geotourism within the network. In addition to explaining the geology and landscape, the company is aware that geotourism is more than just about rocks, it is about experiencing the whole geodiversity of a destination, which also includes its natural, economic and cultural history. Spectacular scenery normally goes hand in hand with incredible wildlife, fascinating cultures and human stories and the excursions promoted by GeoWorld Travel combine all of these things.

The first of these tours planned for 2013, is an excursion by coach over seven days and includes visits to two geoparks, three national parks and two UNESCO World Heritage Sites. The excursion which starts and ends in Wales' capital city Cardiff, will introduce participants to aspects of the geology and landscapes, as well as the industrial, cultural and intangible heritage of Wales. **Day One:** The itinerary includes a visit to Blaenavon World Heritage Site, set in an industrial landscape, and provides an opportunity to visit Big Pit, the National Coal Museum of Wales. From Big Pit the tour will visit sites in the Brecon Beacons National Park and Fforest Fawr Geopark culminating at the magnificent Henrhyd Waterfall, the highest waterfall in South Wales. **Day Two:** Includes a drive across the Black Mountain, to Llandovery via the village of Myddfai which is associated with one of Europe's oldest stories, The Lady of Llyn y Fach. In the vicinity of Llandovery rocks of the Silurian Llandovery Stage, named for this small town, can be seen. The day ends with a visit to the Dolaucothi Gold Mine where gold was mined extensively during Roman times. **Day Three:** The day is scheduled for visits to coastal sites within the Pembrokeshire Coast National Park. The highlight of the day includes a visit to Marloes Bay, one of the most beautiful bays in south Wales with superb exposures of marine Silurian rocks and the continental deposits of the Devonian Old Red Sandstone. A stop at Nolton Haven provides an opportunity to study the Carboniferous Coal Measures deposits and the chance to find plant fossils in boulders on the beach. **Day Four:** Includes further sites in the Pembrokeshire Coast National Park. The day includes visits to the 12th century St. David's Cathedral, the Ordovician graptolitic black shale of Aberiddy Bay and its famous Blue Lagoon, deep sea Ordovician pillow lavas at Strumble Head and the Preseli Mountains, the source of the bluestones used in the iconic Stonehenge monument. **Day Five:** Focusses on sites

in mid-Wales including the famous Devil's Bridge Gorge, carved into Silurian rocks by the River Mynach. The bridge is associated with a legend involving the devil an old woman and a dog. The Cwmystwyth Mine, situated in Silurian Rocks has a long history of silver, lead and zinc mining extending from Roman times to the early 20th century. The day ends in Dolgellau with superb views of the Ordovician igneous rocks of Cadair Idris. **Day Six:** Sites visited are located in the Snowdonia National Park, north Wales. Highlights include the famous Llanberis slate quarries which exploit rocks of Cambrian age and a train ride to the top of Snowdon, a mountain composed of Ordovician volcanic and intrusive igneous rocks, which at 1085 metres above sea level is the highest mountain in Wales. The day concludes with a visit to Caernarvon Castle World Heritage Site. The castle was built by King Edward 1 (1272-1307) and was instrumental in his campaign to conquer Wales and subjugate the Welsh people. **Day Seven:** Focuses on GeoMón Geopark and includes visits to coastal sites with superb exposures of deep ocean Precambrian pillow lavas (Llanddwyn Island) and an interesting rock type called melange which formed within a subduction zone (Pilots Cove). Both sites are evidence of plate tectonic processes during the late Precambrian. The day terminates with a visit to Parys Mountain where mineralized rocks of Silurian age have been mined since the Bronze Age. During the 19th century Parys Mountain was the site of the world's largest copper mine. Convenient overnight stays are included throughout the tour.

GeoWorld Travel proposes cooperating with individual geoparks or groups of geoparks to develop similar excursions emphasizing geology, landscape and relevant aspects of their tangible and intangible heritage. To this end GeoWorld offers the following proposal.

Outline for a business proposal

The information required from Geoparks would include:

1. Sites of geological, natural, historical and cultural interest
2. Accommodation providers
3. Transport companies in the regions
4. Availability of local guides
5. Minimum numbers of participants required to make excursions economically viable.

GeoWorld will act as a travel agent with responsibility for the following

1. Global advertising and marketing of excursions
2. Recruiting tourists, including international tourists
3. Insurance liability

Tourists would pay the deposit and final cost to GeoWorld Travel from which the company would take a fixed fee. The bulk of any income would be paid to the geoparks who might also wish to include a fixed fee.

This proposal does not involve any financial risks to participating Geoparks, however, if successful, it could contribute to a Geopark's programme for geotourism and sustainable economic development.

FREE FLIGHT MASTER PLAN, PRESERVING ROCK BIRDS.

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Keywords: *Nature conservation, outdoor activities, sustainable development, rock birds, partnership project*

The Bauges Massif Geopark's geomorphology presents a lot of high cliffs in its surroundings and bared rocky fortresses in its core. These areas are the last wild habitats in the massif without anthropogenic interference.

These habitats provides shelter for a lot of protected and sensitive species like the Golden Eagle (*Aquila chrysaetos*) and the Peregrine Falcon (*Falco peregrinus*).

In addition, the Park works with professionals to develop outdoor activities and sports. Its charter indicates that it must be the mediator between the different territorial actors to find the best tools to obtain a sustainable development of these activities.

Free flight is practiced a lot in the area (130 000 paragliders takes-off every year around lake Annecy and the 2nd French gliding club is located just below the massif).

The cliffs are major destinations to find thermals but are also propitious for bird nesting. Only one -flight can defeat a bird breeding its chicks...

So, the park wanted to set up a free flight master plan to welcome the free-flyers in good conditions and to preserve the cliff life.

The coordination of the project was given to the League for Protection of Birds. A workgroup has been created to define the actions, combining free flight clubs, ornithologists, elected representatives and RNP agents.

Improve the knowledge on free flight activity and on bird life.

An educational kit has been designed to present the major species that live in the Bauges' massif. This tool is regularly used during the clubs' meetings to raise the members awareness and expand their knowledge on bird life issues : habitats, attitudes, identify birds, The goal was to transfer in a fun way the basics of ornithological knowledge and discuss the main risks of disturbance.

The second step was to cross the naturalists and free flight approaches together. Each year, the Park organizes bird watching to locate nesting, an ideal moment for them to meet. Pilots can talk about their activity, their flight constraints and the naturalists can talk about their knowledge of birds and their ecological requirements.

For 3 years now, the ornithologists and the free flyers are doing an inventory of the nesting sites and informing the Park regularly.



Fig.1. Bird model

Defining the main working sites

Now that the two worlds have exchanged their body of knowledge, the workgroup can operate with better awareness and in perfect cooperation.

The main flight ways, thermals, dynamics, take offs and landings were crossed with the environmental issues (nesting, breeding areas of rock rapacious, special rules and regulations) and has determined the main sites to work on .

The group decided of the main topics to be developed, always keeping in mind to mix both information (technical flight details and naturalist's information) .

Map

The Park has also done an original and successful free-flight map which is distributed in every clubs, schools and tourism information offices of the Park and its surroundings. It's a 3D Map of the massif localizing the necessary information for tranquil free-flight and naturalist information.

Information panels

19 panels have been made and installed on the gliding spots (take-off and landing). It makes the offer on the massif more consistent and legible. These notice boards explain the technical and specific characteristics of each site (cartography, photos, nesting zones and bird's behavior, etc). Two evolving spaces on the panels: one is dedicated to the club's latest news and is updated on a regular basis and the other one is dedicated to ornithological observations, carried out regularly on bird nesting areas etc... .



Fig.2. Panel on one of the take-off spot

Development of a geographical information system

The nesting places change every year. For a good application, the Park only notifies the ones in use. It's a guaranty for the free-flyers understanding. The participative bird watching determines each year the breeding areas without contestation.

But how to transfer the information to the clubs and the flyers ? The only good way is to use a geographical system, hosted on the Park's website and also linked on each club's site. All the information is regularly updated and always available.

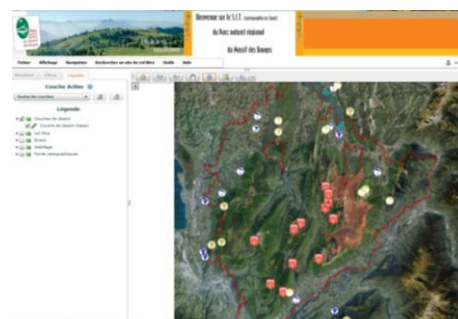


Fig.3. Geographical information system

Free-flyers, genuine partners of the Park

After three years of plan application, the free-flyers have become the most competent people for rock bird preservation. They know them very well, fly friendly with them and work to preserve them beyond the call of duty.

Furthermore, the free-flight world is going to be an important partner of the Park. During Geopark events they organize friendly competitions over the main geosites in order to discover bird issues and to promote the master plan.

A very successful participative action has settled a sustainable collaboration between naturalists, free-flyers and the Park. This experience allows exploration of other topics like preservation of the geological and flora heritage. This type of plan could be transferred to other outdoor activities like canyoning and climbing.

PROVIDING A LINK BETWEEN THIRD LEVEL EDUCATION AND THE LOCAL COMMUNITY IN THE BURREN & CLIFFS OF MOHER GEOPARK

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Keywords: *Burren, third level education, local community*

Education has a long history in the Burren; a law school existed at Cahermacnaughton Fort in the 1600's and during the 18th and 19th century Hedge Schools were common in rural areas where formal education was not available. More recently, many national and international University groups visit the Burren & Cliffs of Moher Geopark each year for the purpose of teaching field studies in Geology, Archaeology and Geography as well as undertaking pure research. While they provide financial benefit to the local businesses, there is little understanding among landowners and residents as to what these institutions actually do and the results of their research are inaccessible to the local community.

As a newly formed Geopark it is important for the Burren & Cliffs of Moher Geopark to bridge this gap and find an ongoing system for providing a link between the activities of visiting third level education institutions and local landowners, businesses and community groups. This will benefit the visiting groups by forging links and understanding. This is particularly important for land access issues. Local residents who are proud of their heritage and land must feel they are getting something in return for allowing access to their land. There is a long and ancient history of learning in the Burren and as education is one of the key pillars of the Geopark movement we must ensure this link continues into the future.

We have developed a three-part strategy to provide this link.

- Contact visiting university groups and present them with a 'Certificate of Appreciation' from the Burren & Cliffs of Moher Geopark
- Initiate discussions about the field-work, research and publications and any possible future collaboration.
- Present this information to interested local groups

The first part is already implemented and we have developed a 'Certificate of Appreciation' which the Geopark presents to visiting institutions (Fig. 1). The second part is ongoing and develops naturally as a direct result of meeting and talking with the visiting groups.

The third part is undeveloped as yet and we are now looking at ways to present the information and research from these groups to the local community. A number of possible options are being considered, these include; a small annual newsletter-style publication, formal presentations at an annual seminar or informal presentations at a number of small locations throughout the Geopark.

The latter option of small informal presentations is favoured at present as this minimises costs and for the purpose of forging links and sharing information provides the most intimate and personal interaction with local communities.



Fig. 1 Dr. Eamon Doyle (centre) presents The Burren & Cliffs of Moher Certificate of Appreciation to Professor Jeff Peakall (l) and Professor Paul Wignall (r) of the University of Leeds, England.

“AROUCA GEOPARK: A TERRITORY WITH QUALITY MANAGEMENT ISO 9001:2008 AND A BRAND 'S CERTIFICATION

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Keywords: *Geopark, quality management, procedures, monitoring.*

Since 2009, the Arouca Geopark territory is member of EGN and GGN. The territory is managed by a private and non-profit association, the AGA - Arouca Geopark Association, created on June 2008. This management structure includes a diversified partnership of local entities in a juridical person with administrative and financial autonomy and has a multidisciplinary technical team, in order to ensure an effective and efficient management of the Arouca Geopark. In 2008, was produced and approved a Strategic Plan for the Arouca Geopark which foresaw the implementation of the Quality Management System based on the ISO 9001:2008, which was done in 2011.

The Quality Management System of AGA - Arouca Geopark Association was implemented taking into account the specific nature of the management of an European and Global Geopark and respecting the principles of ISO 9001:2008, namely: focusing on customer, leadership, involvement of people, process approach, system approach to management, continual improvement, approach facts, mutually beneficial relationships with service providers.

The major aim of the application of this norm is to make an effective management of AGA and meet the requirements of its users and customers, in a logic of continuous improvement and based on the PDCA methodology (Fig.1). Therefore, the management of AGA included all areas, service and projects and an ongoing responsibility for planning, implementing, monitoring and implementation of corrective and preventive action.



Fig.1. PDCA methodology.

AGA is committed to developing a quality policy in order to:

- Ensure that the principles associated to the Charter of Geopark: European Geoparks Network;
- Increasing maturity of the organization in a practice of continuous improvement;
- Ensuring a coordinated organizational and management;
- Ensure high standards of quality in services;
- Ensuring customer satisfaction.

In order to monitoring quarterly the activities of the Arouca Geopark, was defined indicators and metrics for each strategic thematic as Geo-conservation Services, Educative Services, Geotourism Services, Financial and administrative, Human Resources, Quality, Management

and Marketing. Additionally, we monitoring an action plan with corrective and preventive actions in order to solve problems and eliminate the causes.

The involvement of the staff and collaborators in all procedures, with a responsible attitude focused in the user of Arouca Geopark services is part of the success in the implementation of the Quality Management System.

The ISO 9001:2008 certification, obtained on February 2012, reinforces the policy's strategic Arouca Geopark, grounded in a logic of quality and continuous improvement.

In other hand, the Arouca Geopark Association has approved internally norms in order to certify local's establishments, activities and products with the brand and the official logo of Arouca Geopark. This process allows the active involvement of local partners around the geotouristic activities and is a mutual commitment to the promotion and the quality assurance of visitors.

This process is managed by a commission, nominated by the board of AGA, which is responsible for verify and check the respect of these norms. Since 2011, were certified by this brand 16 local partners, of which 4 touristic accommodations, 5 restaurants, 3 activities and 2 products (Fig. 2), 2 sale stations and shops.

This certification is recognized by partners as a good practice, in order to value and differentiate the local and traditional activities inside a classified area, where the costumers and especially the tourists recognize this added value.



Fig.2. Local Product certified by Arouca Geopark Brand (*Pão de ló*).

INTEGRATION OF COMMUNITY PARTICIPATION IN GEOPARK KEY MANAGEMENT PROCESSES – ENHANCEMENT OF ACCOUNTABILITY FOR SUSTAINABLE DEVELOPMENT

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Keywords: *Community Participation, Quality Management, Social Accountability, Sustainable Development*

The membership of a territory in the Global Geoparks Network requires the development and maintenance of a quality based management approach, in line with the standards and guidelines of the GGN. Geopark managements are furthermore obliged to entirely enhance the participation of local communities in the development of their Geopark territories. The integration of *participation* as essential element of the GGN concept and of *quality* as guiding principle of a management approach into the design and performance of a Geopark's key management processes provides the platform for long term sustainable development of Geopark regions with managements standing for social accountability.

Since more than a decade, the Geo-Naturpark Bergstrasse-Odenwald has been incorporating different modes and models of community participation into the key management processes of the Geopark territory. The Geo-Naturpark is located in the south of Germany between the two European Metropolitan Areas Frankfurt Rhein-Main and Rhein-Neckar. The territory offers a broad variety of locations of geological and cultural importance, highlighted by three UNESCO World Heritage Sites. Since 2002, the Geo-Naturpark is a member of the European Geoparks Network (EGN), since 2004 part of the Global Geoparks Network.

One of the key management processes of the Geo-Naturpark is the development and maintenance of a multi-tiered system of infrastructure for visitor information, outdoor education and outdoor leisure activities. For the establishment of the overall regional approach for Geopark infrastructure as well as for the management of the implementation of each individual infrastructure project, the participation of local stakeholders is an integral part of the process. The definition of milestones referring to community participation and a tailored framework for the organisation of participation of local stakeholders are part of the design of the overall process for the establishment of infrastructure.

Governed by the philosophy and the objectives of the Global Geoparks Network, the Geo-Naturpark administration is using the internationally recognized quality management standard ISO EN 9001 and the related quality management tools for the design and operation of its key management processes.

A second example for a key management process under the participatory approach is the development and maintenance of a regional network of community based visitor guides. These "Geopark–Ambassadors" in the "Geopark-on-Site" program are local stakeholders who participated in training provided by the Geopark administration. Up to date, more than 200 Geopark - on - Site - Guides have been trained and are actively involved in the presentation of the territory. Visitors are attracted by the special combination of scientific information with on-site authenticity and local knowledge. At the same time, hidden knowledge and passive expertise of the region is being revitalised and hereby preserved for future generations – a sustainable contribution to the reinforcement of regional identity. The management process

which is related to the Geopark on Site program has a strong focus on participation and hence, requires considerable staff efforts. Meaningful consultation as an element of the management process is enhancing continuous development and improvement of the operation of the program, considering the specific needs of the local guides, their communities, their partners for operation and of the visitors of the territory. The complexity of the program requires high flexibility for the related management process, providing the institutional capability to respond to local conditions and to hereby contribute to capacity building of local stakeholders and their communities in a tangible manner.

The reliability and the quality of Geopark management processes in the perception of local communities, with demonstrated safeguarding of sustainable regional development through the participation of local stakeholders, is a prerequisite for the operation of Geoparks as recognized regional institutions in the long term. The tangible integration of the participatory approach in the design and the mechanisms of management processes at the same time can be regarded the prerequisite for social accountability of Geoparks.

In the GGN context, *social accountability* stands for the human rights based recognition of local skills and needs within geopark development, the meaningful consideration of vulnerable groups, tailored concepts for capacity building to achieve tangible benefits from Geoparks, the enhancement of dialogue and cooperation between indigenous and academic knowledge in order to preserve a territory's earth- and cultural heritage and at the same time to promote economic development.

The implementation of quality based participatory management processes provides an efficient equipment for Geopark managements in order to respond to their specific regional and local settings and socio-economic fabrics and to establish their Geoparks as reliable and accountable institutions for sustainable environmental, social and economic development. In turn, the resulting high performance profile of Geoparks as overall accountable organisations increases opportunities for win-win partnerships with institutions and economy/enterprises on the regional and global level.

AFRICAN GEOPARKS NETWORK: CHALLENGES AND PERSPECTIVES

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Keywords: *African, Network, Geoparks, geoheritage, geotourism*

The geological history of Earth from Archean to Quaternary is inscribed in Africa's rocks which are very well exposed in fascinating geological landscapes, shaped by different orogenies, and are extremely varied. Many sedimentological, paleontological, petrographical and structural witnesses of the history of Earth are of exceptional quality in Africa and many of these witnesses are unique, very educational and deserve to be preserved and presented to the general public in a less academic and more widely accessible way. These sites are even more attractive as their geographical, historical, architectural and traditional frames are exceptional.

For these reasons, the African Association of Women in Geosciences (AAWG, www.aawg.org) created, during the preparatory meeting of its fifth conference held in Abidjan, Ivory Coast in May 2009, the African Geoparks Network (AGN, www.africangeoparksnetwork.org) to promote the African geoheritage. The AGN aims to identify and make an inventory of the geological sites of outstanding value in Africa; Promote and increase the awareness among policy makers and the general public in Africa, particularly local communities about the necessity of the protection and the valorization of African geological heritage through the creation of geoparks for a local sustainable development; Build the capacity of local population in the field of geoheritage through a strong networking and the organization of conferences, seminars, symposia, training courses and workshops.

The network aims through its activities to build long-term bridges among people interested in geoheritage, geotourism, geoconservation, environment and sustainable development (researchers, policy makers, economists, geopark and natural heritage sites and local community administrators and leaders, NGOs, business operators, Medias and individuals) in order to promote the Geopark concept and make it a lever of local sustainable development in Africa.

Within this framework, the AAWG and the AGN organized in collaboration with UNESCO Cairo Office the First International Conference on African and Arabian Geoparks from the 20th to the 28th November 2011 in El Jadida (Morocco) entitled "Aspiring geoparks in Africa and Arab World". This conference was attended by representatives of 31 countries from the five continents. This event comprises, one day pre-conference course on geoconservation and geoparks, two days technical sessions including conferences to build the capacity of the participants and six days post-conference field trip through the Moroccan High-Atlas and the Anti-Atlas Mountains as potential geoparks.

The main outcome of that first conference is "El Jadida Declaration". As a follow up to the conference, numerous workshops and roundtables will be organized in some African and Arabian countries in order to promote the geopark concept and to build the capacity of local population.

GEOHERITAGE AND GEOPARKS: A TOOL FOR LOCAL SUSTAINABLE SOCIO-ECONOMICAL DEVELOPMENT IN DIFFERENT REGIONS OF MOROCCO

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Keywords: *Morocco, Geoheritage, Geoparks, local sustainable development*

Morocco presents a varied and globally important geology reflecting its position on the north-western edge of the West African Craton and its Earth history influenced by the Tethys Sea and the opening of the Atlantic Ocean. Some of the Moroccan key features include: terranes resulted from plate subduction and plate collision episodes, ophiolite complexes, granitoid complexes associated with plate edges and tectonics, diversified volcanism, various stratigraphic sequences, didactic sedimentary features, excellent exposures of fossil-bearing stratigraphy, arid zone landforms, numerous humid zones...etc. Morocco is also well known by its valuable fossils [dinosaurs, trilobites, cephalopods (orthoceras goniatites and ammonites), Devonian and Liasic reefs...] and minerals. The location of Morocco in an arid environment provides excellent exposures of many of these features (Figs 1, 2). The diversified geology is even more attractive as its geographical, historical, archaeological, architectural, cultural and traditional frames are varied and exceptional (Fig. 3).

The geoheritage inventory in Morocco is still in its early stages, despite some localized attempts by few Earth Scientists enrolled in universities. Our research group « Geodynamic, Geo-education and Geoheritage » is working in different parts of Morocco [Doukkala-Abda region (Meseta), Toubkal Natural Park (High Atlas) and in the Central and Eastern Anti-Atlas]. These works aim, to make an inventory of the geological, geomorphological, historical and cultural sites of outstanding value, to evaluate the existing socio-economical infrastructure, and try to propose management plans in order to show the benefit that could make these regions from the valorization and preservation of their heritages. The creation of a data base will help and encourage the decision makers to transform their regions into geoparks.



Fig. 1. Jbel Kissan of Ordovician age (Anti-Atlas, Morocco).



Fig. 2. Merzouga sand dunes of an intense orange color (Anti-Atlas, Morocco).



Fig. 3. Ait Ben Haddou Kasbah, an example of a traditional architecture of a pre-Saharan habitat.

GEOPARK KARAVANKE/KARAWANKEN – GEO ADVENTURES IN THE CROSS-BORDER GEOPARK BETWEEN SLOVENIA AND AUSTRIA

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Keywords: *Geopark Karavanke/Karawanken, cross-border geopark, Slovenia, Austria, geoeducation*

The Geopark Karavanke/Karawanken lies in the area between the Peca/Petzen and the Košuta/Koschuta mountains, on the border between Slovenia and Austria. The Geopark area includes 13 municipalities and it extends over an area of 1000 km² with a population of 50. 000. The geological history of the Geopark is long. The oldest stone formations in the area date from around 500 million years ago. The area has a rich mining, iron and coal mining tradition. Due to the varied geological basis of the area, the habitats, vegetation and fauna have developed the same richness and variation.

Until now, 48 geosites, from those 14 Geopark localities have been registered in the Geopark Karavanke area. This localities demonstrate the great geodiversity of the area which is exceptional and unique on a global level. Some of its treasures are: one of the three richest deposits of Carnian crinoids in Europe, in the Helena creek valley; the Mežica mine has one of five lead-zinc ore outcrops of this type in the world; wulfenite deposits in Mežica are the richest in Europe and one of the most famous in the world; the Topla valley mine shows evidence of sediment creation of ore deposits of global importance; Dobrova pri Dravogradu is a typical deposit of dravite mineral and one of the five major deposits in the world; the Periadriatic lineament is the joint of two large lithosphere plates – the African and Eurasian plate – that can be observed in nature; Obir Tropfsteinhöhle is the most beautiful stalactite cave in Austria, discovered by coincidence during a lead-zinc ore excavation; slopes of dark grey pillow lava in the Obir gorge are evidence of volcanic activity; several mineral water sources;

Podzemlje Pece tourist mine and museum in Mežica and Obir caves in Bad Eisenkappel/Železna Kapla – are the central information points in the Geopark Karavanke/Karawanken. The Mežica mine and museum have an ethnological collection, ore, mineral and fossil collections, mine surveying room, and a photo collection. A guided tour to the core of the Peca/Petzen mountain is available, in which one can travel in mining carts, followed by a 1.5-kilometre walk through the underground world of the Peca with a presentation of mining work and equipment through history. As a unique experience, visitors can choose to explore the mine by bike or canoe. Deep underground, they can enjoy a miner's lunch, and in the shop by the entrance, souvenirs and publications about the area are available. The Obir caves information centre is located in the centre of Bad Eisenkappel/Železna Kapla. It offers information, souvenirs and a collection of interesting minerals. It also organizes visits to the mine and caves of Obir mountain with a tourist bus connection from Bad Eisenkappel/Železna Kapla. Right after entering the cave, there is an 800-metre-long

underground discovery park with stalactites and traces of mining activity that are presented through the use of innovative animations.

In the Geopark, a significant amount of attention is given to education: starting with the youngest (i.e. kindergarten children) and also pupils and students as well as their teachers and professors. Different education workshops are also organised for the local tourist guides. Within the framework of the educational programme Geopark Karavanke - It's fun, it's educational and no chore, courses for teachers and workshops for kindergarten and school children are organized in both information centres, schools, kindergarten and also in the field. Programmes carried out in the Geopark Karavanke/Karawanken area are:

- geo-adventures – workshops for pre-school children (up to 8 years): children learn about geology and the geo-features of the Geopark through games, thus developing a positive attitude towards this heritage and contributing to its conservation in the long term.
- mysterious world of rocks, minerals and fossils – workshops (over 8 years): children and high school students develop a positive attitude towards geological heritage through practical work.
- It's fun, it's educational and no chore – workshops and courses for kindergarten and school teachers and tourist guides;
- geo-project days and an international exchange for students from the Geopark area: intended to strengthen cooperation and improve knowledge of the Geopark;
- guided visits for families with children to discover geosites and Geopark localities as well as learn about the geology and heritage of the area;
- annual Geopark week with different activities for different target groups;
- teambuilding: a unique team experience for business people;
- guided tours for school children, locals and tourists, including geosites and Geopark localities,
- activities to include the Geopark into the tourist offer.



Fig 1. The unique experience in Mežica mine.



Fig. 2. Geo-adventures, workshop for schoolchildren.

THE GREEN MARKET IN GEOPARKS THROUGH ECO-LABELS

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Keywords: *Certification, Eco-Label, Geopark, Geotourism*

Eco-labels on one hand help a quality product stand out in the market, and also allow customers to recognize and choose the products with a low negative impact on the environment (earth friendly products); on the other hand, they can guarantee and support entrepreneurs, small and medium size businesses, products and services (Farsani *et al.*, 2012).

This paper focuses on the role of Eco-labels, certifications, and local labels on development of green market in geoparks as geotourism destinations. To this end, 25 geopark strategies have been analyzed (20 in Europe and 3 in Asia – Malaysia, Japan and Iran, 1 in Australia and 1 in South America - Brazil). E-survey method was used to investigate whether geoparks take advantage of eco-labels and brands in their territories to promote the geotourism market and local economy or not. The data was collected from March 2009 to January 2010.

On the basis of the results of this research, applying the geoparks brand or eco-labels in geotourism marketing (in festivals, publications, research projects, common marketing, higher prestige, accommodations, restaurants, educational programs, and local businesses) can be a strategy for the development of geotourism and local economy.

According to Table 1, the majority (84%) of geopark authorities stated that geotourism markets take advantage of the geopark brand, and 68% affirmed that geoparks brand can play a role in the development of local economy. In addition, 28% of local authorities believe that providing a label for regional food or local gastronomy is a way to promote this market in rural areas.

Among geoparks, Vulkaneifel Geopark (Germany), Nature Park Eisenwurzen (Austria), Naturtejo Geopark (Portugal), Psiloritis Natural Park (Greece) Cabo de Gata - Nijar Natural Park (Spain), Naturepark Terra Vita European Geopark (Germany) and Parco Naturale Adamello Brenta (Italy) emphasize that using the geoparks logo or eco-labels contribute to promote local businesses and geotourism; for example, the Parco Naturale Adamello Brenta launched a project titled as “Qualità Parco”. This project aims to use the logo as a local environmental / marketing certification for hotels and local products. Moreover, the brand is used for agro-alimentary as well. Parco Naturale Adamello Brenta (Italy) is the first geopark in Europe which obtained ISO 14001 certification; the park can also boast of EMAS registration (Moranduzzo, 2008).

Furthermore, Geo-Naturpark Bergstraße-Odenwald (Germany) is currently implementing ISO EN 9001 standards in order to improve the management framework and the regional development (Eckhardt, 2011). Cabo de Gata-Nijar Geopark (Spain) implemented the European Charter for Sustainable Tourism (ECST) in its territory and it uses adequately the logo of the ECST for its activities (Elviro *et al.*, 2011). Besides, North Pennines European Geopark (UK) has used the Green Tourism Business Scheme (GTBS) as an environmental accreditation for the geopark (North Pennines Geopark Authorities, 2007). This eco-label has been designed to guide visitors to tourism destinations and help them to select promoters of ecotourism products and the new experiences which offer by destinations. It is worth mentioning that some geoparks such as the Papuk Geopark (Croatia) believe that geotourism market has still not been developed in the country as it should be and authorities should try to introduce the geopark brand as a sustainable tourism brand. It can be concluded that geotourism marketing and local economy can take advantage of geoparks brand as well as eco-labels.

Table 1. Local Labels and Brands in Geoparks (questionnaires filled by authorities of 25 geoparks around the world).

Questions	N	Missing	Yes %	No %
whether geoparks take advantage of eco-labels and brands in their territories to promote the geotourism market and local economy?	-	-	-	-
Geopark has a brand and logo of its own	25	0	100	-
Geotourism markets take advantage of the geopark brand	25	0	84.0	16.0
Brand plays a role in development of local economy	25	0	68.0	32.0
Efforts which are taken to create and promote regional geotourism products of the geopark				
• Producing regional and/or ecological products in restaurants	25	0	44.0	56.0
• Organizing local markets for regional and agricultural products	25	0	24.0	76.0
• Providing a label for regional food or local gastronomy	25	0	28.0	72.0
• Making casts and souvenirs	25	0	56.0	44.0
• Serving local food on tours	25	0	52.0	48.0
• Creating initiative activities	25	0	48.0	52.0
A label given to the regional services	25	0	36.0	64.0

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PECULIAR TAFONI STRUCTURES AT SITIA NATURE PARK: A PRELIMINARY STUDY

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Keywords: *geopark, tafoni, geotope, landform, Sitia, Crete*

Tafoni are considered small geomorphological cavities resulting from aeolian weathering of granular, inhomogeneous rocks, mainly volcanic and sandstones. They present ellipsoidal, pan-to bowl-shaped, natural rock cavities that include tiny pits, softball-sized cavities, truck-sized caves, and nested and cellular honeycomb forms. Tafoni typically develop on inclined or vertical surfaces and occur in groups, ranging from small (centimeter) to larger (meter) scale. The term “tafoni” comes either from the greek word “taphos”, meaning tomb or from the Corsican/Sicilian word “taffoni”, meaning windows. The earliest known publication of the term “tafoni” was in 1882 (www.tafoni.com).

The driving forces for tafoni development are considered to be salt weathering, differential weathering processes, lithologic variation, and micro-climates developed. Tafoni usually develop in dry climates but can be found also in other cases. The influence of tafoni on coastal area retreatment and erosion is considered to be very important. Gill et al. (1981) estimate that tafoni weathering processes cause 10 percent of all coastal retreat.

At the area of Sitia Nature Park in eastern Crete, Greece extensive tafoni structures can be found in various places, but the majority of them are concentrated in the Toplou gorge. These structures develop either at metavolcanic rocks of the coastal areas of Vai and Itanos or within the neogene sediments of Toplou gorge. The gorge has a length of 2.5 kilometers and a southeast to northwest development leading to a small bay and is part of a circular geo trail of Sitia Nature Park. Lithology consists of Eocene flysch sediments forming the basement rocks over which rest unconformably late Miocene sediments of about 50 meters in thickness. The base of these sediments is constituted by well sorted fine sands with intercalations of conglomerates and thin bedded sandy limestone of about ten meters thick. These rocks are overlain by thick bedded or massive deposits of angular conglomerates and breccias, cemented with a sandy, calcareous matrix of about 20-30 meters thick. Finally on top of the stratigraphic pile rest reefal limestone of Tortonian-Messinian age containing abundant coral fossils.

The various shape cavities occur mainly within the thick bedded breccias and the underlying fine sands. The dominating process for their development appears to be the carbonate dissolution due to coastal humidity and the Aeolian erosion, as this particular part is one of the windiest in Crete. The cavities can be classified in almost all tafoni types and sizes ranging from millimeter scale in the fine sands to decade-meter scale at the massive breccias, both facts very rare globally for a unique site (Fig. 1). Honeycomb like cavities form at fine sands and sandy limestone representing millimeter to centimeter clusters of well-developed small tafoni, also known as alveoli. Small and large tafoni develop both in fine sands, sandy limestone and massive breccias and are common everywhere at the Toplou gorge but also at the coastal metavolcanics of Vai and Itanos areas. However, within the massive breccias and conglomerate, nested tafoni dominate. These refer to cavities ranging in scale over many orders of magnitude, from several millimeters to many meters and are supposed to be the result at small scales of common chemical weathering of the calcareous matrix, rock differential weathering and Aeolian erosion. These nest and large tafoni may have sizes of several to decades meters arranged along sediment bedding planes that often nest smaller tafoni within them.

Such structures have been extensively studied in other geoparks, like in Lesvos Petrified Forest (Gumus & Zouros 2005) forming spectacular geotopes and landscape features that may have

cultural or historical value attracting thus the interest of visitors. In particular, one of such tafoni in the Toplou gorge hosted the Partisan's radio during the Second World War. Tafoni structures are regarded as the most important geotopes and landforms of the Toplou gorge walking trail that can combine various geological issues like rock types, earth processes, and climate effects together with cultural, historical, ecological and aesthetic issues.

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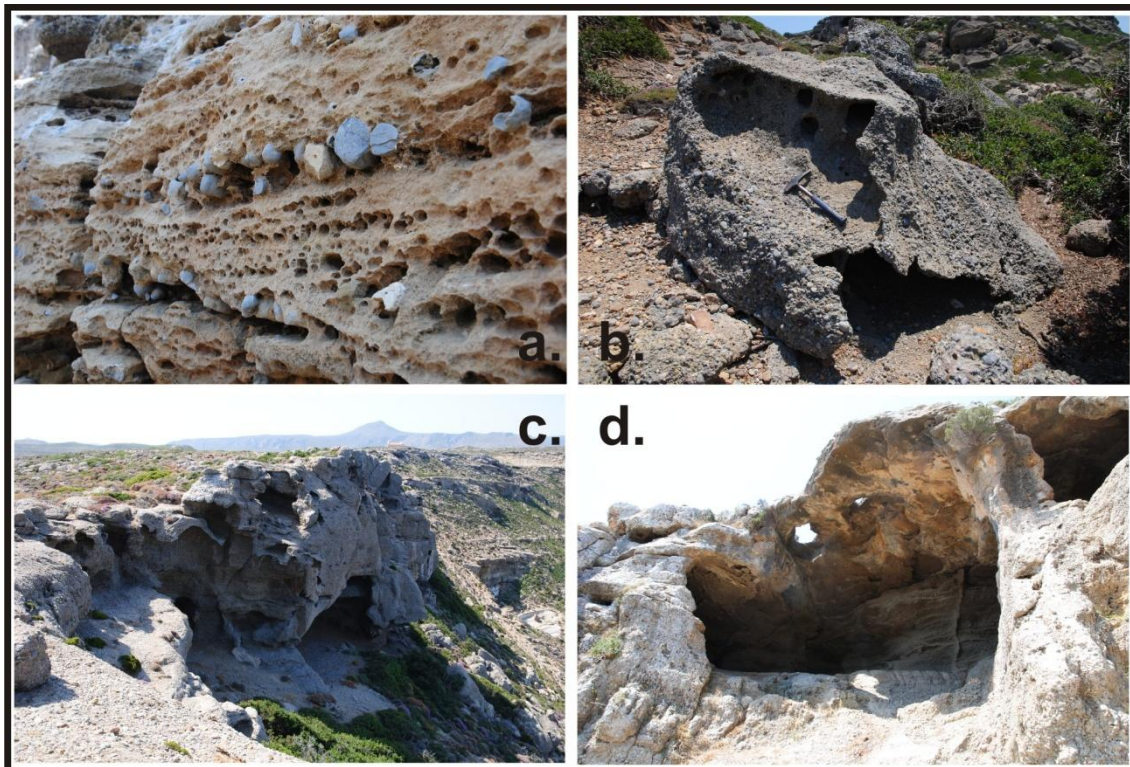


Fig.1. Tafoni in Toplou gorge. a. honeycomb cavities in fine sands; b. nested tafoni at breccias; c. and d. large and nested tafoni in the massive breccias and conglomerates.

THE USE OF MODERN TECHNOLOGIES IN ASSESSING GEOTOPES AND DEVELOPING MANAGEMENT PLANS IN GEOPARKS: THE CASE OF SITIA NATURE PARK

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Keywords: *Geopark, geotope, assessment, Google maps, Sitia, Crete*

It is well documented that quantitative assessment of geotopes (geosites) is a tool to reveal the various values and importance of geotopes but also an important process to develop management plans of geoparks. The process serves the needs for sufficient management and protection of geoheritage in a certain territory as it can reveal priorities for sustainable tourism development, including geotourism and educational tourism activities, and conservation of geotopes. The last two decades various methods have been developed to assess qualitative and quantitative geotopes, geomorphosites and geomorphologic assets that can support the needs of geoparks too.

In order to develop a management plan for Sitia Nature Park of eastern Crete, as well as to establish necessary geotouristic and educative infrastructure for an aspiring geopark we combined a method for assessing geotopes proposed by Fassoulas et al (2012) with Google maps and relative desktop and online GIS tools. A field inventory was first undertaken to identify, study and map important sites of geological, geomorphological, environmental, aesthetic and geo-archaeological or geo-cultural value. Data were recorded using high sensitivity GPS devices, digital images and web based Gis platforms. A geodata-base was then created to store data and use for the desktop analysis that followed field activities. Geotopes were subdivided in to several classes according to their context, like fossil sites, geomorphological, petrological, tectonic, hydrological, geoarchaeological etc., and additional data were retrieved from literature, personal interviews and other records.

The database was then transformed in a “*kml*” format and thus connected with the developed Google maps in a way that all necessary information can appear on the maps together with the collected information for each geotope (including description, images and the future evaluation). The selection of transforming the database and putting it on the Google map platform was based on the concept that not only GIS experts should access and then evaluate the data, but also all the stakeholders of the project, considering that Google provides one of the most friendly-user web based GIS tools.

The quantitative assessment of about 75 geotopes that have been identified was contacted using the method of Fassoulas et al (2012) resulting in the tourism and educative value as well as in the protection necessity of each geotope, using sophisticated desktop GIS analyses. These values were then introduced into the database and were also visualized through the Google maps.

Based on these results certain issues of the management plan were then developed dealing with conservation priorities, educational project design, infrastructure activities and promotional actions. 12 geological and environmental trails, 2 road or bicycle trips and info points were proposed to join the various geotopes, environmental, cultural and tourism sites of the area. The necessary information and guiding panels, as well as the web-based platform to disseminate the activity will be developed based on the database and Google maps. The use of the Google map database will be enhanced through its appearance on the website of the park, where the data will be clearly visible through interactive Google maps to any of its visitors. In addition, the visitor will freely download the data in “*kml*” or “*gpx*” format for further usage in other mobile devices such as hand-gps, I-Pads, netbooks etc.

Two educational suitcases dedicated to the fresh water presence and endemism of the area will be developed to support local schools, environmental educational centers and other visitors. Finally, a local Nature History Museum at Zakros village and a cave center at Karidi will be established, whereas various publications and dissemination tools will be realized.

The whole project titled “GEOTOPIA” for developing aspiring geoparks at the far eastern part of Crete in Sitia area in Greece and in Troodos Mountain in Cyprus is funded under the INTERREG Greece-Cyprus Cross-border Cooperation Programme.

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THE BEAUTY OF FAR EAST CRETE: SITIA NATURAL PARK

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At the easternmost part of Crete, at the former prefecture of Lassithi, is located the Sitia mountains which forms a low, relative to other in Crete, mountainous area that dips into the Mediterranean Sea. Dominated by calcareous rocks, the mountains act as huge aquifer that concentrate precipitation during winter providing lowlands with this vital resource all over the year, especially for this area which is the driest of Crete (Fig. 1).

On land but mainly underground, water routes have shaped the landscape and rocks of the area forming numerous plateaus, ravines and gorges, as well as cave systems. Some of the caves in the mountainous area of Karidi and Sitanos form km-long underground systems attracting many speleologists every year. Some others are of great archaeological and cultural importance not to mention that many of them have a high aesthetic value due to their decoration. Marine erosion is also impressively present, especially at Zakros and Xerokampos areas, forming on the limestone coastal areas terraces in step mode up to 500 meters height. These terraces are the most robust evidence that Crete has risen up in respect to the sea level many hundred meters due to the tectonic forces.

Geologically, at the area of Sitia the older rocks of Crete can be found, namely the amphibolites, schist and marbles of Paleozoic age. The purple color of the schist is a landmark feature of the area, as well as the reddish marble that intercalate with them. Three carbonate rock sequences occur, one below these schist and two over it. The lower carbonates and the schist have been metamorphosed under high pressure conditions 23 million years ago during the formation of the Cretan mountain ranges. At present a low angle detachment fault, the Cretan detachment fault, separates these metamorphic rocks from the unmetamorphosed, upper carbonate series. In Tertiary and Quaternary times a variety of sedimentary rocks (clay, marl, sandstone, etc.) were deposited within the newly formed tectonic basins and the coastal areas hosting marine and terrestrial fossils. The most impressive are the teeth fossils of *Deinotherium gyganteum*, the largest mammal ever lived on Crete, found few years ago at the area of Zakros, as well as the abundant fossils of Pleistocene mammals (deers, hippos and elephants) that are known since 1905. Other fossils existing are carboniferous ferns, Mesozoic ruddists, and Miocene echinoids, bivalves, and mollusks.

The natural environment of the area includes some of the hotspot ecosystems of Crete that are the famous Vai palm forest and the small islets with the sea and migrating birds. Vai is a Nature 2000 area hosting the largest in Mediterranean palm forest of the *Phoenix theophrastii*, the endemic palm of Crete and southern Turkey, whereas the islets of Elassa, Grandes and Prasonissi is a breeding place of many sea-birds and a resting point of *Falco eleonora* during its long journey from Madagascar to northern Europe. Many aromatic, endemic and wild plants can be found in the gorges, plateaus and coastal areas, as well as beautiful wildflowers, like orchids, crocus or lilies.

This marvelous area, attracted humans since their early presence in Crete not only because its proximity to Asia Minor and Middle East but also because of the wealthy natural environment. Some of the most important archaeological sites of Crete can be found there. The most famous is the Zakros' Minoan palace, the one of the three palaces of Minoan civilization that reveals masterpieces of the famous culture, like jewelry and handicraft. The ruins of the classical towns

of Itanos (near Vai) and of Praissos (located in the area of Chandras, up in the mountains) are other archeological sites. A great variety of monuments cover the whole period from the Minoan times to present, with the architecture using stoned of the mountain being the most noticeable fact.

Local tradition and products, especially wine and olive oil are famous since antiquity and are one of the reasons to visit this place. The other reasons deal with natural environment and landscape. As this area it is located far from the main cities of Crete, and the scenic (but long) road from Agios Nickolaos is the main entrance to the area, tourism is not so developed and intense than in the rest of the island. Thus, this is a place to calm and enjoy nature in all its aspects. Mountainous trails, some following the old coble pathways, join the small villages, the plateaus and the cultivated yards. The gorges are often the only entrances from the coastal to the mountainous areas and plateaus, with some of them (like the Zakros and Chochlakies gorges), receiving thousands of visitors every year. Coastal trails connect also the small and totally private beaches of crystal clear waters to the main tourist places. Kouremenos and Chiona beaches are also famous for windsurfing and are probably the only places in Crete where playing with the wind have such a fun.

Under the project titled “GEOTOPIA” that aims to develop aspiring geoparks at the far eastern part of Crete, in Sitia area (Greece) and in Troodos Mountain (Cyprus) and is funded by the INTERREG Greece-Cyprus Cross-border Cooperation Programme, certain initiatives have been designed and undertaken to improve geotouristic infrastructure, educational activities, and nature conservation. Among this are interpretation of walking trails and geotopes, development of new routes and info centers like the Zakros Natural History Museum and Karidi Speleo Center, emplacement of info panels and info points, development of two educational kits, a geopark targeting management plan and many other promotional activities, some of which already implemented.



Fig.1. Views of Sitia Nature Park.

RAISING PUBLIC AWARENESS ON NATURAL DISASTERS AND THE ROLE OF GEOPARKS

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Natural disasters are those effects of natural phenomena that can be seen as rapid, instantaneous or major collisions between the natural environment and socio-economic system. The catastrophic effects of a natural disaster depend on the point of view we are investigating the problem. The loss of valuable or expensive constructions without human loss is commonly the greatest negative effect on the more developed and advanced countries, but in poorest countries the most expected consequence is human loss or even the establishment of unfavorable conditions for survival.

Natural phenomena like earthquakes, volcanic eruptions or flooding are those closely related to geological processes that have caused the greatest disasters in recent years (Sumatra and Japan earthquakes and tsunamis). For humans particularly, an earthquake is a sudden, stressful and traumatic event because it doesn't offer time for psychological preparation, it reduces the sense of control that can be gained on nature and life and causes intense fear and a sense of helplessness, modifying for longer time the biological and psychological equilibrium. United Nations reports have documented that disastrous events caused by earthquakes and volcanic eruptions affect the areas hit with long term effects, disrupt economies and change landform (UN & WB 2010). Depending on modern life such disasters cost much more than in past in human losses and economic resources. As an example, a French government report estimated that the effects of a strong earthquake of magnitude 6 in Richter scale that hit Haute Provence in 1909 with 46 deaths, 250 injuries and serious material damage, would have 10 times more serious effects in the same area in modern times.

In all cases the reasons for the severe influence of natural disasters on humans is the lack of preparation and adequate infrastructure for such cases, in order to minimize the effects. The role of preparedness especially in the cases of sudden and unexpected natural disasters like the earthquakes and secondary flooding and volcanic eruptions is thus fundamental and the hurt of any civil protection plan and initiative.

The development of geoparks globally opens a new window in raising public awareness and increasing knowledge on natural phenomena and natural disasters. Core aims of geoparks according of EGN Charter are education and engagement of local communities and visitors in geoparks activities and initiatives (Zouros & Martini 2003). Geoparks design and continuously develop educational activities, contact public and training events, collaborate closely with schools, stakeholders and various groups transferring and simultaneously popularizing scientific knowledge to people.

Three European Geoparks, the Psiloritis Geopark through Natural History Museum of Crete (NHMC), Natural History Museum of Lesvos Petrified Forest (LPF) and Reserve Geologique de Haute Provence (RGHP), together with four more partners, the Earthquake Planning and Prevention Organisation of Greece, the Italian National Institution for Geophysics and Volcanoes/Vesuvius department, as well as the educational centers Villa Montesca from France and CEI from Bulgaria are implementing for two years a project funded by the Civil Protection Instrument of EU, titled "Raising earthquake Awareness and Copping Children Emotion - RACCE". The project is addressed to children, including those with movement disorders, aiming to palliate the emotional burden and help them cope in case of a serious natural hazard

(primarily seismic and secondary volcanic). RACCE is thus focused on raising awareness, improving knowledge on earthquakes and simultaneously, on educating relative groups (teachers, parents, volunteers and civil protection operators) on the best practices and state of the art responses.

As a first step, a Needs analysis of the situation in each participating country has been contacted through literature analyses, personal communications, and interviews with experts, as well as use of questionnaires. In all cases the need for public information, drilling implementation and specified support was apparent. In collaboration with psychologists a textbook containing Guidelines to cope children emotions was prepared offering basic information on the psychological effects and disorders that such natural disasters may imply on children, description of the common symptoms as well as first aid, psychological measures.

The main outcomes and preparedness tools of the project are the Travelling exhibition, the Mobile Educational project and the Informative Project for seismic simulators. The Travelling exhibition is composed of 20 posters that were designed to cover all preparedness needs on the topic, in such a way that could be rented to as many and as remote beneficiaries as possible. The mobile educational project was designed using the modern educational approaches of the scientific pathways so that schools, teachers or families can take advantage of it, regardless their location or ability to visit museums or educational centers, implementing step by step or individually the various activities of the project. Furthermore, an informative project was developed to accompany the realizations of past earthquakes on the seismic simulators of NHMC and LPF. All project's outcomes are gradually hosted at project's webpage (racce.nhmc.uoc.gr), but also at partners websites for further dissemination.

All partners, but mainly the geoparks, took advantage of promotional tools and activities scheduled to inform their visitors on the Natural risks and Natural disasters during the various events they organized. The celebration of the International Day for Disaster Prevention on the 13th October 2011 gave the chance to all geoparks to organize public events, exhibitions and educational activities on the earthquake and volcanic eruptions risks. More than 50000 visitors at NHMC and LPF took the advantage to experience the Informative project developed for their seismic simulators during the 6 months of its implementation. Furthermore, RGHP participated in last November at the 3-years national event "Sismo-tour" on the memory of 1909 earthquake, hosting at Digne Les Bains the exhibition "Natural Risks: is your place safe?".

For the final period of project implementation various training activities have been scheduled to transfer gained experience and knowledge to certain target groups, like teachers, parents, civil protection volunteers etc., to train teachers and parents on the implementation of educational projects, as well as to realize educational activities at museums and info centers.

The gained experience from their participation of the three geoparks in the implementation of RACCE project indicated that geoparks can be excellent organizations to raise public awareness on local natural hazards and risks, educate local societies and visitors on best practices and protection measures and popularize scientific knowledge to broader public. Geoparks should never forget that, among others, they are the most privileged initiatives to mitigate and promote policies, methodologies and best practices on the broader natural environment, because they are living within people and work for the people.

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PROJECT YOUNG PALEONTOLOGISTS IN THE ARARIPE GEOPARK'S TERRITORY

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In 2011, the Araripe Geopark, in partnership with URCA, the Museum of Paleontology and the Municipality of Santana do Cariri, started the project Young Paleontologists. Aiming to stimulate the scientific vocation and the awareness of students of secondary schools and of mineworkers of laminated limestone, about the geological and paleontological heritage in Santana do Cariri - CE, as well as promoting conservation actions of this heritage of worldwide importance. The project is being implemented in the municipality of Santana do Cariri, with the performance of three young scholarship holders of high school, beyond the direct involvement of workers in mines and under the coordination of the Araripe Geopark team. The proposed work follows these steps: 1) survey and registration of the exploration areas of laminated limestone (Cariri stone) and its mining, 2) awareness of the mine workers about the importance of fossils for research in Earth sciences and to conservation of this heritage; 3) collecting of fossils offered for workers in mines and referral to the Museum of Paleontology of URCA, 4) sorting of the collected material by local researchers (URCA and DNPM), 5) exposure of the "new" collection in museums and schools in the region. The results expected from this project are: the increase society's awareness and appreciation about the local paleontological *and* geological heritage; appreciation of the work of the miners that work with the Cariri Stone ; awaken the socio and scientific interest of the young people that live in the municipality; disseminate good practices in paleontological heritage conservation; increase the collection of the Museum of Paleontology, with scientific and educational purposes, and finally environmentally aware the young people , the miners and all the local society. With the Project Young Paleontologists the Araripe Geopark collaborates with its guidelines about the Geoeducation, the Geoconservation and Geotourism.



Fig 1. Activities of young paleontologists with the workers of the mine (Cariri Stone).



Fig.2. Field activity of the Young researchers.

THE OLDER THE VOLCANIC ISLANDS, THE RICHER THEIR GEODIVERSITY. THE CASE OF PORTO SANTO (MADEIRA ARCHIPELAGO, PORTUGAL) AND ITS POTENTIAL FOR GEOPARK

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Keywords: *Porto Santo; Geodiversity; Geotourism; Education*

Porto Santo Island, as part of the Madeira archipelago, located at the Eastern North Atlantic, is a small (at present day with 43 km², approx. 1/4 of its past total area) and relatively old volcanic island. Formed during the Miocene by hot spot driven volcanism, since then important erosional and sedimentary processes also took place, altogether presenting this island with three main geological heritages. These derived from as many volcanic, tropical marine and last glaciation aeolian processes, through a variety of outcrops including its long carbonate-sand beach on the southern side of the island, and the two main islets (Ilhéu da Cal – lime islet, a reference to the occurrence of mines for lime production - and Ilhéu das Laranjas – orange islet, a reference to the common occurrence of fossil rhodoliths).

To promote the interpretation and popularization of the three geological heritages of Porto Santo, several strategies have been delineated varying from illustrated comparisons of main development stages of an island and of a person (The Ages of Porto Santo Island) to Geo-Medicine strategies through the publication of the Porto Santo Island – Unique Natural Health Resort book, and already implemented as a differentiation strategy by one of the local tourism enterprises.

Several activities have been tested as is the case of the didactic “Porto Santo’s round-pebble game”. Adapted to students of all ages (K12) it relates the main build-up stages of this volcanic island to the several types of rocks that can be found along their beaches today as round pebbles. Other examples include the recent *Geotourism course and the Porto Santo geopark* (March 8-10th, 2012) whose main purpose was to disclose among the local authorities and tourism agencies the potential of Porto Santo’s geosites for geotourism, capable of defining new tourism markets and niches for this island, at present day heavily affected by the seasonal dynamics of its Sun-Beach main present day usufruct.

Further activities are planned to take place in the near future. Among them are the Porto Santo Great Route, geo-activities specially designed for future local geo-restaurants (pebble soup activity) as well as websites, guide-books and leaflets, suitable for both walking, geocaching and earth-caching, sailing and 4-wheel driving tours.

These aspects have been actively used for more than five years to promote the concept of the (aspiring) Porto Santo geopark among the local authorities, tourism enterprises and the general public although economic sustainability of this project has not yet been guaranteed.

GEODIVERSITY INTEGRATION AND RELIGION IN THE COLINA DO HORTO GEOSITE

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Keywords: *Geopark Araripe, Religiosity, Geodiversity; Colina do Horto.*

The religious tourism in the city of Juazeiro has provided the social and economic development in the Cariri, grounded in the faith of the Patriarch of the city, Father Cicero Romão Batista. Since the mid-nineteenth century, when Father Cicero began his work of evangelization that has attracted pilgrims and tourists visiting the Brazilian Northeast town, and later, the “saintly” reputation spread to other regions of Brazil, and currently the city has become a major pilgrimage centers of pilgrimage in Brazil. In the Garden Hill, where the Padre Cicero began his work of evangelization is the geosite Colina do Horto, where there are the oldest rocks of the Araripe Basin with 650 million years. The rocks present in the Colina do Horto has a very significant meaning in the religious site, this is because there is a trail that leads to the Holy Sepulchre where a chapel was erected on the rocks and that according to legend, when visiting the site the devotee is expiated their sins. Passing beneath the Stone of Sin the Palmer believes that all his sins were forgiven. The main interest for the visit of pilgrims to the Holy Sepulchre is based on information that the rocks of the crystalline basement was a place of meditation of Padre Cicero. At the end of the visit the trail, the pilgrims rest the shade of trees sitting on the outcrops and reports all faith mysticism of the place. Even brands that exist in the blocks of granite, they believe were left by Padre Cicero. Along the way, we can find tree trunks filled with pebbles in allusion to the thirds recited by pilgrims and the relation of man to geodiversity is exacerbated on days when we find many pilgrimages knee carrying rocks in his head as payment of promises fulfilled. This relationship geodiversity with religiosity makes the job of protecting natural resources have a better acceptance and better response with this population.

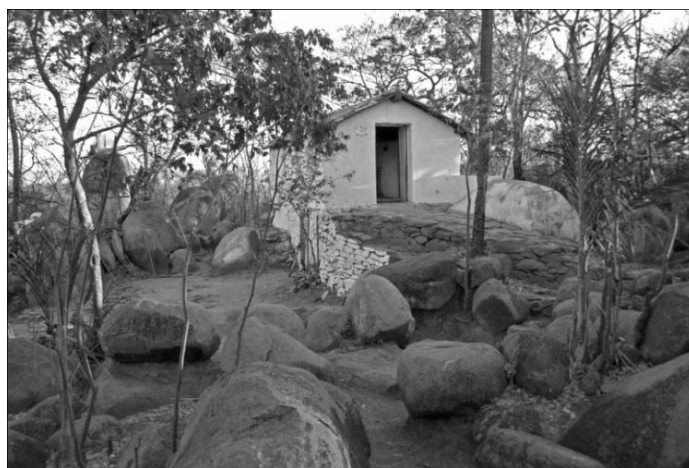


Fig.1 - Geosite Colina do Horto: Church built on the rocks of the Holy Sepulchre.

CONTRIBUTION TO SUSTAINABLE AND INCLUSIVE DEVELOPMENT IN THE ARARIPE BASIN

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Keywords: *Araripe Geopark; Sustainable Development; Geodiversity; Society and environment; Geotourism*

The Araripe Geopark, is located in the southern state of Ceara, Brazil, whose geological, paleontological and cultural features are attracting great interest from local, regional and international levels, especially in regard to scientific research, geotourism and geoconservation, which are important factors for sustainable development in the region. Araripe Geopark is consolidated in the Ceará portion of the Araripe Basin, one of the main sites of the Cretaceous Period of the Earth. The region is special by unpublished geological and paleontological findings, since the early years of the nineteenth century, with records between the Jurassic and Cretaceous Periods, in exceptional state of preservation and diversity. In Araripe is more than one third of all records of vertebrate and invertebrate fossil described in the world. There are these very similar species in Africa, an indication of when the continents were one at the time of the Primate Gondwana continent. However, through actions such as preservation, conservation and dissemination of heritage for the purpose of awakening and build ecologically awareness. The richness of the Araripe Basin is based not only by its natural heritage, but also for its rich cultural, historical and social stuff, which is of huge importance, since they are potential values that helps the territory. Thus, the Araripe Geopark implemented educational programs and economic development of the regional territory and through the union of sectors of society and of the municipalities included in the areas of Geosites, offering courses and training local people in various segments to generate using resources without harming the natural environment. The projects aimed at sustainable and inclusive development, initially sought a recovery of actors in the territory of the Geopark valuing the culture and crafts with the improvement of quality of life and incomes of communities living in the surrounding of the Geosites. These results can be seen through the work that is being developed as the leather crafts, clay, wood, cariri stone, dolls, wooden images of saints, among other natural elements, which are marketed and distributed to other regions of the country. For holding of workshops intended for the school community the Geopark forms partnerships with professionals in the areas of theater, music, dances, as well as the work for making plaster replicas of fossils to be sold as souvenirs for the tourists visiting the region. The tourism in the region is quite significant, especially the religious Juazeiro do Norte, under the auspices of the legendary figure of Father Cicero Romão Batista, has been the main factor of economic and social development in Cariri. Associated with the religious tourism, the ecotourism has been strengthened through the provision of natural resources that are of great potential the sources of crystalline waters of the hillsides, and mild climate and the presence of the Araripe National Forest - APA. Other cities in the region as Barbalha and Crato offer more specialized services in the leisure area, such as exhibitions, religious festivals, in addition to the tradition of brown sugar mills, the Feast of the Santo Antônio flag in Barbalha and the city of Crato the Expocrato, in addition, the historical architecture and cultural identity, which increases the potential for tourism in the region. The commanding presence of the Araripe Plateau, framing the urban agglomeration of the other cities, reflects a great potential for exploitation and economic growth, aimed at eco-tourism. The existence of the Araripe APA and other UCS should encourage partnerships and financial institutions to conduct tours, circuits and trails in the environment of the plateau. In a globalized economy, the great challenge of the Araripe Geopark is to promote the region's development through the integration of various segments of their society. This integration usually involves

the diversification of production as a way to expand the economic space and reduce vulnerability to market fluctuations. The changes required to improve the quality of life, especially the populations of the poorest municipalities are important, because it suggests integrating social inclusion, this can only be realized if the social and economic differences that still exist are reduced, and this work depends on the conditions and productive activities implemented in the area of the Araripe Geopark in regional, national and international contexts.



Fig. 1. Pieces of wood craft made by Mestre Noza in Juazeiro do Norte.

FROM A PIT TO A VISITOR CENTRE AS GEOTOURISM ATTRACTION AND LIGHTHOUSE OF THE TOURIST DESTINATION ODENWALD: BUILDING UP A SUSTAINABLE INFRASTRUCTURE AT THE MESSEL PIT WORLD HERITAGE SITE, GEO-NATUREPARK BERGSTRASSE-ODENWALD, GERMANY)

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Keywords: *geotourism, management, marketing, education, research*

Introduction

The UNESCO Messel Pit World Heritage Site (WHS) is the north entrance gate of the Geo-Naturepark Bergstraße-Odenwald, Germany. Because of its Eocene fossil fauna and flora it is a window into the environment of an Eocene rain forest, 48 Million years ago. Since the 1870's of the 19th century the Messel Pit was discovered as exploitation site on oil shale. The industrial use ended in the year 1971 when the open air quarry closed down and a follow up use as waste disposal area was planned and this was constructed by the district of Darmstadt-Dieburg in South Hesse. Local residents fought against these plans and the construction for about 20 years time. When a formal mistake was discovered the whole process was finished. An open air quarry with a depth of about 60 meters below surface within a forest area remained with a lot of amateurs digging for mammal fossils of the Eocene period.

When in the year 2003 the Administrative company of the WHS Messel Pit was changed from a one hundred percent state company into a three shareholder company – a non profit ltd. Company nobody was aware of the challenge to realize this as a company structure. One of the main aims defined is to give public access into the WHS and to present the WHS Messel Pit in general. Up to this year these two aspects have been mainly worked upon by the Senckenberg Society for Nature Research, the Hesse State Museum and the “Fossil und Heimatverein Messel e.V.”. Since about 1975 the scientific institutes have done regularly excavations to safeguard fossils from Eocene time in front of the situation of the construction of a municipal waste disposal site. The efforts to inform the population about the very special findings also integrated to offer visits into this unique site. Within the 1960's in the town of Messel, four kilometers away from the Messel Pit, a small museum was established and also within the Senckenberg museum in Frankfurt/Main and in the Hesse State Museum special fossils from the Messel Pit have been presented within a special exhibition rooms. However no info point or welcome centre existed at the Messel Pit WHS itself. The first demand on a visitor point was given by FRANZEN in the 1970's. After having received the membership within the UNESCO WH list a first approach was a viewing platform. The rising number of people visiting the 1st natural UNESCO-WHS in Germany indicated the big interest of the population on its outstanding, unique value.

Aim, start off & first steps

The first steps for the actual infrastructure were started in the year 2003. Based on the philosophy of the European Geoparks Network the site was from then on developed to become a geotourism attraction within the Rhine-Mine-Metropole up to international level. By this aim and the establishment of a non-profit limited company to be responsible for realizing the aim automatically the frame was given for the further development.

To start all activities a scientific concept was prepared to develop the necessary measures and actions to fulfill the economic demands necessary because of the official company structure. Basically was defined that a visitor centre would be a pillar next to the site itself to achieve the defined aim: a geotourism attraction. By this the different phases were:

- 1) Developing and offering guided trips regularly into the Messel Pit for visitors
- 2) Establishing an information, welcome and booking service at the UNESCO Messel Pit

- 3) Developing a concept for a visitor centre and guide the planning and realization of the future visitor centre
- 4) Take over the new infrastructure of a visitor centre and go ahead to
- 5) Have a longterm perspective for this geotourism Locus Spiritus with its outstanding, unique value as UNESCO WHS within a geopark.

The following photographs show the main steps from a simple “stand” across two interim info points for visitors towards a new visitor centre with a high quality architecture facing the locality challenges.

Product and service logistics as basis for sustainable, economic development and benefit

In spring 2004 the first regular weekend guided trip by geologists and biologists were presented to the general public as 1 hour offers. Next to this two hour trips for adults, school class trips were offered and 2,5 hour offers for children’s birthdays (FREY & WURCHE 2009). The offers followed the concept to raise income, give information and create a “need to return”. After about nine years of experience on these offers, in the year 2012 it is obvious that by change of society new type of offers have to be developed. The results of the development of visitor numbers from 2004 up to 2011 will be presented. The number of staff as well as of guides being paid on honorary basis which was developed was raised up to now eight people.

These results indicate clearly that new products need to be defined across the frame of the main aim. (FREY 2001; FREY, SCHÄFER & BÜCHEL 2002; FREY & BAUER 2001). By this too the ways to inform about the activities and to place the offers is different. It has to go across tourism promotion and marketing. The frame conditions for this type of products are different: regular booking office times, regular staff to do the guided trips, high level quality of contents of products, high service quality at the booking office and adequate price for the products as well as paying logistics for the “clients” (FREY, SCHÄFER, BÜCHEL & PATZAK 2006).

Value of tourism marketing partnership

In the year 2009 the German Federal Government has launched a programme on financing projects for German UNESCO Sites for the first time ever. After a first collaboration with the Odenwald Tourism Service since 2005 by this perspective the aim was defined after now too having new infrastructures on tourism in Odenwald to prepare the project: “Development of the UNESCO-WHS Messel Pit as a lighthouse within the tourism destination Odenwald and within the Geo-Naturepark Bergstraße-Odenwald”. The partnership was agreed for five years up to 2014 to realize these aims. Main steps for this development have been realized now after three years. To achieve a “common line” for two different labels is one of the most amazing challenges within this. An example on this will be presented in July 2012 in the context of a new exhibition within the visitor centre Messel Pit to rise higher awareness on the general public.

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THE SESIA SUPERVOLCANO: A PROPOSAL TO CREATE A NEW GEOPARK UNDER THE AUSPICES OF UNESCO

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Keywords: *supervulcano, Ivrea Zone, crustal section, geotourism, Val Sesia*

The Associazione Geoturistica “Supervulcano Valsesia” will submit a proposal to the Geopark under the auspices of UNESCO to create a new geopark in Italy. In this valley, Alpine uplift has exposed the renowned section through the pre-Alpine continental crust that comprises the Ivrea-Verbano Zone and the Serie dei Laghi and is capped by a >13-km-diameter, Permian rhyolitic caldera, a.k.a. supervulcano. The collective geologic relations within the Sesia Valley are truly unique. The magmatic system that fed a supervulcano can be traced to >25 km depth through contiguous geology and directly linked to the intrusion of mantle melt into the deep crust, a process commonly referred to as magmatic underplating. A paper⁵ published in 2009 in the journal, *Geology*, demonstrated that the caldera-forming super-eruption, intrusion of granite at mid-crustal levels, and deep-crustal magmatic underplating were contemporaneous and related geochemically, combining for the first time temporal and geochemical links between magmatic underplating and super-volcano-scale, explosive eruptions in a single, structurally coherent crustal section. The significance of this section and the geologic story it contains have been validated by distinguished European and American scientists including members of the US National Academy, and by the Geological Society of Italy, which awarded the *Geology* paper the Capellini medal in 2009. Immediate public interest in the Sesia Valley was sparked by the *Geology* paper, wide coverage by the European press, including all national newspapers in Italy, Italian television RAI 1 and 3, and more than 20 web sites, including National Geographic, MSNBC, ScienceDaily, and Scienceweek.

The significance of the geology of the Sesia Valley cannot be overstated. In no other place on earth are the roots of a supervulcano unambiguously exposed to a depth of more > 5 km, nor has any other place on earth been identified where exposures directly link magmatic underplating with devastatingly powerful explosive silicic volcanism. Thus, the Sesia Valley constitutes a unique geologic reference section that not only allows scientists to place 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 supervulcano like the charismatic Yellowstone and Campi Flegrei calderas.

Along the Sesia River and its tributaries, visitors may observe a virtually complete section of the continental crust, containing a variety of rocks ranging from mantle peridotite to metamorphic crustal rocks intruded at different depths by igneous bodies. In a one-day excursion, visitors may make a journey “from the center of the Earth”, starting from the famous Balmuccia mantle peridotite to the surface, having the opportunity of see: (1) an 8-km-thick mafic intrusion that provided the heat that drove melting of deep-crustal schist and gneiss, providing silicic melt for granite formation and ultimately supervolcanic-scale explosive silicic volcanism; (2) a >6-km-thick granite that fed the caldera eruption and that is rooted deep-crustal, magmatic schist and gneiss; (3) a spectacular 3- to 4-km thick ignimbrite that filled a >13-km-diameter caldera when it erupted more than 280 million years ago; (4) relics of the caldera wall, which juxtapose ignimbrite and basement schist and gneiss. Processes that are clearly displayed include explosive eruption, magma intrusion, magma mingling, magmatic assimilation, anatexis (i.e. melting of crustal rocks), contact metamorphism, high-temperature

plastic deformation and faulting, low-temperature brittle deformation and faulting. Most significantly, these processes may be observed in readily accessible outcrops that place the processes into the context of a journey from the base of the continental crust to its top.

Responding to widespread public interest, local communities and organizations formed the Associazione Geoturistica “Supervulcano Valsesia” (www.supervulcano.it/home.html) to promote the scientific and didactic significance of the geology of the Sesia Valley. Membership includes the largest towns of the valley, Borgosesia and Varallo, the “Comunità Montana Valsesia,” the “Comunità Montana Val Sessera, Valle di Mosso e Prealpi Biellesi,” the “Ente di Gestione delle Aree Protette della Valle Sesia,” the Università di Trieste, Southern Methodist University in Dallas, Texas, and local associations including the Alpine Club of Varallo, and the “Società Valsesiana di Cultura, and “Confraternita ex-allievi Liceo Scientifico di Borgosesia.” Since the first public conference in Borgosesia, in October 2009, which was attended by over 500 persons, 25 sponsored public lectures have fully filled lecture halls in the valley, and the geology of the valley has been incorporated into the curriculum of the local schools. A popular booklet containing a simplified explanation of the geology and a field trip guide published by the Associazione in 2012 has already sold more than 500 copies, and 16 field excursions (Fig. 1) organized in collaboration with the “Associazione Nazionale di Geologia e Turismo” have been attracted hundreds of participants. An exhibit under construction in the archaeological museum of Borgosesia, will prominently feature the geology of the valley.

Community leaders consider the creation of a Sesia Valley Geopark 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 Neolithic habitation at the regional park of Monte Fenera. The Sesia Valley Geopark will be readily accessible to tourists visiting Monte Rosa, the Walser villages of Alagna, Rimella and Fobello, and the artistic masterpieces of the UNESCO Heritage Site of Sacro Monte in Varallo. World-class field-trip stops along 30 km of the Sesia and Sessera Rivers have already generated a spirit of unity and cooperation among communities in the valley and will draw tourists to dozens of communities and that are otherwise overlooked.

⁵ Quick, J.E., Sinigoi, S., Peressini, G., Demarchi, G., Wooden, J.L. and Sbisà, A., 2009, Magmatic Plumbing of a large Permian caldera exposed to a depth of 25 km, *Geology*, vol. 37, p. 603-606.

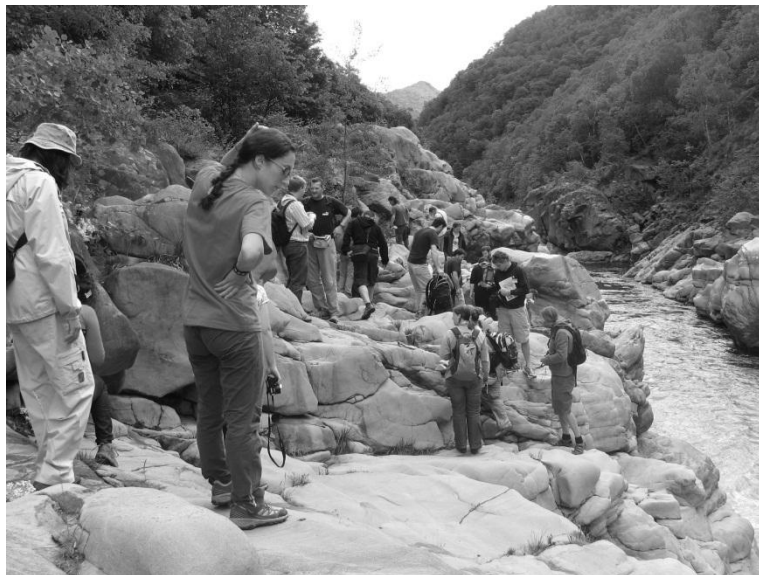


Fig.1. Geotourists on the Balmuccia Peridotite during a field trip operated in collaboration with the Associazione Nazionale di Geologia e Turismo.

ALTOGETHER ARCHAEOLOGY': A COMMUNITY PROJECT IN THE NORTH PENNINES AONB & GEOPARK

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Keywords: *North Pennines, landscape, archaeology, volunteers*

The landscape of the North Pennines AONB and Global Geopark not only records 500 million years of Earth history, but also a remarkable history of human settlement and land use going back 10,000 years. This rich archaeological and historical record is intimately linked with our geological heritage, through the very shape of the landscape and the working of local stone and minerals. However, our knowledge of these past communities is very patchy and the AONB Partnership is working with local volunteers to fill some of the gaps in our knowledge.

The AONB Partnership recently ran a community project called 'Altogether Archaeology', which enabled local people to work with professional archaeologists at sites across the North Pennines. This project attracted over 400 local volunteers who studied and recorded prehistoric rock art, medieval castles and 19th century lead mining sites. This talk will focus on one of the most interesting sites, Whitley Castle, which is one of the best preserved but least known, Roman forts in Britain. Occupied from the early second century until AD 400 and lying on an important Roman road, it was almost certainly linked to Roman lead and silver mining in the area. Working with the farmer who owns the land and with many local volunteers this remote location has yielded intriguing artefacts and also evidence of many previously unknown Romano-British settlements in the surrounding landscape. Through the efforts of local volunteers, detailed recording and surveying is helping build a fascinating story of the evolution of North Pennine landscapes and communities nearly 2,000 years ago.

The success of 'Altogether Archaeology' has led to the securing of further funding from the Heritage Lottery Fund to continue this project for another four years.



Fig. 1. Altogether Archaeology volunteers excavating the Maiden Way Roman road adjacent to Whitley Castle Roman Fort. © Paul Frodsham/NPAP.

RECOGNISING THE VALUE OF GEOPARKS IN PROMOTING HEALTH: AN INTERDISCIPLINARY APPROACH

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Keywords: *hiking trails, human health, sustainable territories*

In an attempt to understand the human-nature relationship, the *Biophilia Hypothesis* was developed by Edward Wilson (Wilson, 1984), describing the innate human tendency to be drawn to the natural world. In this context, the physical and emotional health benefits of a connection to nature have been well documented (Maller, C., et al., 2008). An ecosystem approach to human health has suggested enhancing the health of communities by instituting ecosystem-management methods that will foster the sustainability of the ecosystem itself and the health of the human beings who are part of it (Forget and Lebel, 2001). However, this approach must take into account that the change from a very physically demanding lifestyle in natural outdoor settings, where our current genome was forged via natural selection, to an inactive indoor lifestyle is at the origin of many of the widespread chronic diseases that are endemic in our modern society (O'Keefe, J.H., et al., 2011). There is already some scientific evidence about added beneficial effects on mental and physical wellbeing, health related quality of life and long-term adherence to physical activity, with the participation in physical activity in natural environments compared with indoor physical activity (Thompson Coon, J., et al., 2011). Therefore, the natural territories are essential to our survival and in offering recreation and health services for many citizens, makes them happier and their bodies healthier. Complementary to outdoor recreational sports activity and considering the sustainability of our natural resources and environment, as well as looking for the improvement of health and well-being, outdoor projects can be developed to give the opportunity to tackle demanding physical working tasks that improve both health and the environment at the same time.

Since Geoparks are sustainable territories and considering the *Shimabara Declaration* from the *5th International UNESCO Conference on Geoparks*, it is possible to emphasize several roles that can be developed and implemented in geoparks, also as a crucial support in promoting healthy lifestyles, namely:

- As educators on climate change that should strive to become known as the best practice approach to utilizing renewable energy and employing the best standards of "green-tourism."
- In Natural Resource Management by informing about the sustainable use and need for natural resources, promoting respect for the environment and the integrity of the landscape.
- On the establishment of cooperation among local people, scientists, the tourism industry, municipalities and nations is indispensable for geoheritage conservation, education, tourism and management in the geoparks.

Walking constitutes an ideal physical activity in initiating a change in behaviour often needed to obtain health benefits, as it is accessible to all segments of the community and can be incorporated into daily routines. As consequence, the hiking trails use has become very popular for a wide variety of users and purposes (professional, recreational, health or educational purposes) and are a crucial infrastructure to achieve the roles of the geoparks. The aim of our paper is to suggest an interdisciplinary approach to be applied in geoparks that includes relevant information and proposes for a standardised survey and grading methodology, which can be employed to assess the ability of a hiking trail in promoting a healthy lifestyle. That approach was developed, in order to be improved in conjunction with recreation ecology research focused on developing new survey methods for assessing formal and informal trails or unsurfaced roads in the wilderness and backcountry settings (Marion, J.L., J.F. Wimpey, and L.O. Park, 2011). The interdisciplinary approach suggested, will contribute to promoting geoparks not only as an essential sustainable natural health service to support a healthier population but also with a solid understanding of the value of the natural territories that can help to reduce environmentally damaging behaviour and to preserve a healthy environment and healthy population.

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TEACHER AND MANAGERS TRAINING IN ARARIPE GEOPARK

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Keywords: *Geosites, Environmental Education, teachers, managers*

The project aims to develop educational activities, priority teacher training and management of basic education, a working mentality of preservation, conservation and environmental sustainability. The work involved all the municipalities in the territory of Araripe Geopark (Barbalha, Crato, Juazeiro, Missão Velha, Nova Olinda and Santana do Cariri) in three separate stages two counties at a time. The central idea was to socialize the many facets and possibilities of the Araripe Geopark Project for regional sustainability from a better understanding of the particularities of each geosite. The methodology consisted of oral presentations, video screenings, group work, texts of environmental education workshops on replicas of fossils, engraving workshops, Puppet Theater, educational games and teaching environmental education, and a visit to a geosite previously elected by the participants. In all were made three (3) training involving a total of 180 teachers and school managers.



Fig.1. Fundação casa Grande Nova Olinda/CE



Fig.2. Oral lessons



Fig. 3. Oral lessons.



Fig. 4. Geosite de Missão Velha.



Fig. 5. Field classes a Geosite.



Fig. 6. Ecological Trails.

THE GEOSITES SUMMER CAMP: AN EDUCATIONAL EXPERIENCE OF ARARIPE GEOPARK, BRAZIL

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Keywords: *environmental education, geosites, Summer camp*

This abstract is about an experience developed by the Araripe Geopark which consisted of a Summer Camp aimed to students from public schools near the geosites during the school holidays. This practice aims to contribute to the awareness of children about the need for maintenance and preservation of life on the planet enabling them to act as multipliers of environmental education. The Summer Camp program had diversified activities related to sports, culture, arts and environmental education. This proposal was based on the understanding of the relevance of educational experiences that involve different languages which contribute for the increasing of knowledge, attitudes and behaviors of the students. In the presentation of the experiment are considerations regarding the importance of playing for the expansion of many skills related to language, the motor aspects, social interaction and cognition.



Fig.1. Play Wheel of Redemption.



Fig.2. Games and Play.



Fig.3 Replica Fossils.



Fig.4. Environmental Education.



Fig. 5. Ecological Trail.



Fig.6 Puppet workshop.

COPPER COAST GEOPARK - VISUALISING MOUNTAIN TO SEA IN 3D

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Keywords: *3D visualisation, animation, fly-through, copper mining, Irish geoparks*

The Copper Coast Geopark (www.coppercoastgeopark.com) is developing a new perspective on the evolution of this part of County Waterford during the last 18,000 years. This will create a fully integrated 3D visualisation of the current landscape and adjoining portions of the sea floor, and how it has evolved over time. The final “real” map of the region will be the first of its kind in Ireland and Europe, and for any Geopark to date.

Copper Coast Geopark extends along the Co. Waterford coast and is centred upon Bunmahon, one of Ireland’s premier 19th Century copper mining districts, from which the region and the Geopark, derives its name. This 3D product is being developed through the INTERREG IVB Atlantic Area funded “**ATLANTERRA**” project (a successor to the “**GREEN MINES**” network established under INTERREG IIIB) in which ten partners are developing a range of shared practices and products and transnational cultural cooperation to promote activities related to their mining legacy. The 3D visualisation is being developed by the Geological Survey of Ireland (GSI) with support from the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW).

The integrated visualisation of the post-glacial landscape evolution extends from the Comeragh Mountains north of the Geopark to the present day Copper Coast coastline and its now submerged continuation offshore. The flythrough will document the ice sheets, melting glaciers and the creation of the two major Tay and Mahon river valleys, to rising sea levels and coastal submergence. It will include human adaptation of the natural landscape from the Bronze Age to the use of water power along the river valleys both for milling purposes and for powering the copper ore processing.

Central to the visualisation is a detailed 3D animation of the 19th Century Bunmahon and Tankardstown historic mining centre which follows the processing of the copper ore from mining to its exportation to Swansea in Wales. The mine buildings have been digitised using 19th Century six inch mapsheets and modern artistic reconstruction drawings, and are being ‘rendered’ using ‘Sketchup’ software, with some additional professional animation input. GIS layers have been registered accurately in a 3D landscape, derived from DEMs and draped aerial photography, using GeoVisionary 3D landscape visualising software.

The creation of these digital 3D products has been achieved with the support of the INFOMAR programme (managed by the GSI and the Marine Institute), which is the national seabed survey of Ireland’s marine resources, using ship mounted acoustic multibeam and geophysical technology. This detailed mapping has a variety of applications including water depth for shipping, seabed type, ocean renewable development, environmental protection and marine archaeology.

Recent INFOMAR 3D imaging of Waterford harbour channel and the Suir and Barrow river confluences shows a range of riverbed features from whirlpool scour marks, sand waves and shoals, to igneous dykes and shipwrecks! One such 60m wreck is thought to be that of the SS

Harvard, dating from 1870. The vessel, en route from Huelva in Spain to Liverpool, ran aground when trying to anchor, with its precious cargo of copper ore and oranges.

The integration of onshore landscapes, particularly those of coastal geoparks, with adjacent offshore seabed data in a 3D environment, is an exciting new development in Ireland. Under the INFOMAR Survey, there is now interest in looking at integrating offshore seabed and inshore bay areas (Galway Bay) with the Burren and Cliffs of Moher Geopark landscape, which will enhance the scope and tourism outputs of this latest Irish Geopark to the EGN and GGN network.

Through this project it is hoped to help extend the Copper Coast Geopark's footprint, both spatially and temporally, through these 3D visualisations of its former mining landscape and more distant glacial past. This will enhance understanding of the Geopark's mining and glacial past, and will be an engaging new outreach tool that can be used in its new Visitor Centre and exhibition area at Bunmahon. Such animation products will hopefully become commonplace in other European Geoparks, amongst the new suite of digital tourism and educational downloads and smartphone applications.



Fig.1. A 3D visualisation of the 19thC Tankardstown copper mining centre.

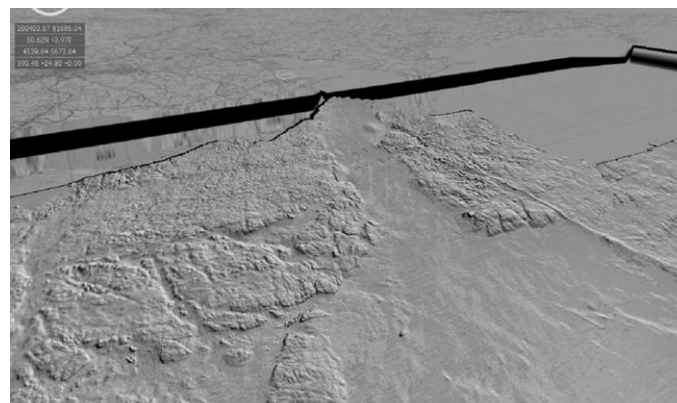


Fig.2. INFOMAR 3D imagery, offshore Waterford and mouth of the River Suir.

THE eMILIA ROMAGNA APENNINE GEOPARK PROJECT

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Keywords: *Geodiversity, Education, Valorization*

Gal (Local Action Groups) are public and private Associations for the development of rural areas in the Leader Programme, by means of the Local Action Plan following the Rural Development Plan 2007-13 and 2013- 2017 ,managed by the Emilia-Romagna Region.

Five Gal have been constituted in Emilia-Romagna, two of them have been involved since the onset of ERAGP: “Gal Appennino Bolognese” and “Gal Altra Romagna” have set up a common project following the Leader guide lines thanks to a cooperation project.

“Gal Appennino Bolognese” represents the organization in charge for the management of ERAGP from the preliminary actions to enjoy the Network to the actions development in the selected area. ERAGP planned actions carried out through the Local Action Plan, aim to appraise and improve the geological, cultural and natural heritage, linked to the European and Global Geopark Network. Gal, represented by Sara Gentilini, attended several national, European, and international meetings with the aim to create a strong, effective project integrated with EGN-GGN strategy and define a holistic approach to Geoparks.

The organization is composed of a five-person internal staff, one Director, two project managers one accountant and a geographer in charge of the data bank.

In particular, the ERAGP staff is composed of: the Gal Director (working 30% only for ERAGP, the accountant working 15% for ERAGP, one geographer working 30% for ERAGP, two project managers employed by Gal for the management of ERAGP, one Geopark specialist and one specialist in Regional development). The scientific committee, coordinated by professor emeritus M. Panizza, a geologist from Modena and Reggio Emilia University, is composed of several professors from the Universities of Modena-Reggio Emilia and Bologna led by Gal on behalf of ERAGP. The public/private composition combines the most important political institutions and the category associations. The choices made through the Local Action Plan are a direct expression of a bottom-up effective process recently approved by the European Commission and ERAGP is the clearest expression of this programme.

ERAGP covers an administrative area of 1950 km² in between two districts: the Province of Bologna and the Province of Ravenna with a total of 32 municipalities, 29 in the Bologna Province and 3 in the Ravenna Province.

The project partners (meaning the subjects involved in the activities plan in the Local Action Plan and other subjects just interested in the project) will be public and private boards: the Emilia-Romagna Region, Bologna Province, the Science Departments of Bologna and Modena-Reggio Emilia Universities, the Geological Museum:“G..Capellini”, the APT Destination Company,the Regional Speleological Federation, the “G.Marconi” Foundation.

There are six natural Parks, from North to South: the Gypsum Seam Park, the Bologna Gypsum Park and Abadessa badlands, the Monteveglio Abbey Park, the Montesole Park, the Pliocene Ridge Park, the Lakes Park and the Corno alle Scale Park. The recent Law n. 24 of 23 December 2011 on the management of the Natural Areas in Emilia-Romagna, will allow the area of competence and the roles of the partners in the ERAGP management to be defined. In the meanwhile, Gal has already started actions, supported by the Parks, in order to investigate the main Parks activities and their compatibility with the ERAGP initiatives inside the EGN and GGN.

In a broad sense, the values of the ERAGP landscape are quoted as geodiversity, biodiversity, spectacularity, cultural heritage etc. All these values should be considered as inter-related and inter-dependent elements within a holistic conception, including also social components. These are not fixed or immutable values but rather dynamic ones, in agreement with the evolution of society itself. Indeed, even in the presence of the most untouchable values, conservation actions and protection measures should challenge the changing of the environmental and landscape physical data or even the manner in which these data are perceived and interpreted by the irreplaceable topicality of the present. The holistic view should be intended as a united strategy among the criteria of assessment, which show typical objectivity characteristics of the extrinsic type and the local criteria of the European Landscape Convention, which show typical subjectivity characteristics of the intrinsic type and recognise the specific identity of a landscape (an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors).

Therefore, the knowledge of the landscape is achieved by searching for all the causes that in space and time have contributed to its formation. All the landscape features should be analysed from various standpoints related to different cultural and disciplinary backgrounds in order to obtain many sensitive landscapes which, eventually, in the integration and synthesis phase will make up the cultural landscape. The landscape is increasingly becoming a basis for research and comparison, challenging the culture of a given territory and claiming new answers to sometimes ancient questions.



Fig.1. ERAGP location.



Fig. 2: Vena del Gesso from Tossignano view point.

TRANSFER OF THE GRAND TRUNK FOSSIL FOUND IN THE SIERRA NORTE DE SEVILLA Geopark (SPAIN)

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Keywords: *geoconservation, fossil trunk, Permian.*

In 2005 was found in Sierra Norte de Sevilla Geopark (Seville – Spain) a Permian fossil trunk (more than 290 million years). During the summer of 2011, the Ministry of Environment of Andalucía Regional Government concluded the labours of moving this fossil trunk to the Visitors Centre "Cortijo El Berrocal" in Almadén de la Plata (Seville). The new location of this great fossil exemplar will facilitate their conservation, study and general knowledge.

The discovery of this fossil (Fig.1.) occurred when researchers of the Department of Geodynamics and Palaeontology of the University of Huelva and Cordoba Botanic Garden developed the Paleontological Charter of the Ecological Compensation Area of Melonares Reservoir and found in different areas, several sedimentary levels with flora, both sheets as part of rooted trees and many fragments of logs rolled. The owner of a private farm communicated the existence of a large fossil tree in one of these areas.



Fig.1. State of the fossil trunk in April 2005: only six meters length were visible.

The fossil trunk is from a conifer (*Araucaria primitive*) composed mainly of chert, but in the cup with signs of charring. The level of conservation, virtually from the root to the crown, and its size make this a unique specimen in Spain and there are only a few other similar cases in the world.

In 2006, various preliminary works were executed. On one hand, began the works of dig to remove the sediment that was hiding the fossil trunk and thus, to know the length, which was estimated initially in about 15 to 16 meters. Then was proceeded to the placement of a coating of geo-textile and a cover with sand to protect it until the completion of the research project and transfer, and also have all the pertinent permissions.

After completing all the steps, the Ministry of Environment undertook a set of actions, in order to recover this occurrence, avoiding fragmentation by the exposure to atmospheric and biological agents at the local, and allowed the displacement to another most suitable location.

First was created an adequate access for the transit of machinery and was also improved the hardness of the path to prevent vibration during transport, which could cause serious damage to the fossil. After the suitability of the land, has proceeded with an excavation of a perimeter around the trunk, that left the entire fossil in sight, which had about 20 meters length and weighed about 12 tons. These works also allowed to determinate the separation zones, and initiate treatments and coatings with gauze protection. The staff made efforts to consolidate the breakage sectors with the application of ethyl silicate and the sewing of loose parts.

After that the tree was divided at the fewest number of parts possible, through the existing cracks. Iron plates were then placed in the base of the blocks and welded to iron beams (Fig. 2.) and finally, the pieces were immobilized by the application of polyurethane foam with a minimum thickness of 5 cm, in a wooden box.

Finally, were performed the shuttering upper block by a box composed of steel girders welded, and anchored to the boxes, so that could withstand the weight of the block avoiding bending thereof. The boxes were transported in a truck crane to the Visitors Centre "Cortijo El Berrocal" located in the village of Almadén de la Plata, about 14 kilometres far away from the extraction point.



Fig.2. Lift works in a block in which the fossil trunk was divided.

LABELS, CERTIFICATIONS AND QUALITY IN GEOPARKS – THE BURREN & CLIFFS OF MOHER EXPERIENCE

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Keywords: *Labels, Certifications, Quality, Tourism, Networks, Geoparks*

The development of the Burren Ecotourism Network (BEN) was a priority for the Burren Connect Project, which managed the application for Geopark status, and the existence of a network of accredited ecotourism businesses was one of the crucial deciding factors for our success in attaining the award. The relationship between the Geopark and the Network is symbiotic and fruitful; the Geopark provides the administrative and financial supports, and BEN provides the tourism experiences that make the Geopark an exciting, sustainable and world class tourism destination.

The development of the network has been a long, challenging and interesting journey. Representatives of agencies and interested tourism businesses formed a working group in 2008 and met regularly to discuss and plan the development of a sustainable tourism movement in the Burren. The process of certification was seen as important from the beginning; it was considered a mark of quality, of pride, and of genuine commitment to the ethos of sustainability.

The working group researched several UK and Irish 'Green' tourism certification labels, before deciding to adopt an Irish grown label developed for 'the Greenbox', an innovative ecotourism destination created in the NE of Ireland. Failte Ireland, Ireland's national tourism agency, agreed to pilot the Burren to test the transferability of the label to other potential destinations. The key criteria are:

- Using environmentally sustainable practices
- Bringing people into nature
- Promoting natural and cultural heritage
- Contributing to conservation
- Maximising benefits for local communities
- Ensuring visitor satisfaction
- Marketing responsibly
- Increasing cultural respect and awareness

Eighteen businesses were accredited, after an extensive training and certification programme. Failte Ireland raised concerns at this stage as to the certification programme's long term sustainability; citing cost, resources and marketability as key challenges. However, optimism and belief in the process prevailed, the Burren Ecotourism Network (www.burrenecotourism.com) was formed by the accredited group of businesses and due to popular demand, it was decided to extend the network and to seek funding to train and accredit 23 more businesses.

Funding was sought, successfully, under the LEADER Rural Development Programme 2007-2013 for training, accreditation, animation and the creation of baseline research and benchmarking on the economic, social and environmental impacts of the ecotourism network on the Geopark region. The process has focused our attention on the future of the certification

process; its resource requirements, marketability and economic impacts on individual businesses and the region as a whole.

Certification plays a vital role in sustainable tourism. It is a quality mark that undermines attempts at ‘Green washing’. But it is expensive and resource hungry; for the participants and the certifiers. Can the EGN develop a resource efficient system of certification that would attract, and keep a sufficient number of tourism business to have quantifiably positive economic, social and environmental benefits in our Geoparks?



Fig.1. Product development in field studies training day.



Fig. 2. Ecotourism business networking day.

*MY GEOPARK! HARNESSING THE RICH, NARRATIVE RESOURCES
OF INTANGIBLE CULTURAL HERITAGE TO GENERATE ARTS
WORKS FOR A POSITIVE REINFORCEMENT OF CIVIC AND
INDIVIDUAL IDENTITY IN GEOPARKS.*

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Keywords: *narrative, arts, intangible cultural heritage, good practice, identity, affirmation.*

We live in stories of ourselves, and need to share these with others. (Kleinman 1988; Phelan and Rabinowitz 2005). By telling stories we find meaning, by sharing them we are affirmed (Ochs 2001). This is enhanced when stories are not only shared, but also developed and disseminated (Pennebaker 1999; 2000). This paper will examine how the English Riviera Geopark has used the work of creative practitioners to facilitate this process to bring about a positive affirmation of civic and individual identity for its indigenous and transient tourist populations.

Since 2010, the Geopark has commissioned artists, under the umbrella of the Geotrio Collective, to create works that explore its unique geology and intangible cultural heritage. This work is local. It grows from the practitioners' experience of inhabiting the park and interacting with others in it. In this way, the work begins as site-specific: the stories that it generates (and generate it) come from a unique and tangible interaction in a specific place and time. These stories are rich stimuli. They are not only verbal but also embodied and cognitive - shared via gestures, rituals, objects/artifacts, songs, emotions and recollections. They also span time. Although these are spontaneous practices, which express a contemporary, lived-understanding of cultural heritage, they are also an expression of histories, memories, myths and past experience. This recent practice has created a uniquely 'situated' body of work that affirms identity.

To illustrate this model, I will use a 2012 Arts Council England funded project that has created a growing collection of songs through a dynamic, cyclical Anglo-Japanese collaboration. It is notable because this project not only generates work from local stories, but also through sharing it with other local, regional and international audiences, it reaffirms the people and place who created it, and importantly catalyses a new sharing of stories with new communities.

GEOSITE IDENTIFICATION IN ASPIRING KULA VOLCANIC GEOPARK, TURKEY

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Keywords: *Geosite identification, Volcanic Geopark, Kula, Turkey*

Kula is one of the youngest volcanic regions of Turkey, situated at Western Anatolia in Manisa province covering an area of 300 km² (Figure 1). The geosites of the proposed Geopark area spread on Kula and Salihli municipalities.

Three main stages of volcanic activity in Kula from 1.2 my to 12 ka years have created about 80 volcanic cones along NW-SE trending fissures overlying the Paleozoic metamorphic rocks. Cinder cones and the lava flow plains of the last eruptive period (Holocene) are well preserved and have not been entirely vegetated yet.

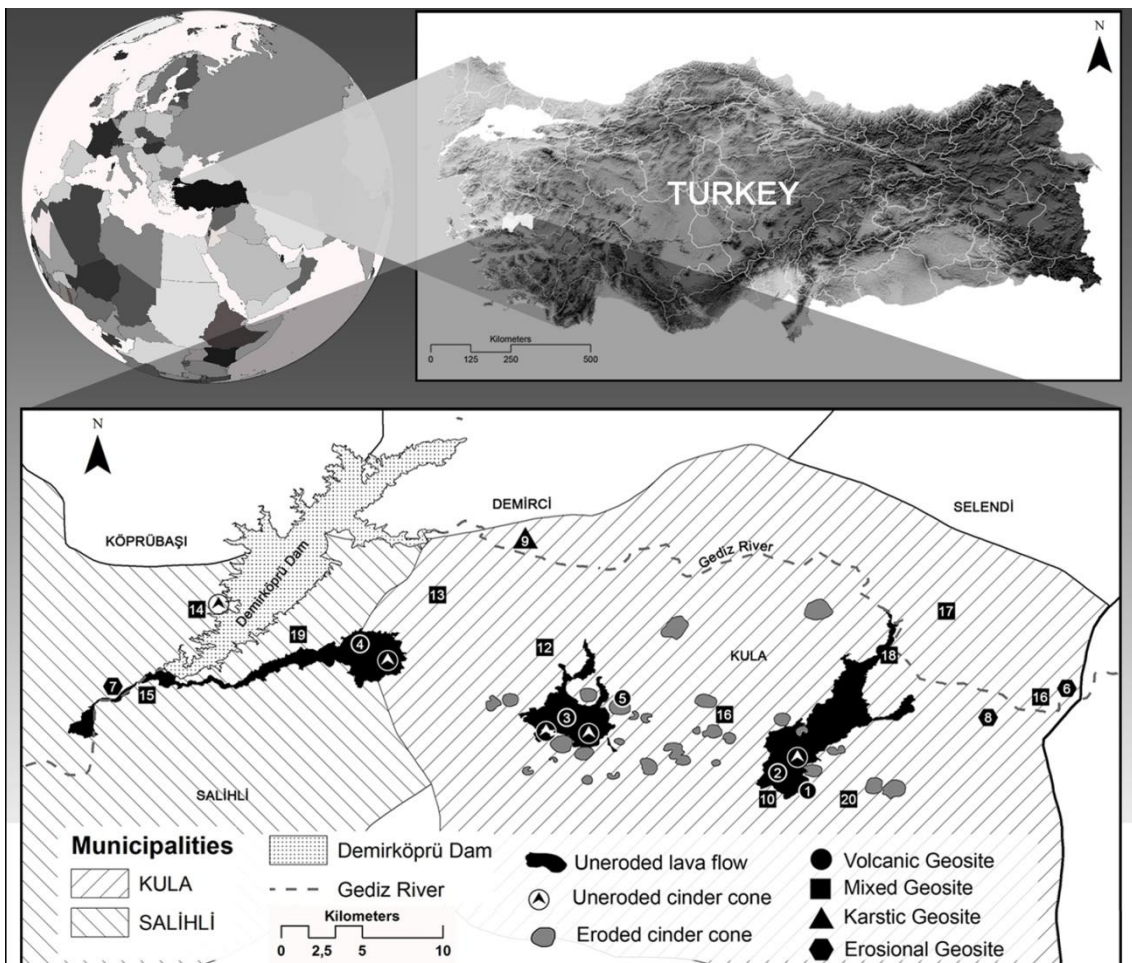


Fig.1. Location map of the Kula Volcanic Geopark area and distribution of its main geosites.

The rich geodiversity of Kula Geopark encompasses various lithologies ranging from Paleozoic metamorphites (schist, gneiss, marble) to Quaternary volcanic (basalt) and sedimentary rocks. Kula Quaternary volcanics represent almost all characteristic landscape and structures of constructional and destructional volcanic processes including cinder cones, lava tubes, lava plains, maars, columnar lava, etc. Moreover the fluvial erosion of volcanic rocks and volcano-sedimentary deposits has created other unique landscapes like volcanic canyons and fairy chimney formations. Kula area also reveals one of the most impressive unconformities where the oldest (Paleozoic) and youngest (Quaternary) rocks of Turkey are found together.

Turkey is very rich in volcanic sites. Almost 1/3 of Turkey's surface is covered by volcanic rocks including the majestic volcanic mountain of Ağrı (Ararat) reaching to a height of 5,165 m. What makes Kula Volcanic region unique is that it represents all features of volcanism in "miniature size" so even in a single day someone can climb on a volcanic cone, walk around the crater rim, explore lava tubes and volcanic canyons, pass along lava flow plains with little risk and effort. Thus its touristic and educational values in terms of accessibility, is incomparable to any other volcanic site in Turkey.

In context of the "Kula Volcanic Geopark Project" under the auspices of Kula Municipality, the majority of the geosites of Kula Volcanic Geopark area have been identified and classified under four main categories (Figure 2). The first category "Volcanic Geosites" comprises constructional volcanic structures (columnar lava, xenolith boulders) and landscapes (cones and lava plains) which are considered to be the flagship monuments of the Geopark. The second category "Erosional Geosites" includes badlands topographies (fairy chimneys) on volcano-sedimentary deposits, and volcanic canyons created by fluvial erosion of the basaltic rocks. The third category "Karstic Geosites" includes limestone caves and the fourth category "Mixed Geosites" encompasses distinctive landscapes and monuments created by the geo-anthropogenic processes. There are many geosites formed by geological processes but reshaped by the human and gained a cultural value. Among them are the 12 thousand years old fossilized footprints of prehistoric human found in Kula, that reflects the oldest interaction of man and active volcanoes in Anatolian mainland.

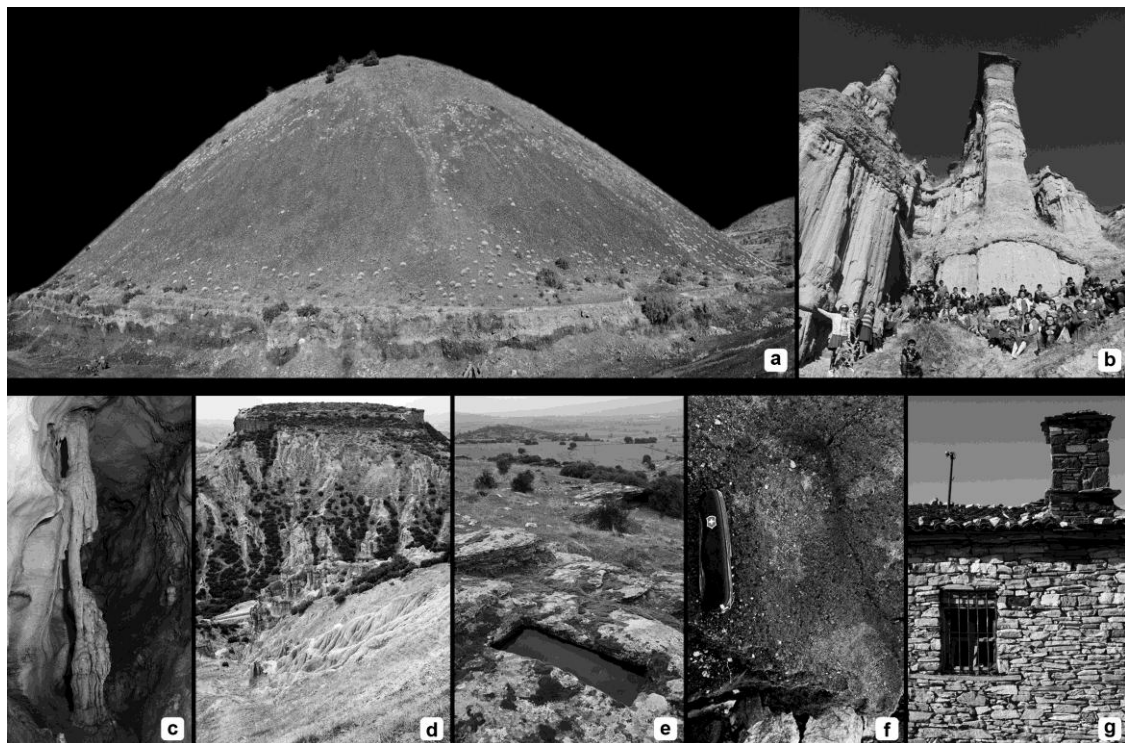


Fig.2. Volcanic geosite (a), Erosional geosite (b), Karstic geosites (c), Mixed geosites (d-e-f-g).

SMARTGUIDES AND TURFHUNTS - APPS IN GEOPARKS

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Fig.1 Locatify-logo

Keywords: SmartGuide, Scavenges Hunt, Platform, Apps, Maps, Audio

Locatify Ltd. is a service provider for technology and platforms, allowing our partners in the field of tourism, education, and entertainment to publish their location-aware content on Smart Devices. Locatify has already released its SmartGuide technology, using GPS location data and augmented reality to offer guided audio tours with pictures and maps. Locatify has extended this platform to create a treasure hunt game.



Fig. 2 Screenshot-TurfHunt

The platform makes it possible to design and publish guides and treasure hunt games to be enjoyed on location, via Smartphones. The games, which use GPS, 3G, and maps, are designed as real-time, competitive treasure hunts to be played by teams. They involve problem solving and exploration activities, finding treasures, and playing mini-games; with the game mechanics also including virtual game items.

The system's design tools are suitable for amateur and professional designers alike. They can create and publish their material on Smartphones and pads. The system is available to all game and tour designers, wherever they want to create, edit, and publish guided tours and treasure hunt games.



Fig. 3 Welcome screen - SmartGuide North Atlantic

Fig. 4 SmartGuide – pictures – audio – maps



Fig. 4 TurfH.- logo

- *Locatify was founded in 2009 in Iceland.
- *Locatify received a grant from Nordic Game in 2010 to develop the platform.
- *In a Nordplus project the platform has been tested and improved for

schools and geoparks; Magma Geopark in Norway, Katla Geopark in Iceland and Silurian Geopark in Estonia.

*In 2011 Locatify was winner at the European Satellite Navigation Competition for the Scandinavian countries for the idea of platform for SmartGuides and Treasure Hunt Games.

*Locatify was a leader in a NORA (Nordic Atlantic Cooperation) project and made SmartGuide North Atlantic in cooperation with partners in Norway, Greenland and Faroe Islands.



Fig.6 TurfHunt- items in games



Fig. 7 Children playing TurfHunt in Magma Geopark in Norway

Locatify has built up a good cooperation in three geoparks in Europe where the platform has been used to make guide- and game apps for travelers and students.



Fig. 8 TurfHunt - scoreboard



Fig. 9 TurfHunt- minigame



Fig.10 TurfHunt - question

ANALYSIS AND CONCLUSIONS FROM A STRUCTURED GEOSCIENCE TEACHING METHODOLOGY, CHABLAIS GEOPARK, FRANCE

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Keywords: *geoheritage, mediation, geopark, methodology*

The Chablais Geopark has a small core staff. In order to deliver the Geopark projects, it created a series of working partnerships across the territory. One of the first projects the Geopark established was to communicate the regions rich geoheritage with the public. In order to do this, a partnership was developed with the tourist stakeholders. An extensive network of tourist and heritage guides was indentified across the territory. These guides were the ideal partners to communicate with the public, however they had no training in geoscience.

The Chablais Geopark worked with the University of Lausanne and the University of Savoie to devise and test a new teaching methodology (Fillon *et al.*, 2010, Fillon *et al.*, 2011). The structured methodology aimed to provide the heritage and mountain guides with a thorough training in the geosciences. The training programme also included the teaching of scientific mediation skills, built around core geoscience principals. This was to ensure that the guides could communicate the geoheritage of any site or feature they encountered spontaneously.

This approach delivered a powerful and engaging communication tool, offering greater versatility and depth of knowledge than rote learning for selected sites, as remarked by Tim Badman, IUCN “...*the geosciences training available to heritage and mountain guides is very effective. The tourist professionals we met understood the subject thoroughly, which we valued*” (SIAC, 2012).

The Chablais Geopark undertook a through review and reflection in order to prepare a new methodology (Kramer, 2012). An innovative approach was established and formalized in order to clearly convey the core geological principles that (i) geology is a continuum of ever evolving processes and changing environments and, that sudden, catastrophic changes are a rarity (the Three Ages of Geological History : deposition, structuring, erosion, Kramar 2003; Marthaler and Kramar 2003; Kramar 2005), that (ii) superposition analysis of events helps unravel each geological story (e.g. rocks eroded into cliffs are then partly obscured by recent weathering deposits), and (iii) modern environments can used as ‘living ‘examples the ancient ones recorded by the rocks and the landscape (Principals of *Uniformitarianism*, Hutton 1795). These principals were clearly set out and taught to the guides as a basis for their geoheritage mediation.

Since 2009 the Chablais Geopark has trained 74 French and Swiss heritage and mountain guides, of which over 60% have passed a formal evaluation and are now officially recognized by the Geopark (Figure 1). Prior to the structured training programme, the guides had been nervous of the geosciences. They often perceived the geosciences to be a very complex subject. The teaching methodology devised by the Chablais Geopark and implemented in the training programmes resulted in a confident group of mediators who understood their landscape and heritage. The guides use their knowledge extensively in their independent daily work, whether

as a component of a mixed heritage presentation or a dedicated geological excursion. The Chablais Geopark offers an “after sales service”, namely a support service available for all trained guides for queries or concerning any particular localities; this includes free consultation of the extensive Chablais Geopark library.

In order to assess the impact and success of this training, a questionnaire was prepared and distributed to all participants. Initial results are positive and during this paper we will present the detailed analysis and conclusions of this approach to mediation. Guides were questioned extensively on a number of topics including (i) their pre- and post- training understanding of the geosciences, (ii) their confidence and success in geoscience communication having been taught the mediation method devised by the geopark and (iii) the frequency, duration and nature of the geoscience talks currently offered to the public. A second stage of assessment is planned in the form of a series of structured, detailed individual interviews.

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Fig.1. Field based geoheritage training for a group of mountain guides 2010, source: SIAC.

LANDSLIDE MORPHOLOGY AT BATUR VOLCANO AREA

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Keywords: *landslide, morphology, slope stability*

Batur Volcano is located in North-East Bali, Indonesia. Two catastrophic caldera-forming eruptions occurred at the volcanoes. The first caldera was formed 29,300 years ago and the second one was formed 20,150 years ago. The volcanic activities, including these two events, created beautiful landscapes in the area.

One part of the beautiful landscapes in the area is the Lake Batur (Figure 1) that has the potential to generate flooding when heavy rain occurs. Water can flow over the areas surrounding the lake. The morphological instability of walls around the Batur Caldera generates frequent landslides. The landslide morphology (ML) is defined by several factors, *i.e.*, seismicity, material, erosion, infiltration, and time. Mathematically, it may be expressed as $ML = f(s, m, e, i, t)$. Moreover, human activities may be added as one special factor.

A monitoring system for landslides with integrated slope engineering is required to prevent the disaster in the Batur Volcano Area. Models by Integrated Slope Stabilization and Engineering (ISSE) are proposed in this paper to tackle such problem.

The Integrated Slope Stabilization and Engineering (Zakaria, 2010) is a series of mitigation activities and it consists of (1) mapping systems of landslides, and mapping of landslide-prone slopes, (2) slope stability analysis, as well as an early warning system (EWS) for stabilization, (3) simulation of slope stability & engineering, and (4) direction of environmental management with monitoring, by the participation of scientists, government officials, social community and business employers.

Morphology of the Batur and its surroundings is highly vulnerable for landslides and morphologic deformational forms in the area can be distinguished into some different types of landslides such as debris avalanches, debris flow avalanches, or rock avalanches. The landslides may be observed visually in the field through landslide mapping techniques described by (Dearman, 1901). The identification of vulnerable areas, therefore, can be done early through the study of the landslide morphology. This knowledge can be applied in any region, including those areas of tourism, geopark territories, areas of urban planning, and others.

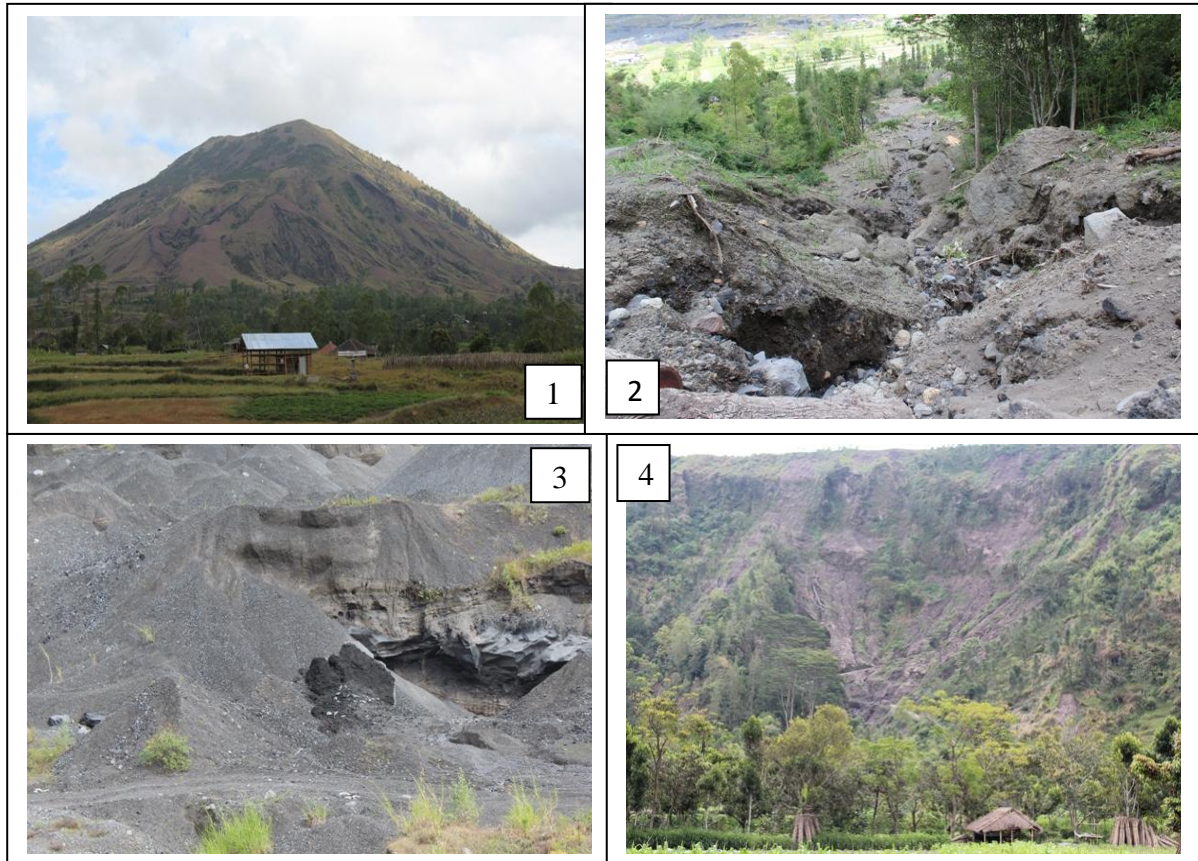


Fig.1. General view of the Batur Volcano North-East Bali, Indonesia.
 Fig.2. Debris flow after a rain.
 Fig.3. Debris flow. Observed at the northern part of the Batur Volcano.
 Fig.4. Morphology at a slope bounding the Batur Caldera 1.

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“FLYSCH, THE WHISPER OF THE ROCKS” : A SCIENTIFIC DOCUMENTARY FOR THE INTERNATIONAL PROMOTION OF THE BASQUE COAST GEOPARK

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Keywords: *Flysch, Scientific documentary, promotion, education*

Basque Coast Geopark has been working during 8 years on its comprehensive program for the popularization and interpretation of its famous Flysch formation. This program is based on the wide scientific knowledge of the section, which has been carefully treated to get an attractive and educational language and message. Almost everything can be interpreted with a proper language.

The full program covers all kind of potential public and is formed by:

- Educational programs for schools.
- A wide net of geological auto-guided tracks with interpretative panels and 40 points of interest located along the paths. This net has been thought to control the visitors along the protected area.
- “Flysch biotope” field guide with more than 240 pages for the visitors who want to understand everything on site.
- “Flysch Algorri Mendata”, with spectacular photographs of the geological formation, has been conceived to be enjoyed in your own place and travel with your mind to the outcrop.
- “Flysch, the whisper of the rocks” documentary

This documentary was filmed during 2009 and 2010 in Zumaia (Basque Coast Geopark), Iceland, USA and Mexico with the next main objectives:

- Create an interest about earth sciences among the normal public.
- Demonstrate that understanding geology is basic to face current environmental challenges.
- Make a worldwide promotion of this formation (Basque Coast Geopark) for the Geotourism.

This project was much more expensive than usual promotional documentaries, and its funding was possible thanks to private-public cooperation. 50% of the budget was financed by the local bank of the region, demonstrating that these kind of companies can be interested on being identified with a geopark project to get a good image among its clients. The rest of the budget was financed by the local government and the Spanish TV, which has been also very important for the broadcasting of the project.

The working team was about 15 people and it was leaded by Alberto. J Gorritiberea (Film director) and Dr. Asier Hilario (Geologist). The scrip of the movie has been carefully worked by film business experts, as well as the sound, photography and general production. This professional quality is very important for the international promotion of the film

We wanted to create an international product, a documentary that can be shown everywhere in the world, so we could not make a film only about the flysch of the Basque Coast Geopark. This documentary departs from this concrete geological outcrop, but then it gives you a general idea about the history of life and climate on Earth, it analyses current environmental challenges and discusses about the sustainability of our development model from the geological point of view. All these matters are discussed through 22 interviews to 22 famous scientists from all over the world, and this is the most valuable aspect of the project. The message has to be powerful

and credible. The list of scientists is formed by paleontologists, sedimentologists, geologists, biologists, astrobiologist, meteorologists, economists, oceanographers and anthropologists. All of them were concentrated during the same week in Zumaia and one hour interview was made for each of them. These interviews tried to find the personal face of the scientist, because the message has to be impassioned and not only scientific.

After two years, the documentary has been watched by more than 700.000 people, has been selected in different worldwide film festivals and has been awarded by the “International Association of Media for Sciences”. The documentary has been also blessed by the IUCN and it has been shown also in the “International IUCN World Conservation Congress” in Jeju (September 2012) just after the general meeting of the IUCN, with more than 2.500 people in the main auditorium. This is a great chance for geology and for the European Geopark Network to be present in the most important worldwide Nature Conservation Congress.

Conclusions:

- In Spite of the high cost of producing a professional documentary, it is absolutely profitable because it is the most effective way to expand the message.
- Scientific approach can be more effective than only promotional point of view for the international promotion. Geosciences make us different.
- Geology has to be shown together with other scientific disciplines to demonstrate that it can be very useful for current environmental challenges.



Fig. 1. Recording of the “Flysch, the whisper of the rocks” in the Basque Coast Geopark.

PARTICIPATORY GEOSCIENCES EXPERIENCED IN THE BAUGES GEOPARK (FRANCE)

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Keywords: *Bauges Geopark, Participatory sciences, Hybrid research, Geoeducation, Karst, Dye water tracing.*

Participatory sciences are developed in France, and also in Europe, particularly in the fields of Biology and Ecology. In territories as Geoparks, we assume that this concept is convenient for involving and training the population and the public about the topics of geoheritage and georesources. This is the reason why researchers of the University of Savoie work with the staff and the stakeholders (especially with the association CalcEre) of the Bauges Geopark to find and experiment suitable experiences of participatory geosciences.

In the Bauges Geopark is highlighted its karst heritage and resources, especially the karst waters that are very vulnerable and difficult to protect. Therefore, the first participatory geosciences experiments developed since two years ago, consist in participatory activities with dye tracing experiments.

In karst regions, a dye tracing experiment is usually used by hydrogeologists to establish the catchment area of a spring by injection of an artificial fluorescent tracer in potholes and, after that, is performed the monitoring of the surrounding springs to detect where the tracer is going out.

In the case of participatory in the dye tracings, the stakeholders, concerned by the stakes of the experiment, are closely associated to its implementation (fig. 1). Pupils of elementary or secondary schools are also associated with this framework, through a pedagogic project.

Such experiments are part of the “living geosciences concept” developed by academic researchers and the members of CalcEre, in association with the geologist and the head of the Bauges Geopark. Within the framework of the concept of “hybrid research”, the aim is to develop a tool useful both for increasing the scientific knowledge of the karst systems and for managing as well the karst water resource, and for geoeducation and raising awareness of the children and inhabitants of the Geopark (fig. 2).

Three very successful experiments have been implemented in the Bauges Massif in 2010, 2011 and 2012, in different contexts and with different stakes and stakeholders (elected representatives, farmers, cavers, inhabitants) and we are now thinking about the way to develop adaptations for geotourism. This concept is also exported to neighbour natural parks (Chartreuse...), and of course we hope it will interest also other Geoparks located in karst areas.

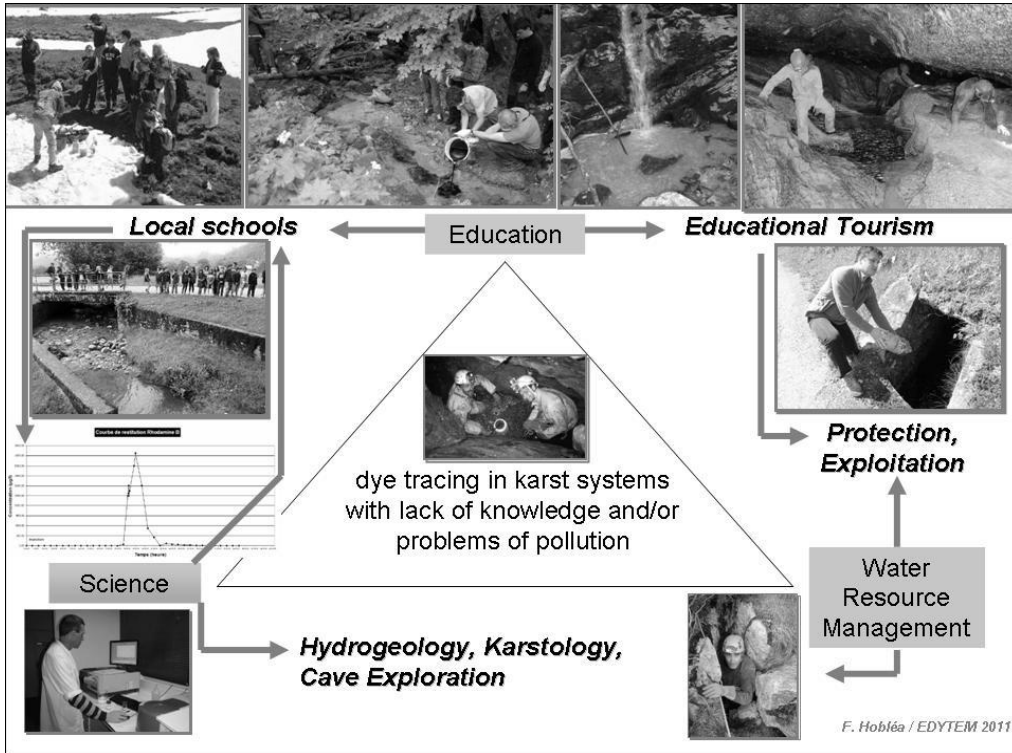


Fig.1. The “Multifunctional Participatory Dye Tracing” (MPDT): concept and implementation in the Bauges Geopark (2010-2012).

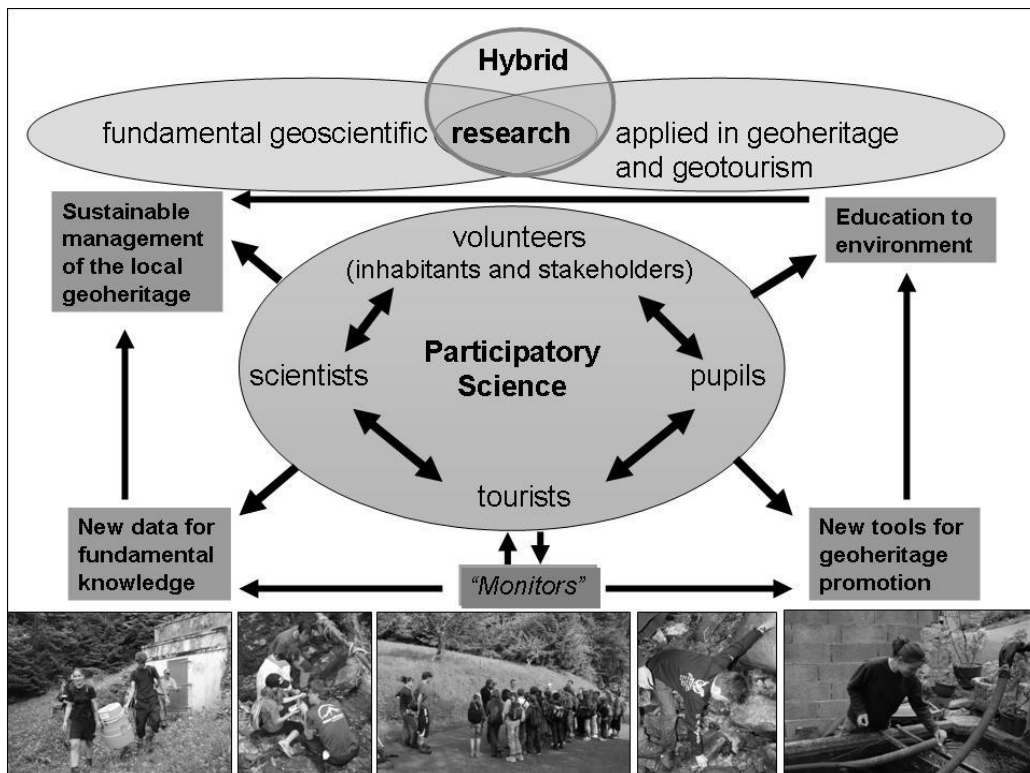


Fig.2. Hybrid Research and Participatory Science for the knowledge and the promotion of Geosites and Geoheritage of the Bauges Geopark.

“GEOLOGISTS MEET ARTISTS” – COMMUNICATING GEOLOGY THROUGH ART

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Keywords: *geology, art, communication*

Gea Norvegica Geopark in Norway can tell a long and vivid geological story. The oldest rocks, more than 1100 million years old, have been involved in several mountain building cycles and ice-ages. We can see a lot of signs of all the different processes, the rocks tell their story just like an illustrated book of history. Connected to the mountains and rocks of Norway we can find a lot of myths, about origin, appearance and strange looking forms. In former times, different natural phenomena's were often connected with superstition; structures, land forms; boulders and erratics were connected to the mythological creature's trolls and their activities. These intangible memories and myths are parts of Norwegian folklore and cultural heritage and can be used as an entrance to geological knowledge.

In the society, now and in the future, there is and will be a need for educated people with knowledge of natural science. Geology is part of this, management of natural resources, protection against floods, slides and other natural hazards and construction are just few examples of areas where geosciences is important. Still, we see that a lot of young students opt out natural science, so the interest for these fields should be improved. The idea in our geopark was to try out how to make use of the mythology, nature as an artist and the connections to geology, as a possible link between nature and art. The material itself used in different art forms may be of geological origin (rocks, clay, and sand) and structures and landforms can give way for great art. Through support from the Norwegian Directorate for Education, we created a project called “artists meet geologists. The grant was dedicated for testing of new models of interdisciplinary subjects in school and focused upon combining mythological stories, the material (clay, rocks), artistic techniques and earth science.

During the European Geopark Week 2012, Gea Norvegica Geopark carried out well prepared test projects. Together with professional artist we focused upon art and geology and implemented three different activities. The three art types was ceramics, drawing and painting, and the activities were all for children and youths. We had a close cooperation with the artists to strengthen their geological background and prepare for a different art experience. Both geologists and artists attended all activities and took active part in the lectures. The project will be finished with a report, but we already have some indication and some ideas for further work. The feedback, in form of personal interviews of the participants and artists shows that the learning outcome was positive; they got new perspectives of the rocks and the landscape. The participating artists suggested a continuation of this project in order to prepare a program for schools, and this will most likely be the first conclusion in our report.

METEORUM GEOPARK PROJECT, SWEDEN

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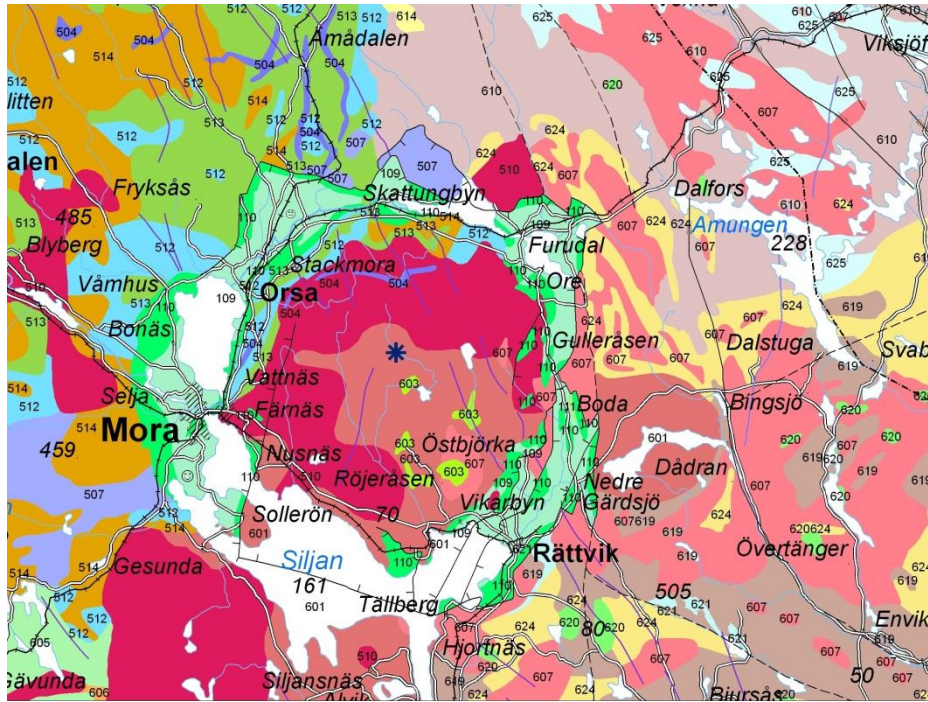
If you visit the Siljan district in Sweden, you will find it being a fantastic and very special place on earth! Fabulous natural surroundings, extending view of Siljans glittering waters for miles around, blooming meadows: a given place for relaxation and natural serenity. Here you'll find an intriguing mix of the traditional and the modern in the form of music, festivals, working summer dairy farms and much more. In an old limestone quarry you will find a world famous music theatre called Dalhalla. A multitude of activities and adventures await all, young and old alike! What is the history of this place that makes it so special?

About 377 million years ago, a big meteorite struck earth causing chaos and disorder for all living creatures within a big area. The diameter of the meteorite has been estimated at 3-4 km and the speed at which it hit the earth was 100.000 km/hr. The powerful impact caused depression of the bedrock and rock strata that were originally horizontal, were either tripped to vertical position or inverted. At the edge, inside the crater, a geological depression was formed where the sedimentary rocks have been protected from erosion by water, wind and inland ice. This formation is today called The Siljan Ring Structure. In our area, you will be able to visit several places where you can see preserved strata of sedimentary rocks, find fossils and discover some of the species diversity on the sea floor from about 400-500 million years ago. Siljan is one of Sweden's biggest lakes situated on the fringe of the epicentre. So are also the municipalities Rättvik, Leksand, Mora and Orsa. The Siljan Ring is the largest impact structure in Western Europe. It is sufficiently big to be notable at first glance of a geological map.

From all this chaos and destruction, life rose again. This is why the natural surroundings, the region's topography, biology and the ecosystem of our district are so unique. The agriculture conditions gave people the possibility for farming, the richness of limestone in the bedrock made it possible for many men to work in the limestone quarries, and to bring their lives forward until today and tomorrow. *This* is the story we want to capture and spread.

The Meteorum project was started in 2008 by support from the Swedish National Heritage Board. After receiving support by a Scandinavian Heartland interregional project in 2010, Meteorum was transformed into a transnational Leader project in 2011 in co-operation with LAG Leader organisations of Bohemian Paradise Geopark in Czech Republic and a Leader project in Italy. We also have support from the Geological Survey of Sweden and the County Administrative Board of Dalarna.

By the Meteorum project, our aim is to create a Geopark in the Siljan Ring area. This work includes everything from creating geological trails, market research, storytelling, conceptualisation and lay-out to infrastructure and marketing. Our aim for the Geopark is also to include different workshops to encourage visits from local schools, family groups and University scholars on geological research projects. We will especially focus on the connection between geology and sustainability. We wish to remain in contact with other Geoparks of the EGN network as we continue our work and our learning process in creating the Meteorum Geopark in the Siljan Ring Structure of Sweden.



Meteorum – the Siljan Ring Structure, geological bedrock map. © SGU.



Sedimentary bedrock tripped to a vertical position.
 Photo by T. Jacobs at the Styggforsen canyon,
 Rättvik, Sweden.

IVALOJOKI PLACER GOLD AREA IN FINNISH LAPLAND: A POTENTIAL GEOPARK

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Keywords: *Placer gold, Quaternary deposits, Ivalojoeki, Lapland, Finland*

The Ivalojoeki River in northern Finland flows in an ancient preglacial valley that is part of a fractured zone in Precambrian bedrock. It begins from the watershed near the Norwegian border, and stretches 180 kilometres through wilderness areas towards Lake Inari and the Barents Sea, merging with dozens of small streams and tributaries along its length. For a distance of some ten kilometres between the tributaries of Appisjoki and Sotajoki, it flows through a canyon up to 150 metres deep. The bedrock belongs to the granulite zone of Lapland, which was formed during the Svecokarelidic orogeny about 1,900 million years ago. The most common rock type is quartz-feldspar gneiss. The conspicuous dark red mineral grains consist of garnet, which frequently forms speckled bands together with quartz and feldspar. Gold deposits in the bedrock also formed gradually over the course of millions of years. Recrystallisation of the bedrock evidently formed lenses consisting of quartz, sulphides and gold, the same type as the richest bedrock gold deposits of the Klondike in Canada.

During the Quaternary the area has been covered by continental ice sheet several times. Glaciers carved and eroded the rock, weathered bedrock and previously deposited layers of soil. The most common glacial deposit is basal till that covers present-day bedrock. Gold grains loosened from the bedrock and weathered bedrock also mixed in with the till. In the final stage of the last glaciation, the ice sheet flowed from the south-west to the north-east. During deglaciation around 10,500 years ago, meltwater from an expansive area pooled in the Ivalojoeki River valley, from where it flowed towards Lake Inari and further to the Barents Sea. The meltwater streams that formed during the last glaciation, as well the ones before it, played a significant part in enriching the gravel deposits along the shores and in the channels of the Ivalojoeki River and its tributaries to the south, such as the Sotajoki River and the Palsinoja brook, with gold nuggets from moraine. Such gold deposits are called placers. They are the result of being repeatedly eroded, transported and deposited by the flowing water. Placers do not contain gold throughout, but rather separate pockets of gold-rich areas or layers can be found in them.

Among the formations eroded by glacial meltwater, the most impressive are the gorges carved into the mountain ridges. They appear as sharp slits in the otherwise steeply sloping, rounded mountain formations. The gorge of Kulmakuru, more than 20 metres deep, with steep edges, was formed under the glacier as a powerful sub-glacial meltwater stream passed over the mountain ridge. The melt water erosion capacity was due to the strong hydrostatic pressure in the conduit. Rounded pot holes, eroded by the flowing melt water, appear on the bottom of the Ivalojoeki River valley next to the suspension bridge in Kultala. They were formed at the bottom of the glacier, as a result of swirling, pressurised melt water flows. Stones were also swept into these potholes and swirled around with the force of the current, over time drilling smooth, rounded cavities in the rock. Marginal channels formed at the headwaters of the tributaries of Moberginoja and Palsinoja between the edge of the melting ice sheet and the fell slope. They are several metres deep and more than a kilometre in length. From their shape it can be concluded that large volumes of melt water that had broken out from the glacier margin or from ice-dammed lakes flowed through them. They form channel networks which describe the gradient of the ice surface, its thinning out and the retreat of its margin. Sharp-crested eskers

with steep sides were formed in the glacial melt water conduits at the bottom of the ice sheet. Esker chains are discontinuous and consist of several hummocks and ridges in succession. They reflect the flow of melt water from inside the ice sheet toward its margins.

Finnish Lapland's gold history begins with the Ivalojoiki River in 1868, when the first discoveries of gold nuggets in the soil were made there. The discovery led to a great gold rush amid the uninhabited wilderness. At its peak, close to 500 men could be counted in the area, digging and panning for gold in the hopes of striking it rich. The river valley was transformed into a colourful gold-panning community and life there was a unique phenomenon in Europe. Authorities distributed prospecting permits, exchanged gold for cash and upheld law and order in the area. They lived in an official log residence called Kultala Crown Station, which nowadays serves as a museum and is the most important cultural-historical site. Between 1870 and 1910, 464 kilogrammes of gold were discovered, but in all likelihood, only one third of the actual amount of gold finds made it into the official statistics. The great gold rush came to end within a few years, but panning for gold in the area still continues today.

The natural Arctic landscape and its many attractions provide a good base for nature tourism in Northern Finland. Travellers are interested in hiking, kayaking and canoeing, camping, as well as exploring geological nature sites. Historical sites related to gold prospecting and mining, not to mention modern-day gold panning, are also popular among tourists to the area. The Gold Prospector Museum in Tankavaara and Metsähallitus, Natural Heritage Services, have carried out valuable work in inventorying old gold-mining areas and restoring partially destroyed structures. The Geological Survey of Finland (GTK) has researched geological formations in the area, as well as gold deposits and its origins. If the Ivalojoiki River is chosen to be part of the European Geoparks Network (EGN), it would become the northernmost geopark in the world. It would represent an impressive combination of unique untouched nature, geological natural monuments, gold prospecting history and modern-day outdoor recreation and gold panning.

CONNECTING LOCAL GEOTOURISM INITIATIVES INTO WIDER TOURISM NETWORKS

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Keywords: *keywords list* (geotourism, intelligent-communications, awareness-building, alliances)

For over a decade sustainable development principally through the promotion of geotourism, has been one of the three central pillars of the geoparks concept. The responses across the EGN to this requirement have been as wide and varied as the spread of earth heritage features and processes that those initiatives seek to present to the general public. From coast walks to cave tours, to mine visits and museum exhibitions, there have been a prolific number of individual geopark interpretations and considerations as to how geotourism might work in assisting these territories buck the trends of rural unemployment and loss of population particularly amongst the youth.

Naturally these efforts have very much focused on features and opportunities within individual geoparks, but this paper argues that now the greatest potential for sustainable geotourism growth lies in optimizing the strengths that lie in stressing the broader European Geoparks Network itself, and by cementing closer ties with tourism stakeholders at national and international levels beyond the immediate geoparks network, thereby placing geotourism within the context of the wider tourism industry.

Having visited, spoken to key ‘geoparkians’ and observed geoparks practice across Europe and Asia, a number of existing and future possible linkages will be highlighted and their impact on local domestic, national and international tourist visitation will be assessed. A brief reflection will also be shared on the significance to such a strategy, of further realizing the potential of the Geoparks brand by greater association with the proven ‘super-brand’ that is UNESCO.

THE KOREA DMZ PEACE GEOPARK PROJECT

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Keywords: *Korea DMZ Geopark, the Korean War, DMZ and its adjacent areas, Gangwon Province, inter-regional cooperation*

The DMZ (Demilitarized Zone) and its adjacent areas (Cross-Border Regions) in Gangwon province, the Republic of Korea, have comprehensive and academic geo-scientific sites. Their historical assets, cultural uniqueness and ecological resources which have still remained intact and unexplored due to the Korean War in the early 1950s and the tension between the South and North during about 60 years.

The project on establishing the DMZ geopark as a global geopark was launched in 2010 by the Ministry of Knowledge & Economy, Gangwon Province and 5 local authorities (rural & peripheral regions with 140,000 residents).

Main aims of this paper are to introduce main geo-scientific sites, cultural and ecological resources, training of local people, community business and regional development. Along with these aims, this paper is divided into 4 sections. Firstly, the history, concept and values of the Korean DMZ's adjacent areas are explored in terms of its spatial scope, the political and historical backgrounds, and geopark's values. Secondly, its' adjacent areas in Gangwon province have geo-scientific resources which are represented as processes of the formation of the Korean peninsula. In the DMZ and its adjacent areas, there are three types of petrographical features which are basalt, metamorphic rocks and granites.



Fig.1. Goseok : basalt canyon



Fig.2. Haean erosion basin



Fig.3. Neungpadae : taffoni

These geo-scientific assets can be used as sources for geotourism, training of local people, and community business and regional development. Thirdly, how to build softward infrastructure and to educating local people is introduced with respect to the institutional arrangement, and connections between geosites and the locally embeded socio-economic, culutral and historical life of the people. Finally, geotoursim, community business and regional development are discussed with regard to a way in which such concept of the Korean DMZ Peace geopark project contributes to its regional development.

TERRA.GENESIS – A 3D-VIDEO-ANIMATION EXPLAINING THE LOCAL EARTH HISTORY TO A WIDE PUBLIC

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Keywords: *3D animation, geological processes, education, storyboard*

The geological processes that form a landscape are often hard to understand for non-geologists. The enormous duration of geological periods and the massive movements within the landscape make it impossible for many people to understand the history of the environment they live in. TERRA.vita has produced a 20 minute 3D computer animation that gives an introduction to the local earth history by explaining the climatic changes that took place in the region as well as the tectonic movements and erosion processes that formed the surface.

The geological structure of the TERRA.vita Geopark contains manifold elements while the sediments give a detailed record of the past 300 million years. Despite of this variety the structures are simple enough to be understood by a broad public as soon as a good explanation is provided.

The new animation is based on four structural elements: Block diagrams show an aerial angled view of the wider Geopark area. In this view large-scale processes are explained like flooding, the forming of sediments or the spread of vegetation.

The second element is landscape impressions and flights. For some geological periods, more detailed presentations were necessary to explain the individual situation. In these parts, plants, animals and rocks are portrayed from a shorter distance, sometimes as films, in other cases as fixed images. A flight sometimes leads the observer into the detail. Most of the processes described in the first part are based on the change of the sea level. The forming of marine sediments, river deltas or layers of coal is visualized. The choice of elements explained in the film was taken according to the visibility of the elements in the landscape, so the viewer can later find them in the real environment.

The second part of the animation uses a simpler, sketched animation to explain the huge tectonic movements, the selective weathering and the erosion processes, that gave the surface its final shape.

Finally, some sequences describe more complex processes e.g. the forming of an endmoraine. For this reason some more precise detail-animations were produced.

The animation is being used in various contexts. It is presented on the Geoparks website, given to schools to be used for educational purposes and to museums to show it in their exhibitions.

The production of the film needed a very close cooperation between the animation-experts and the Geoparks Geoscientist. Based on a detailed storyboard, written by the Geoscientist, the illustrator created first images and sketches to give a first impression of what is possible. Further on scene by scene was produced, revalidated, corrected and finally combined with the other scenes. The costs of 40.000,- Euro (excluding the geological part) were covered by funds from the federal state of Lower Saxony by 80 %.

INTERESTING FRAMEWORK ABOUT TRAINING COURSES AND INTERPRETATION ACTIVITIES IN THE BAKONY–BALATON ASPIRING GEOPARK

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Keywords: *Hungary, Bakony–Balaton Geopark, Balaton Uplands National Park, courses for geotour-guides, geopark contest, geological visitor centre*

The area of the proposed Bakony–Balaton Geopark is a geological–geomorphological mosaic on 3.100 km² in West Hungary, comprising 171 different formations: Ordovician metamorphites, Permian sandstone, Alpine Triassic carbonate succession near Central Europe’s largest, shallow-water lake, Lake Balaton; Ammonite-rich Jurassic and new dinosaur genera-bearing Cretaceous above bauxitic tropical tower karst, Eocene large foraminifers and Miocene mollusc fauna with several hundred genera in the Bakony Mountains. The former Lake Pannon’s diverse endemic mollusc fauna is unique in limnic facies in the Earth’s history. Silicified sandstone cemented into ‘seas of stones’ around the Káli Basin; outstanding remnant hills of one of the “densest” volcanic fields in Europe (Mio-/Pliocene) that formed an outstanding landscape (Fig.1.); almost 700 caves in gorges and on karst plateaus; hundreds of sinkholes; a 9-km-long thermal-water maze under a town and more than 1.600 clear-water springs — these are all under the nature conservation supervision of the Balaton Uplands National Park Directorate, the managing body of the Geopark project. The Application Dossier was submitted to the European Geoparks Network in December, 2011.

The Balaton Uplands National Park Directorate started the preparations of the Bakony–Balaton Geopark project in 2004. Our prospective partners (municipalities, regional development experts, representatives of geological, tourism and civil organisations, etc.) were informed about the concept of the Geopark and the possibilities of the co-operation in spring 2006, and a great interest was shown by them. The invited future partners all seemed to understand that the essential goal is not only the acquisition of a ‘Marketing Diploma’, but also providing the concerned region with a basically new function, which may be useful for local communities from several points of view. By virtue of the introduction of the name and logo of Bakony–Balaton Geopark as a trade-mark of high-quality sustainable services and products, the inhabitants of the area are provided with new development potentials.

To this end we have launched trainings since autumn 2009 enabling geotour-guides (Fig.2.) to appear in the area offering geo-touristic programmes, or completing the range of their currently provided services (rural tourism, wine tourism, etc.) therewith. As the area of the planned



Fig.1. One of the most dramatic landscapes of Hungary: volcanic remnant hills in the Tapolca Basin
Geopark is huge, we have divided it into geo-touristic regions, and the syllabus of the 60 hour trainings (including field practice) focuses on the geological and other knowledge related to the specific area. Keeping in mind the holistic approach of geoparks the range of lecturers is not limited to a geologist and a geographer, but includes a biologist, an archeologist, a historian and

an ethnographer as well, and even an ambulance doctor lecturing on the prevention of field accidents. We have conducted courses in 5 regions so far, with 25 to 30 participants each (it has been a very positive feedback for us that some participants have attended all of our trainings held so far!). Geotour-guides promote their geo-touristic activities independently (on their own websites, etc.), but we are displaying them on the recently launched independent webpage of the Geopark (www.bakony-balaton-geopark.hu) also, as well as in other promotional spaces.

Facilities interpreting primarily a geological theme, managed by the Applicant and mostly run by contracted local entrepreneurs, utilised by geotourism and geoeducation: Hegyestű Geological Exhibition Site, four show caves, Disused Sand Pit of Várpalota and the Lavender House Visitor Centre of Tihany. Our four geo-touristic attractions (Lavender House, Csodabogyós Cave, Szentgáli-kőlik Cave and Disused Sand Pit of Várpalota) each have their own webpage. The great majority of the participants of the caving tours check in on-line for the tours lead by qualified local caving guides.

The Open-air Schools in Tihany and in Bakonybél are our own facilities, utilised primarily for education purposes, including geoeducation. The Breuer László Education Centre of the Pangea Association (one of our Geopark Partners) in the Bakony Mts is the site of partly geoeducation activities. Pangea organises the Gaia geoconservation volunteer camp annually with 30–40 participants, within the proposed Geopark area, in cooperation with the Applicant.

We have been conducting a geopark-focused geological and nature conservation contest each year as of 2008, to which the pupils of the primary schools of the area are invited (this is our most popular contest). The finalists not only produce a presentation on a specific subject, but also compete in demonstrating their knowledge of the geological values, acquired in the field.

The Lavender House Visitor Centre located on the Tihany Peninsula (rewarded with the European Diploma), considered as the eastern gate of the Geopark, opened in the summer of 2011. The area boasts a diverse geological-volcanological heritage, thus the majority of the interactive exhibition interprets these fields: visitors can see the formation of an impact sag during a phreatomagmatic eruption, and even enter a rumbling scoria cone.



Fig.2. Participants of the geotour-guide course in the Káli Basin

A NEW INTERACTIVE PANORAMIC MAP PRESENTING THE SITES AND SERVICES OF ROKUA GEOPARK

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Keywords: *Laser scanning data, Panoramic map, 3D map, Rokua Geopark*

The area of Rokua Geopark was laser scanned by the National Land Survey of Finland in Spring 2011. This very accurate elevation data covering the whole area is now used in many ways to explain and promote the Geopark. The first product was made by the Geological Survey of Finland in the form of Rokua Geopark Geological Outdoors Guide, published in May 2012. The guide is largely based on the data received from the laser scanning. Simultaneously this elevation data was also processed to make an interactive panoramic map of the Geopark area, including detailed 3D maps of the three most presenting parts of the Geopark. The interactive panoramic map is going to be published in August 2012 (figure 1.).

The panoramic map is going to be used as a picture in the new brochures and outdoor information panels describing the area and its main sites to the visitors. The interactive panoramic map with 3D maps is prepared for use in internet. The Interactive panoramic map presents the area with photographs, video and text. The inbuilt three 3D maps offer the possibility to explore the area and its geological formations in detail (figure 2.). The 3D parts are prepared from the core areas of the Geopark, Rokua esker and dune area, Rivers Oulujoki and Muhos, and the Lake Oulujärvi recreational area.

This new way of exploring the area offers the Geopark staff numerous ways to explain the area and its formations. The Geopark has for example started cooperation with local schools in order to give them the possibility to use these products in education. The schools have for example suggested to make short video presentation clips to the platform the panoramic map offers. The new products also offer the visitors a better way to visualize the area and plan their visit before arriving there.

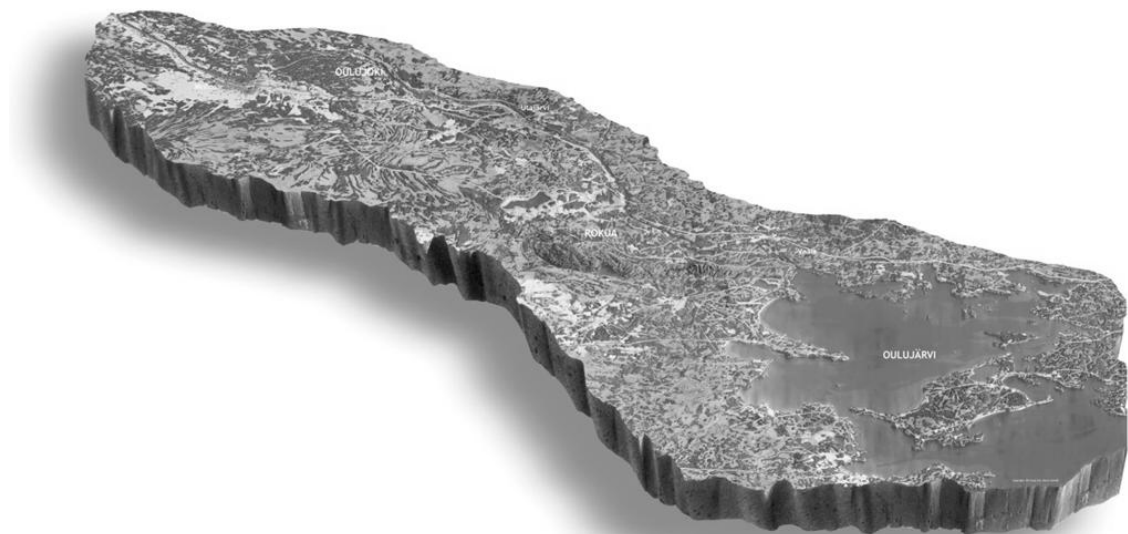


Fig. 5. The Panoramic Map of Rokua Geopark.

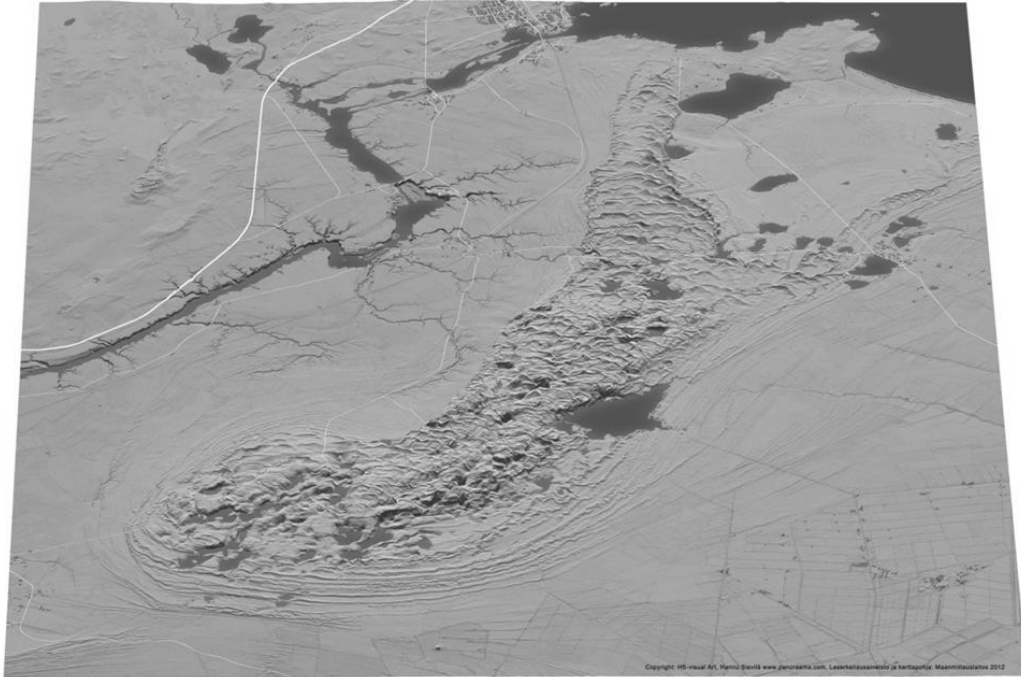


Fig. 6. The Rokua Esker and Dune Area 3D map.

GEOPARK MANAGEMENT STRATEGY IN KOREA

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Keywords: *Geoparks Master Plan, Strategy, Quality, South Korea*

Jeju island Geopark's joining the GGN triggered the national interest and the Ministry of Environment (MOE) was among the first central government to respond to the interest of local communities. MOE reviewed the characteristics of geoparks and determined to incorporate the geopark into the national park system in Korea to enhance the quality level. The first step was to contact the national assembly to amend the Natural Park Act (NPA), which was passed in 2011.

Ministry of Environment is now reviewing the draft of the master plan and guideline on the national geoparks which are prepared by the Korea Environment Institute and the Korean National Park Service (KNPS). The master plan includes vision, mission, sectoral strategy and action plan etc. MOE's top priority is to open and hold permanent national accounts to give a firm basis for the geoparks. So a total of 25 million dollars budget by 2016 is claimed to promote geopark infrastructure. Certification of national geopark will be examined by the National Committee and the management of the Korean Geoparks Network will be audited by KNPS.

MOE will quality control the geoparks applying strict criteria; limiting 2 national geoparks per year and holding only about 19 national geoparks in relation to the spatial size of South Korea. Only excellent geoparks, less than 10 geoparks, will win the candidate for the application to Global Geopark. To mitigate the financial burden of local communities, MOE will start the national survey for geological resources in terms of geological heritages. Then the local communities can easily determine whether they are eligible for the geopark or not. If eligible, the KNPS geopark team will help them to proceed the geopark project. As international cooperation is one of the key performances of geopark, MOE will support the overseas visiting program, attending and hosting the conference etc.

GEOPARKS PROGRESS IN KOREA, AFTER JOINING GGN

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Keywords: *Korean Geoparks, International Cooperation, Cross-boundary geopark*

The Korea's first Global Geopark was established in 2010, in Jeju Island Geopark. The major media of Korea had headlined 'Jeju Island earned the UNESCO triple crown' concerning to the classifications achieved of The Man and the Biosphere, in 2002; World Heritage Site, in 2007; and Global Geopark, in 2010. Since then, it has been drawing national interests. The visitors from inland has increased and many local governments expressed their interest about the geopark.

Soon after joining the GGN, the National Assembly started the legislative action to change the classification of Natural Park Act (NPA) for introducing the geopark system in Korea. The NPA (approved in 2011) is now a firm basis for the development of geoparks and one of the most important value is that it can provide financial support from the central government to the local government. The Ministry of Environment, as regulatory body for national parks, is planning to open 2 million dollars, in 2013, and a total of 7 million dollars in national accounts every year for the creation and development of geoparks in Korea. The budget includes international cooperation sector, so we expect to play an important role in global cooperation program.

The National Committee will be soon organized and will be defined the master plan, guidelines, including the criteria for the national level geoparks. The Korean National Park Service, an empowered organization under the NPA, will soon open the national office for geopark management and will recruit some geologists to support the Korean Geoparks Network. It also co-hosted a workshop to inform over 100 local communities of governmental geopark master plan with Korea Environment Institute, which is an umbrella organization under the Office of the Prime Minister. About 19 national geoparks will be certified among 24 candidates by 2018 and we hope to have 8 GGN members by 2020.

The Korean geoparks have the intention of cooperate with the North Koreans, if they want to start the geopark project and join the GGN, which can contribute the mutual understanding of the geological heritage of the Korean peninsula. We expect to live in geotopia in a near future and to have some trans-boundary geoparks near the Demilitarized Zone (DMZ), which will ease tension and facilitate the reunification of the Korean peninsula.

MONITORING GEOSITES: A GEOCONSERVATION TOOL AT AZORES GEOPARK

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Keywords: *Geosite, Geoconservation, Monitoring, Azores, Geopark*

The Azores archipelago is located in the North Atlantic and is composed by nine islands and some islets. This archipelago, and the surrounding seafloor, has a remarkable geological heritage of international scientific relevance, which constitutes the basis for the establishment of a geopark that is under evaluation by the European Geoparks Network (EGN). Its integration in the EGN is expected for September 2012 (Lima *et al.*, 2010a).

Lima *et al.* (2010b) have identified 121 geosites in the 9 islands and surrounding seafloor, most of them with international and national relevance. Based on this inventory and on the major goals of a geopark, 57 geosites were selected to be managed by the Azores Geopark.

In order to assure that geosites are well preserved considering its present use, a monitoring work was foreseen as a possible tool to geoconservation of these sites. This monitoring strategy intends to identify the factors affecting the geosite's values and to quantify the eventual decrease of relevance that geosites has been experiencing throughout time

As a first step on this geoconservation general strategy, during the last year a monitoring work has been under development in the geosite "Ponta da Ferraria e Pico das Camarinhas" (São Miguel island), given its importance for the Azores Geopark and its relatively ability for the strategy implementation. In what concerns the scientific value, this geosite occupies the 14th position among all the Azores geosites and the 3rd in S. Miguel Island (Nunes *et al.*, 2011). Ponta da Ferraria is a lava delta formed by the basaltic lava flows emitted from Pico das Camarinhas scoria cone, 840 ± 60 years ago (Nunes & Lima, 2009; Moore, 1991). Among the many geological features of the geosite, the littoral cone (or pseudocrater), the 62°C submarine thermal water, the fossil sea-cliff, the trachyte lava dome, and the ultramafic xenoliths are worth mentioning (Figure 1).

This site is a formal protected area since 2005 due to its unique geological heritage and its historical, geographical, biological, scenic, and socio-economic importance. This Natural Monument has a high value/use in what concerns science, education, culture and economy (e.g. tourism) (Nunes & Lima, 2009).

The factors that are affecting the relevance of this geosite can be divided into natural and anthropic ones. In the first category can be mentioned the marine and slope erosions. In what concerns anthropic factors, trampling in the littoral cone, vandalism and littering in the viewpoint area, urban pressure on the lava delta and quarry activities in Pico das Camarinhas scoria cone are the most important.

One of the geological features that are being monitored is the littoral cone (or pseudocrater), a very rare landform in the archipelago, highly vulnerable and that is being under increased treat due to trampling, even if this is forbidden according with the protected area regulations. The monitoring includes registration of the number of people that climb the cone and the periodic control of the path changes through marks measurements and photographical control.

The monitoring strategy also intends to characterize how visitors evaluate the contents and quality of the interpretative panel located in the geosite. This evaluation is based on the time that each visitor spends looking/reading at the panel.

Finally, the monitoring strategy aims to produce a visitors' assessment, through two complementary approaches: a) the number of visitors is being determined by direct counting of persons visiting the geosite, 6 hours per day, 70 days dispersed along one year (including the high and low tourism seasons); b) the visitors' profile is being outlined based on data obtained with a short personal questionnaire.

The analysis of the evolution of the conservation status of a geosite plays a very important role in the control of its decline. The decrease of relevance of a geosite could be justified either by direct degradation of a geological feature or by lack of concern in the maintenance of the site by local authorities. Thus, the monitoring of geosites is a very important tool to assure the permanent conservation and so the sustainable use by the public of a given geosite, a policy that the Azores Geopark intends to reinforce in the years to come.



Fig. 1. Pico das Camarinhas scoria cone (a) and Ponta da Ferraria lava delta (b).

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AZORES GEOPARK PROJECT: INTERPRETING THE AZOREAN GEOLANDSCAPES

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Keywords: Azores Geopark project, environmental educational programs

The promotion of an environmental education and awareness in an interdisciplinary and holistic way is one of the main aims of any geopark. Therefore, the Azores Geopark developed some Educational Programs that includes a set of activities which are adjusted to the schools curricula and are designed for the different students, from basic school to the secondary school.

It is expected that these activities, which will be implemented in all the islands, will improve the approach of geo-education, in an inter-disciplinary perspective and the promotion and enhancement of the geological and natural heritages.

The actions of the Azores Geopark Educational Programs include:

- i) the availability of online contents at the geopark web site (www.azoresgeopark.com), under the themes “Azorean Volcanoes” and “Azorean Geolandscapes” (Fig. 1), adapted to different school levels;
- ii) field trips programs named as “Geosites of My Island”;
- iii) the development of the theme “Geology in Our Village/Town”;
- iv) carrying out recycling and training courses on geoenvironmental interpretation for technicians of the Island Natural Parks and the AZORINA S.A., teachers and other professionals with specific interests in these fields;
- v) lectures and thematic talks;
- vi) other contents are being developed, such as the book “Azorean Volcanoes and Geolandscapes” for painting (for kindergarden) and another book named “The Volcanoes of the Azores” (for 1st grade of basic school).

The integration of these activities in the Regional Plan for Awareness and Environmental Education of the Azores (“PRESAA - Plano Regional de Sensibilização e Educação Ambiental dos Açores”) and in the activities of the Regional Network of “Ecotecas”, centers of environmental interpretation, science centers and similar structures (Fig. 2, 3 and 4) will ensure: (i) a broad thematic scope of the educative actions, (ii) their effectiveness and, (iii) the complete dissemination among the target audiences of the different islands of the Azores.



Fig.1. This information is available in www.azoresgeopark.com.



Fig. 2. Example of educational activities: study visit to Gruta do Carvão lava cave (São Miguel island) by kindergarden children.



Fig. 3. Example of educational activities: study visit to the São Miguel island geosites, in this case Caldeira Velha fumarolic field by high school students.



Fig. 4. Example of educational activities: geosafari at Santa Maria island geosites, in this case Barreiro da Malbusca, by high school students.

COMMUNICATION TOOLS OF THE AZORES GEOPARK PROJECT

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Keywords: *Azores, geopark, communication tools, visibility, public engagement*

Communication is a process that involves the exchange of information and its understanding, so the message should be kept simple (to avoid noise or that its content is distorted) and appealing. The image of the Azores Geopark project has been built over nearly five years. Over the last two years it was reinforced the idea that communication is a strategic policy for the geopark visibility, both internal and externally. The communication should thus be structured to allow better promotion, dissemination and knowledge about the Azores Geopark territory, the activities it performs, the ongoing projects and results. This public knowledge ensures a better informed and integrated community, and a higher public engagement with the geopark policies and activities.

The mainstream communication tools of the Azores Geopark are:

- the web page www.azoresgeopark.com (Fig. 1), bilingual (Portuguese/English), which provides access to information on the Azores Geopark territory, its management structure and is the main instrument of the dissemination of the events and activities of the Azores Geopark and partners;
- the facebook of “GEOAÇORES - Azores Geopark Association”, with constant updates on news and events and sharing photos of Azorean geosites through several contacts;
- promotional materials (brochures, geosites maps, panels, poster's and other exhibition materials), bilingual (Portuguese/English), available in several regional, national and international fairs/events (Figs. 2 and 3), and also through the Azores Geopark partners interpretative centres or infrastructures;
- the image of the Azores Geopark Staff is also part of the communication strategy (t-shirt's and pin's identification);
- dissemination of information through the partner organizations, namely through the newsletters, weblinks and events;
- media coverage of the Azores Geopark activities and projects, at a regional, national and international level, the latter with higher incidence on the Azorean emigrant communities.

For the near future special focus will be made to improve and increase the above mentioned tools, but also to innovate them. The new approaches include an educational-cultural program on a regional radio station and on the regional television channel, and a regular column at a local newspaper.

Also, to facilitate the access to the contents produced by the Azores Geopark Staff, an online catalogue is being prepared, that should include promotional materials, educational materials, articles, communications, maps, etc.

The communication strategy of the Azores Geopark was defined to attend two main levels of communication: 1) at a regional level: the challenge has been, since the early works of the Azores Geopark project, to disseminate the concept and the advantages that local people can get through the community involvement on the project, so that they can feel part of the geopark and can profit from it; at a regional level the communication strategy also serve as a tool to promote education and environmental awareness; 2) at a national and international level: to give

visibility to the Azores Islands, promote its geological heritage, increase the geotourism, and also to broadcast the strategies, policies and activities of the geopark.

Being the Azores Geopark a true archipelagic territory, with delegations, infrastructures and personnel in all the nine islands, internal communication among the staff and partners is also very important to ensure the adequate coordination and implementation of projects and activities, including regular meetings of the Board. In this field, besides regular use of e-mail, phone and use of servers to share data and files, an innovative policy was implemented: the use of video-conference for the general assembly's of the Board.

With these communication tools, the Azorean community and all the geopark stakeholders have easy access to suitable tools that allow them to “look inside” the Azores Geopark and feel integrated and committed with it.



Fig. 1. Webpage www.azoresgeopark.com

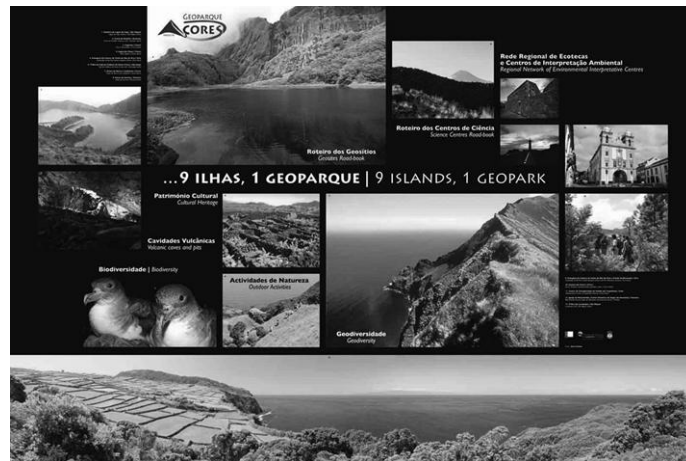


Fig. 2. Promotional panel used in several fairs/events.



Fig. 3. Stand of the Azores Geopark Project at the 1st International Geosciences Congress of the CPLP, Coimbra, Portugal, May 2012.

INTEGRATED CULTURAL LANDSCAPES: A CONCEPTUAL FRAMEWORK OF HERITAGE AND GEO(CULTURAL)TOURISM IN TERRITORY ENHANCEMENT (SERRA DA ABOBOREIRA, BAIÃO).

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Keywords: *integrated cultural landscapes; geocultural tourism; geosites; archaeosites; sustainable development*

In the context of a conceptual framework that faces landscape as integrated natural and cultural heritage, the main objective of this study is to demonstrate the importance of geocultural tourism while sustainable development and territorial valuation factor. This integrative view, namely expressed in the guiding criteria of Geoparks creation, implies that in addition to sites of geological and geomorphological interest (geosites), also be considered other sites whose added value is linked to its ecological and cultural potential, promoting the divulgation of archaeological, historical, religious or even ethnographic heritage.

The study area, the municipality of Baião (fig. 1A), is a territory of morphological, climatic and socio-economic transition, which gives it a character of enormous heterogeneity, that's results from the combination of different spatial dynamics. Located in a mountain area with a traditionally rural vocation, Baião has a past filled with memories and symbolic marks that dates from prehistoric times, and is a privileged area for an integrated landscape analysis. Moreover, in recent decades this municipality has failed to reverse demographic, economic and social less positive records. Therefore it needs to promote innovative development strategies that enhance their natural and human resources. It's in this context that should be viewed geocultural tourism, which requires a careful survey of the heritage that characterizes the relationship between nature and Man.

In this sense, was carried out an inventory of Baião geo and cultural heritage, the latter centered on sites of archaeological interest. This inventory involved a methodological sequence that began with a preliminary identification of geological and geomorphological sites, based on field survey and bibliographic references. Therefore 45 geosites were recorded - including structural aspects, landforms and surficial formations essentially related to the predominant granite substrate of the area - and characterized through a database that includes three major items: (1) identification and location of the proposed geosites (2) thematic classification and assessment framework - the latter essentially qualitative, based on geosites content/values, potential of use, existence or non existence of associate cultural patrimony and conservation status/need of protection; (3) geosite characterization, carried out through text, cartography and photographic records. Each of these items includes several fields that provide detailed information of geosites.

For archaeological patrimony we used a database provided by IGESPAR, complemented with information assigned by Professor Lino Tavares Dias, a specialist in roman period. A total of 112 records were found, among which stands out megalithic monuments associated with funerary rituals, essentially located on Serra da Aboboreira summit surface. All these archaeosites have been properly georeferenced and mapped in association with geosites.

Combining this information with the location of tourism support services and equipments, we proceeded to the development of a geoarchaeo-tourist map, a base document for pathways definition, which contributes to the divulgation of Baião environmental and cultural heritage, promoting its social and economic development.

This map presents several geo and archaeological sites (Fig. 1 B to I). Regarding the first ones, we would like to emphasize that its classification beheld the articulation of previous proposals for Portugal geologic and geomorphologic patrimony, seeking to define the more important

landforms of an Iberian Massif area, as well as surficial formations that are correlative of its evolution. In this context, we mainly stand out the medium scale 'granitic landforms' (degraded/dissected plateaux, *castle kopjes*, *tors*) and the detail ones (weathering pits, blocks with polygonal cracking and pseudobedding), as well some 'tectonic landforms' (fault scarps and fracture valleys) and places of geologic specific interest where can be observed some aspects of mainly scientific and educational value (lithological contacts, veins, faults). In the surficial formations domain, also received attention a set of profiles that presents different weathering layers, sometimes associated with solifluxive deposits indicating evolutionary processes characteristics of a periglacial ambience.

Always related with these geosites are the archaeological remains that reflect the history of Baião human occupation, showing the geocultural tourism potential of this area and contributing to the promotion, protection and (geo)conservation of landscape, faced as patrimony. Space of appropriations, senses, cultural references and symbolic meanings always linked with physical environment, landscape reflects the way by which the man explored the endogenous resources of its territory. Telling this 'story' through integrated touristic routes, helps to mobilize strategies that mark the directions of development.

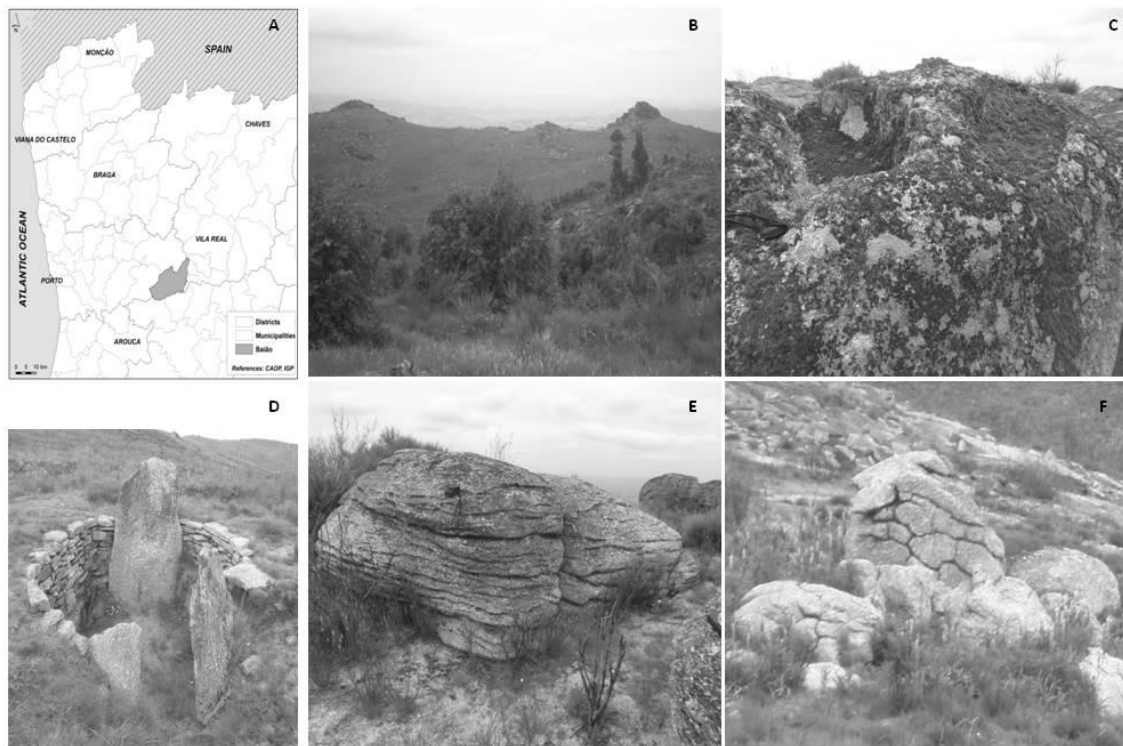


Fig. 1 – Study area location (A) and some examples of its natural and cultural heritage: B. Estaladouro Tors; C. Weathering pits; D. Mamoa (Outeiro de Ante); E. Pseudobedding; F. Polygonal cracking.

EVAPORITES IN SICILY: GEOLOGICAL AND KARST FEATURES

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Keywords: *evaporites, karst, Sicily*

Sicily hosts the most complete and extended Messinian evaporites successions of the Mediterranean Basin. These rocks occur extensively in central and southern Sicily with narrow, but significant outcroppings present in the western, northern, north-eastern and south-eastern part of the island.

The Sicilian evaporites belong to the Gessoso-Solfifero Group. They are composed of a succession of evaporitic limestone, gypsum, and salt (mainly halite and K- and Mg-salts) with intercalations of clays, marls and carbonates. The evaporites are generally arranged into two main cycles, separated by an erosional surface: the lower cycle consists of evaporitic limestones (Calcare di Base), massive selenite gypsum (Lower Gypsum, Cattolica Fm.) and salts (Salt Unit); the upper cycle comprises interbedded gypsum and marls containing brackish to fresh water fossils (Upper Evaporites, Pasquasia Fm.) overlain by siliciclastic deposits (Arenazzolo). However, these successions display different features in relation to their tectonic settings. Considerable sulphur deposits are included within the Calcare di Base. Salt and sulphur deposits were exploited for many years representing a milestone in the economic and social history of Sicily. Today only three salt mines are still active.

The evaporite successions were involved in the Plio-Pleistocene tectonic phases that generated south-trending fold-and-thrust belts, and NW-SE and E-W high-angle faults.

Due to their high solubility the Sicilian evaporites are affected by karst processes responsible for the origin of a large variety of surface landforms and subterranean caves (Agnesi et al., 2003).

Karst affects mainly the widespread gypsum rocks. Gypsum karst displays different kind of landscapes according to the different geological and environmental settings occurring in the island. From a morphostructural standpoint, the most common styles are tabular plateaus, homoclinal ridges, fault scarps, fold relief, and isolated large gypsum blocks floating on clays. As regard the environmental and morphodynamic factors hilly, fluvial, lacustrine, coastal marine and hypogean landscapes are well distinguishable.

The surface karst landforms show a large variety of typologies, ranging in size from a few microns to some kilometres (Macaluso et al., 2001). Karren are widespread and display many morphologies depending on their size, lithology, and genetic processes (Fig. 1A). Bare rocky gypsum surfaces can be characterised by particular forms, such as bubbles, resulting from an alternation of intragranular solution and precipitation processes (Ferrarese et al., 2003).

Among the medium and large sized landforms, the dolines represent the most typical forms (Fig. 1B). Blind valleys, polje-like depressions, subsidence and collapse lacustrine basins in rock overlying the gypsum can also occur. The dolines in gypsum are mostly of point recharge type and there is a nearly complete range of intermediate terms between the blind valleys and the point recharge dolines.

Karren and small funnel-shaped dolines characterize the narrow salt outcropping of central Sicily.

More than 200 caves were explored in gypsum rocks. Generally they consist of superimposed levels of galleries, related to the ancient or actual piezometric surface, connected by shafts of different depth (Madonia & Vattano, 2011; Fig. 1C). These cavities can reach up to 130 m in depth and about 2 km in length. Sink caves, spring caves and active caves, without any explorable connection to the sink or spring point and relict caves, represent the most typical

forms of the underground systems in gypsum. The filling consists mainly of carbonate and gypsum speleothems and thick alluvial deposits (Fig. 1D).

The evaporitic areas of Sicily are extraordinary environments for their original natural and human landscapes, and great variability of karst landforms. They can be considered as geosites and real open-air laboratories where observations, experiments and studies of solution forms can be carried out with a significant didactic value for students of all ages. For all these reasons the Sicilian Region Government designated some karst areas as nature reserves and established the “Sicilian protected evaporite areas network”, that also include the Sicilian European and Global Geoparks, to preserve the unique karst landscapes and their natural and human heritages, to promote forms of sustainable development and to encourage year-round scientific tourism (Di Maggio et al., 2012; Panzica La Manna & Chiaramonte, in this volume). In addition, the Sicilian Region Government passed the legislation for identifying, cataloguing, and safeguarding the geosites in Sicily (LR 25/2012), in order to make known, enhance and promote a sustainable use of Sicilian geological heritage sites. For this purpose, the European Geopark Network was recognized as an institutional partner for the policy of the regional system of geosites.

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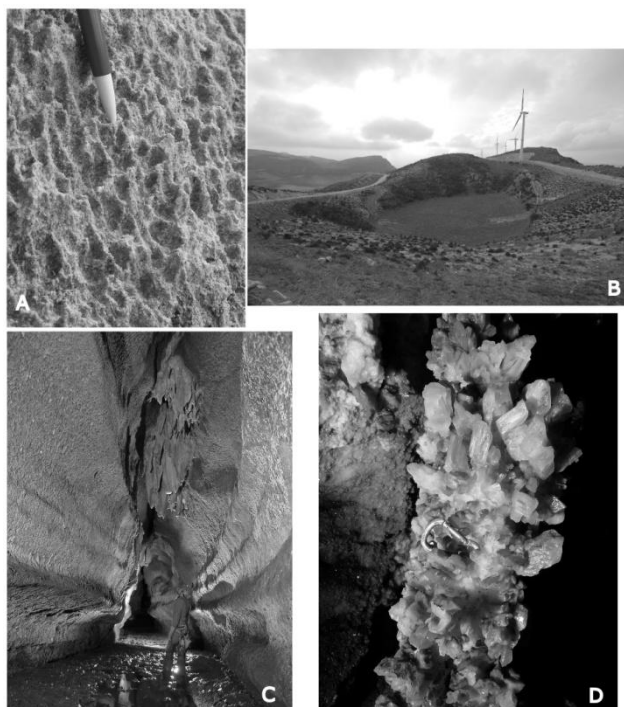


Fig.1. A. Rainpits on selenite gypsum (Rocca di Cerere Geopark. Ph. G. Amato); B. Example of truncated-conical solution doline in gypsum karst area (northern Sicily); C. Sub-horizontal gallery in gypsum cave (Grotta di Santa Ninfa Nature Reserve); D. Gypsum crystals in Inghiottoio di Ciminna gypsum cave (Serre di Ciminna Nature Reserve).

CREATING A NEW STRONG GEOPARK IDENTITY IN FRONT OF OTHER WORLD UNESCO TERRITORIES: THE PPF CONCEPT

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Keywords: *Geoparks; World Heritage Sites; Biospheres Reserves; Natural Parks; PPF concept*

More than 10 years after the creation of the first Geoparks, for some scientists, stakeholders, politician institutions as well as for local and National authorities, a confusion between Geopark and others territories promoted by UNESCO still exists.

The question concerning the real difference existing between Geoparks (G), World Heritage Sites (WHS), Biospheres Reserves (BR) or Natural Regional Parks (NRP) is still active.

This embarrassing situation, which could be problematic for the Geoparks development worldwide, needs a clear analysis with evident and pertinent solutions.

The difference between these territories is much more difficult to establish between G and BR, by reference to their “founding” definitions¹.

Even if the field reality of Geoparks differs significantly with BR, it could be theoretically considered that, in the concept, Geoparks should be considered like a BR specialised on Geological Heritage values.

In spite of the important achievement of the Global Geoparks Network operation and management since 2004, The Geopark’s unique and fundamental networking, the true transnational cooperation, the exchange of experience and staff, the establishment of a territory revalidation each four years, the above elements constitute, de facto, poor arguments to oppose the defenders of the vision “Geoparks are like a BR sub-category”.

This situation is relatively the same within a comparison between Geoparks and French NRP if we don’t take in consideration the topic of revalidation 4 years period.

Geoparks should appear to their visitors totally different with the other categories of territories.

But, for several reasons, they have real difficulties to make it evident.

In this territorial juxtaposition, the Geoparks, as experimental territories, need to promote their singularity both on the field and on their techniques to manage their territories. If Geoparks avoid demonstrating to the public fundamental conceptual differences from others territories and innovative territorial management techniques their similarity with all classic “natural” territories will work against Geopark.

For example, Geoparks are offering to the visitors, in many cases, the same interpretation and communication tools used by any kind of protected and managed territory. Following the supports created by the first American National Parks in 1872, they are still limited in a vision of “nature equipment trilogy” based on pedagogic trails, museum, pedagogical panels. Trilogy, which has no conceptually evolution – a part on a design point of view - from 150 years.

The unique clear particularity is that a visitor will meet in Geoparks «more» panels on geological heritage!

Therefore in the core of their concept, from their first origin, the Geopark embody an indisputable uniqueness, which seems nowadays forgotten. This unequalled Geopark feature, base of their utility, necessity and function has to be founded in the real semantic significance of the Geological Heritage.

¹ Biosphere Reserves are areas of terrestrial and coastal ecosystems promoting solutions to reconcile the conservation of biodiversity and promoting sustainable development in communities of the surrounding region.

Geopark is a nationally protected area containing a number of geological heritage sites of particular importance, rarity or aesthetic appeal. These Earth heritage sites are part of an integrated concept of protection, education and sustainable development.

Speaking on geology, on the “Memory of the Earth” is, overall, speaking about time. Because of its focus on Geology, a Geopark is the unique territory able to provide new questions about time, about that it’s considered like the surrounding reality. About the necessary relativity that it has to be given to the actual interrelation and vision that the human society is developing with the planet, using the human time scale like unique temporal referent. Coming back to the Geopark concept, the constitutive aim of a Geopark is not simply to « teach geology », but to educate, share and to inspire thoughts on another vision of time, the vision of the 4.5 billion years of the Earth, its millions of paleo-environments, past « faces » of the planet. It’s providing a fourth dimension to the daily vision of the planet. Geoparks, like others natural territories, are trying to open a kind of “time window”. But this attempt is limited on an elementary round trip Present-Past-Present. For example, a landscape or a site, like it’s directly seen, is explained and its genesis, its geological origin is interpreted. Even if this type of pedagogy constitutes a step for including a fourth dimension vision, it can’t be considered conceptually satisfactory. Time is a continuum which can’t be stop in a «present» and getting sense in a two-way vision “Past-Present”. Geoparks have to offer a time fourth dimension, in an attempt of a better comprehension and thoughts of a « today », needs to be completed necessarily by a vision of a future. A vision, as for a past vision, which should only be given by Geosciences. With this time conceptual necessity, the -Past-Present-Future concept- (PPF concept) should afford the complete specificity and unquestionable difference between the Geoparks and the other territories. PPFc, on development from 2000², is based on the systematic use, in Geoparks, of interpretative supports which could present, on each site open to visitors, three superimposed images of the locality corresponding to its present situation, its origin and genesis and its future evolutions. The time scale used for the determination of the image for “Future” could be different from a site and based on the necessary time, which will produce significant changes to the present situation. To materialize PPF concept, in Geopark , three categories of interpretative supports can be defined:

- classic interpretative static panels composed by a three time segmentation;
- dynamic interpretative panels;
- virtual interactive panels, which constitute the best solution to provide to visitors the sensation of temporal continuum through an easy time travel play and experience.

With a complete and coherent PPF concept equipment in their territory, Geoparks will be matchless with any kind of existing territory and will demonstrate clearly its uniqueness and function. A territory offering another experience with the planet, a true travel in the time, a different place where visitor are invited to develop new thoughts and experiences around the time. A territory where visitors are walking in a fourth dimension.

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REFLECTIONS ABOUT THE GEOTOURISM CONCEPT

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Keywords: *geotourism, concept, Arouca Declaration, geological tourism*

The enjoyment by travellers of landscapes dominated by geological features is far to be a recent tendency. Just to give an example, in 1841 Edward Hitchcock published a report about the geology of Massachusetts with one chapter named “Scenographical Geology”. The aim of this chapter was to “call the attention of gentlemen of taste, intelligence, and leisure, to those striking features of our scenery, that are the result chiefly of geological changes, and which produce landscapes abundant in beauty and sublimity.” However, the academic discussion about this type of tourism is much more recent. In 1995, Thomas Hose presented a geotourism definition based on geological tourism and on-site interpretation of geological features. Some years later, the National Geographic Society from the USA has decided to use the same word but with a broader sense and not specifically focused on geology. Nevertheless, among the geoscientific community, geotourism mean the recreational use of the geodiversity, in association with some sort of informal education addressed to the general public. The interpretation of the main geological character of the territory is always the main aim for this type of geotourism.

In 2011, the Arouca Geopark organized an international congress on geotourism with the perspective of promote the discussion about this concept. During the closing ceremony, the organizers have presented the Arouca Declaration where geotourism is defined as “as tourism which sustains and enhances the identity of a territory, taking into consideration its geology, environment, culture, aesthetics, heritage and the well-being of its residents.” The idea was to use the broader definition of geotourism but clearly showing geology as a fundamental asset. This perspective of geotourism is not against the more restrict one because in the same declaration is clearly affirmed: “geological tourism is one of the multiple components of geotourism”.

What are the advantages of expand the concept of geotourism beyond geological tourism?

Geotourism, like any other type of tourism, is an economic activity. This means that it is expected that this activity generate money in order to provide a solid income to investors and workers. In general, a higher tourism income is directly related with a higher numbers of tourists; this is what all tourism agents aspire. Without losing the sense of environmental and social sustainability, geotourism managers also expect to have success in their businesses. Nevertheless, geoscience is not a popular subject among the general population. For most people, geology is just rocks besides dinosaurs, volcanoes and earthquakes. The number of people really interested in travel and spending money to participate in nothing but a geological tourism activity is unquestionably low. Of course that these activities are very welcome by geoscientists and by those with some geological background, but the number is too low to guarantee the economical sustainability of many geotourism companies. Broadening the concept of geotourism will increase the number of potential tourists, an essential trend to guarantee the success of this economic activity.

Still, some geologists have reacted to a broader tourism approach as threatening to geological conservation and public education. This creates an issue where none exists, for public education is not a zero-sum game. Indeed, tourism that promotes a general ethic of conservation is more likely to foster a protective attitude toward unique geological sites than a strictly geological focus that willfully ignores a destination's related attractions. Such a narrow focus can be counterproductive.

Whatever the name of the featured area, a positive attitude toward geoconservation depends on responsible, educational tourism that generates sufficient economic benefit for the community. In geoparks, residents are then more likely to value the geological features that warranted a geopark designation in the first place. To that end, and in keeping with the Arouca Declaration, the National Geographic Society has already published comment that their definition of the geotourism approach can be expanded explicitly to include "geology" whenever desired and that the broad approach also includes the established narrower "geotourism" meaning focused on the topic of geology. Done well, the broad approach should improve public appreciation for geology.

The low social recognition of geosciences and geoscientists has many reasons. The fact that geoscientists usually work in close circles is one the explanations for this situation. Geologists are accustomed to communicating with a very obscure technical jargon, using millions of years when they speak about time and explaining how the rocks that form the Alps today were once formed on the seabed! It is very difficult for the majority of people to understand geologists and to give them credit. During decades, many geologists have failed to communicate with the general public. They failed to clearly show that it is the geodiversity that controls everything in our planet and that almost all living organisms are dependent on this geological diversity. Or how local rocks are determinant in the use of geological materials since the Stone Age. Or how the vineyards that produce Porto wine are completely dependent on the soil developed on a specific type of rocks. Geologists have often failed to clearly demonstrate that without them it was impossible to have all the technological development based on very rare minerals used to build all the electronic equipment that we are completely dependent today. The broader concept of geotourism is a tool to show these relations and to underline the relevance of geodiversity in the planet and in our lives. These geotourism programmes will allow tourists to know the local geology but also to better understand that this geology is closely related with all the other assets of the territory, such as biodiversity, archaeological and cultural values, gastronomy, etc. Perhaps that some of these geotourists will finally understand that geology is much more than just rocks!

With this broader definition of geotourism, we loose nothing (the geological tourism is still there) but we can gain a lot!

THE LNEG ATLANTERRA SOUTH PORTUGUESE ZONE GEOSITE CHARACTERIZATION PROGRAM

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Keywords: *Geosites, South Portuguese, Iberian Pyrite Belt, Upper Paleozoic*

Included in the Atlanterra European Interreg Space Atlantic Project the LNEG is presently developing a geosite characterization program dedicated to the South Portuguese Zone (SPZ) territory, one of the major geological domains of the Variscan terrain. The work is carried out using a regional database with ~100 sites selected for their scientific interest, considering the following categories: geomorphology, Atlantic coast, Guadiana, Chança and Sado rivers, fossils and microfossils, tectonic, geological formations (Flysch, Volcano-Sedimentary Complex and Phyllite-Quartzite Group), ore exploitation (pyrite, copper, manganese), aggregates exploitation and geological gardens and geomonuments. The site characterization follows the Progeo methodology (Brilha, 2005, 2012), considering also the Iberian Pyrite Belt (IPB) initial framework of 7 proposed geosite program. The LNEG team applied the expertise and know how developed during the mapping surveys performed at different scales. The database output will be complemented by a regional map with the geosite distribution and possible route networks. This approach also considers the previous work developed in the Pyrite Belt, including the Pyrite Route (Matos et al. 2008) based in interpretation centers, located at Lousal (Science Center), Aljustrel (Municipality Museum) and São Domingos (miners house). The project objectives are the geological heritage promotion, locally inserted in the main mining scenarios, the identification of geoheritage routes considering their sustainable exploitation. The LNEG team wants to collect the existing information and show the SPZ geodiversity as a scientific argument to substantiate future geopark and geological garden project proposals.

THE SPZ GEOLOGICAL FORMATIONS, AN UPPER PALEOZOIC GEODIVERSITY

In Portugal the SPZ is represented in the Alentejo and Algarve (north) regions. The SPZ includes Devonian and Carboniferous formations (Oliveira et al. 2006, Pereira et al. 2008) represented by the Pulo do Lobo Domain, the IPB and by the Baixo Alentejo Flysch Group. The Pulo do Lobo Domain is an antiformal structure located in the northern sector of the SPZ. In the structure core outcrops the Pulo do Lobo Fm. (age unknown) formed by phyllites, quartzites and amphibolites (MORB-type basalts, Munhá 1983). The north limb of the antiform is represented by the sedimentary formations of the Ferreira-Ficalho Group Ribeira de Limas (lower Frasnian), Santa Iria and Horta da Torre (upper Famennian). The southern limb of the antiform is represented by the Chança Group represented by the sedimentary formations Atalaia (age unknown), Gafo (lower Frasnian) and Represa (upper Strunian). The IPB includes the Phyllite Quartzite Group (PQG) and the Volcano Sedimentary Complex (VSC). The PQG forms the IPB basal detritic sedimentary unit and consists mostly of phyllites, quartzites and quartzwackes with a thickness is in excess of 200m (base not known). It is dated as lower Givetian to late Strunian age (Mid to Upper Devonian), by ammonoids, conodonts and palynomorphs (Oliveira et al., 2006, Pereira et al., 2008). The VSC incorporates several episodes of volcanism, with dominant rhyolites, dacites, basalts and minor andesites, and intercalations of black shales, siltstones, minor quartzwackes, siliceous shales, jaspers and cherts and a purple shale member at the upper part of the complex. The thickness is variable, from few tens of meters to more than 1000m. The VSC is dated as Upper Devonian to upper Viséan age based on palynomorphs and rare conodonts. Overlaying the VSC are the turbidites of the Baixo Alentejo Flysch Group (BAFG) that consists of mostly gravity flow sediments that form a continuous southward

prograding turbiditic successions, that includes from base to top, the Mértola (upper Viséan), Mira (Namurian) and Brejeira (Bashkirian to upper Moscovian) formations (Oliveira et al. 2006, Pereira et al. 2008). The SPZ geological formations are characterized by short geological time period (middle Givetian to upper Moscovian) and by a significant geodiversity represented by different volcanic and sedimentary units and by important base metals mineralizations of massive sulphides, Mn-Fe oxides, carbonates and silicates and by Cu, Pb-Ba and Sb vein type structures. The massive sulphide deposits (~93 deposits) and related hydrothermal systems are associated with the VSC felsic volcanic and/or black shales represents the main geodiversity, with world class deposits as Neves Corvo and Aljustrel (both active mines). These deposits characterise the IPB as one of the main European metallogenic base metal province.

GEOSITES, MINING AREAS AND NATURAL LANDSCAPE

The SPZ has an exclusive natural heritage characterised by environmental, geological, biological distinctiveness, as well as outstanding seaside coastal landscapes and an inland flat morphology, the typical landscape of Alentejo, and the smooth Andalusia mountains. This region is a significant geodiversity examples, not only due to the variety of the sedimentary and volcanic stratigraphic sequences, very well represented in Portugal by classical cross-sections along the Guadiana, Chança and Sado river valleys and in the Pomarão, Ourique, Castro Verde and Cercal antiformal structures, but also by the massive sulphide deposits and associated hydrothermal systems, exposed in old mines open pits such as Lousal, Caveira, Montinho, São Domingos and Chança and the active mines of Neves Corvo and Aljustrel (world class VHMS deposits) Matos et al. 2011. The significant mining activity changed the IPB landscape and the culture of the region, leaving a rare industrial archaeology heritage that includes exploitation open pits, industrial systems, railway trails, river harbours for the ore transport mining villages and a mining cultural memory of the populations promoted as the Pyrite Route (Matos et al. 2008, Gómez & Martinez 2009). The IPB mining scenarios are an excellent way to access to the local stratigraphy and to the understanding of the geological process related with ore metalogeny (hydrothermal systems) and their later evolution during deformation and late supergene alteration and erosion. In these and natural contexts upper Paleozoic sequences are exposed, showing variety of volcanic and sedimentary facies, mainly marine environments, showing the SPZ as a regional basin were related with volcanic bimodal activity a unique metalogenetic environment was developed. The SPZ fossil record of the SPZ extends from middle Givetian age to upper Moscovian age and is represented by microfossils (miospores, acritarchs and prasinophytes), *Posidonia becheri*, ammonoids and conodonts (Pereira et al. 2008). Several palynostratigraphic studies are being carried out for exploration companies, to identify key horizons favourable to the presence of massive sulphide mineralization - e.g. Strunian age black shales (Matos et al. 2011, Pereira et al. 2012).

DISCUSSION: THE IPB GEOLOGICAL HERITAGE VALORIZATION

The SPZ presents a large number of well documented geosites related with Devonian and Carboniferous times, including the Iberian Pyrite Belt, a unique European metalogenetic province, with world class mineral deposits. The sustainable promotion and valorization of the SPZ heritage must be considered and developed according the local Alentejo and Andalusia landscapes. The Atlantic coast and the Guadiana/Chança rivers present the most favourable scenarios to be well documented and to aspire a future Geopark projects. The geosite SPZ LNEG inventorying database will help to define the best rout planning activities, showing the most studied areas, some of them unique. Municipalities are key entities to promote future geological gardens and geopark projects. Other themes can complement the geological and mining heritage, supporting the Geopark concept, for instance the natural landscape and ecologic agriculture, biodiversity, archeology and the Alentejo's culture (rich gastronomy, ethnography and music).

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COMBINING GEOLOGY AND ARCHAEOLOGY IN IRELAND: A NEW GEOTOURISM RESOURCE.

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Keywords: *Geology, Archaeology, Geotourism, Ireland, Newgrange, Granites.*

The Island of Ireland boasts 3 UNESCO World Heritage Sites including the Giant's Causeway and Causeway Coast (inscribed under Natural Criteria VII and VIII) and the Archaeological Ensemble of the Bend of the Boyne - *Brú na Bóinne* (inscribed under Cultural Criteria I, III and IV). Moreover, the cities of Belfast and Dublin both offer close access to a remarkably interesting and varied geology and archaeology. On a 'points score' basis Belfast would be the "European city winner" in terms of the range of geology in its vicinity: features, landscapes, rock types, fossils and rocks of different ages. Moreover, Ireland as a whole offers outstandingly interesting and varied archaeology, which includes a range of stone axeheads, portal/court/wedge/passage tombs, stone circles, High Crosses and gold/bronze artefacts, all of which can be related to geology.

In this contribution we stress that the combination of geology and archaeology provides a hitherto unrealised, high quality, 'cross-border' resource: we illustrate this with the Neolithic *Brú na Bóinne* Passage Tomb complex (Newgrange, Knowth and Dowth) and the derivation of their rock materials from diversely distant areas, which include the Mourne Mountains/Newry granite area of Co. Down, the Carlingford and Clogher Head areas of Co.Louth and the Wicklow Mountains near Dublin. For example, a single day excursion can easily include a visit to Newgrange (Fig.1.) and the outcrops of some of the rocks used in its construction, e.g. the granites of the Mourne Mountains and the cobbles on the beaches of the Carlingford Peninsula.

This combined approach could be applied in other parts of Ireland, e.g. Sligo, and overall it provides important opportunities for promoting geotourism throughout the entire island.



Fig.1. Newgrange Passage Tomb, Ireland. Granite cobbles, quartz fragments and greywacke sandstone kerbstones.

GEO-WINE-TOURISM PROJECT IN THE LUBERON GEOPARK (FRANCE)

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Keywords : *wine, geotourism, terroir*

The *Parc naturel régional du Luberon*, European and Global Geopark, recently undertook a vast project to promote geo-wine-tourism with the aim to learn more about its *terroirs*, to share this knowledge with wine and tourism professionals, and to imagine promotional activities to exploit this tourist destination for customers.

The foundations of the project are from diverse backgrounds. First, a work on the repositioning of the Luberon AOC took place in 2009 with the ambition to reaffirm the identity of the designation and re-anchor on its territory by insisting on two elements that create its specificity: belonging to the Regional Nature Park and the attraction of its landscapes. Then, the Luberon Regional Nature Park, in partnership with the Union of the AOC Luberon, appealed to the agency in 2010 Planeth Tourism to set the positioning and strategy planning marketing of wine tourism. Finally, as a Geopark, the Luberon Regional Nature Park wants more emphasis on the link between *terroir* and wine, in a target of geological and tourism promotion.

The notion of *terroir* is central to the geo-wine-tourism project, in the sense that promotion activities proposed should allow to understand easier the relationship between *terroir* and wine and to develop a true education on this topic. The *terroir* can be defined as a system of interactions between a community of men and his natural environment that provides distinctive features for the original products of this space. The notion of *terroir*, the sense we understand it, includes both natural factors (the specific characteristics of climate, soil, subsoil geology and topography) and human factors (wine-related practices).

The project, currently underway, involves two phases. The first one is to study *terroirs* of Luberon, that is to say about the different factors involved in the system *terroir* and their influence on the character and quality of wine. What types of soil/subsoil is located the vineyard? What are the natural conditions favorable to the development of a quality wine? How the winemaker takes into account the natural environment to adapt its practices in the vineyard? Is it possible to recognize a *terroir* by the wine? So many questions that appeal even if the answers are many and do not always have scientific explanations.

The second phase, in turn, concern the promotion activities of the links between *terroir* and wine, based on experience already gained in the territory of the Geopark and on existing initiatives in other territories.

Initially, it is important to train the professionals of the wine industry and tourism to communicate on this notion of *terroir*. Some trainings «*terroirs & landscapes*» for wine and tourism professionals will be set in order to provide a common knowledge base, to help them to communicate on Luberon *terroirs* and wines, to promote exchange between professionals and to organise a «*training-action*» with a group of local expert.

Then, we can imagine a various activities for geological and tourism promotion, which would enrich the already existing wine tourism services in the territory. Partnerships with two tourism companies will be developed. The first partner «*La Maison de la Truffe et du Vin*» will provide a Discovery space of Luberon *terroirs* and wines (reading of landscapes; exhibition «*Luberon terroirs and wines*»; wine tasting). The second Partner «*Vélo Loisirs en Luberon* » will organise

Bike tours «Terroirs, vineyard and wines» (audioguided tours in the vineyard; wine tasting in the cellars; link landscapes, terroirs & wines).

The project geo-wine-tourism is part of a dynamic of sustainable tourism, by promoting knowledge of the Luberon *terroirs* and wines to the inhabitants of the territory and tourist clientele. It will also allow giving back to nature its place in agriculture with emphasis on the natural environment as a determinant factor of production.

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A NEW STRATEGY FOR GEOPARKS IN TUNISIA: GEOLOGY FOR DEVELOPMENT

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Keywords: Tunisia, geological site, Geopark

It's essential to understand what a Geopark is and what that concept can comprehend, than it is necessary to analyze what are the goals and the interests of this type of geotouristic offer and then to mention the different steps to complete this project. Finally, it is necessary to ask why such area was selected as a geotouristic offer and why these places deserve a valorization.

Tunisia offers a variety of landscapes and geological sites of scientific interest, which summarizes the geological and mining history of the country.

- 1) The International stratotype Cretaceous-Tertiary boundary (KT) cutting the track Mellègue Hammam, southwest of the town of El Kef. It was selected at the 28th International Geological Congress in Washington in 1989.
- 2) Permian and Permo-Secondary mismatch in southern Tunisia is the only Paleozoic outcrop in the region and the unique marine Permian outcrop in the Mediterranean area. The angular Albian unconformity well exposed here provides additional scientific and educational interest.
- 3) The caves of Jebel Serj were discovered in 1901 at the bottom of a zinc mining gallery in the mountains of Jebel Serj. The recent work by the Office National of Mines has clarified the structure of the cave (1582 meters long and a vertical drop of 333 meters); the cave is among the five important vertical cavities in Africa.
- 4) Important Cretaceous Vertebrates and plants were found near Tataouine. They include dinosaur remains (vertebrae, manure, claws ...) in the fluvio-deltaic sediments, and fossilized remains of a forest (tree trunks and impressions of plants between the layers of clay); these have an important paleogeographic significance.
- 5) Galb saadmoun: main town of a former volcano. These are small outcrops in the form of lava flow strata, intrusions, dykes and pyroclastic deposits, with a bipolarity of acid and basaltic compositions. These igneous rocks represent a particular geodynamic context and have a major scientific interest because of their originality and their presence in a country composed mainly of sedimentary rocks

For the situation and the importance of Tunisian geological patrimony elements, an inventory of geological interest is essential. Regions with a wide variety of interesting geosites should "rediscover" the theme of geology for tourism. Natural conditions and landscape are ideal in many regions of our country. The presence of Geoparks in such an extraordinary rich landscape area, can be a key to success of ecotouristic development.

ADMINISTRATIONS INITIATIVES FOCUSED ON THE MOLINA AND ALTO TAJO GEOPARK PROJECT (SPAIN), COORDINATED BY THE MUSEUM OF MOLINA

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Keywords: *Geopark, Museum, coordination, Guadalajara, Alto Tajo, Spain*

In order to the integration of the region of Molina in the European Geoparks Network, Molina Museum has obtained the commitment of the administrations that manage this region such as: The Ministry of Environment through the Alto Tajo Natural Park, Guadalajara Provincial Council, the Rural Development Association of the region of Molina, and Spanish Geological Survey. These administrations have worked coordinated by the Museum of Molina to investigate the needs of the region facing the sustainable use of natural and cultural heritage and develop the necessary actions to become part of the European Geoparks Network, including in their programs, concrete actions aimed at fulfilling the directives of the European Geoparks Network. Here we describe the main actions that these administrations have undertaken.

ALTO TAJO NATURAL PARK

The new administration has taken over the Natural Park has focused on maintaining of the ample supply of geotourism resources available to this protected area and the efficiency in their management. The main areas of work are: (1) Renewal of Geo-routes displays; (2) Restructuring the management of visitors' centres and information points by granting to external companies, and (3) new publications about the natural heritage of the region.

GUADALAJARA PROVINCIAL COUNCIL

This administration supports the implementation of Agenda Local 21 sustainable development plan in this territory and management development aid fund FEADER, and also have developed various approaches to the Geopark project activities, among which are: (1) drawing of the geological routes of the Sierra de Caldereros and the Mesa River Valley, thus remedy the lack of such facilities in the north of the Shire; (2) geological Bike Route for the District of Molina (Fig. 1), joins through 300 km, the main geological attractions of this area, improving accessibility to its natural heritage; and (3) support for the creation of the new Human Evolution Room in the Museum of Molina (Fig. 3), which completes the large sample of the natural heritage of the region in this museum. Also noteworthy is that this administration has enabled a budget to support the development of the European Geopark candidacy.

SPANISH GEOLOGICAL SURVEY

This national organization is aware of the great potential of the region of Molina for the dissemination of Earth science and is providing valuable support to the proposed Geopark with constant advice to the different lines of work. Especially in the application of a legal form of protection to ensure the conservation of Fuentelsaz del Campo geological outcrops and Permian fossil forest of the Sierra de Aragoncillo. Also noteworthy is the new edition of the Alto Tajo Natural Park Geological Guide (Fig. 2).

MUSEUM OF MOLINA FRIENDS CULTURAL ASSOCIATION

As an association based in the region, coordinates the work lines for this project and is the link between this territory and European Geoparks Network. It also develops multiple actions of diffusion of natural and cultural heritage of the region.

MOLINA – ALTO TAJO RURAL DEVELOPMENT ASSOCIATION

The local development group that manage budget LEADER funds for Molina area has joined the team that promotes this project.



Fig.1 Cicloturistic route of Molina de Aragón

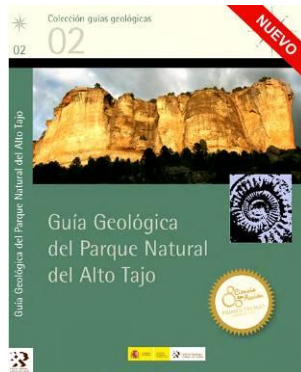


Fig. 2 Alto Tajo Natural Park Guide



Fig. 3 Human Evolución Room of Molina Museum

CONCLUSIONS

All agencies that administer the district and act for sustainable development, are involved in the application of the Geopark and develop projects focused on this objective.

AROUCA GEOPARK AND THE PROJECT ROUTES OF WOLFRAM IN EUROPE - MEMORY OF MEN AND INDUSTRIAL HERITAGE – THE CASE OF “RIO DE FRADES” MINES

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Keywords: *Geotourism, Geodiversity, Wolfram*

The enjoyment of nature and the landscape is something that is becoming more common among visitors to a region. Its richness and diversity is undoubtedly an asset to a tourist destination and a tourist experience.

The growing concerns about the environment and nature conservation or sustainable tourism practices, are factors that are increasingly present in the mind of visitors when looking for a destination.

It is in this context that the concept of geodiversity, emerges as a new opportunity to promote tourism so that tourists can understand and appreciate the natural heritage, making it sustainable at the level of local communities and environmental impact, so that visitors can enjoy the natural-historical heritage of a singular region.

In this perspective, Geotourism emerges as a type of tourism that allows visitors to acquire knowledge to understand the specifics of a region, evoking the need for enhancement of the environment as a whole, also contribute to mitigating the environmental impact (inherent in the tourist industry) and to increase local economic development, promoting the concept of sustainable tourism according the Arouca Declaration.

Arouca is inserted in a single context of geodiversity, on which is inscribed the Arouca Geopark.

In this context, the Arouca Geopark has guided its activities especially in the context of the protection, enhancement and promotion of the natural and cultural heritage, always in a perspective of dissemination and sharing knowledge, promoting tourism, looking to the sustainable development and environmental protection.

It is precisely in this perspective of protection and promotion of the natural and cultural heritage that appears a collaboration with the project "Routes of Wolfram in Europe – Memory of Men and Industrial Heritage", intended to be Europe-wide, and that inserts in their trails the “Minas de Rio de Frades”, located in the territory of Arouca. The project aim is the recovery and conservation of existing material and immaterial heritage, sharing the ambitions of Arouca Geopark, is still pretension of the project develop the territory and introduce the common values to several European countries who shared the exploitation of this ore.

The creation of a European route that connects Wolfram mines, comprising the context of Geotourism, helps to strengthen the guidelines of the project that are based on valorization, sustainability and conservation of nature and heritage.

A project with European visibility enables the international dissemination of Arouca territory and allows to consolidate itself as a tourist destination, on the other hand, allows the tourist to go through geodiversity paths entering in the Geopark Arouca, enhancing his visit and stay.

The mine of “Rio de Frades” and its proximity to the territory of Geopark enables a diversity in regards to a tourism with heritage conservation, learning and admiration of landscape goals. The diversification of the tourism offer is a great asset, and this proximity to Arouca Geopark is a perfect cooperation, ambitioning enhancement of tourist offer of a destination.

These two projects, working hand in hand, contribute to potentiate this territory giving an unparalleled European recognition in their differentiation and helping the preservation of traditions, heritage, landscape and infrastructures, and in the recognition of his bio and geodiversity.

GEOPARK PROJECT OF EL HIERRO ISLAND: CELEBRATING THE STRONG LINKS BETWEEN PEOPLE AND VOLCANIC HERITAGE

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Keywords: *Canary Islands, Biosphere Reserve, Geopark, volcano, management plan*

The island of El Hierro is the youngest of the seven Canary Islands, the furthest southwest in the Archipelago, with a surface area of about 272 km² and it counts 10,892 inhabitants. It is divided into three municipalities: Valverde, La Frontera and El Pinar de El Hierro. Its economy is mainly based on the primary sector (agriculture, livestock and fishing), and also tourism has a secondary income, contrary to the rest of the islands of this archipelago. El Hierro, since it has been little exploited and conserves its autochthonous lifestyle in a magnificent natural environment, offers a great potential for nature tourism. The type of new tourism arriving on the island is highly environmentally aware, enjoys nature and is looking for peace and quiet and authentic experiences, outside the classic mass destinations looking for sun and beaches. To its visitors, the island offers tourism bureaus, interpretation centres and a wide offer of hotels and rural accommodation, with over 1,500 beds.

The island was declared a Biosphere Reserve by UNESCO in 2000 and has other six protected natural areas (PNA), covering 60% of its territory, including the *Integral Marine Reserve of the Mar de Las Calmas*. Some of the PNA were declared due to geological and volcanic singularities that include the protected landscape of Ventejis, the biggest phreatomagmatic crater (*maar*) in the island, and the Natural Monument of Las Playas, which constitutes one of the first landslides that took place in El Hierro.

These natural resources offer a great potential for geo-tourism and nature tourism, especially for sports (trekking, paragliding, cycling, fishing and scuba-diving), as well as scientific tourism. Together with the rich geological and biological diversity, the island has a rich cultural heritage (material and immaterial) giving it an identity of its own, different from that of the other islands of the Archipelago.

El Hierro is a well known example of an oceanic island with a 120° regularly spaced three-armed volcanic rift with superimposed monogenetic volcanoes, and enhanced by large scale landsliding creating deep embayments. It rises from the surrounding sea floor at 4,000 m depth to an altitude of 1,500 m above sea level, with the oldest subaerial rocks dated at 1.12 million years. El Hierro, known as "the island of the 1000 volcanoes", has the greatest concentration of recent, well-preserved eruptive vents in the Archipelago.

On 10 October 2011, a submarine volcanic eruption started 2 km south from El Hierro Island. This recent activity offers a privileged scenario to study and spread the knowledge on volcanic processes, even when the island has a long-standing tradition of scientific research and knowledge transfer on geological matters to society. Its population has very strong ties with the territory and, since ancient times, has learnt to coexist with the geological events and is extremely aware of the relevance of understanding this special geological environment.

Following the Socio-economic Development Plan of El Hierro (1997) and the Biosphere Reserve Management Plan (2000), the main social agents on the island – the Island's Government (*Cabildo Insular de El Hierro*), in conjunction with the Town Councils, scientific institutions, business associations and other, and with a large support from its inhabitants, and also with an explicit support in terms of financing and human resources from the Ministry of Industry, Energy and Tourism (Spanish Government) – has been developing the management of the natural and cultural heritage of the island following a model that can be compared to those in geoparks, looking for a direct positive impact on the environment and the quality of life of its inhabitants. Action plans are being implemented on sustainability, competitiveness, mobility, water management, environmental education and recycling. There is already a large network of nature trails, and work is being done on volcanic trails (Figure 1) and to open to the public the volcanic caves (lava tubes), among other activities.

The Geopark Project includes planning actions in the mid-term and long-term that is contained in the agreement adopted by the Council of Ministers on the 28th of October 2011. The order IET/460/2012 establishes sector measures to support the promotion of tourism, to revitalize industry and to boost ICTs on the island of El Hierro.

Given the coincidence with the objectives of the geoparks – protecting heritage, revitalizing the social and economic life of the territory based on the sustainable management of its peculiar geodiversity (especially through geo-tourism and related economic activities), scientific research, environmental education, quality of local products, etc. – the *Cabildo Insular de El Hierro* is leading a Geopark's Project covering the whole island (including the Marine Reserve), focusing on the central value of the ancestral interaction between the inhabitants of the island and its geological environment, which has ultimately come to build the identity of El Hierro, and continues to do so. This project has gained a lot with the advice received from two Spanish geoparks: the Basque Coast Geopark (Basque Country) and the Villuercas-Ibores-Jara Geopark (Extremadura). Recently, the Director of the UNESCO Division of Ecological and Earth Sciences has valued the initiative of the candidature of El Hierro very positively, mentioning its uniqueness.

El Hierro can contribute in several ways to the European Geoparks Network, for example, with its experience in energy self-sufficiency thanks to a new hydro-wind plant, with its experience in managing geological hazards or with the island's Sustainable Mobility Plan.



Fig.1. Guided tour of the *Hoya de los Roques* (Course "All about our Volcanoes", 2012).

ESTIMULATING A GEOPARK PROPOSAL IN FERNANDO DE NORONHA ARCHIPELAGO – BRAZIL

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Keywords: *Fernando de Noronha Archipelago, Tourism, Geoparks, community*

Islands typically create a positive image in the tourist, because in contrast to many continental regions, have a distinct and immediately recognizable identity (Pearce, 2003). This is the case of Fernando de Noronha Archipelago, where the insulation contributes to the sensation of breaking the routine, and their geological and geomorphological attributes further strengthen its vocation for geotourism and a possible creation of a Geopark.

Fernando de Noronha is located in northeastern Brazil, and the archipelago has only 26 km² (nine of marine platform and seventeen of land area) with a main island, which is surrounded by 18 smaller islands and dozens of rocks (Fig.1). The administration is divided into two protected areas: a Marine National Park and an Environmental Protection Area.

For UNESCO (2002), the geographical position of the archipelago, the peculiarities of the portion above water and underwater complex conformation (with caves, canyons and coral reefs) are some of the factors that contributed to its recognition as World Heritage since 2001.

Fernando de Noronha has many beaches, forts and historical monuments, natural beauty and geological monuments, where the geological aspects related to volcanism are evident in the landscape. The vegetation is mainly shrub and herbaceous. On the island there is only found on mangrove islands in the South Atlantic ocean and also endemic plants. Regarding the fauna, is one of the most important regions for the breeding of marine birds in the Atlantic and nursery for species such as dolphins and sea turtles (IBAMA *et al*, 2005).

Ecotourism is the main source of income for islanders, and the archipelago has many lodging options, bars and restaurants (seafood, regional and international cuisine), craft shops, receptive agencies, taxi drivers, rental cars, diving operators, boat tours, dolphin watching tours, deep sea fishing, among other options. To assist in the interpretation of the environment there are two visitors centers. In the Tamar Project every night there are environmentally-themed videos and lectures are held on topics related to the archipelago. The ICMBio (Brazilian agency responsible for national protected areas) Visitor Center is undergoing reformulation. There is also a museum for the sharks and a memorial that presents the historical aspects of the island.

The community trainings are performed continuously. The “Centro do Golfinho Rotador” (Spinner Dolphin Center), offers free courses, such as english, management, scuba diver, dolphin watching guide, and in 2007 offered the first course of geotourism guide in Brazil.

Population growth in Fernando de Noronha is controlled. The entry and stay of visitors are limited and everyone must pay the Environmental Preservation Tax. This fee is to ensure the maintenance of environmental conditions of the archipelago, created to preserve the safety and comfort suitable for the wellbeing of the community and visitors.

There are several trails and natural viewpoints and guidelines must be followed: There is a restriction on diving in certain areas, local guides are required in certain trails, the National Park trails and beaches closes during the night and in some geological monuments the visitation is prohibited.

According to the Brazilian Geological Survey (CPRM, 2011), the area presents important geological, geomorphological and geotouristical aspects, highlighting the exceptional beauty of the landscape. 26 geosites were classified, i.e. Morro do Pico, Dois Irmãos Islands (Fig. 2), Porcos Bay, Sancho, Leão and Atalaia Beachs, Caieira Enseada, Buraco da Raquel, among others. These aspects when coupled with other attributes observed in the area justify the creation of a geopark, under the auspices of UNESCO.

This way, actions are being carried out: a PhD research on the topic (Moreira, 2008), a Guide training course about Geotourism (Moreira & Bigarella, 2008), lectures on geotourism and

Geoparks (2008) and the publication of the island's Geological Guide in 2009. In 2012 a further visit to the archipelago was made to encourage the community to initiate actions for the composition of an application package. Presentations were made at meetings of the National Park Management Council, Tourism Council of the Archipelago, meetings with local NGOs, a lecture to the community at the Tamar Visitors Center, and proposals for Econoronha (the concessionaire of the National Park) and the chief of the two protected areas.

The feedback was positive and the next steps in 2013 and 2014 are start other actions related with the preservation of the geosites, involve the community in educational activities, develop interpretive resources, encourage new enterprises and create geoproducts. In the future, the Archipelago can be recognized and has the potentiality to integrate the Global Geoparks Network.

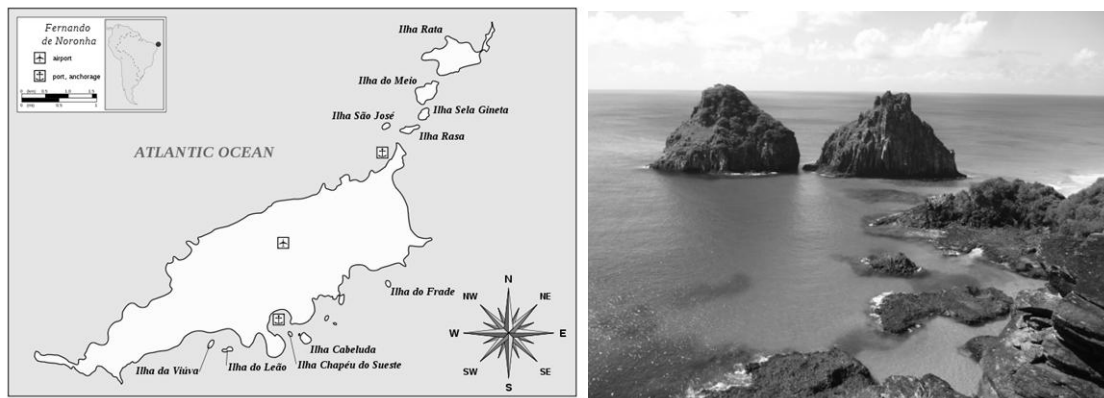


Fig. 1: Location map of the Fernando de Noronha Archipelago - Brazil. Source: Wikimedia Commons, 2011. Fig. 2: Dois Irmãos Islands and Porcos Bay.

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IT'S NOT ONLY GEOTOURISM ! TYPES OF TOURISM IN GEOPARKS, AN ANALYSIS BASED IN 37 GEOPARKS

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Keywords: *Geotourism, Tourism, Segmentation, Geoparks*

Tourism comprises the activities of persons traveling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes not related to the exercise of an activity remunerated from within the place visited (OMT, 2003).

It is characterized by being a socioeconomic and cultural phenomenon, as it involves contact with people and different cultures. This is an activity that has been performed increasingly in the world and therefore has been acquiring importance in world economic growth, since it is an alternative that can be used to engage communities.

The tourism activity happens because people travel with different motivations, such as searching for places to relax, do sports, meet different cultures, escape the routine, among other reasons. Therefore, tourists seek tourism in a way to satisfy these needs, leaving aside what they do normally.

Since that were created Geoparks, Geotourism is becoming more popular. Unlike the traditionally assumed view of Geotourism as an activity mainly depending on scientific and administrative factors, the potentiality and development of Geotourism depends largely on purely touristic constraints such as financial sources, touristic merchandising and facilities, and easy connections with other touristic products, as well as the financial agreements and “bridges” with local Administrations. All these factors lie far behind the purely scientific interest of the site. We are speaking about accommodation and eating facilities, the quality of accesses and services, and the excellence and attraction of merchandising products (Meléndez et al, 2011)

Geotourism integrates the Guidelines and Criteria for National Geoparks seeking UNESCO's assistance to join the Global Geoparks Network, since an analysis of geotourism potential of the proposed Geopark is necessary.

However, this is only one form of tourism that can be found on Geoparks. On the other hand, many of these places already had a vocation for tourism before join the Global Geopark Network.

Considering that the tourism plays an important role in Geoparks, the objective of this study was to perform an analysis about the other types of tourism that we can found in Geoparks. The study was realized with 37 members of the GGN, from 18 countries, from the viewpoint of their representatives. The questionnaires were applied personally during the 10th EGN in Norway, the 2011 International Congress Geotourism in Action, in Portugal and directly in Geoparks. They were also mailed to all other members of the network. With these collected data were generated graphics and an analysis was done.

The European Geoparks represent 78% of respondents, 28 Geoparks: five Geoparks from Spain, four from Italy, three from France and Germany, two from England, Norway, Portugal, Ireland, and Scotland, and one from Czech Republic, Finland and another one transboundary between Germany and Poland.

Asian respondents were six Geoparks: one from Malaysia, one in Vietnam, two from China and Japan. North America is represented by its only Geopark (in Canada) and South America also for its only Geopark (in Brazil).

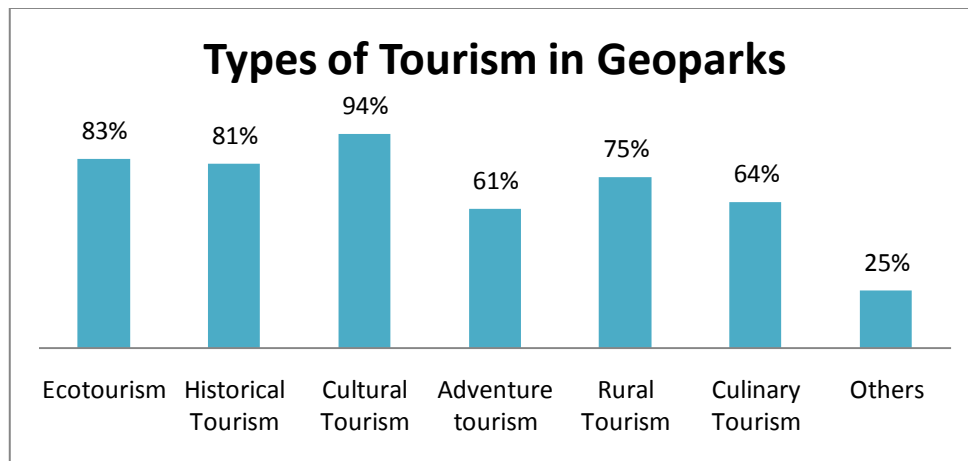


Fig.1. Types of Tourism in Geoparks, an analysis based in 37 Geoparks.

The main question was which other types of tourism that could be found at the Geopark. The results showed that the Cultural Tourism are the most popular type of tourism that we can find in Geoparks, followed by Ecotourism (83%), Historical Tourism (81%), Rural Tourism (75%), Culinary Tourism (64%), Adventure Tourism (61%) and others (25%). Between the other types of tourism cited are: Religious tourism, beach tourism, fishing tourism, scientific tourism, cruise ship tourism, thermal tourism, among others.

It is known that an area to become a Geopark, need not just geosites, but also cultural characteristics and this is what makes each Geopark unique. In many societies, natural, cultural and social history are inextricably linked and can not be separated. Since the connection of Geoparks with the tourism in natural areas (Rural, Adventure, Ecotourism, among others mentioned) is evident, as a Geopark must have representative areas related with the Geological Heritage. It is worth mentioning that many of these attractions, by itself, already attracted tourists.

Anyway, all these types of tourism, together with the Geotourism, are bound, since the interpretative resources and the entire tourist infrastructure will be used for any of these segmentations identified (Moreira, 2011). Regardless the type of tourism, it is important to involve professionals in tourism planning, respect the carrying capacity of attractions and offer a tourist product with quality.

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VALORISING PALAEOLOGICAL HERITAGE THROUGH THE DESIGN OF GEOPARK PRODUCTS

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Keywords: *Sierras Subbéticas, geotourism, merchandising products, ammonites, CETS*

Through the development of tourism products related to geological heritage, geological tourism materializes in Geoparks territories.

The valuable heritage of the European Geoparks can be reflected in “Geopark products” inspired in landscapes, fossils, rocks, geological structures, etc., contributing to strengthen the identity of territories.

In Sierras Subbéticas Geopark (Andalusia, South Spain), ammonites have special relevance among fossil organisms. They are very abundant in Jurassic and Cretaceous rocks and show a high morphological diversity through time. The study of ammonites in this territory has contributed to outstanding scientific advances, especially regarding biostratigraphic and phylogenetic analyses.

All inhabitants in Subbéticas are familiar with ammonites. They know well where to find the best samples; they consider them as something as their own. They can daily watch them in paving stones, facades, fountains, benches, etc. However, very few people know the term “ammonite” or their approximate age or any aspect about their way of life.

From the park’s management, ammonites have been chosen as the undeniable Geopark’s emblem. Their origin and characteristics are disseminated among society, and the beauty of their varied shapes are used to inspire the design of merchandising products, especially handcraft.

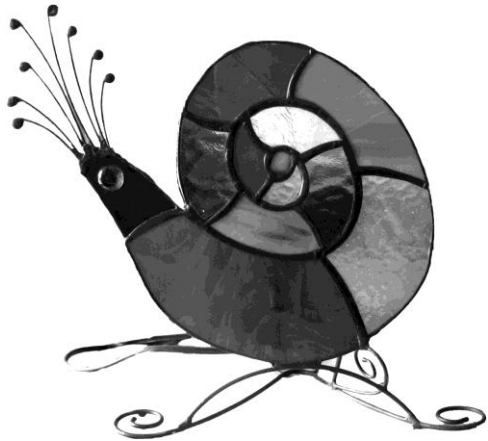
In order to create Geopark products, the following strategy was designed in Sierras Subbéticas Geopark.

Contracting of a geologist with specialized knowledge in design. The involved enterprises are technically and aesthetically advised. The Geopark not only supervises the initiatives of enterprises to guarantee accurate and up-to-date information, but also can provide them with scientifically based designs and with texts containing geological information expressed in an accessible language. This facilitates and accelerates the creation of Geopark products.

The European Charter for Sustainable Tourism (ECST) forum meetings. In Subbéticas there are 25 enterprises adhered to the ECST. The Geopark’s management has taken advantage of this meetings formed by entrepreneurs strongly committed to environmental practices. Through the creation and introduction of Geopark products, sustainable Geotourism is enhanced in the territory. Besides, the Geopark searches for entrepreneurs with potential to develop products and these are invited to participate in the forum meetings. Through speeches on the Geopark, on the importance of conserving and promoting the geological heritage, on the advantages of participating in this project, enterprises are encouraged to create Geopark products.

In the frame of the ECST forum, Geopark products are promoted by the group of enterprises concerned, constituting a cooperating network under the auspices of a common branding, “Geoparks”, that provides them with visibility and strength.

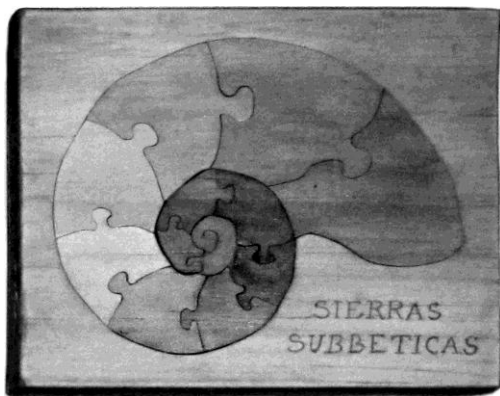
The development of Geopark products can be considered a powerful tool that allows a strong population involvement and a boost for economic local development. Products contribute to promote collaborating enterprises, to disseminate geological values in the territory, to raise visibility to the European Geoparks Network and to strengthen the local identity of a region through its natural heritage.



‘Fig. 1 Vidriomundo (Cabra): ammonite lamp screen made of glass, designed by S. Subbéticas Geopark’.



‘Fig. 3. Pensión Guerrero (Cabra): guesthouse decorated with Geopark motifs, sale of Geopark products.’



‘Fig. 2. Arteamano (Priego de Córdoba): ammonite puzzle made of wood.’



‘Fig. 4. Castellarejos Hotel (Luque): Ammonite shell made with swimming pool tiles. Designed by S. Subbéticas Geopark’

*FACIES AND PALEOENVIRONMENT OF THE PERMIAN
MENGKARANG FORMATION AND ITS IMPLICATION TO THE
POTENTIAL OF JAMBI PALEOBOTANY*

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Keywords: *Mengkarang Formation, Permian, Jambi province*

The flora fossil that was found in Jambi region is the oldest flora in Southeast Asia, and it is connected to the flora of Cathaysian and Euro American provinces. The fossil content with 250-290 million years ago was discovered in Mengkarang Formation that outcrops in Jambi Province, located at Indonesia. Were found exemplars of stems and leaves of Lepidodendraceae family with Carboniferous age, and a branch with a shape of fork of a Sphenophyllaceae which lived from the upper Devonian until the Permian.

The Mengkarang Formation contains remnants of volcanic activities such as ash falls and pyroclastic flows, which contains high contents of silicate. Therefore, plants have been preserved. The fossil samples of flora have been studied in laboratory, in order to predict the depositional environment. The Mengkarang formation can be divided into two separate associations based on the composition of its floral assemblages through the different species composition and ecology. In the early Permian, the sea level changed. Fusulinids and brachiopods, found in the limestones, indicate deposition changes into shallow marine environments, lacustrine and non-marine environments, which are characterized by sandstone alternating with mudstone where coal is inserted.

The concept of organic facies can be a parameter for the interpretation of depositional environment of the Mengkarang Formation.

OUTCOMES FROM 5TH INTERNATIONAL UNESCO CONFERENCE ON GEOPARKS AT UNZEN (JAPAN)

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Keywords: *International Geoparks Conference, Japan Geoparks Network, Unzen Volcanic Area Global Geopark, Shimabara declaration*

Fifth International UNESCO Conference on Geoparks successfully ended. It was held in the Unzen Volcanic Area Global Geopark, Japan, during May 12-15, 2012. The main theme of the conference was “Earth heritage and sustainable development”. Five hundred and ninety three (593) people made registration in this conference from 31 countries and areas. This is the largest number of attendees in geoparks conferences. Top four countries of attendees are Japan (287), China (153), Korea (21), and Indonesia (18); 89 % of the attendees came from the Asian-Pacific region.

Unzen is one of the active volcanoes in Japan. In this volcano, 44 people became casualties of volcanic ash flows in the last eruption (1990-95) and 15,000 people were killed by volcanic landslide and tsunami in 1792. On March 11, 2011, huge tsunamis occurred in the eastern coast of Tohoku, soon after a big earthquake with the magnitude 9.0, taking away lives of about 19,000 people including missing. Considering these geohazards in Japan, holding the international conference held in Unzen-Japan had become important to exchange the information and experiences of these disasters and recovery from them among the geopark communities. Therefore, session themes of the conference included “Geohazard and recovery from disaster”. Totally 234 papers were accepted by the science committee, and about 80 % of them were really presented in this conference. About half of them were done in posters.

The main venue located in the City of Shimabara. This city had the experience of international conference of volcanology (Cities on Volcanoes conference of IAVCEI) in 2007, with the size almost similar to this conference. Therefore, citizens of Shimabara were used to hold the international meeting. Again this time, many events welcoming the attendees were held in many places outside the venue during the conference. Local people joined the opening and closing ceremonies and came to enjoy plenary talks, public forums and the Geopark Fair.

Presently 20 geoparks, including 5 global ones, scattered throughout Japan, and make up the Japan Geoparks Network, most of which are sponsored by local municipalities (prefectures, cities, towns or villages depending on geoparks). The central government had been not positive to the activity of geoparks in Japan. In the opening ceremony, however, the Vice-Minister of Environment, Japan, promised that the Environment Ministry side will coexist with and support the geopark activity to recover the National Park in Tohoku, strongly damaged by tsunamis. Therefore, this was a good advance for the Japan Geoparks Network.

As one of characteristics of this conference, five public forums run in parallel to usual conference sessions; geotourism, geoguides, disaster prevention, kids' Q&A with presentation, and Kitchen Volcano (experiment) forums. Local peoples and Japanese geoguides joined these forums. To make a good communication, simultaneous translation between English and Japanese were operated in these forums. School pupils also joined some of public forums, and welcomed the attendees with their performance in their schools during the mid-conference excursions. As a total, 5,300 people joined the official events of this conference including these forums. The Royal family of Japan (Imperial Prince and Princess, Akishino) attended the Kids'

Q&A forum on the second day. They exchanged views on geoparks with members of the GGN Bureau and the Organizing Committee, and dropped by exhibition booths of the Geopark Fair (Fig. 1).

The Shimabara declaration was issued in the closing ceremony. The declaration includes utilization of tsunami experiences of March 11, 2011 in order to mitigate future possible natural disasters in geoparks over the world. Geopark is the most effective platform to educate the natural power of our Planet and geodisasters. Roles of geoparks in climate change debate and in natural resource management were noted. Establishment of cooperation among geopark-related communities and the importance of networking for sustainable development were also written. Our experience of holding this conference confirmed that the direction of Japanese geopark activity we had taken was not wrong, and that we can contribute to sustainable development of geopark activity in not only Asian-Pacific but the world.



Fig.1. Imperial Prince and Princess, Akishino-no-miya (left), listening to our explanation in the GeoFair at Shimabara City, Japan, on May 13, 2012.

ROKUA GEOPARK OUTDOOR GUIDE

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Keywords: *Rokua Geopark, outdoor guide, geo sites, LiDAR technique*

In the spring of 2012 the Geological Survey of Finland published a new outdoor guide for Rokua Geopark intended for hikers and all people interested in nature. The guide contains information on the geological development of the region as well as the bedrock and origin of the Rokua esker area. The hiking routes and geo sites have also been marked on the guide and described by explanation texts and photos. The guide contains 64 pages, 50 of which are maps.

The landscape of Rokua Geopark is a combination of landforms which can be divided into seven categories on the basis of their age and geological origin.

- Bedrock (gneisses, age 2,700–2,500 Ga; granites and schists, age 2,060–1,790 Ga; sandstones, siltstones and shales, age 1,200–600 Ga).
- Glacial deposits/landforms (drumlins, hummocky moraines and end moraines, age 11,700–10,500 years)
- Glaciofluvial deposits/landforms (esker core and deltas, age 11,100–10,500 years; kames and kettle holes, age 10,700–9,700 years)
- Littoral deposits/landforms (beach ridges, shoreline terraces and shore cliffs related to the land uplift stages between 10,400–3,000 years ago)
- Aeolian deposits/landforms (dunes with superimposed blowouts, shore dune-ridges and deflation basins, age 10,000–7,000 years)
- Fluvial deposits/landforms (deltas, ravines and meanders, age 9,500–)
- Peat deposits (mires, age 9,500–)

In the terrain all these landforms are linked one to another in a puzzle-like manner. Together, they precisely tell the geological history of Rokua Geopark. In the outdoor guide, the terrain is represented by a puzzle-like graphic, which also serves as a table of contents. The maps are based on the quaternary and bedrock field mapping, an inventory of the geosites and above all a laser scanning elevation model. (LiDAR, Light Detection and Ranging).

Airborne laser scanning is an active method where a spray of laser beams are sent into the terrain to illuminate the Earth's surface, while photodiodes register the backscatter radiation with remarkable accuracy. Laser beams find their way to the surface even through tight tree canopies.

The National Land Survey of Finland started the production of the new nationwide digital elevation model in 2008. The model, used in the maps for the Rokua outdoor guide, is a two-meter grid with a height accuracy of 0.30 meters. This kind of exact model brings out many new geological details of the target area. It provides a decisive advantage in regional inventory of minor morphological features. In Rokua, it proved to be a very useful method especially in the mapping and interpretation of the complex network of kames, kettle holes, dunes and shore deposits. Fig.1.

The accurate airborne digital elevation data provides for new applications as well as it makes it possible to improve current ones. Laser scanning data results in savings and can accelerate several processes for a variety of users. In Finland, the most common applications for airborne

laser scanning are forest inventory, flood protection, geological mapping and archeological studies. The data produced by the National Land Survey of Finland is free of charge.

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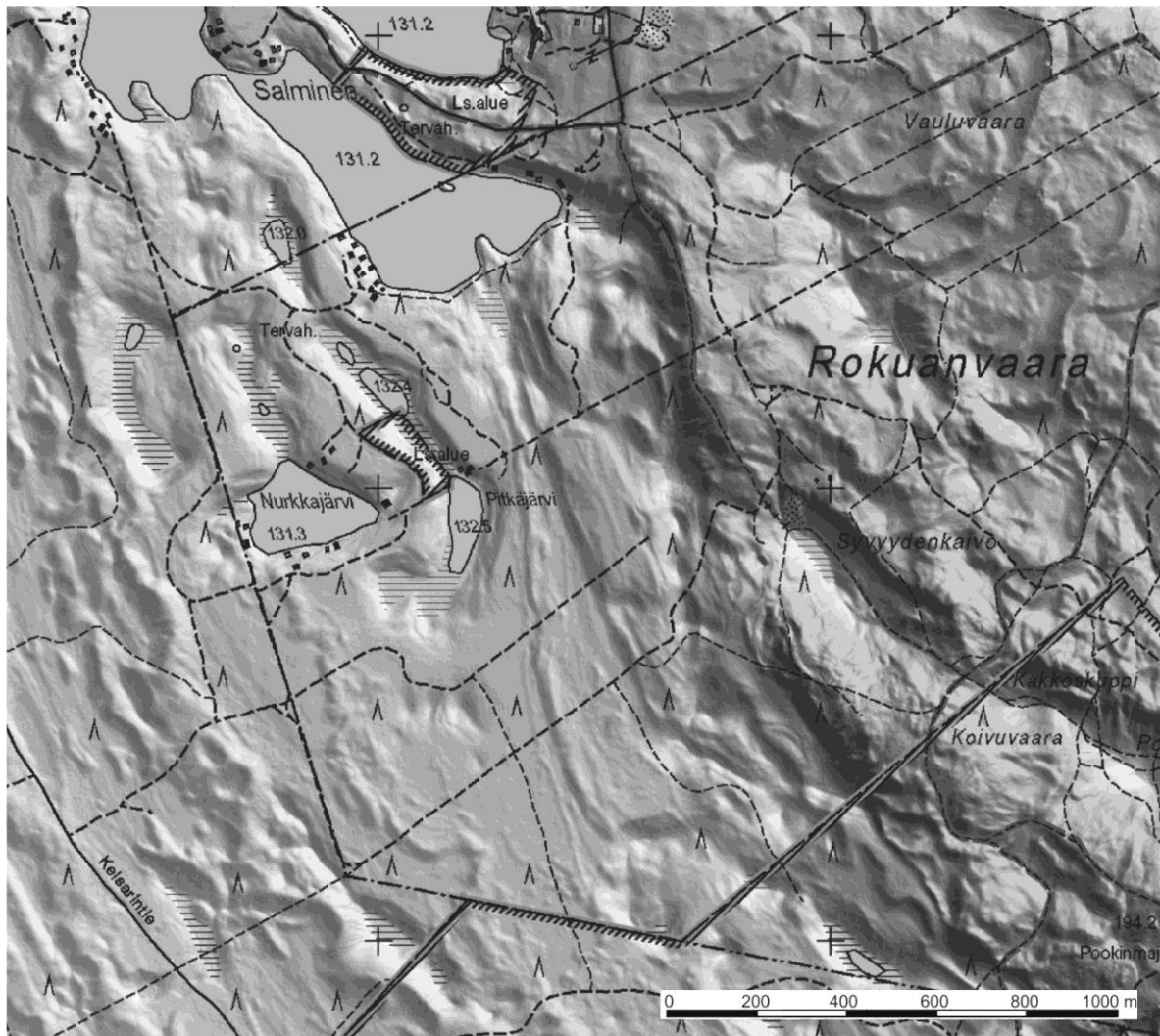


Fig.1. An example of the detailed elevation model in the Rokua outdoor guide.

BUILDING A GEOPARK WITH A BRIGHT FUTURE IN THE OKI ISLANDS GEOPARK

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Keywords: *Oki Islands, Geotourism, Japan Geoparks Network*

The Oki Islands Geopark (Japan Geoparks Network) encompasses the entire Oki Region, including the four inhabited and 180 uninhabited Oki Islands, as well as the surrounding sea area of the islands. The Oki Islands are located in the Sea of Japan, the world's newest marginal sea.

One of the unique features about the Oki Islands Geopark is the fascinating mix of flora and fauna that is intricately connected to the islands' geohistory. The influx of sub-boreal (subalpine) zone vegetation that occurred during the coldest stage of the last ice age can still be seen today, mingled with warm-temperate (basal) zone vegetation. This unique ecosystem is linked not only to environmental elements such as terrain and climate, but also to the origin of these islands and their geography. The foundation for this diverse vegetation is the geology of the land. The basement of the Oki Islands is a fragment of the Eurasian Continent, left behind during the formation of the marginal sea, and later overprinted by volcanic activity. This process and combination of activity is unusual throughout the world, and provides important clues to understanding the process of the expansion of the Sea of Japan, and the separation of land from the continent. Moreover, coastal erosion of these rock faces has created stunning coastal scenery and many uniquely shaped rocks.

In summary, the Oki Islands Geopark features a unique ecosystem that incorporates relict species from the last ice age, and geology that records the geohistory of the islands. However, it is also a place where visitors can experience the unique traditions and culture inherited from many different origins and times, and preserved throughout the long history of the islands. These key elements of the geopark can be summarized in the following points.

1. Geological diversity: Over 20 different types of rocks record the geohistory of the islands.
2. Ecological diversity: Subarctic plants that spread to the islands during the ice age and subtropical plants mingle to create a unique and fascinating distribution of plants.
3. Cultural diversity: A long history that dates back to the excavation of obsidian in ancient times. Ancient cultural features that developed on the isolated island have been preserved over time. The complex topography of the islands created isolated communities, fostering the high cultural diversity found within the islands.
4. Scenic diversity: Stunning eroded coasts have been carved by the rough waves of the Sea of Japan, and interesting geography formed by rocks of different types and compositions.

As isolated islands, influence from outside has been minimal. Consequently, the connections between the above themes of geology, ecology, culture and scenery, are clearly observable, and visitors can enjoy the many interconnected stories of the islands. The Oki Islands Geopark utilizes these abundant natural resources to develop geotourism, and teach visitors and locals alike about the Oki Islands, and about the earth.

This form of geotourism runs in conjunction with community activities that have been carried out at the local level long before the geopark initiative. These activities were commenced with the important objective of revitalizing, and increasing the value of the Oki Islands, so that local residents can become proud of their islands, and realize the importance of their conservation and protection. As a result, local people have been the main instigators of the geopark movement, with geo-guide training seminars and geopark seminars carried out by groups in the private sector. This community involvement is one of the strengths of the geopark.

We are working hard to ensure that the Oki people are proud of their islands, especially the children who will support the geopark in the future. As a result of geopark education sessions, primary school, junior high school and senior high school students alike who had previously harbored inferiority complexes about their small, isolated islands, are becoming proud of their home. This process is both uniting and revitalize the region, and enabling the people of Oki to convey the value of their home to our visitors.

With the people of Oki at the heart of the geopark, their sense of ownership of the geopark is increasing, and helping develop a sustainable and vibrant geopark.

AZORES ISLANDS AND QUATERNARY VOLCANOES GEOPARKS: A NETWORKING PROPOSAL

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Keywords: *Azores Islands, active volcanoes, Quaternary, geoparks, management.*

The Azores archipelago is located in the North Atlantic Ocean (about 1,815 km from Portugal Mainland and 2,625 km from Canada) at the Azores Triple Junction, where the Eurasian, Nubian and North American tectonic plates interact, with an important seismic and volcanic activity. It comprises 27 volcanic systems all over the islands, 16 being active either as polygenetic central volcanoes, either as fissural volcanic ridges. About 95% of its 2,324 sq km terrestrial volcanic landscape was built by quaternary volcanism, with an impressive footprint of volcanic forms and structures, such as scoria and pumice cones, tuff cones and rings, *maars*, composite volcanoes, calderas, prismatic jointing, hot springs and fumaroles, and lava caves.

Worldwide many geoparks volcanic areas exhibit similar landscapes and thus have similar management challenges, both on social, economical, educational and environmental approaches: in June 2012, among the 88 global geoparks (from 27 countries) and the 50 European geoparks (from 18 countries), about 1/3 overall comprise territories with recent/quaternary volcanism. At the aim of the Azores Geopark project, a networking proposal is made to enhance cooperation among the global geoparks having such a common characteristic, as a way to better implement and improve responds to the above mentioned challenges.

To achieve such goal, a questionnaire was prepared to be sent to every global geopark, allowing a better understand of each territory in what concerns volcanism. The questionnaire includes questions such as: i) do you have volcanic rocks in your territory?; ii) what is the maximum expected age of your volcanic rocks?; iii) what is the younger age of your volcanic rocks?; iv) do you have active volcanism in your territory?; v) when was the last eruption in your territory? To the Azores Islands territory those answers are: i) *yes*; ii) *8 to 10 million years*; iii) *about 10 years*; iv) *yes*, and v) *1998-2001 A.D.*

The questionnaire is the first task of a step-by-step approach for the establishment of cooperation between the Azores geopark and other volcanic territories of the EGN with common characteristics and interests. Thus, through that questionnaire and the answers obtained, it is expected to: a) reinforce networking amongst geoparks; b) strength cooperation among the geoparks staffs and communities; c) built a global database for the “volcanic geoparks”, and d) better understand and share management policies on social, economical, educational and environmental impact of active volcanism.

BURREN ECOTOURISM: THE 'FACE' OF THE BURREN & CLIFFS OF MOHER GEOPARK

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Keywords: *Tourism, Networks, Marketing, Visitors, Geoparks, Destination*

In the context of Geoparks' role in supporting the economic advancement of a region, the development of a general visitor image linked to the geological heritage might be considered a particular challenge. To the average visitor, the concept of a Geopark, with all it represents in terms of geology, tourism and community, is a relatively new and intangible concept. 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.

Since early 2008, the Burren Connect Project, which managed the application for Geopark status for the Burren and Cliffs of Moher, has played a lead role in conceptualising and facilitating the development of an ecotourism network, comprising tourism operators within the region. The existence in 2011 of a strong network of accredited ecotourism businesses was one of the critical deciding factors in the region attaining the award. During 2012, the Burren Ecotourism Network has more than doubled its membership, from 18 businesses to 38, and considerable interest exists from further Burren-based businesses to become involved. It therefore now provides that important critical mass of businesses upon which a destination management strategy can be built.

The joint evolution of the Burren Ecotourism Network and the Burren & Cliffs of Moher Geopark have provided the key elements for traditional tourism destination management. Tourism destinations are a mix of tourism products, experiences and other intangible items promoted to consumers. They are therefore much more than the place, more than the landscape and natural heritage, more than an individual product or experience, 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.

An example of good practice in the development and management of this very organizing framework exists in the Burren & Cliffs of Moher region. The relationship between the Network and the Geopark is symbiotic, collaborative and mutually beneficial, and has led to the evolution of ever-stronger, more visitor-focused marketing and communications materials. It is recognised that the optimum route to commercial success is through pooling their combined resources and working closely in the areas of strategy, marketing and public communications. On the one hand, the Geopark comprises both physical and administrative resources as well as the capacity to provide leadership and vision. On the other hand, the members of Burren Ecotourism provide the people, places and experiences that translate the physical landscape and geological heritage into that all-important destination in the mind of the visitor. It is these elements that give a public face to the Geopark. See Fig. 1.

Following extensive discussion and reflection on the commercial promotion of the sustainable tourism product in the region, the Geopark and Network have begun the destination marketing and planning process. The objective is to place a focus firmly on the visitor and what he/she

can do in the area, to emphasise the holiday experience, while remaining true to the principles of ecotourism that underpin it. Strong people-centred images and messages, that highlight interaction with the landscape rather than the landscape itself, are essential as well as the words and verbal interpretation that allow the Geopark to speak to the visitor in the language of the visitor.

The maintenance and further development of a strong and vibrant ecotourism network comprising local businesses continues to be a strategic pillar of the Burren & Cliffs of Moher Geopark. The evolution of the Burren Ecotourism Network has been informative and challenging. Important factors critical to achieving a viable, enduring network have been identified. These included selecting businesses and experiences, providing training and certification, creating and communicating a vision, allowing and creating space for relationship-building between businesses, promoting collaboration at the level of the destination, benchmarking success, securing support from funding agencies and, above all, allowing time for an organic, bottom-up ownership by participating businesses.

The Burren and Cliffs of Moher Geopark together with the Burren Ecotourism Network is providing visitors, businesses and the local community with a template for the development, imaging, verbalisation and promotion of a sustainable tourism destination.

Fig. 1. Elements of the Burren & Cliffs of Moher Destination



GEOTOURIST AND HIKING MAP OF THE APUAN ALPS: THE FINAL PROJECT

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Keywords: *geotourism, mapping, footpaths, geosites, tourist facilities*

The Geotourist and Hiking Map of the Apuan Alps is a key non-material activity that the Apuan Alps Geopark, as a new EGN/GGN member, must develop in the four-year period 2011-2015. This project is now in its final phase, supported by the belief that a map of this kind represents the best tool to familiarize the general public with the geological and geomorphological elements of the Apuan Alps and thus to appreciate their great scientific and environmental value through their direct experience of trekking in Nature.

Since the Geopark covers a mountain area, footpaths are the better, if not exclusive, communication routes to reach the sites of geotourist enjoyment and not only (viewpoints, peaks, ridges, climbing walls, karst system accesses, mountain huts, rest areas, etc.). Consequently, the CAI footpaths (CAI is the Alpine Club of Italy) have been completely redrawn and geographically referred on the most detailed available topographic base (the Technical Map of the Tuscany Region). Across the whole Apuan Alps range the CAI footpaths provide a very extensive network of connections (more than 600 km!) which are regularly maintained in order to ensure safety in the Geopark (Fig. 1).

The basic geological information is provided as in a traditional geological map, with adjoining polygons depicted with different colours (the colours are deliberately very soft so as not to affect the reading of the footpath tracks). The differentiation of these areas follows two main parameters: the age of the outcropping rocks (Paleozoic Era and Periods for post-Paleozoic ages) and their basic classification (sedimentary rocks vs. metamorphic rocks). The Geological Map of the Apuan Alps (1:50.000 scale), published by the Park Authority in 2000, was the initial geological map used for subsequent analyses and processing.

The geological/geomorphological emergencies were highlighted above the simplified geological map. The shown geosites are those collected in the Geosite Inventory created by the Park Authority. Their number, which is continuously increasing, now comes to 253 geosites. The legend uses symbols (points, lines, areas) which allow for the direct understanding of the simplified meaning of each geological site. In this way the landscape aspects more easily recognizable in the field are emphasized.

Further content of the Geotourist and Hiking Map of the Apuan Alps is the tourist facilities (mountain huts, museums, visitor centres, information points, etc.). A special label is reserved for facilities certified by the Park Authority for their eco-friendly choices.

The final result is a map on a 1:20.000 scale with legends in two languages (Italian and English) derived from combining geological, hiking and tourist content, developed in a GIS project using the ARCVIEW ESRI software. The Geotourist and Hiking Map of the Apuan Alps aims to be an essential document for hikers who want to trek the Apuan footpaths and a tool to disseminate geological and environmental information, with simple but scientifically correct content, addressed to a non-specialist audience and territorial operators (Park and Geopark guides, hiking guides, tour leaders, teachers, etc.). The Map will be printed on a two-sided sheet (4 sides) of paper by the end of 2012.

Since the Map is derived from a GIS project, the further development of the project will create a dynamic and interactive map available via web that will allow each user to select content according to their interests and skills, benefiting from a wealth of information through the activation of additional hyperlinks.



Fig. 1. Signs at the intersection of CAI paths; in the background the peak of Pizzo d'Uccello Mount (1781 m asl).

THE PROTECTED EVAPORITE AREAS NETWORK OF SICILY

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– ³Rete delle aree protette ricadenti in territori con presenza di rocce evaporitiche

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Keywords: *evaporites, Messinian, protected areas network, karst, Sicily*

Evaporitic rocks of the Messinian Gessoso-solfifero Group extensively crop out throughout Sicily, covering an extended area for more than 1.000 km², mainly located in the central and western part of the Island. Gypsum rocks included in the evaporitic outcrops are characterized from very interesting and scientifically important karst features; in these areas we can find both surface (karren, gypsum bubbles, dolines polje) and subterranean forms, such as caves and ponors.

Thanks to the presence of these important features, during the last decade of the twentieth century the Sicilian government set up some natural reserves aimed at protecting and improving gypsum karst morphologies.

Recently, with the decree of 01/23/2012, the Regional Councilor of Environment, set up the “*Sicilian protected evaporite areas network*” (Rete delle aree protette ricadenti in territori con presenza di rocce evaporitiche) that includes Natural Reserves and Parks listed here:

Province	Protected area	Management	Natura 2000 Network	Geopark
Agrigento	Nat. Res. Torre Salsa	WWF Italia	SCI	-
	Nat. Res. Grotta di S. Angelo Muxaro	Legambiente Sicilia	-	-
Caltanissetta	Nat. Res. Monte Conca	CAI Sicilia	SCI	-
	Nat. Res. Lago Sfondato	Legambiente Sicilia	SCI	-
	Nat. Res. Lago Soprano	Prov. Reg. Caltanissetta	SCI	-
	Nat. Res. Monte Capodarso e Valle dell’Imera meridionale	Italia Nostra	SCI	Rocca di Cerere Geopark
	Nat. Res. Contrada Scaleri	Prov. Reg. Caltanissetta	-	-
Enna	Nat. Res. Lago di Pergusa	Prov. Reg. Enna	SCI/SPAs	Rocca di Cerere Geopark
Palermo	Nat. Res. Grotta di Entella	CAI Sicilia	SCI/SPAs	-
	Nat. Res. Serre di Ciminna	Prov. Reg. Palermo	SCI	-
	Regional Nature Park of Madonie	Ente Parco Madonie	SCI/SPAs	Madonie Geopark
Trapani	Nat. Res. Grotta di Santa Ninfa	Legambiente Sicilia	SCI	-
	Nat. Res. Lago Preola e Gorgi Tondi	WWF Italia	SCI/SPAs	-

The aim of the “Network” is:

- a) to create a point of reference about the themes of evaporite territories;
- b) to create a common data base about geological and geomorphological features connected with a geographic information system (GIS) and a dedicated web site;
- c) to promote common projects for study, research, land management and adoption of best practices in joint venture with others bodies, public administrations, universities, research centres, associations, etc.;
- d) to contribute to locating and studying evaporite areas still unprotected;
- e) to realize theme and integrated itineraries about geological, landscape, nature ad cultural features to encourage a scientific and year round tourism;
- f) to realize didactic itineraries, seminars and workshops on evaporite themes for school and university students;
- g) to create partnerships with national and international subjects interested in similar geological and natural features (protected areas, research centres, etc.), with the possibility of joining organizations like the *European* and/or the *Global Geoparks Network*.

For these activities the contribution of the two sicilian European & Global Geoparks (Rocca di Cerere Geopark and Madonie Geopark) that participate in the network with their representatives will be fundamental, due to the experience already proved regarding the study and protection of the geosites and in order to valuate them in geoturistic terms according to the principles laid down by the E.G.N..

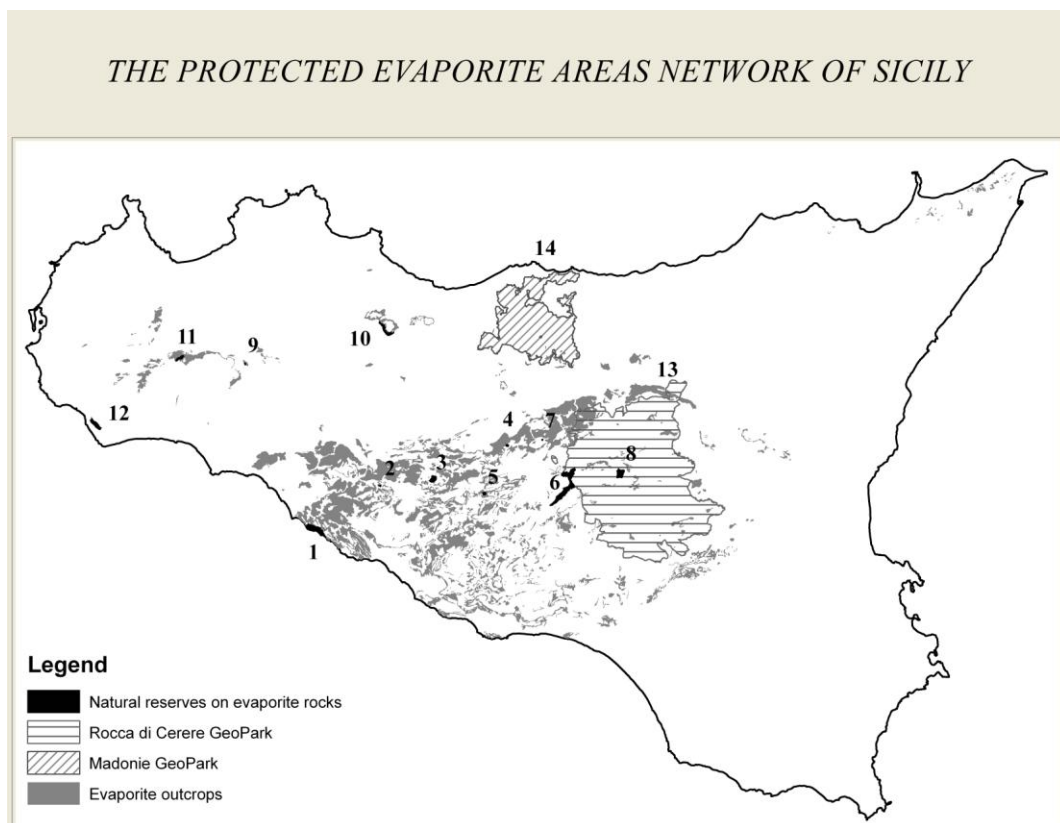


Fig.1. Natural reserves: 1) Torre Salsa, 2) Grotta di S. Angelo Muxaro, 3) Monte Conca, 4) Lago Sfondato, 5) Lago Soprano, 6) Monte Capodarso e Valle dell’Imera meridionale, 7) Contrada Scaleri, 8) Lago di Pergusa, 9) Grotta di Entella, 10) Serre di Ciminna, 11) Grotta di Santa Ninfa, 12) Lago Preola e Gorgi Tondi, 13) Rocca di Cerere Geopark, 14) Regional Nature Park of Madonie (Madonie Geopark).

THE VILLAGE OF MONTIROND, SUSTAINABLE DEVELOPMENT IN PARTNERSHIP WITH THE CHABLAIS GEOPARK, FRANCE

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Keywords: *sustainable development, geotourism, heritage valorisation*

Montriond is a mountain village resort located in the heart of the French Chablais that covers 24.7km². The population as censored in 2006 stood at 812 inhabitants, a figure that is growing annually. The primary economic driver of the village is tourism, with large numbers of seasonal visitors in winter attracted by the skiing, and in the summer for the walking, mountain biking and other mountain leisure activities.

The council has been working to improve and develop the village. This work has been undertaken within the framework of the two principal territorial initiatives of the Chablais, the SCoT (Programme for Territorial Coherence) and the Chablais Geopark. The former, the SCoT, is an integrated planning tool for the Chablais territory addressing issues including town planning, sustainable transport, economic development and the environment. The Chablais Geopark is seeking to promote sustainable development, heritage valorization and education. To this end, the SCoT and Chablais Geopark overlap strongly on two themes (i) Objective 2 of the SCoT, to offer a high standard of living and a quality environment to the local population, and (ii) Objective 3 of the SCoT, to support and promote economic development in the Chablais.

Within these frameworks, Montriond has promoted a series of initiatives in partnership with the Chablais Geopark. Examples of the actions undertaken include (i) the annual Lind'Art Festival, a classical music festival with its associated geological talks, exhibitions and workshops; (ii) stakeholder participation in the geological training offered by the Chablais Geopark; and (iii) inclusion of Montriond Lake, a Chablais Geopark geosite, in the GeoRoute (Fillon et al. 2011). Lake Montriond is a very important tourist site for the village both in winter and summer; it is also the location of an important new village amenity where a number of GeoRoute panels are to be installed in autumn 2012.

This partnership has been carefully developed across a range of themes and knowledge has been disseminated both to the community and to the visitors to the town. It has provided an effective means of explaining the history behind the landscape and permitted local re-appropriation of the village's heritage. During this presentation the nature, results and future of this partnership will be further developed.

J.P. Fillion et al. (2011). Implementation of a georoute in the aspiring Chablais Geopark. Colloque European Geopark Network, Oslo,



Fig.1. Salle du Baron, geosite 'Lake Montriond' of the Chablais Geopark, Village of Montriond. The site will feature a covered picnic area complemented by with information panels at both ends of the lake to explain the heritage of the site : The Baron de l'Espée, The Mappes Sardes and the geological formation of this important site. Source: Montriond Village Magazine, June 2012.

GUIDING GEOTOURS ON THE FIELD IN MOUNTAIN AREAS: THE ROLE OF MOUNTAIN LEADERS IN THE BAUGES GEOPARK, FRANCE

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Keywords: *outings, Pedagogy, security, Mountain Leaders, geotourism*

CalcEre is an association which has been developing geoeducation and geotourism activities in the Bauges Geopark for 10 years on the base of the rich local geoheritage and its inherited typical landscape. But, as the Bauges Geopark is mainly a mountainous territory, guiding people on tours in this specific environment requires security rules. That is why the members of CalcEre are not only scientific mediators about geology but also Mountain Leaders. This double skill makes them specialists in scientific mediation on the field in mountain areas.

A Mountain Leader, as defined by the UIMLA – Union of International Mountain Leader Association - is someone who has been trained and assessed against the challenging physical and theoretical requirements of the UIMLA, concerning both security and knowledge of the mountain environment. The qualification lets the holder lead groups in different mountains all over the world, where the skills of alpinism are not required (Fig.1).



Figure 1: This badge guarantees the proper qualification of its holder as International Mountain Leader.

Concerning geoEducation, the main target is pupils/students, from Primary schools to Universities. The themes of the outings are specifically chosen in accordance with the National Education programs. They are dealt with along itineraries enhancing typical geological features, with the support of booklets which let the scholars be active in the learning process. In parallel, CalcEre also offers guided tours for the general public, always based on specific sites which enhance the geological richness of the territory. In this case as in the former one, the people can experience “safe living geology” in the Bauges mountains, as they are given the opportunity to discover the geoheritage on site with their eyes, their feet and their hands, the security aspects of mountain walks being undertaken at the same time by the guides. This concept fits well the "living science concept" which is developed by the University of Savoie.

Within the frame of the Geopark, the development of the local geotourism also goes through training sessions for professionals or specific groups of interest, such as the Tourism Offices, the Heritage guides, and of course the mountain professionals - Mountain Leaders, Mountain guides, canyoning and climbing guides: they are very efficient enhancers of the natural heritage of their territory, but the experience proves that they are most of the time much more aware of flora and fauna than of geology. The role of CalcEre, in close collaboration with the scientists, the Geopark staff and the local stakeholders, is to highlight the geoheritage in order to give it back the essential place it should have together with the other the natural heritages. This will ensure and protect the quality and the security of this thematic tourism.

In this way the “geo - Mountain Leaders” from CalcEre contribute to the establishment of cooperation among geopark-related communities and enhance the pedagogical use of geological heritage looking for sustainable development, community action, practical initiatives and tourism.

GEOHERITAGE OF TERRAS DE CAVALEIROS ASPIRING GEOPARK (NE PORTUGAL): INVENTORY AND ASSESSMENT

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Keywords: *geoheritage; geosite; assessment; scientific value; vulnerability*

The Macedo de Cavaleiros municipality is preparing a new geopark project in NE Portugal with the scientific support of the universities of Minho (Braga) and Trás-os-Montes e Alto Douro (Vila Real). Terras de Cavaleiros (Lands of Knights) aspiring geopark (TCAG) has an area of about 700 km² corresponding to the administrative limits of Macedo de Cavaleiros municipality (figure 1). This work presents the geoheritage of this territory as the result of a detailed geosites inventory and assessment made by the University of Minho team.



Fig. 1. Location of Terras de Cavaleiros aspiring geopark (TCAG).

The territory of TCAG has a rich and complex geodiversity, mainly expressed by the following geological units, structures and landforms:

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 and the tectonic relieves.
- vi) Incised river valleys as the result of a capture process of the ancient Cenozoic endorheic drainage by the present-day Atlantic drainage system.

The geosites inventorying of TCAG has started with the identification of potential geosites based on bibliographic research, fieldwork and previous knowledge of the area. Eighty-two potential geosites were identified related with mineralogical, petrological, tectonic, geomorphological and hydrogeological occurrences. These 82 geosites were assessed taking into account several criteria corresponding to:

- Scientific value (representativeness, rarity, integrity, scientific knowledge)
- Additional values (ecological, cultural, aesthetic, educational);
- Use values (accessibility, visibility, present type of use, presence of natural and cultural features, legal protection and use restrictions, existent infrastructures);
- Protection values (conservation state and vulnerability).

The application of these criteria to the 82 geosites has resulted in the selection of 34 geosites. The scientific value was considered of utmost importance. The 34 geosites are included in 6 of the 27 geological frameworks that were defined for the Portuguese inventory of the geological heritage, namely: The Iberian W-Sn Metallogenic Province, Pre-Mesozoic granitoids, Exotic Terranes of NE Portugal, Landforms and river network of the Portuguese Iberian Massif, Karst systems of Portugal and Neotectonics in mainland Portugal.

The scientific value and vulnerability of the 34 geosites were then assessed in order to determine geoconservation priorities. The adopted methodology was the same as the one used in the national inventory (table 1). The scientific value was evaluated taking into account 6 criteria with parameters scoring 0 to 4. The vulnerability assessment was based in 5 criteria with parameters scoring 1 to 4.

Criteria for scientific value	Weight	Criteria for vulnerability	Weight
A. Representativeness	30	A. Fragility of the geological elements	35
B. Key-locality	20	B. Proximity to potential damaging activities	20
C. Published scientific literature	10	C. Present protection status	20
D. Integrity	15	D. Accessibility	15
E. Geological diversity	10	E. Population density	10
F. Rareness	15		
Total	100	Total	100

Table 1. Criteria used for the assessment of the scientific value and vulnerability of geosites.

Of the whole 34 geosites, 7 of them are already listed in the national geosites inventory, which justifies their higher national/international relevance. Of the remaining 27 geosites, 19 have good scientific value and 8 have low value. In spite of this low scientific value, these geosites were included in the TCAG inventory due to their representativeness of the local geodiversity.

Concerning vulnerability, 19 geosites have high vulnerability, 8 medium and 7 low. Integrating the results of the scientific value and vulnerability, it was possible to establish priorities for the geosites management.

The high relevance of the geological heritage of TCAG is unquestionable. This region is well known by national and international geologists as one of the most interesting occurrences of the Iberian geology. The TCAG geodiversity is quite different from the other Portuguese geoparks already included in the EGN/GGN and it will be the first Iberian geopark to bring a new geological dimension to the network. The management of the most important geosites offers no major difficulties in what concerns conservation and protections issues

ASSESSMENT OF GEOSITES TOURISTIC VALUE IN GEOPARKS: THE EXAMPLE OF AROUCA GEOPARK (PORTUGAL)

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Keywords: *geosites; touristic value; assessment; Arouca geopark*

A method to assess the touristic value of geosites is presented. These procedures could be applied in areas where geotourism is an essential issue in management that is the case of geoparks. A numerical valuation of criteria is applied as in other methodologies to assess the use value of geosites in a tourism perspective (Pralong, 2005; Rybár, 2010). The present procedure is an adaptation of a previous methodological proposal to assess the various geosites aspects from inventory to management (Pereira & Pereira, 2010).

In this task geosites are assessed numerically using objective criteria and indicators (Table 1). Four main criteria include thirteen sub-criteria. Main criteria “availability”, “use” and “logistics” are intended to be the more objective as possible. “Perceptiveness” criterion is more subjective, depending largely of the assessor’s sensitivity and understanding of the site. Different scores can be applied to the criteria (0 to 1; 0 to 10; 0 to 100) and different weights can be used depending of the assessment aims. Besides the total values it is important to read partial results by main or sub-criteria (Pereira & Pereira, 2010). In the example here presented each criterion was scored from 0 to 10 and no weight was given to specific group of criteria.

The method was applied to the 41 inventoried geosites that constitute the Arouca Geopark main geological heritage (Sá *et al.*, 2009). The assessment was made by groups of non-specialists in geology using a simple and objective form that includes the name of criteria and correspondent indicators that have to be chosen. For each criterion the assessor is invited to describe the real conditions, to justify its score, and to suggest eventual interventions in the site to enhance that score. To improve objectivity in results different people assessed each geosite.

The assessment results show that the geosite with the highest touristic value in Arouca Geopark is the “Canelas Trilobite Fossils” with a score of 103 points (in 130 possible) and the minimum score was obtained by the geosite “Mourinha Fossils” with 40 points. 12 geosites scored below 50% of the possible maximum (less than 65 points) and only 2 geosites had more than 97,5 points (75% of possible maximum score).

It was possible to distinguish the tourism value of the assessed geosites. Well-known geosites like “Pedras Parideiras” or “Canelas Trilobite Fossils” acquired higher scores than other geosites without visiting conditions, with difficult accessibility or without signage. The nonexistence of specific signage related to Arouca Geopark and geosites was the main issue pointed by the assessors. The difficulty to access the sites is mainly related with the absence of signs and information in the roads and in the surroundings. The lack of interpretative tools in the majority of the sites was also referred as a main limitation.

Geosites management (classification, protection, promotion and monitoring) must be considered one of the main issues in geoparks management. Using this method it is possible to detect weaknesses in that management. However it is also important to point out solutions and initiatives connected with the various criteria assessed.

Table.1. Criteria for the assessment of geosites tourism value.

Main criteria	Sub-criteria	Indicators
A. Availability	Accessibility	Difficulty in accessing the site considering the types of roads, possible means of transportation, distances, and the need of special equipment.
	Visibility	Perceiving conditions of the geological elements regarding the distance, the presence of vegetation and human structures and the need of artificial light.
	Safety	Identification of potential danger for the visitor considering steep slope, slippery floor, presence of water and mass movements.
B. Use	Indications	Existence of signage in the surrounding roads and nearby the site referring it as a geosite or with other interests.
	Use of geological values	Promotion of the geosite in the internet, in guidebooks, leaflets and existence of panels and interpretative centers on the site.
	Use of other values	Existence of other natural and cultural values and their promotion and present use.
	Land status	Possibility to visit the geosite regarding property of the land, existence of fences, accessing fees, and functioning hours.
C. Logistics	Cleanness	Sanitary conditions of the site and existence of garbage recipients considering the possibility of picnics or bathes.
	Toilets	Existence of public restrooms nearby or possibility to use toilets from restaurants and cafes in the surroundings, considering their distance from the site.
	Food	Existence of restaurants and cafes, considering their distance from the site.
	Accommodation	Existence of hotels, hostels and camping parks, considering their distance from the site.
D. Perceptiveness	Aesthetics	Enjoyment of the site, considering landscape attractiveness, natural environment, presence of water and vegetation and appeal of the geological and other natural and cultural elements.
	Contents	Understanding of the geological contents using available tools (interpretative panels, webpages, books, leaflets, etc.)

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DANISH POSSIBILITIES OF GEOPARKS

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Keywords: *Denmark, Quaternary, coastal landscape, possible geoparks, tools*

With an area of just 43,094 km², Denmark is among the smallest countries in Europe and of the World, the Faroe Islands and Greenland excluded. It is therefore natural to ask whether it is possible to identify areas that contain a geological heritage of such significance as required to become a member of the family of European / Global geoparks and which also have opportunity to create real progress within the geopark area.

The geology of Denmark demonstrates, with few exceptions, that Denmark is a very young country, from a geological perspective. It is the Quaternary landscape, i.e. the morphological imprint mainly from the last two ice ages (Saale and Weichsel) that characterizes the Danish landscape. All types of Quaternary landforms can be observed in Denmark and they are the basis for a widespread research. Another characteristic feature of Denmark is its coastline nearly 8,000 km long. Together with the coastal landscape, the Quaternary landscape provides basis for observing processes that during the last 400,000 years, or less, have shaped the landscape and continues to do so. Important exceptions to this general picture of the geology of Denmark are sea deposits of clay and chalk up to 75 million years old which are exposed in few places. Another exception is the island of Bornholm in the Baltic Sea which is an up trusted dome of Scandinavian bedrock.

The establishment of geoparks in Denmark is consistent with the increasing attention in preservation and communication of geological values among the decision makers. This is reflected in the area designations, which is suggested as some of the tools to use in identifying possible geoparks. The raising geological awareness is also reflected in the fact that the Danish Government has nominated a Nature canon in which there are clear geo-footprint and geology has become more evident in the national requirements to the teaching in primary and secondary school.

This presentation will identify potential opportunities to develop geoparks in Denmark by using the area designation already made by the government e.g. designation of national geological areas of interest, fig. 1 and 2. At present, in three areas the geopark topic has been in play. In Northwestern Jutland two municipalities have taken the first small step in investigating the possibilities of becoming a geopark. On the island of Bornholm the topic has been on the agenda and in the municipality of Odsherred in Zealand serious work is being done to qualify as a European Geopark and an application is expected to be posted in 2013.



Fig.1. Denmark (light gray) with the designation of areas of national geological interest (dark gray). Top of picture is North.



Fig. 2. Excmple of a geosite of national interest, Aebeløe (Æbelø) which can only be reached by crossing 1,5 km shallow sea. But beware the tide.

LESVOS PETRIFIED FOREST GEOPARK (GREECE): AN ATTEMPT TO EVALUATE 10 YEARS OF ACTIVITIES

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The promotion of local sustainable development is one of the strong arguments frequently used to justify the importance of geoparks, besides their role in geoconservation. The aim of this work was to measure the influence of a geopark in the local community and to evaluate the performance of this geopark in the preservation and promotion of geological heritage, combining the three fundamental keys of a geopark: the geological heritage, the people and the local development. Given its history, activity and importance in the European Geoparks Network, one of the four founders of this network, the Lesvos Petrified Forest Geopark (LPFG), in Greece, was elected as the target of this study that is part of a master thesis of the University of Minho (Portugal).

The following goals were established as an action plan for this work:

- To know the current situation of the geological heritage in the area of the geopark;
- To understand and evaluate the conservation and recovery measures implemented on geosites during the last ten years;
- To assess if ten years after its creation the LPFG meets the principle of integration of the local population in decisions and actions taken by the geopark;
- To understand how this geopark has contributed to the sustainability of local development and how is the social impact in the territory;
- To observe and analyse the attitude and relationship of the population with the territory (natural heritage) and the geopark;
- To know and analyse the educational, geotourism, and cultural activities of the geopark, with special emphasis on those in which communities are involved;
- To evaluate the results of the public participation in activities developed by the geopark and which are the economical, social, cultural, and environmental benefits;
- To understand how the local community “feel” the geopark;
- To collect elements that can help the development of a methodology that allows the evaluation of the geopark’s performance regarding nature conservation and local communities.

Preliminary results based on direct observations, information collected in reports, and questionnaires applied to a sample of the geopark local community – a total of 67 respondents in five villages, including restaurants and hotel managers and general public – show that there is a positive perception of the LPFG role in geoconservation and in communities, namely:

- A favourable assessment of the geoconservation actions, particularly in the geopark's geosites and in the Natural History Museum;
- The success of the educational activities which are recognized by all – students, teachers, and general public – justifying a large number of visitors with a high degree of satisfaction that explain the recurrence of their visits;
- The remarkable success of the museum that is generally recognized by visitors and much cherished by the locals;

- The fact that the geopark has created jobs in the local community;
- The growing sense of identity and pride for their region and its natural heritage felt and expressed by the local population, which is reflected in the increasing sensitivity and awareness for their conservation and promotion.

It is important to keep in mind that, although the collected data does not intend to have a statistical meaning, they are valuable elements that gathered important information and allowed a qualitative assessment of this geopark performance for the last ten years.

Being a new concept promoting local development, it is clear that geoparks are still in an early stage of their evolution which originates many opportunities to improve. Therefore, it is understandable that this work has also identified some weaknesses:

- Some measures of valuation, interpretation and maintenance of the geopark's geosites, especially within the area of the main parks, can be improved;
- Regarding the knowledge and development of their region, a great number of the surveyed people is unaware of the support that the geopark gives to activities, such as: pottery, popular crafts, jewellery production, gastronomy, painting, and also to the promotion of products and other local services;
- Regarding to restaurants and other services related to tourism there are a significant number of respondents that had expected a higher increase in their profit, during the last 10 years, due to the creation of the geopark;
- A major part of respondents is unaware of local companies that develop geotouristic activities;
- In general, the owners and local residents that were interviewed in five villages are satisfied with the development of the region, but there is still a significant part of those who did not felt the real benefits.

It is important to keep in mind that geopark managers cannot be fully responsible for some of these weaknesses. People themselves play an important role in their own success and in this sense they cannot expect that the situation may change without their own cooperation and motivation. This fact stresses once more the need to have local communities really involved in the management of geoparks because they must feel that they are part of the solution and not just beneficiaries of it.

The assessment of the impact of a geopark in nature and local communities is difficult to accomplish. This type of evaluation requires a solid and accessible collection of multidisciplinary data that are usually dispersed and often not cover the whole period of analysis. It is recommended that all geoparks promote the development of common indicators and tools that could be easily used for evaluation purposes and comparison analyses, easily expressed in the native languages and in English.

ASPIRING GEOPARK TERRAS DE CAVALEIROS: A PROJECT TO PROMOTE SUSTAINABLE DEVELOPMENT IN NORTHEASTERN PORTUGAL

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Keywords: *Macedo Cavaleiros, Morais Massif, Trás-os-Montes, Caretos; Sustainable Development, Aspiring Geopark*

The municipality of Macedo de Cavaleiros, located in northeastern Portugal, with an area of 699 km², has unique natural characteristics. Worldwide-recognized by the exoticism of the polimetamorphic rocks of the Morais Massif, the existence of these unusual rocks and its derived soils markedly affect the biodiversity of this territory and, consequently, the people who live here and their traditions and culture.

The appreciation of the natural and human heritage of this region and the increase of its potential as regards the sustainability of local communities is the goal of this project. This territory is known as Terras de Cavaleiros (“The Land of Knights”) and focuses their actions on people and their activities, with the aim of preserving and celebrating their traditions, culture and social values.

The geopark project under development since 2010, intends to promote tourism based on geological, ecological, cultural, historical, scenic and local identity values, pointing out what is authentic and unique in order to achieve the geological and environmental preservation, social justice and sustained economical development for the territory and its inhabitants.

“Land of Knights” is a low population density (22.7 inhabit./km²) territory with six Natura 2000 Network sites. About 58% of the population is linked to the tertiary sector (trade and construction) but the family agriculture is complement to most inhabitants of the territory.

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 lagoon (with a beach ranked as one of the 7 Natural Wonders of Portugal), the Bornes Mountain, the Morais Hill or the Sabor River Valley, which allow visitants to enjoy a landscape diversity and floristic richness and unique fauna.

This is also a region with a rich and diverse historical-cultural heritage, such as the Royal silk spinning factory of Chacim, many religious buildings, stately homes, pillories, typical villages, archaeological heritage and agricultural traditions. Some of these assets have national and international recognition, such as the Masks “Caretos” of Podence, the folk dances of “Pauliteiros” of Salselas, and the hunting and gastronomic traditions.

Presently, a 2012-2016 Master Plan is being implemented based on eight fundamental goals to promote the sustainable development of the territory.

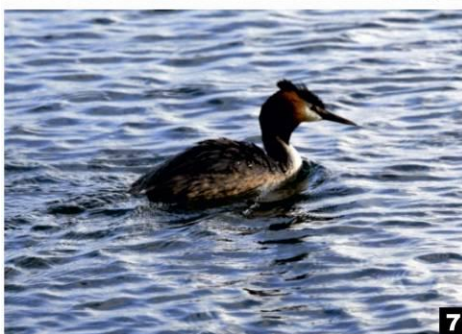


Fig. 1 – Several aspects of Terras de Cavaleiros territory. 1 – Lagoa augengneisses; 2 – Geological excursion on the Morais Massif; 3 – “Careto” of Podence; 4 - The art of traditional oven bread; 5 – “Pauliteiros” de Salselas folk dance; 6 - Museum of olive oil; 7 - Crested Grebe; 8 – Several traditional quality products.

FOLLOWING THE TRAIL OF THE MEDIEVAL IRON INDUSTRY IN THE BASQUE COAST GEOPARK (GIPUZKOA, BASQUE COUNTRY, W PYRENEES)

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Keywords: *Geopark, iron metallurgy, mountain foundry, Basque furnace*

Steel mills and blast furnaces have been very important for the economic development of the Basque Country, especially during the 19th and 20th centuries. This industrial activity constitutes the culmination of a long-lasting tradition of iron metallurgy in this territory, which has been well documented since the Lower Middle Ages, when the hydraulic foundries started to work. For example, in the 16th century, there were over 600 of these foundries working simultaneously just in Bizkaia and Gipuzkoa.

Nevertheless, iron metallurgy in the Basque Country is known since the middle of the first millennium B.C, as can be seen from the excavations carried out in the sites of Gipuzkoa, such as those of Basagain, Intxur, Munoaundi, Buruntza, etc. It wouldn't be surprising if Euskal Herria was one of the first places in Europe to learn the techniques to benefit from this metal, taking into account the quality and abundance of iron minerals in the Palaeozoic rocks and in late Lower Cretaceous. Supporting this hypothesis is the large amount of slag and structures that have been found, a proof of the abundance of pre-hydraulic technology foundries, known as mountain foundries.

These structures are usually associated with the outcrops of sedimentary materials from the Bilbao Anticline that is known as the Urganian Complex (100 – 125 million years). This group of Cretaceous rocks, which is normally over 200 m thick, was formed in a marine area under distension, registering an important magmatic and hydrothermal activity at depth, which caused sulphurous emissions and small fissure volcanoes in surface areas and an active flow of water rich in metals. The main iron sites in this anticline would replace Urganian limestone, from hot flows rich in iron and magnesium.

Until recently, the work done on the mountain foundries (“haizeolak” in the Basque language) mentioned that the reduction furnaces relating to these facilities would have been destroyed as a consequence of time and erosion, land cleaning, etc. However, in recent studies it is shown that, despite all the factors that have negatively affected their conservation, there are still many remains of furnaces from these types of foundries, most likely due to the large proliferation of these during the medieval period.

In the 2010 campaign, and for the first time ever, one of these furnaces (figure 1) was excavated in Galdakao (Bizkaia), known as “Basque furnaces”, which show a set of features that are different from those of other from a similar time.

Ever since it was created in 2010, the Geopark of the Basque Country encourages this research by supporting the fieldwork of a multidisciplinary team made up by the Departments of Stratigraphy and Palaeontology, and Mineralogy and Petrology of the University of the Basque Country (UPV-EHU) and the ARANZADI Science Society. The first works have made it

possible to discover mountain foundries in two of the municipalities within the Geopark (Deba and Mutriku).

The interest of the Geopark in this research is focused on three objectives: learning about the long-standing tradition of metallurgy in the territory, the conservation of this type of archaeological heritage and disseminating this nearly forgotten activity both to the inhabitants of the area and the visitors of the Geopark, to help them better understand the identity of the Basque people, especially their economic development.



Fig. 1. Photo where you can see the furnace narrowing, around 50 cm, in the lower third of the furnace in the whole of its perimeter, except in the right side, where the opening is. Photo by J. Artaraz.

KENTS CAVERN JAWBONE: THE OLDEST HUMAN FOSSIL IN NW EUROPE DISCOVERED IN THE ENGLISH RIVIERA GLOBAL GEOPARK

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Keywords: *Geopark, Neanderthals, modern humans, tourism, economic regeneration*

Abstract: Research published in November 2011 in *Nature*, the internationally renowned science magazine, confirmed that a fragment of human jawbone, unearthed in Kents Cavern, in the English Riviera Global Geopark, is between 44,200 and 41,500 years old making it the oldest modern human fossil in northwestern Europe and certainly in Britain.

The Kents Cavern jawbone, a maxilla (upper jawbone), was found in 1927 and has been intriguing scientists for decades. In 1989 it was dated at 31,000 years old and tests were carried out recently to determine if it could be Neanderthal.

The new date is hugely significant because it means that modern humans are likely to have co-existed with Neanderthals in the English Riviera Global Geopark for several thousand years, in a part of the world at the furthest extremities on northwestern Europe. Evidence of Neanderthal occupation in Kents Cavern is widespread.

Deriving economic benefit from this story was a key objective for the 2012 marketing efforts. In this oral presentation, the owner of the geosite tells the story of the jawbone, describes how the press embargo period was managed and what has been done to encourage visits to Kents Cavern and the English Riviera Global Geopark.

CONSERVATION TOOLS OF QESHM ISLAND GLOBAL GEOPARK (IRAN)

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Keywords: *Qeshm Geopark, Conservation, Zoning*

Qeshm is one the four free zones of Iran with the major mission of improving the industry and trade that always threatens the sensitive diversity of the Island. In this occasion, Geopark works as a filter for guaranteeing sustainability.

In the island's Master Plan (1973) whole western parts of the island have been reserved for establishing a National Park with promotional and tourism targets. It inspired us to introduce this park as a Geopark due to it's fantastic geological landscapes and excellent combination of human life and geographical aspects. Besides people can simply see the history of earth by looking the vast area of Salt Dome in west of island.

Considering to a long history of conservation in Iran, we offered a special system - similar to the standards used in the Department of Environment of the I.R. Iran - to save the identity and territory of the Geopark and manage its fragile landscapes. Physical conservation plays an important role in Management of protected parks.

Our field experiences proved that it does not work lonely, therefore we established a compound of tools beside other mechanisms, for instance educating locals and making investment vacancies.

All parts of the Qeshm Geopark area belong to the authority and Qeshm Free Area organization represents as the the Central Government, so we had no problem to make new legal structures.

As Qeshm Island is reputed for it's bio and cultural diversity, the main idea is sustainable development of the Island. To access the main strategy is based on conserving in all parts of the Island by extending the territory. The other strategic aim is to orient two Million annual arrival tourists to the concept of the Geopark and encourage them to be fans of nature. Obviously, expanding knowledge between people guarantees the future of Qeshm Geopark.

In the field of conservation we are pursuing three major approaches due to our domestic problems and complexities: Zoning, Guarding and Limiting visits. This scheme has been achieved during six years of try and errors between Geopark, authority and stakeholders.

Zoning: Qeshm Island is a dry arid land, created from soft sedimentary rocks (like Marl type), so the landscapes are very fragile. In some geosites even after a rain, the shape changes, therefore we need some legal tool to save the geosites and soundings. It is an important tool to control the future developments. We predicted and published Zoning Plan in three levels; 1. Territory Zone, 2. Connection Zone and 3. Fragile Zone other than an Entertainment (E) Zone. Each zone has a specific criteria and we only permit the new investments to establish in the (E) Zone as well inside the villages.

Guards: Their main duty is to protect the geosites from tourists destructive, irregular activities of developers and other usages of the geosite, i.e. as a movie stage that is common in Qeshm. They also help visitors in any other case may happen. We have a weekly system to collect data

from guards which helps us having a clear image from the number of visits and their combination.

Limiting Visits: We are going to provide an online system for counting and ceasing visits; we need more conducted tours. We believe visiting Qeshm geosites MUST perform by educated local leaders. Nowadays the larg amounts of visits, destroy the sensitive fragile rocks and hills. Qeshm Geopark faces a huge number of visitors from February to April, in spite the sites are solitude between April and December.

We have also a cleared Management Plan that conducts coming projects of the Island to aims of the Geopark. This criteria is provided on basis of country laws and legislations and it is necessary for the experts and supervisors already work or are going to work in Qeshm Geopark Management.

NEW DEVELOPMENT STRATEGIES: I-PARKS PROJECT CABO DE GATA-NÍJAR GEOPARK AS AN EXPERIMENTAL TERRITORY

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Keywords: *Inclusive Parks, I-Parks, Geoparks as experimental territories, universal accesibility, inclusive experiencie, inclusiveness, Cabo de Gata-Níjar Geopark*

“I-Parks” is a proposal project that is being developed in Cabo de Gata-Níjar Geopark which focusses on building a network of Natural Protected Areas (NPA) with management and participation bodies, that promote the development and offer of unique, inclusive and quality experiences.

This project aims to offer the NPA as a tourism destination to the wider sector of people with disabilities, that will not only enable everyone to enjoy environmental tourism, but also include a package of services, information and experiences adapted to every need.

We define *Inclusiveness* as a design for everyone, assuming that the human nature can not be defined only through measures or standards but must be seen in a global perspective, where diversity is the rule and not the exception (I National Plan of accesibility 2004-2012, Spanish Ministry of Work and social matters). In a broad general sense, and for the purpose of I-Parks, inclusiveness consist of treating all groups, or all members of a group, equally and without exception.

Biosphere Reserves and Geoparks are specially well suited territories to develop I-Parks; both recognitions have a global network and share objectives regarding sustainable development and social inclusion.

Natural Protected Areas, due to the national laws and regulations, already has developed accesibility to natural sites and infrastructures accesible for people with disabilities. But often this information is not accesible by itself or moreover, is not contrasted by the users.

I-Park is not only a project to adapt facilities or geosites, it is designed as a platform where find all the initiatives existing in and outside the Geopark, that should be taken in account to ensure an enjoyable and fulfilling experience in the territory. Of course this include accesible facilities, geosites and adapted touristical visits but also includes information of the nearest specialize medical assistance, mechanical services (for wheel chairs for example), physical therapist, etc..

In the decade of the eighties the perception of disability changed dramatically and the disabled ceased to be regarded as a problem. Instead the social environment started to be seen as the real problem, and as a factor that diminished the equality of opportunities (EUROPARC Catalogue of good practices in accesibility in NPA).

Nowadays, we need to change again our point of view, and treat people with disabilities not only as a group with the same opportunities, but also as an attractive challenge for developing sustainable tourism in NPA, a new market that is waiting to be open.

In the same way as the well-known quote of Cliff Stoll & Gary Schubert, “ *Data is not information, information is not knowledge, Knowledge is not understanding, Understanding is not wisdom*”, the suppression of barriers is not accesibility, the accesibility is not universal accesibility and Universal Accesibility is not Inclusiveness; I-Parks project is aimed at filling this gap in the forthcoming years potentially with 9% of the regional population of and 16,2% of the population of the 25 European member states. Considering also that people with a disability travel, on an average with 1,5 persons, we will access a huge section of the population as potentials new visitors.

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- INEGI (National Institute of Geographic Statistics and Computing of Mexico)

ASPIRING GEOPARK OF MENORCA ISLAND: GEODIVERSITY AND GEOLOGICAL HERITAGE IN A BIOSPHERE RESERVE

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Keywords: *Menorca, biosphere reserve, geodiversity, sustainability, aspiring geopark*

Menorca is the easternmost of the Balearic Islands, with a geological history of over 400 million years. In less than 700km² area there is a great geodiversity and stunning geological heritage. The island was declared Biosphere Reserve by UNESCO in 1993 in recognition of its conservation of physical and natural environment, preservation of local culture and customs and as an example of sustainable development.

From a geological and morphological point of view the island is divided in two different halves. The southern half (usually called Migjorn) is 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. The carbonate rocks of this region are dissected by deep fluviokarstic canyons, from north to south, separated by relatively flat areas. The northern half (usually called Tramuntana) is characterised by folded and faulted Palaeozoic, Mesozoic and Oligocene strata presenting a wide lithological variety. It is made up of Palaeozoic siliciclastic turbidites, Mesozoic sandstones, marls and dolomites and few outcrops of Oligocene conglomerates. Palaeozoic sediments range from Devonian to Permian in age. Devonian formations consist of grey shales and sandstones. Carboniferous rocks are made up of shales with sandstones and conglomerate lenses deposited in a turbiditic environment. A sequence composed of Permo-Triassic red shales and sandstones with paleosols, dolomitic limestones of Muschelkalk facies and marls with gypsum of Keuper facies lie unconformably on Palaeozoic rocks. The Jurassic rocks are mainly dolomites whereas the Cretaceous rocks are micritic limestones.

Since thousands years ago the inhabitants of the island have used and developed several bonds with the geological heritage. Probably the most evident example is the dry stone culture, composed by a network of wall stones and other traditional buildings of dry stone. In Menorca exist 12.000 kilometres of dry stone walls, most of them used from centuries as field boundaries, as retaining walls for terrains with steep slopes and to manage livestock's foraging.

Although Menorca's economy is based largely on tourism, the primary sector is considered a strategic sector, because it manages most of the territory (50 % of the island are laboured lands), giving to the territory a high degree of personality, and it offers economic support to the conservation of the natural and cultural heritage and one of the most important assets of the island, the landscape.

Since Menorca was declared Reserve Biosphere the inhabitants and visitors have gradually realised of the importance of guaranteeing the conservation of natural heritage by regional legislation. In that sense, not only the authorities but also most of the population (organized through several NGOs) have adopted a clear commitment with a sustainable tourist development that respects those principles inspired by the Biosphere declaration.

In 2003 was approved a law known as 'Territorial Plan of Menorca' (PTI). PTI's ultimate objective is to preserve the island's environment by limiting both urban and tourist land consumption, in such a way that a sustainable growth is guaranteed. PTI was awarded in the National Award of Urbanism in 2005 because of the commitment to develop a sustainable

territorial planning model. Nowadays, more than 68% of the island's surface is under protection including, 19 areas of special interest (ANEI) and a marine reserve.

Since PTI's approval, several measures were approved aiming to protect and explore all the island's possibilities (economic, tourism, educational, scientific and cultural) based on the its heritage. The organisation that has had an important role on developing these issues has been the *Institut Menorquí d'Estudis* (IME) by different means such as editing an encyclopaedia about natural and cultural heritage of Menorca , organising scientific conferences or developing a sustainability indicators system, helping this way to progress towards environmental sustainability.

Menorca could be a good example of the use of the natural/geological heritage for socio economic activities on sustainable rural development, especially in the tourism sector. In that sense, tourist activities related to cultural and nature heritage have become the major challenge for economic activities in the island. Therefore, is advisable to open up channels of specialisation of business, as well as the creation of small enterprises to respond such a new demand by offering experiences to discover the natural and cultural heritage through trekking, cycling and horse riding.

In the other hand, the island's government should keep reinforcing this emerging tourism. A good example of doing so is the recently structured network of trails and rural paths (being the most important the one known as "Camí de Cavalls"), which has become a true window to landscape, meaning to the natural and cultural heritage.

To sum up, Menorca should advance towards sustainable tourism by combining natural and cultural heritage. Menorca should also adopt a sustainable development, understood as a commitment between people about landscape. A key pillar on Menorca's sustainability strategy would be the combination of being a Biosphere Reserve and the chance to become part of the geopark network.



Fig.1. View of the geodiversity in the north coast with a combination of Carboniferous and Triassic materials, the rare quartz-queratopil subvolcanic rock and quaternary fossil dunes.

THE GLOBAL WATER CRISIS: AN EDUCATIONAL ROLE FOR GEOPARKS

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Keywords: *population growth, economic developments, water shortages.*

Water is the basis for life on Earth, however, one sixth of the world's population lacks access to safe fresh drinking water and water-related diseases are the foremost cause of sickness and death¹. Population growth and associated economic developments are placing pressure on available resources of fresh water worldwide and water shortages, affecting an estimated 5.3 billion people by 2025, will become a major problem in the 21st century¹. Most of the world's water, 97%, is saline and stored in the oceans, 2% occurs in icecaps and glaciers and less than 1% of the total water supply is available as fresh water. Based on calculated water volumes and flows², at least 99% of available fresh water occurs as groundwater. The Earth's water stores are linked within a circulation system, the water cycle^{3,4}, in which water evaporating from the ocean, either returns rapidly through rainfall and rivers or becomes fixed for long periods of time in icecaps or in groundwater. Climate and geology determine the distribution and availability of fresh water, either at the surface, in permanent rivers and lakes, in artificial reservoirs or in aquifers². Using water from any of these resources, however, requires an understanding of an area's water budget, i.e. the balance between the sources of supply and subsequent discharges with respect to a drainage basin or aquifer⁴.

Groundwater discharge from aquifers provides the most common source for permanent stream flow^{3,4}, other sources include marshes and ice caps. In temperate regions evapotranspiration, the product of temperature and plant growth during summer months exceeds average rainfall circumventing or impeding the recharge of aquifers through infiltration. Aquifers are therefore recharged during the winter months when low temperatures and light levels retards most plant growth and evaporation. Thus winter droughts can seriously affect groundwater² and surface water resources in the following years. The rise in extreme weather events, however, including floods and storms, since 1980⁵, could be linked to increasing evaporation rates in response to the rise in temperature of the upper 700 metres of the world's oceans⁶.

Water shortage is both natural and man-made. Available water resources are unevenly distributed, and subject to waste, pollution and unsustainable management. During the last century water use involving irrigation 70%, domestic households 10% and industry 20%^{7,8} grew at twice the rate of population increase⁸. Thus some areas are experiencing water stress with annual water supplies below 1,700 m³ per person and water scarcity with supplies below 1,000 m³ per person⁹. An analysis of the blue water footprint (consumption of groundwater and surface water) as a percentage of natural runoff minus environmental flow requirements (20% runoff)^{10,11} shows that five of the 10 worlds most populated river basins (Ganges, Indus, Krishna, Huang He (Yellow River) and Hai), all in the developing world, already face severe water shortages, i.e. water consumption exceeds 40%. The Niger and Nile river basins face severe shortages by 2050. The growing level of water consumption in these basins threatens to derail their share of the growing global economy, predicted to rise from 3% to 12%. China's aim to dam or divert each of the five major rivers emerging from the Tibetan Plateau (Indus, Brahmaputra, Irrawaddy, Salween and Mekong) and India's proposed Brahmaputra –Ganges Canal are causes for concern in Bangladesh, Burma, India, and Vietnam¹² and raise legal

questions concerning the ownership of water, the need for trans-boundary governance for water security and implications for geopolitical security¹³.

Compared with surface water, groundwater is of relatively high quality and owing to its depth is less vulnerable to pollution². Water from underground aquifers is therefore subject to depletion through over-pumping, particularly in arid regions where water withdrawal for irrigation, much of it derived from groundwater, represents 90% of total withdrawal⁵. Isotope studies used to determine an aquifer's age and rate of recharge reveal ancient hydrological conditions in which the recharge of very old groundwater occurred in regional climatic conditions very different from those of the present day¹⁴. These aquifers, e.g. the Nubian Sandstone Aquifer¹⁵ contain fossil water which is being mined without being replenished and will eventually run dry. In temperate regions natural outflows of groundwater to springs, as base-flow to rivers and the water extracted from wells is replenished through recharge by rainfall. However, even these regions are subject to groundwater droughts in which the environmental impact can be exacerbated by over extraction.

Natural disasters and their enormous impact make instant headlines in the media and produce an immediate global response. However, it is imperative to draw attention to the growing problems associated with the availability of water. Geoparks can demonstrate the sources, uses management and conservation of water in their own territories, raise awareness of the nature and relevance of the water cycle, the relationship between geology, landscape and water supply and the influence of climate and weather. The necessity for the sustainable use of water and the need for environmental protection should also be emphasised. Geoparks can and should play a vital educational role in raising awareness of the global water crisis.

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THE IDRIJA GEOPARK – »FROM THE EXPERTS' IDEA TO FINAL REALISATION WITH PARTNERS

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Key words: *mining heritage, geo-conservation, local development, partner cooperation*

The mercury mineralization containing cinnabar and native mercury in Idrija is known worldwide. After 500 years of mining, a decision to close the mine was made in 1987 due to economic and environmental causes. Despite the decision on its shutdown, some parts of the mine have remained accessible, as it is necessary to carry out constant supervision in mine shafts and galleries in order to ensure the safety of the town of Idrija. The long history of mining has had a significant impact on economic development, social life, science, technology and culture in the Idrija region. The extremely rich geological histories, cultural and natural heritage of the Idrija region have encouraged geologists, nature conservation experts, and the municipal authorities to establish the Idrija Geopark. The **Idrija Geopark Initiative** was presented for the first time in 2007 at the European Geopark Network Conference in Scotland, which became a cornerstone for understanding the »geopark idea«. A decision to establish the Idrija Geopark was finally made, and only a few months later a cooperation team was formed by Idrija's mayor. One of the key reasons why this idea has developed was also our cooperation with partners from the Portuguese Arouca Geopark and the Norwegian Magma Geopark. Exchanging ideas and practices at the very beginning of a geopark's establishment is absolutely imperative. Some good practices introduced at the very beginning of our effort have been realised.

Since 2007, the local authorities have devoted many efforts into the establishment of the geopark. In 2008 and 2009, concrete steps were taken in connection with inventory, thematic trails, evaluation of geoheritage, educational programs, research study, etc. In July 2010, the Idrija local community approved the local decree establishing the local institution “**Idrija Heritage Centre**” (IHC) and its internal unit, the Idrija Geopark. On the basis of an inventory of geological heritage and the implementation of systematic protection of geological heritage, the outstanding richness, unique mineralisation, and the complex geological structure of the surrounding area were recognised as an internationally important geosite. This process is, however, extremely complex and requires the preparation of a wide range of documents, analyses and information.

The management of the Idrija Mercury Mine has shown great concern for ensuring the long-term safety and protection of the most valuable geological sections. Shutdown works are successfully being conducted by the mine's geology experts and the Institute of RS for Nature Conservation in line with the guidelines for the protection of geological natural sites. A **geological collection** kept at the official seat of the Idrija Mercury Mine has also been proposed for protection within the scope of the ore deposit. **Anthony's Main Road** (Fig 1), is the oldest part of the mine, renovated in 1994, and is open to visitors. The Idrija Municipal Museum offers a rich geological collection of minerals and fossils from the Idrija and Cerkno regions. Visitors are invited to follow the story about the origin of the mercury ore deposit at the Mine Geological Collection near Francis's shaft, though there are numerous historical and technical monuments devoted to mining throughout the town. In the vicinity is the Zgornja Idrijca (Upper Idrijca River valley) Landscape Park, proclaimed in 1993. Geomorphological (karst features, springs...), geological (tectonic sights, fossil locations...) and botanical natural features prevail. The **Divje jezero** (Wild Lake) Natural Monument is one of the most impressive karst phenomena in the area. The landscape park also includes important historical and technological sights of cultural heritage that are directly linked to the mine in Idrija. Due to the exceptional variety of its natural and cultural heritage, the town of Idrija was included in the **UNESCO's World Heritage List on 30th of June 2012**.

The establishment of the Idrija Heritage Centre as the geopark's manager was merely the first important step on our long journey, and serves as a basis for actual tasks and actions to be carried out in the future. The managing body of the Idrija Geopark is the Council of IHC, which adopts the long-term programmes and documents and is steered by the Director, who works closely with the Geopark Experts Group. **The Idrija Geopark Experts Group** is an advisory body joining institutions in the fields of geology, nature and environmental protection. Its members are: the Slovenian National Commission for UNESCO; the University of Ljubljana, Faculty of Natural Sciences and Engineering, Department of Geology; Institute of RS for Nature Conservation/ Regional Unit Nova Gorica; Institute for the Protection of Cultural Heritage of Slovenia/Regional Unit Nova Gorica; Slovenia Forest Service/Idrija Unit; the Idrija Mercury Mine; the Karst Research Institute Postojna; the Geological Survey of Slovenia, and the Farmland and Forest Fund of the Republic of Slovenia. IHC also works closely with two key managers of cultural and natural heritage, i.e. the Idrija Municipal Museum and the Idrija Mercury Mine.

After the geopark's official establishment and its intensive promotion among the local inhabitants, there has been a considerable increase in the number of partnerships. From the very beginning, numerous activities have been carried out with **local partners**. For example, projects with the Idrija Mercury Mine, exhibitions with the Idrija Municipal Museum and the Idrija Lace School, cooperation with schools, universities, the creation of thematic trails, etc. Our partners are well aware of the significance of the Idrija Geopark, and they have their own original ideas. One of our challenges will be how to incorporate their contributions into the Geopark on the one side, and how to realise their expectations regarding the Geopark on the other. The partnership has a formal basis in the Partnership Agreement. At the moment, the **Partners Group integrates more than 30 partners** from the public and private sectors, such as schools, sports and cultural associations, tourism farms, museums, local authorities, area managers, etc. In future months, we have planned many activities for children and numerous promotional activities. We are resuming the interpretation of natural heritage and the formation of thematic trails, all with the participation of the geopark's partners.

This truly highlights the power of the support given to the Geopark and what partners can achieve if they are given the right support. Our work is ongoing within the entire range of the team's activities relating to the promotion and recognition of the Geopark, hopefully with the upcoming confirmation of the geopark's inclusion in EGN and GGN this year.



Fig.1: Anthony's Main Road, the oldest entrance in to the mercury mine (photo by D.Wedam)

DEVELOPMENT OF GEOTOURISM IN THE BOHEMIAN PARADISE GEOPARK

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Keywords: *Bohemian Paradise Geopark, Geotourism*

The Bohemian Paradise Geopark is full of natural and geological unique objects and of noteworthy archaeological, historical and cultural monuments. Without a proper image, it is difficult to attract tourists. Geotourists in particular, are much more demanding. They can become acquainted with the geopark when riding horseback or from a canoe or when rafting on the Jizera River. The more courageous visitors can do it when flying in a steerable balloon or in an aeroplane from the aerodromes in Jičín, Lomnice nad Popelkou or Mnichovo Hradiště. Fans of paragliding use the local air streams to fly around the hill of Kozákov. Walkers, bikers or rock climbers will not be disappointed by what the Geopark has to offer. What looks fantastic from a distance is even more impressive when viewed from up close. Bohemian Paradise Geopark is known for its trail systems.



Fig. 1. Ages of participants of the Bohemian Paradise Geopark programmes ranged from 3 upwards to 89 years.

The attention of the majority of visitors is concentrated on the known and renowned places and a lot of remarkable and less accessible ones are omitted. For this reason, certified guides of the Geopark are available to tailor-make a guided programme to suit the requirements of any individual or group of Geopark visitors. The Bohemian Paradise Geopark prepares various programmes that are adapted to the needs and demands of each of its visitors. Special programmes are made for schools, families with children, students, undergraduates and for seniors, too. Programmes for the blind or sight-impaired are also offered: the Geopark is ready to respond to any groups with special needs or requirements. Geotourism programmes in Bohemian Paradise Geopark include creation of interpretation centres museums and interpretation panels, organization of temporary travelling exhibitions, conferences, promotion of common geotourism packages and organization of events promoting alternative tourism and publication of books, visitors guides, DVD's and production of multimedia presentations.

Bohemian Paradise Geopark promote themselves as destinations for educational activities. Geotourism is closely tied to education. Level information and the interpretation was tailored to the needs of each age group. Main target group for geotourism are schoolchildren and University students. Educational activities for school classes and universities include preparation and organization of field trips and workshops. The Geopark prepares various programmes that are adapted to the needs and demands of each of its visitors. Special programmes are made for schools, families with children, students, undergraduates and for seniors, too. Programmes for the blind or sight-impaired are also offered: the



Fig.2. Breweries in the Geopark allow visitors to get acquainted with the beer production technology.

Geopark is ready to respond to any groups with special needs or requirements. The all-round preparation of the programmes by the Geopark is one of its great advantages. Certified guides of the Geopark are available to tailor-make a guided programme to suit the requirements of any individual or group of geopark visitors. Visitors can even receive information through mobile Internet locations. In more than two hundred localities of the Geopark, there are instructive and fun making geotags offering texts, pictures and cartoons using a cell phone. Geotourism makes use of all regional sights and includes all senses. The geological objects of interest, architectural sights and medieval castles will be retained in the memory far better when their visit is completed with a degustation of the local specialities. Rather unusually, the Bohemian Paradise also offers up the experience of eating fresh and tasty fruit picked from apple, pear and plum trees growing along the roads. The Czech beer is one of the best known and most sought-after beers throughout the whole world. The breweries in the Geopark not only produce beer, but they also allow visitors to get acquainted with the beer production technology. Dozens of business operate within the Geopark, providing an array of services from lodging and dining to stores with all basic needs. The Bohemian Paradise Geopark has created links with restaurants, hotels and tourist enterprises in order to meet the needs of the increasing number of park visitors.

ARARIPE GEOPARK, SOCIAL INCLUSION AND ART PROJECTS

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Keywords: *GeoparkAraripe, Cultural Heritage, Graphic Arts, Photography*

The Geopark Araripe is located in the Cariri region, in the semi-arid backland of Northeast Brazil, part of the Ceará State. The Geopark, which in 2006 became the first in the South-Americas, is famous for its extraordinary variety of well-preserved cretaceous fossils and paleobiodiversity and for the beauty of landscape. The Araripe sedimentary basin is recognized as one of the richest cretaceous areas of the world.

The region is also known as storehouse of local culture, with rare examples of arts and crafts, folklore and religious devotions. In the region early evidences and examples of indigenous, afro-brazilian and ibero-portuguese cultural patterns can be found. The territory offers a strong and vibrant culture of traditional arts. This work emphasizes the relationship between art and nature, people and the Earth, with special emphasis on the aesthetic dimensions of brazilian graphic and pictorial heritage in a holistic perspective. It also deals with the search for a visual identity of the Geopark, involving local young people in creative ways to participate. The Geopark stimulate actions of urban intervention, graffiti, photo excursion, pinhole e other expressions of modern (street) art. The communication will explore the cultural heritage and its links to contemporary culture and geo-diversity.



Fig. 1 Photo-workshops (pinhole and photographic tours).

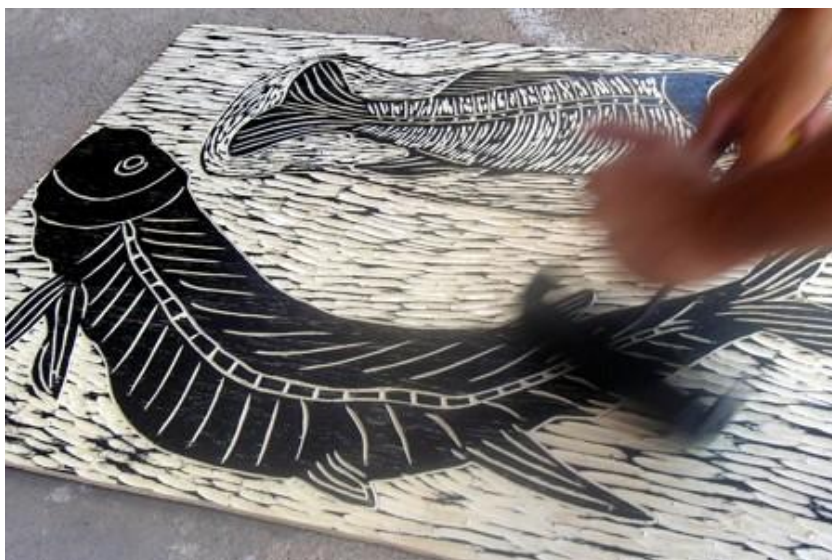


Fig. 2,3,4 Woodcut (xylographic) workshops and exhibitions.

PRELIMINARY DATA OF A PROPOSAL FOR A FUTURE AROUCA GEOPARK EXTENSION: THE “MONTEMURO AND GRALHEIRA” TERRITORY

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Keywords: *Arouca Geopark, extension, “Montemuro and Gralheira” territory*

The "Montemuro and Gralheira" territory is a mountainous region corresponding to the municipality of Arouca and six neighboring municipalities: Castelo de Paiva, Cinfães, Castro Daire, Vale de Cambra, S. Pedro do Sul e Sever do Vouga, covering a total area of 1,690 km² with about 127 thousand inhabitants (Census 2011).

The geodiversity of the "Montemuro and Gralheira" territory is dominated by metasedimentary and magmatic Palaeozoic rocks (550-245 Ma) and also recent sedimentary rocks (< 2Ma) (Sá *et al.*, 2009) (Fig. 1).

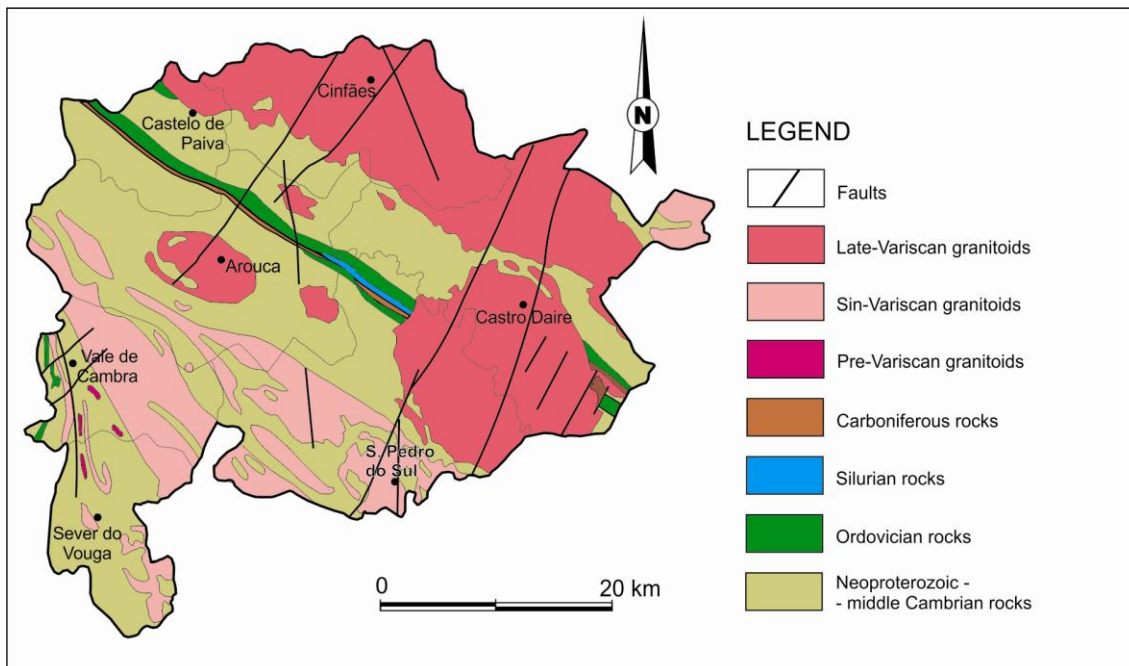


Fig. 1 – Geological simplified map of “Montemuro and Gralheira” territory.

The "Montemuro and Gralheira" territory integrates four Natura 2000 Sites: Montemuro Mountain, Paiva River, Freita and Arada, and Vouga River. Concerning the cultural heritage, there are 60 protected properties (10 National Monuments, 40 Public Interest buildings, 1 Monument of Public Interest and 9 Municipal Interest buildings).

The inventory of geological heritage of "Montemuro and Gralheira" territory is the aim of the first author doctoral thesis, to be held at the University of Trás-os-Montes and Alto Douro. The inventory methodology to be adopted include: i) bibliographical review, ii) definition of the thematic frameworks, iii) fieldwork to identify and assess geosites, iv) meetings with local authorities. The geosite assessment procedure uses a quantitative methodology to evaluate the

most vulnerable geosites. At the same time, this evaluation will also allow to estimate the potential educational and tourism uses.

Preliminary data have identified already some sites with geological relevance (Fig. 2).



Fig. 2 – Examples of sites with geological relevance in the " Montemuro and Gralheira" territory: a) Braçal Mines, Sever Vouga; b) Cabreia Waterfall, Sever Vouga; c-d) Montemuro Doors, Cinfães; e) Spa Queen D. Amelia, S. Pedro do Sul; f) Spa Carvalhal, Castro Daire.

The "Montemuro and Gralheira" territory presents a very rich natural and cultural heritage with emphasis on the geological heritage. Successive territorial development strategies are being implemented by the LAG – ADRIMAG (territorial development agency), focusing on the usufruct, enhancement and promotion of these resources. The possible extension of the Arouca Geopark territory to the "Montemuro and Gralheira" territory could be a decisive contribution for the sustainable development of this region.

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NATURTEJO GEOPARK SCHOOL PROGRAMME ANIM'A ROCHA AT PORTAS DE ALMOURÃO GEOMONUMENT

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Keywords: *Naturtejo Geopark, Anim'a Rocha, annual school programme, Portas Almourão Geomonument*

Introduction

Anim'a Rocha (which may be translated as “Hearten Rock”) is an annual school programme designed for local schools, where Naturtejo Geopark works closely with teachers and students, in a long-term project approach, endorsing activities that reach the specific needs and interests of each school under the frame of the Geopark's territory.

The latest project was developed during Biology and Geology classes, by 20 students from the 11th grade (16 years old) from Pedro da Fonseca High School (Proença-a-Nova), and their teacher with the support of the Naturtejo Geopark staff, during the school year 2011/2012.

The students organized two field trips, the novelty of this project being that the students who guided the visit only knew the stops in theory, after studying them in the classroom, making these young rangers more aware about the features to be presented in each site.

Portas de Almourão Geomonument Didactical Interest

The selected area for their study was the Portas de Almourão Geomonument, the most important one near the school, a place with almost 500 million years of geological history. This site includes important geological heritage (Neto de Carvalho *et al.*, 2009; Lobarinhas *et al.*, 2010) with tectonic, geomorphological, geocultural, palaeontological and stratigraphical interest.

To learn about the geosites the group chose the geotourist trail “Travel across the Earth bones”, a walking trail that introduces students to the geological context of Serra das Talhadas mountains and Portas de Almourão in particular, providing examples within the curricular contents of the 11th grade studied in the classroom. On the other hand this trail introduces the gold context in the area providing excellent views of remains of the Roman gold mining (*conheiras*).

To close the project the students recreated the ancient mining techniques “There's Gold at Foz!”. “Gold of Portas de Almourão” (Rodrigues *et al.*, in press) is a thematic route around Portas de Almourão Geomonument that combines different geotourist products under the gold subject, from its source rocks and geological setting to its ancient and contemporary past exploitation as placer ore. Besides its scientific and didactical interest this route has a great cultural (including traditional jewelry) and ecological importance.

Classroom activities

At the classroom the students got the first contact with the geosites, together with the Geopark's staff: they analyzed rocks and fossils from the area, models of geological structures, and observed maps and photos.

For the “Travel across the Earth bones” trail the students also used some of the material produced last year by their colleagues in the *Anim'a Rocha* programme “Searching... what is ours” (Rodrigues *et al.* 2011). For this walking trail the students prepared a guided visit and a booklet with questions to be answered during the field trip. The group was divided in small teams. Each one had two stops to discover, explore and encourage their colleagues to observe

and analyze, raise questions, take conclusions and fill the booklet with questions and tasks also prepared by them.

For “There’s gold at Foz” the students were divided in the same teams and made research about gold: physical properties, geological setting, exploration, mines distribution around the world, gold in their municipality - Proença-a-Nova -, etc.

Field activities

The 18 km-long walking trail “Travel across the Earth bones”, was one of the innovative experiences of the project. The students were divided in groups and they were the trail guides for the other colleagues, using as didactical tools the booklet and posters with schemes and models of geological processes. The teacher and the Geopark’s staff only supported the teams, helping the pupils chasing the goals established by them previously or helping in the development of new objectives. The students saw the sites for the first time during this field trip and despite they already knew the theory of the geological aspects of the region it was the first contact with the rocks and the structures. For most of the students this surprise approach involved them and increased the knowledge acquired in the classroom, applying theories already learnt.

During the activity “There’s gold at Foz!” the students experienced these ancient techniques used since Roman times and practiced all the process from the sediment selection till the fine sediments washing, and panning like the former miners. The students filmed all the processes to prepare a small documentary “The Gold in Proença-a-Nova” combining previous knowledge with information achieved during this project.

Conclusions

This educational programme of Naturtejo Geopark was developed to answer to modern society changes, asking for more conscious and skilled citizens, where sustainable development is a priority. While students are working on the heritage around their school they are improving the sense of belonging, understanding geological concepts that otherwise would be studied only in the textbook and learning from examples which exist near them. This project not only contributed for raising awareness for Geology, Biology and Nature conservation but also developed their skills for interpretation.

Anim’a Rocha programme is designed specifically for each case, to answer to specific needs, adapting strategies and methodologies according to student’s age and project goals, and teacher’s needs.

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ABOUT TILLS AND ERRATICS IN THE ASPIRING GEOPARK HONDSRUG (THE NETHERLANDS)

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Keywords: *Saalian Ice age, megaflutes, tills, erratics, geo-education*

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 gives insight in the forming-conditions of these till-ridges and contributes to a new glacial model of the Hondsrug-Hümmeling Ice Stream (fig. 1). The model implicates the source area of the ice stream in the North Sea, the Hondsrug area, as well as the area where clasts and sediments were dumped in the Münster Basin in Germany (Bregman and Pierik, in prep.) 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 distinguished 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 insight in the 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 (Fig. 2).

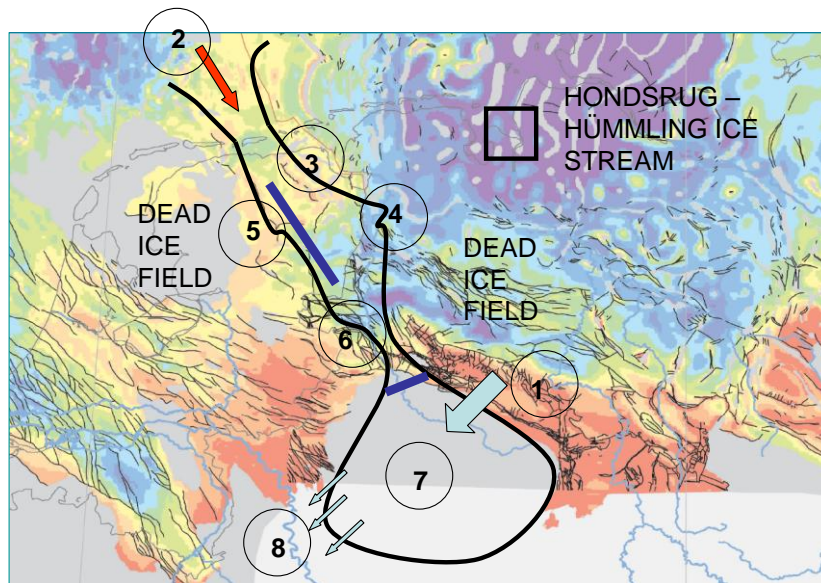


Fig.1. Positioning of the Hondsrug – Hümmling Ice Stream (Saalian, MIS 6; phase 4: Pierik, Bregman & Cohen, in prep.). Dark arrow above: flow direction of the ice stream. Thick line in the north indicates the Hondsrug area; in the south the ice margin (deglaciation phase; indicative). Background map: Lower Trias (PBA, 2011) indicating also tectonic structures.



Fig. 2. Viborgiet, a very rare kind of rapakivi, recently found in an outcrop

QUADRILÁTERO FERRÍFERO, MINAS GERAIS, BRAZIL - ASPIRING GEOPARK: CULTURAL AND NATURAL HERITAGE, DEVELOPING ACTIONS

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Keywords: *Geopark Quadrilátero Ferrífero; cultural heritage; natural heritage*

Brazil has a wide variety of geological structures with sites that remarkably display a wide range of features. However, the absence of a geoconservation policy has led to the disappearance of some important historic records of the Earth, therefore resulting in the loss of part of mankind's scientific heritage. Located in the Southeastern region of Brazil, in the State of Minas Gerais, there is a Precambrian terrain of acknowledged scientific importance: the Quadrilátero Ferrífero.

The geological context of the Quadrilátero Ferrífero is characterized by three rock associations, two of Archean age represented by granite-gneiss terrains and by the greenstone belt of the Rio das Velhas Supergroup, and one metasedimentary Paleoproterozoic sequence containing banded iron formations of the Minas Supergroup. The deposition of the so-called Banded Iron Formations (BIF) occurred worldwide mainly between 2,5 and 2,0 Ga; they correspond to about 15% of the total volume of Proterozoic sediments.

The Quadrilátero Ferrífero shows a unique geological assemblage with many testimonies of the geo-ecologic evolution of the Earth and of the mining history, since the gold rush in the 17th and 18th centuries until the modern iron-ore mining. Some of the most representative sites are: Pico do Itacolomi (Ouro Preto), Inhotim (Brumadinho), and Serra do Rola Moça (Ibirité), which constitutes important geosites, not only of scientific interest (geological and botanical), but also from the pedagogic, touristic, and cultural point of view due to its unique geologic-cultural landscapes. Therefore its preservation is not only a concern of Minas Gerais but of the whole country.

In acknowledgement of the importance of the Quadrilátero Ferrífero in understanding the Earth evolution and the history of mining, studies were started in 2006 to assess the region's potential for the creation of a geopark to be included in the Global Geoparks Network – GGN (assisted by UNESCO). In 2007, a project was started aiming to select and set up the pilot sites for the establishment of the Quadrilátero Ferrífero Geopark with the support of the Mineral and Metallurgic Cluster of Excellence of the Secretariat of Science & Technology and Higher Education –SECTES MG, and financed by the Foundation for Research Support of the State of Minas Gerais - FAPEMIG. From 2006 to 2009, lectures were held during renowned events to present the proposal, as well as workshops for the communities surrounding some geologic sites. In April 2009, the Promoter Group of the Quadrilátero Ferrífero Geopark was created to prepare and submit the application dossier to the GGN in 2010.

In 2011 the Quadrilátero Ferrífero Geopark received an evaluation mission from UNESCO and officially became a GGN aspirant geopark. That same year the geopark was recognized by the State of Minas Gerais as one of the main platforms of action.

Some of the recommendations of the UNESCO evaluators for the recognition of the geopark are: the reduction of the area originally proposed; more effective actions with established sites -

such as the Institute of Contemporary Art and Botanical Gardens Inhotim; expansion of educational actions and geotourism.

In this context, several actions have been established in order to have the Quadrilátero Ferrífero Geopark better prepared to integrate the network, including: a systematic study to reduce the proposed area involving a smaller number of municipalities facilitating the management; development of projects with the Institute of Contemporary Art and Botanical Gardens Inhotim with sponsorship of the Foundation for Research Support of Minas Gerais – FAPEMIG; expansion of educational activities, particularly in association with the Friendly Rock Program at the University of Lisbon. These actions have been accompanied by institutional strengthening of the Quadrilátero Ferrífero Geopark, mainly through itinerant meetings to discuss the cooperation and interaction among the founders and partners institutions of the geopark also leading to the maturation of the shared management.

It is expected that the possible recognition of the area by UNESCO will strengthen the Geoparks Program in Brazil, which first Geopark – Araripe Geopark – was integrated in the GGN in 2006 during the 2nd Global Geoparks Conference held in Belfast. It is believed that the creation of new geoparks in Brazil will increase the interest of the public sector, the scientific community and local communities in this new mode of conservation and promotion of natural and cultural heritage, leading to the integrated development based on the geological heritage.

ASPIRING GEOPARK OF BATUR CALDERA – BALI, INDONESIA

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Batur Caldera Geopark is located in Bangli District, situated in the northern part of Bali Island – Indonesia, and is the first National Geopark in the country. It was established by the Ministry of Culture and Tourism on June 21, 2010 (decree number 06/Kep/DPDP/VII/2010). The Geopark is managed by the Government of Bangli District, which proposed in 2011 Batur Caldera Geopark to become member of the Global Geoparks Network (GGN), which is expected to occur in 2012.

The aspiring Geopark has an area of about 370.5 km² and raised a phenomenon of an active volcano, Batur, with its beautiful double-calderas. The area covers the outer and inner-calderas and extends to the surrounding area. Since 2008, the Batur volcano is considered a Geological Protected Area, that became a National Protected Area. The delineation of the Geopark area is based on the geodiversity and geoheritage values, fauna and flora, culture, and the requests from the local community, who believe that Batur Volcano and its lake are sanctified places. 2075 hectares of the Geopark area is a Natural Tourism Park: the Batur Volcano and Payang Hill Natural Tourism Park.

The geological diversity in the Geopark area includes elements of morphology - major: caldera, volcanic cones, cinder cones, craters, parasitic cones and locally volcanic ash; and minor elements, related with the formation of micro-structures on lava: aa lava, ropy lava, pillow lava, and so on, including lava tunnel or lava cave. Relatively to the litology, two main types of rocks were produced by Batur volcano eruptions: pyroclastics (ignimbrite, welded-tuff, tuff, volcanic sand) and lava flows. Some hot springs help to shape the geodiversity of Geopark. Therefore, were identified 21 geosites within the Geopark area, which have been defined as Geological Nature Reserve by decree of the Head of Geological Agency of the Ministry of Energy and Mineral Resources. The Batur Lake geosite is also classified as UNESCO Cultural World Heritage.

The proposed Geopark has a considerable biodiversity. Most of these floras and faunas live in the Natural Tourism Park area. The vegetation species are mostly forest plantation (classified as protective forest, production forest, wildlife forest and recreation forest), including acacia (*Acacia sp.*), puspa (*Schima noronhaea*) and some other minor plant species, which also includes rare edelweiss flower. Highlight to the fertile soils, produced by the weathering of pyroclastic rocks, which supports the growth of famous Kintamani oranges, coffee, bamboo, cabbages and onion, among other farm products. The typical wildlife fauna have about 30 species - particular emphasis to the presence of monkeys near the top of Batur volcano and the Kintamani dog – considered as one of the Race Asia Dogs. Kintamani dog is original from the Kintamani Highlands in Banfli Regency, located at Bali Province, and became the pride and symbol of the fauna of Bangli District.

The inhabitants of the aspiring Geopark are very religious, in which their belief is motivated by Hinduism - the Hindu culture. In accordance with their beliefs, geological elements such as mountains, lakes and springs are considered as sacred objects. Therefore, were built temples within the Geopark area having the igneous rocks from Batur volcano as raw material. Its

construction dates back tens of centuries ago, when the Hindu religion came to Bali. In accordance with the customs of the society, all elements of the natural diversity, within the Geopark area, are supporting the undertaken conservation programs.

As the education takes an important role in Geoparks, were implemented educational programs in the Geopark area, especially for students. These programs are called “Geopark to School (manager goes to school, in order to introduce knowledge of volcanology and how to manage the nature in sustainable way) and “School to Geopark” (students visit Geopark with the aim to learn and understand the volcanic phenomenon and Earth’s history during the Quaternary). In cooperation with the Museum of Mount Batur, the Geopark management structure also performs basic geological and tourism formation for the tour guides, a program which will be intensified in the future. As a natural laboratory, the Batur Caldera Geopark becomes a place for research in various aspects (geology, flora, fauna and culture). Several students from various universities, and different educational background, do their research to obtain their bachelor, post-graduate and doctoral degrees.

The tourism activities (in form of tour packages) in the Geopark area are divided in four types: geotourism, agrotourism, ecotourism and cultural-tourism, taking advantages from the geodiversity, biodiversity and cultural diversity. A geotrail map was created to give a complete picture of the tourism package in Batur Caldera Geopark with 18 geotrails, which identify the geosites and sights, to help visitors and tourists. In addition, at the Geopark, visitors can be entertained by the local customs, traditions, beliefs and local wisdoms of the communities, through cultural-sites spread all over the area, including the relationship between the rocks, flora, fauna and traditional culture which has a major role in the preservation of elements and maintenance of relationships among those components.

In conclusion, Batur Caldera Geopark was selected to be submitted to join GGN due to its advantages in comparison to other volcano-calderas in Indonesia. These advantages include various aspects such as the high values of geodiversity, biodiversity, cultural diversity, ease of accessibility, strong support from the local community and reality, that the area has grown as a touristic destination of national, regional and international levels. In terms of aesthetics, van Bemmelen (1949) called the Batur Caldera as one of the most beautiful calderas in the world.

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A FANTASTIC LANDSCAPE FORMED FROM ERUPTIVE PRODUCTS OF BATUR VOLCANO: A CHARACTERISTIC OF GEOPARK IN BALI, INDONESIA

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Batur Volcano is located in the north-eastern part of Bali Island, approximately 55 km north Denpasar. The subduction of the Indian Ocean-Australian plate beneath the Asian plate (part of Eurasian megaplate), which began in Pliocene (15 million years ago) resulted in a row of volcanoes in Sumatra, Java and Nusa Tenggara Islands. In Bali, the subduction created Batur Volcano which developed on 160-165 km depth of Benioff zone (Hutchison, 1976; Hamilton, 1979).

Geovolcanology: Old Batur volcano began as a large strato-volcano, perhaps about 3,000 meters high. Then it violently erupted in 29,300 years BP (based on carbon-dating, C₁₄). This paroxysmal eruption resulted in a first caldera of about 13 x 10 km square, and ignimbrite deposits (Ubud Ignimbrite). Furthermore, the eruption developed the second Old Batur Volcano and some volcanic cones. In the caldera rim Mt. Abang was developed. There was another eruption around 20,150 years BP, producing the second caldera (7,5 km in diameter) within the first caldera. Fissure-eruptions produced Mt. Payang and Mt. Bunbunan. The resulting ignimbrite is called Gunungkawi Ignimbrite. Then, about 5,500 years BP formed the Batur strato volcano. During its activity histories, Batur Volcano produced lava flows, cinder cones and maars. Lava flows were issued from the craters on the top of three active cones. The oldest lava flows was recorded in 1804. Five stages of the formation and development of Batur Volcano, as described by Kemmerling (1918), includes a three phases of volcano construction (Stage-I, III, V) and two phases of destruction (Stage-II, IV). The eruption now often shows Strombolian type.

The eruption of Batur Volcano produced an extremely fantastic landscape. The vertical-walls of the first and second caldera, volcanic cones, craters, cinder cones and caldera lake become geomorphic elements that have an outstanding beauty. Lava flows, both block-shaped and ropy-shaped, not only have geomorphology features on its surface (clinker/slag, spatter cones, hornitoes, tumuli, dribble spires, lava pipes, lava spiracles, lava balls, lava steptoes) but also subsurface features (lava tunnels). In this region there are about 18 lava tunnels. Lake of Batur with its blue and calm water creates fascinating scenery at the south-eastern slope of the volcano. Therefore, it is not an overstatement that Bemmelen (1949) called Batur Caldera as one of the most beautiful calderas in the world. At Toya Bungkah, in the edge of the lake, there are some hot springs. The entire Geopark area can be enjoyed from a place called Penelokan.

Components of geodiversity such as rocks and landscapes are a protected geological object. Twenty one geodiversity components consisting of lava flows and landscapes in the area of Batur volcano have been determined to be geosites and geoheritage which have legal protection for its conservation. Several articles in Government Regulation No. 26/2008 assigned volcano landscape such as crater, caldera, solfatare and fumarole as a National Protected Area. As an important geological protected area, the 21 geosites established by the Geological Agency of the Ministry of Energy and Mineral Resources were integrated into the Batur Caldera Geopark. Two other aspects, that is biodiversity and cultural diversity also become the pillars of Geopark development. The relationship between geology, biology and culture is identified strongly. The linking of these three components, both tangible and intangible, is supported by the religious Kintamani society (in particular, and Bali in general). They uphold the principle of Tri Hita

Karana (the relationship between man and God, man and man, man and surrounding nature), customs, norms, and things that are taboo (forbidden).

Batur Caldera Geopark is established by Kintamani people living around the volcano. They get strong support and guidance from the Bangli District Government and several ministries (the two main ones are the Ministry of Energy and Mineral Resources and the Ministry of Tourism & Creative Economy). Geopark is constructed by integrating the three components of natural diversity (geological, biological, and cultural) as a whole. The concept of Geopark is selected as a tool to promote a sustainable regional development. The purpose of Geopark development based on a bottom-up principle is to appreciate the nature in a fair, balanced and sustainable in order to achieve the three main objectives (conservation, education and triggered the growth of local economy value through tourism and agro-industry). Batur Caldera Geopark then becomes the first National Geopark in Indonesia. It was established by the Ministry of Culture and Tourism on June 21, 2010 (decree Number 06/Kep/DPDP/VII/2010).

Geopark manager conducts conservation programs by maintaining geosites from damage caused by mismanagement, in addition to reforestation in the surrounding area. A "Geopark to School" and "School to Geopark" become an education program of the geopark. The Geopark manager also conducts research collaboration with universities and related government agencies. Geotourism activity is organized by the local government through community groups who reside around geosites. The manager of Geopark educates and trains the groups into a professional tour guide. Currently, Batur Geopark has 18 geotrails. In order to expand the understanding and knowledge of Geopark, the management makes comparative studies to some Global Geoparks in Asia, such as Malaysia, China and Japan. Based on the experiences and the presence of infrastructure that are considered sufficient (which will be improved in the future), the Government of Indonesia has proposed the aspiring Geopark of Batur Caldera to become a member of GGN-UNESCO.



Fig. 1. Panoramic view of inspiring Geopark of Batur Caldera shown Batur volcano (left), Batur Lake (middle), and Mt. Abang on caldera rim (right).

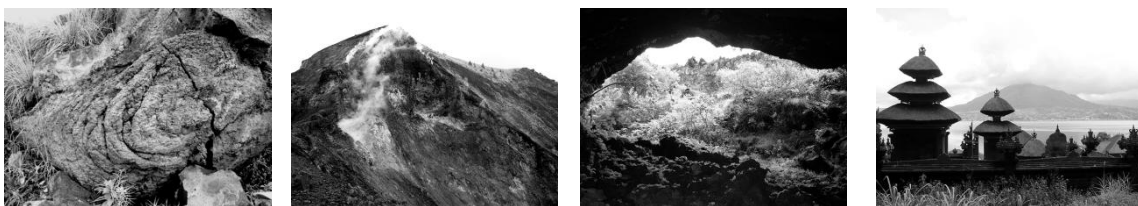


Fig. 2. From left to right: ropy lava of 1849, active crater of Batur, Kesaksak Cave, and Hindu Temple within the Geopark area.

SCIENTIFIC RESEARCH IN THE GEOPARK CARNIC ALPS – A NEVER ENDING STORY

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Keywords: *Carnic Alps, Austria, Geoscience, Palaeozoic*

Active scientific research, as exemplified in the Geopark Carnic Alps, is a backbone of every Geopark. Management and administration are important activities, the role that geologists and other Earth scientist play are however much more important assets of a Geopark. Thus, it seems rather logical that every Geopark employs at least one geoscientist as member of its staff ; otherwise geoscientists from outside have to be encouraged to undertake Earth science-related studies. Fortunately, the majority of EGN Geoparks has recruited at least one Earth scientist as permanent staff member.

The Carnic Alps are widely regarded as being among the most attractive mountain ranges in Austria and beyond. Their intrinsic beauty originates from the interplay of spectacular limestone mountains with gentle mountain pastures and foothills. A great diversity of colors is derived from the contrasts between the pink to pale-colored limestone massifs and the intervening green forests and flower-covered mountain meadows.

The mountains rise either as isolated peaks or ranges with intersecting ravines, in places forming spectacular arena-like sceneries. Some limestone sections extend vertically over more than 1,500 m and thus rank among the highest limestone cliffs found in the Alps.

Pioneering geologists were among the first who were excited by the beauty of the mountains, and their writing and subsequent publications attracted generations of scholars and visitors alike to become acquainted with the extraordinary aesthetic and scientific appeal of the area.

Soon after the visit of Leopold von Buch, the famous German geologist, paleontologist and geographer in the Carnic Alps in 1824 systematic study of rocks and fossils of the Palaeozoic sequences started in the area of the Geopark. During the first field campaign carried out by the Geological Survey of Austria shortly after the middle of the 19th century the equivalents of the Ordovician, Silurian, Devonian, Carboniferous and Permian were recognized which stimulated the first palaeontological studies. Until today generations of Earth scientists have worked in the Carnic Alps which during these times have become one of the best and most intensively studied mountain range. The current knowledge is based on more than 1500 scientific publications covering geology, structural geology, palaeontology, sedimentology, geochemistry, and Quaternary research.

The Carnic Alps of southern Austria and northern Italy provide an almost continuous sequence of sedimentary rocks from the Ordovician to the Triassic, or almost 250 million years of Earth's history. They are characterized by highly diverse marine fossil assemblages ranging from shallow water lagoonal deposits to coral-stromatoporoid reefal buildups, slope and open and deep sea environments. The record of life of both faunas and floras in the Carnic Alps has been documented in numerous palaeontological descriptions dealing with almost all fossil groups ranging from eye-catching macroscopic creatures to micro- and nanofossils. The rich faunal spectrum covers planctonic, nectonic and benthonic animal 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 of the expanding Tethys Sea. They are characterized by exceptionally rich faunal and floral remains. During the late Lower Permian shelf-edge reefal deposits accumulated which were terminated due to an uplift event resulting in a short gap in sedimentation and subsequent karstification. In the Middle and Upper Permian this episode was succeeded by the red clastics of the Gröden Formation and the locally evaporitic Bellerophon Formation.

In a global comparative analysis there is no other property in the world which comprises such a continuous succession of rocks ranging from the late Ordovician to the lower Triassic Periods with evidences of rich fossil occurrences, shifting palaeoclimates, plate drifting, and mountain building processes. They suggest a steady northward drift of one of the Peri-Gondwanide terranes from high southern and cool-tempered latitudes in the Ordovician to the moderate and tropical belt in the Silurian, Devonian and Carboniferous followed by an equatorial position with desert conditions in the Permian; ongoing drifting during the remaining 250 m.y. moved the continental plates to its present

position. The fully marine succession spanning some 250 m.y. of Earth's history has opened a window to many groups of organism in a true oceanic setting – where evolution primarily takes place. This case strongly differs from other world famous fossil sites listed in various compilations (e.g., "Evolution" eds. D. Palmer & P. Barrett 2009) which have almost nothing in common with the Carnic Alps since they mainly comprise freshwater and shallow marine faunas (tetrapods, arthropods, fishes). To date, more than 100 fossil sites across the state border between southern Austria and northern Italy are shown in a specially designed Google Earth map. This list is based on more than 160 scientific papers published in renowned journals in different countries. It includes the name of the locality, its coordinates, elevation, lithostratigraphic assignment, main fossil groups and the bibliographic references. In addition, photo images of both the outcrop and fossils can be downloaded. This new service of the GeoPark Carnic Alps is the result of a close cooperation of an international team of young scientists who, with the same spirit as the pioneers from the 19th and 20th centuries, continue cross-border research in the area of the EGN Geopark Carnic Alps and beyond.



Fig. 1. The new generation of geologists working in the Carnic Alps joined by some older scientists. From left to right Thomas Suttner and Erika Kido (University of Graz), Damien Pas (Université de Liège, Belgium), Claudia Dojen (Landesmuseum Kärnten, Klagenfurt), Claudia Spalletta (University of Bologna), Monica Pondrelli (Università d'Annunzio, Pescara), Maria Corrigan and Carlo Corradini (University of Cagliari), Luca Simonetto (Natural History Museum Udine), Enzo Farabegoli (University of Bologna), Werner Piller and his wife (University of Graz), Maria Christina Perri (University of Bologna), Hans P. Schönlaub (Austrian Academy of Sciences, Vienna).

THREE YEARS OF A SCHOOL CONTEST BETWEEN PORTUGUESE GEOPARKS ON EDUCATION FOR SUSTAINABLE DEVELOPMENT

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The United Nations Decade of Education for Sustainable Development - UNDESD (2005-2014), for which UNESCO is the lead agency, seeks to integrate the principles, values, and practices of sustainable development into all aspects of education and learning, in order to address the social, economic, cultural and environmental problems faced in the 21st century.

Partnerships are an important key to promote an Education for Sustainable Development (ESD) and networks such as the European Geoparks Network (EGN) / Global Geoparks Network /GGN) can be very useful to share ESD ideas and practices. With a view to develop the aims of the UNDESD among the state members, UNESCO has requested the involvement of the National Commissions, at a national level, to promote those aims based for example in the United Nations Convention on Climate Change, the Convention of Biological Diversity or the Earth Charter and also based in International Years proclaimed by the United Nations Assembly, for instance the International Year of Forests (2011). The Portuguese Commission for UNESCO concluded that these partnerships would involve more people, institutions and resources in order to achieve the UNDESD goals.

In the framework of this Decade and also the United Nations Decade on Biodiversity (2011-2020), the celebration of the International Year of Biodiversity (2010) and the International Year of Forests (2011), the Portuguese Commission for UNESCO, the Arouca Geopark and the Naturtejo Geopark promoted several school contests with the main title *Decade of Education for Sustainable Development (2005-2014)*. These contests were one of the activities included in the protocols signed between the Portuguese National Commission for UNESCO and both Portuguese Geoparks and also under the umbrella of the Portuguese Geoparks Forum.

The three main objectives of these school contests were: i) to create awareness among students, teachers and local communities about issues related with the referred Decades and International Years, ii) promote the curiosity of the young people and encouraging them to create posters, videos, written works, prototypes, models and advertising spots appealing to their imagination and creativity, iii) contribute to the implementation of an ESD involving in this process all teachers, students and their families and also the existing Municipalities in both territories of the Geoparks and capturing the interest of the media about this activity. The school contests also aimed to increase the knowledge about the Portuguese Geoparks and the EGN/GGN and their contribution to the UNDESD. It also had the aim to stimulate students desire to learn and to explore, to undertake research and analyze the findings, to draw conclusions and find solutions and to take responsible action. Such an approach enabled teachers to become facilitators and students to be at the centre of the learning process.

The first edition of the contest was in 2009/2010 and was entitled “Climate Change & Biodiversity”. The second edition (2010/2011) was entitled “Natural Resources for Sustainability” and the third edition (2011/2012), focusing in real solutions given by students was entitled “How can I improve the environmental quality of my community?”. The general statistic data are presented in Table I.

In the Arouca Geopark, the school contests were co-organized by AGA – Arouca Geopark Association, the Arouca Municipality and the Portuguese National Commission for UNESCO with the support of Naturtejo Geopark.

In the Naturtejo Geopark, the school contests were co-organized by Naturtejo Geopark and the Portuguese National Commission for UNESCO, with the support of the six Municipalities belonging

to the Geopark territory, three companies related with nature sports (*Incentivos Outdoor*, *Vila Fraga* and *Trilobite Aventura*) and the Arouca Geopark.

All the school contests had rules of procedures, a registration form and three types of awards (1st, 2nd and 3rd prize) distributed between different school levels, namely Pre-school, Primary and Secondary level. Each registration form was proposed by one coordinator teacher and it would involve a group of students (2 to 32 students).

The school contests in the Arouca Geopark were addressed to teachers and students from public and private schools of the Oporto Metropolitan Area (composed by 16 municipalities, including Arouca). In Naturtejo Geopark the school contests were addressed to teachers and students from public and private schools of the 6 municipalities of the Naturtejo Geopark's territory (Castelo Branco, Idanha-a-Nova, Nisa, Oleiros, Proença-a-Nova and Vila Velha de Ródão).

The results of the school contests were always released during the European Geoparks Week. The winners who received the first prize had also the opportunity to make an exchange visit between both Geoparks during the referred Week. The visits were very important for the students because this way they had the opportunity to visit the most important geosites and to get in touch with the biodiversity of both Portuguese Geoparks. They also learned more about the EGN and GGN and the importance of these Networks worldwide. They also received a diploma giving recognition to their newly acquired expertise and contributions.

During the three years of the school contests, the Arouca Geopark organized an award ceremony, which occurred during a Seminar under the same title of the school contests from every year. The winner students and teachers were invited to present their works to a large audience (including other students, teachers, families, etc.). They also took the opportunity to explain how they had began to adopt new behaviours and practices in favour of a sustainable lifestyle and how they had influenced their families during their research. They demonstrated that they had become more enthusiastic and motivated learners. Also in every editions of the school contest, the works done by the students were presented to the local community, in a big exhibition in the Arouca Municipal Museum. At the Naturtejo Geopark, only in the first edition of the contest it was organized an exhibition with the works of the students at the hall of DINOEXPO (*in Nercab Exhibition Centre* at Castelo Branco). The reason for this was that in the second and third edition of the school contest the majority of the works presented were videos. But these videos will be available in the Geopark Naturtejo website (www.geonaturescola.com).

These school contests are one of the most important annual activities of cooperation between the Portuguese Geoparks and the Portuguese National Commission for UNESCO.

Due to the success of this activity, the Portuguese National Commission for UNESCO, Arouca Geopark and Naturtejo Geopark have decided to continue this work also in the framework of the Portuguese Geoparks Forum. However, because of the distance that separate both Geoparks, and due to the new rules of the bus companies, the exchange visit of students will be reformulated and the students will have now two days of field trip, instead of only one day. This will require new sponsorship to support the costs involved (meals, accommodation, insurances).

This kind of partnership promoting school contests can inspire many other schools and other Geoparks to undertake similar projects in favour of the UNDES D while enhancing quality education and learning throughout life.

School Year	Number of students		Number of coordinator teachers		Number of works	
	Naturtejo G.	Arouca G.	Naturtejo G.	Arouca G.	Naturtejo G.	Arouca G.
2009/2010	249	585	11	32	23	73
2010/2011	62	367	5	21	5	47
2011/2012	104	386	7	20	17	31
TOTAL	415	1338	23	73	45	151

Table I. General statistic data of the School Contest in both Portuguese Geoparks.

ARCHAEOLOGICAL POTENTIAL WITHIN AN INTEGRATED STRATEGY OF GEOPARKS MANAGEMENT: APPLICATION OF PREDICTIVE MODELS IN TERRITORY VALUATION

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Keywords: *archaeological sites; predictive models; binary logistic regression; geoparks management; geocultural tourism.*

The integration of natural and cultural heritage is considered an added value in the context of Geoparks. In fact, according the guidelines set by the Global Geoparks Network (2010), they must be addressed according a holistic point a view, linking the geosites to the whole landscape heritage, as 'meeting point' between nature, culture and social history (Domingues, 2001; Pereira, 1995; P. Pereira, D. Pereira e Alves, 2004, 2005). Thus, within a sustainable development strategy, Geoparks should include not only geological or geomorphological sites, but also those of ecological, archaeological, historical and cultural interest. This approach implies the association of Geoparks with a geocultural landscape concept, which reflects the evolution of an area according physical constraints and opportunities presented by its natural/environment dynamics and social, economic and cultural forces (Hernández, 1996). This integrated vision, in a way similar to the concept of 'integrated cultural landscapes' as defined by Panizza & Piacente (2003), fulfills the guidelines and criteria that drive the creation of Geoparks, ensuring the community involvement and establishing multi-cultural bridges that enable geotourism, or, in a broader perspective, geocultural tourism.

But considered an important activity to territorial development, tourism must be properly planned and included in management strategies of Geoparks, ensuring the preservation of its places of interest, regarded as geocultural resources whose values (scientific, educational, cultural, aesthetic) must be disclosed and exploited according principles that highlights environmental, social and economic sustainability (Rodrigues & Fonseca, 2008). In this context, to ensure the attractiveness of Geoparks we must promote its entire heritage, providing a constant updating of scientific knowledge that, in essence, is the foundation of its significance.

This perspective of integrated heritage valuation, clear in some Geoparks and mainly focusing the archaeological sites, is not always explored. For instance, in the Portuguese Geoparks of Arouca and Naturtejo, references to archaeological heritage are relatively limited, though both retain a vast number of archaeological sites identified in IGESPAR database: in Arouca, a total of 127 sites, while in the municipalities included on Naturtejo are recorded 1521. However, like any other database this one must be continuously updated, a process that involves a lengthy and expensive field prospecting work, for which the use of predictive models of archaeological potential may be an important tool (Wheatley & Gillings 2002).

This is the context of our study main objective: to demonstrate the applicability of predictive models (PM) as a tool to support the enhancement and conservation of archaeological heritage in the planning and management of Geoparks. As study area we selected Baião and immediately surrounding municipalities, an area located very near of Arouca Geopark, that presents a wide geological, geomorphological and cultural patrimony, which must be promoted and preserved. However, and despite several proposals made to integrate the mountains of Aboboreira and Castelo in the national network of protected areas (three law projects have been submitted, but all have expired without results), until now only the management plans of the involved municipalities enhance the importance of this area, identifying it as a 'natural heritage area' or as 'operating unit of planning and management'. Moreover, the proximity of Marão and Alvão mountains, classified as Sites of

Community Interest and being the last one also a Natural Park, could perhaps justify the insertion of all this area on the European Geoparks Network.

For accomplish the objective above expressed, we used an inductive model based on the physical environment interpretation of archaeological sites, which allow us to understand the criteria that justify its establishment in a specific area, and thus help to define the locations where more likely exists undiscovered remains (Conolly & Lake 2008; Costa, 2009). The predictive model was applied to 91 megalithic sites of the study area and to 250 randomly defined 'non-sites' (functioning as additional dependent variable), who's location does not match any of those already known.

The definition of physical conditioning factors (independent variables) that characterize the study area and may have influenced the establishment of "habitats" in a specific location, was carried out by applying statistical significance tests (chi-square and Mann-Whitney). In these tests each factor is crossed with the two dependent variables (sites and 'non sites') for determining the effectively significant 'location' variables: those that characterize the archaeological sites and therefore are distinct from the ones that marks the 'non-sites' (Brandt et al., 1992). In other words, the conditioning factors used in the PM must reveal statistically different behaviors for the two dependent variables, defining the location patterns which are common to megalithic sites. Applied the significance tests, we found that only six of the assessed factors - altimetry, slope, curvature, aspect, insolation, and flows accumulation - should be considered. In order to obtain an MP representing the archaeological potential in a single map, it was used a binary logistic regression (carried out through SPSS Statistical Package for Social Sciences) to calculate the coefficients that will be attributed to each factor (Soares, Costa & Gomes, 2010). The resulting formula allows to define the megalithic sites probability of occurrence on a scale from 0 (very low potential) to 1 (high potential), a procedure accomplish with the raster calculator of ArcGIS 10. The evaluation of the model performance, establish by a ROC curve, gave an extremely favorable result (0.9).

The obtained map (fig. 1) allows the identification of areas where there is a strong probability of existing unexplored archaeological sites, providing to those responsible for territory management a work document that directs the archaeological prospecting and encourages its release and preservation in a dynamic and multiscale territorial context.

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THE PROCESS OF THE MANAGEMENT AND ESTABLISHMENT OF THE BODOQUENA PANTANAL GEOPARK: ADAPTING THE METHOD TO THE CONTEXT

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Keywords: *management system, action plan, Geopark Bodoquena Pantanal, systems of governance.*

The creation of Geopark Bodoquena Pantanal through a legal act (Decree 12,897 /12/22 /2009) of the State government of Mato Grosso do Sul is an extremely relevant fact for the history of protection of the natural heritage world wide. Due to its geological, paleontological and cultural importance and its relevance for geoconservation in Brazil (since there is only one geopark linked to the Global Geopark Network - GGN - in Brazil). This is particularly so for specifically, the state of Mato Grosso do Sul as it establishes a formal commitment by this government with the people of Mato Grosso do Sul. If on one hand this is memorable, on the other the limited financial and structural resources impose a great challenge for its concrete implementation and operation.

These issues could be considered as common problems for all Geoparks being established, however the Bodoquena Pantanal Geopark was created with area of 39,000 km² and 57 geosites, involving 13 cities. Just by the size of its area and the number of Geosites, this would already be considered as one of the largest of all geoparks. Which in practice makes it impossible to apply the current concept of Geopark as defended by GGN. So much so that one of the main recommendations of the GGN, during its assessment visit to the Bodoquena Pantanal Geopark in 2010, was that this area should be reduced.

This is not a technical issue, because the Geopark's existing geological, paleontological, cultural and environmental attributes, would allow the zoning of one, two, three and even four different areas (within the current perimeter of the Bodoquena Pantanal Geopark) to be considered as a single Geopark. The issue is, however, political, cultural and social, and rests on how to decide which of the cities would still be contemplated in the project and which would not? Or how to inform the communities that already participated in the present proposal that their local history or culture were left behind for a technical or any other criteria?

Faced with these specific questions and presuming that all activity or action for the protection of the geological heritage and locally based sustainable development, should be considered and improved, we chose to work the current Bodoquena Pantanal Geopark starting with the concept of "a Future Bodoquena Pantanal Geopark Network", or as a large "Territory of potential Geoparks". Geoparks, within this new context, originate from nuclear areas, a set of geosites which are articulated by their geological and cultural identity. The technical workteam of the Bodoquena Pantanal Geopark would assume the function to subsidize and induce the creation of new Geoparks within the territory of the present Bodoquena Pantanal Geopark, according to the local cultural and geological potential. The basic proposal is to enable each group of cities/communities that identify themselves with the geological heritage site to define the area as a Geopark within the network.

According to this premise the present Bodoquena Pantanal Geopark Network would be developed by an organizational and management strategy based on a systemic approach. This presumes working with cyclic systems, the feedback - in the case management and information exchange between Geosites and visitor centers - and self-adjusting Geosites, related but independent, developing within a temporal and spatial framework - understanding the establishment and operation of a geosite as a function of local interest, and not just of the technical workteam - according to the structure and

function - complexity of pre-existing factors or factors created in the structuring of each geosite - establishing, according to these interactions, a varying degree of resilience.

Thus the Bodoquena Pantanal Geopark Network will consist of a mosaic of organizational structures and arrangements, such as: geosites, Geosite core, Centers of reference/visitor centers and Geoparks themselves.

This model does not precognize or predefine which geosites would be considered geosite or geosite core, or which city or community would receive a Referral or Visitor Centre . Not even the establishment of a geosite and or referral center in a given place would neutralize the possibility of another such structure in the same location. What defines a Geosite, with respect to its structure and degree of importance within the Geopark, is the arrangements of the local community related to it.

To put in practice this new approach with the Bodoquena Pantanal Geopark, has been prepared an Action Plan has been structured with the main general objective "to promote and develop effective actions of geo-education, scientific research, conservation, geo-tourism and sustainable local development for the establishment, promotion and consolidation and structuring of geosites and Reference Centers (visitor centers) with qualified human resources and materials. The Action Plan was designed with four Development axes:

- Axis 1: Research, conservation and management of geosites and surroundings;
- Axis 2: Local socioeconomic Development;
- Axis 3: Environmental education and geo-tourism;
- Axis 4: Consolidation of the structure and management system.

The Action Plan is being developed as an experimental, or pilot plan, in three distinct Geosites, but which somehow represent the context of other remaining geosites, namely:

- 1- an already structured geosite, with heavy existing visitation and relevant geological attributes;
- 2 - not yet established geosite with strong geological attributes and good potential for low income, local communities involvement , etc.;
- 3 - not yet established geosite implanted with strong geological attributes and "commitment of the local manager" to foster its implementation.

Although the present proposal seems very ambitious and almost intangible, it is necessary to consider that the establishment of a Geopark is above all a continuous process and not an end in itself and that each such unit presents a specific context that must be considered. A number of issues have to be considered in the specific case of the Bodoquena Pantanal Geopark. It is situated within the 27 states of Brazil, with an area of 357,124.962 km² area – larger bigger than Germany, for example - is bordering two countries (Bolivia and Paraguay) and is waiting to be inserted in the bioceanic route (Atlantic Ocean - Pacific). With an inexpressive population of only 2.5 million, counts with a herd of more than 20 million cattle and is one of the states with the largest number of land conflicts, including indigenous land claims, within a patchwork of extensive land ownership.

CAMINHOS DOS CÂNIIONS DO SUL ASPIRING GEOPARK, SANTA CATARINA AND RIO GRANDE DO SUL STATES (BRAZIL)

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Keywords: *geoparks in Brazil, transfrontier geoparks, local governance*

The region of Caminhos dos Cânions do Sul, aspirant to join Global Geoparks Network, under the support of UNESCO, is characterized by its rich cultural diversity and its geological and geomorphological singularity. The region is recognized by the highest concentration of canyons in Brazil, with elevations up to 900 meters high on the slopes of the Serra Geral, in a context of close proximity to the coastal zone. Its geological history records one of the major tectonic events that occurred on Earth, associated with the rupture of the Gondwanan continent (135-119 Ma) and extends to the recent period, with emphasis to the coastal processes.

In the context of exceptional scenic beauty and scientific importance of the region, various natural environments are formed as the beaches of clear waters, dune fields, caves, waterfalls and ponds. Coupled with all these environments, also highlighted the regional biodiversity represented by the Atlantic Forest biome composing a plurality of environments.

All this natural wealth adds to the cultural and historical heritage left by the first inhabitants of the region – the Carijó and Xokleng Indians –, and the first European immigrants – descendant of Azorean and Italian – known for their hospitality and holders of cultures marked by their food, their customs and traditions. Some of these early inhabitants left evidence of their existence in archaeological sites and are immortalized in museums, others left their participation stamped on the culture of descendants who continue to give contribution in the development of the region. In this context, tourism represents an economic potential of the region with strong cultural, ecological and scientific determination.

The aspirant Geoparque Caminhos dos Canions do Sul is located in southern Brazil, within the states of Santa Catarina and Rio Grande do Sul. Its territory consists of 15 municipalities of the extreme south part of Santa Catarina: Araranguá, Turvo, Maracajá, Balneário Arroio do Silva, Sombrio, Balneário Gaivota, Santa Rosa do Sul, São João do Sul, Passo de Torres, Meleiro, Morro Grande, Timbé do Sul, Ermo, Jacinto Machado e Praia Grande and four more neighboring municipalities of Rio Grande do Sul State: São José dos Ausentes, Cambará do Sul, Mampituba and Torres, totaling an area of 5.750 square kilometers.

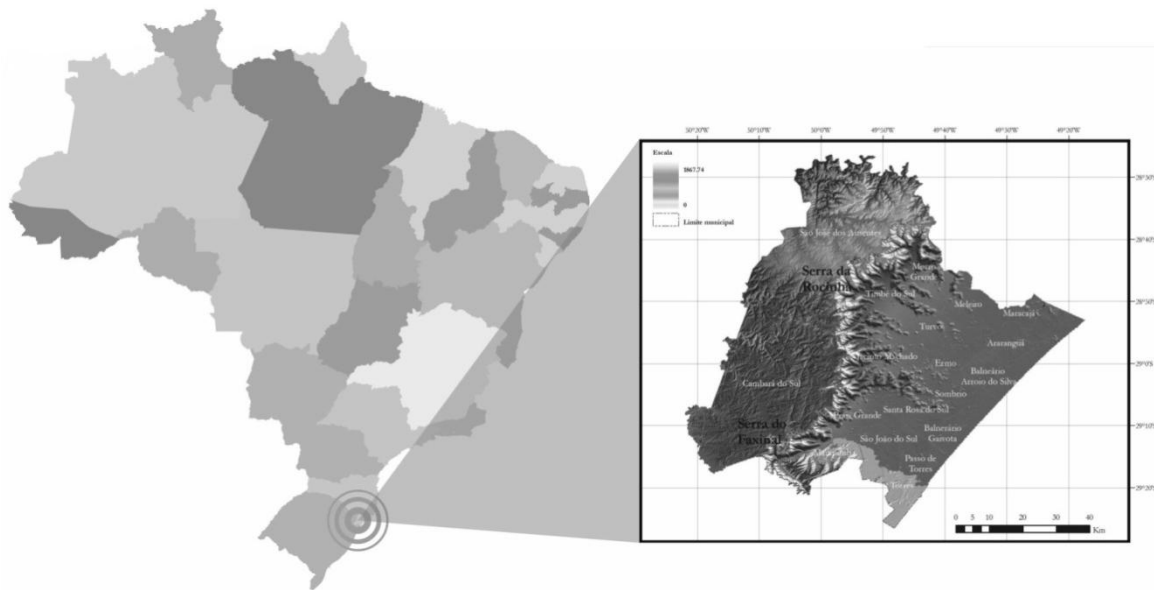


Fig.1. Location of the Caminhos dos Cânions do Sul Aspiring Geopark.

The constitution of the Geopark is being promoted by two institutions: one governmental – Santa Catarina Araranguá Regional Development Bureau of Santa Catarina State (SDR/Araranguá), and one non-governmental – The Santa Catarina Extreme South Municipalities Association (AMESC). These two institutions, after consulting the mayors of the nineteen municipalities that compound the proposal area, all of them appreciated the initiative presenting their letters of support. With the support letters in hand, the proponents looked for the National Geological Service (CPRM), that supports the constitution of Geoparks in Brazil by carrying out studies for the identification, characterization and evaluation of geological sites in the territory candidate, resulting in an official report with twenty geosites inventoried. With these steps taken, a process for building collective and participatory project was initiated with the formation of a coordination team composed of technical representatives from each of the agencies leading the project and a consultant on Geoparks.

For further work, it was adopted a governance model³ that highly prestige the participation and the qualified performance of the local community and stakeholders in the management of its territory, with a view to local demands. This model consists of five learning cycles: the Initial Agreement, the Economy of Experience, the Learning Community, Strategies of Governance, and the Evaluation and Propection, and involves the participation of public agencies, civil society, private sector, research institutions, basic education teachers and indigenous and quilombola⁴ communities.

³ GATS – Territory and Water Governance Model. It is a social technology for the management of common property, developed by the Interdisciplinary Research on Water Governance and Territory Lab (GTHidro - www.gthidro.ufsc.br), coordinated by Professor Daniel José da Silva, from the Department of Sanitary and Environmental Engineering of the Federal University of Santa Catarina (UFSC).

⁴ Title attributed to the communities of descendants of black slaves who during the period of slavery in Brazil have fled their landlords.

PERCEPTIONS AND IDEAS ABOUT GEOPARKS EXPRESSED BY STUDENTS OF A SECONDARY SCHOOL OF PORTUGAL

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Keywords: *Education for Sustainable Development; Earth Sciences, Geoparks; Arouca Geopark; Portugal*

This paper refers to the perceptions and ideas expressed by students about geoparks within the framework of a research in science education centered in an intervention that involved students from two classes of the 11th grade of the High School of Ponte de Sor (Central Portugal). The intervention was developed under the "Theme IV - geology, current problems and materials", and resorted to strategies of fieldwork in small groups.

Based on the vision that geoparks represent relevant educational resources for the promotion of sustainable development, the intervention included fieldwork activities in small groups (3 students per group) which have been implemented during a journey of a day in the Arouca Geopark (Portugal), by exploring geodiversity elements in 5 of its geosites: Geological Interpretative Centre of Canelas, Frecha da Mizarela waterfall, Mizarela geological contact, Castanheira folds and Pedras Parideiras (Rocks delivering stones).

From the methodological point of view, this research is qualitative in nature, a study case type, with data resulting from direct observation and content analysis of the answers presented by pupils to questionnaires (diagnostic and intervention assessment) and to work sheets, expressly created for the research. Quantitative data, has also been integrated, and presented as "descriptive statistics".

The results of this research show that educational interventions involving both collaborative work and practical work, using geoparks as a resource for the implementation of field work, can contribute to promote significant and relevant learning on Geoconservation, as well as to stimulate curiosity and interest for learning more about Earth Sciences, seen as a main goal for the global present day problems mitigation, which affect contemporary societies and endanger Humanity's future.

Concerning geoparks issues, the research has also shown that the activities have induced important changes in the student's perceptions and ideas about geoparks goals (Fig. 1).

Moreover, after the intervention, most of the students could identify properly the Arouca and Naturtejo Geoparks as Portuguese geoparks included in the Global and European Geoparks Networks assisted by UNESCO (Fig. 2).

The students have also expressed interest in visiting not only the Arouca Geopark in the future, as others in Portugal and abroad. In fact, when asked whether they intended to return to the Arouca Geopark, 31 students answered yes and 6 students said they were not interested in doing it. The same opinions were collected in relation to the intention to visit another geopark (Fig. 3).

These results are related to a study case, but put in evidence that educational interventions including visits to geoparks can stimulate curiosity and interest for learning more about geology, as 14 of 37 students involved in this research have decided to pursue studies in geology, and have attended the discipline of Geology of the 12th grade in the academic year 2011/2012, thus giving rise, for the first time in the High School of Ponte de Sor, to the creation a class of this discipline.

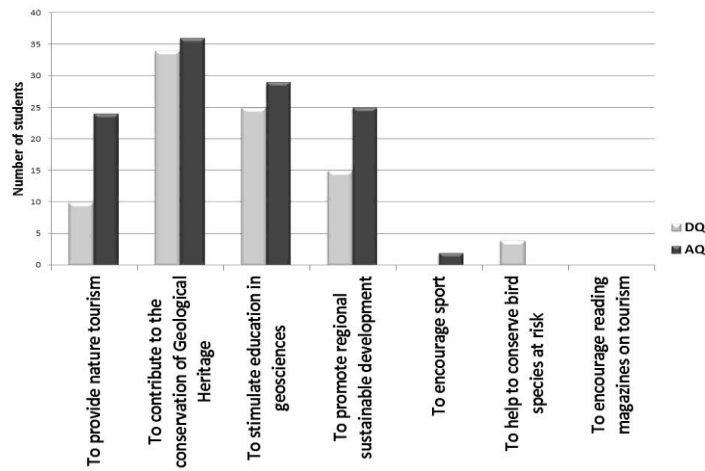


Fig. 1. Student's ideas about geoparks goals according to their responses to diagnosis (DQ) and assessment (AQ) questionnaires (Tomaz, 2011).

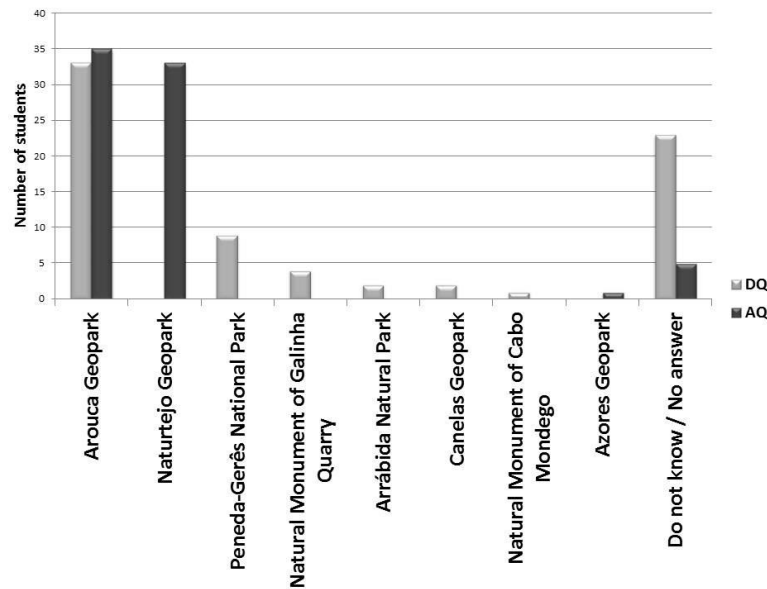


Fig. 2. Student's ideas about Portuguese geoparks according to their responses to diagnosis (DQ) and assessment (AQ) questionnaires (Tomaz, 2011).

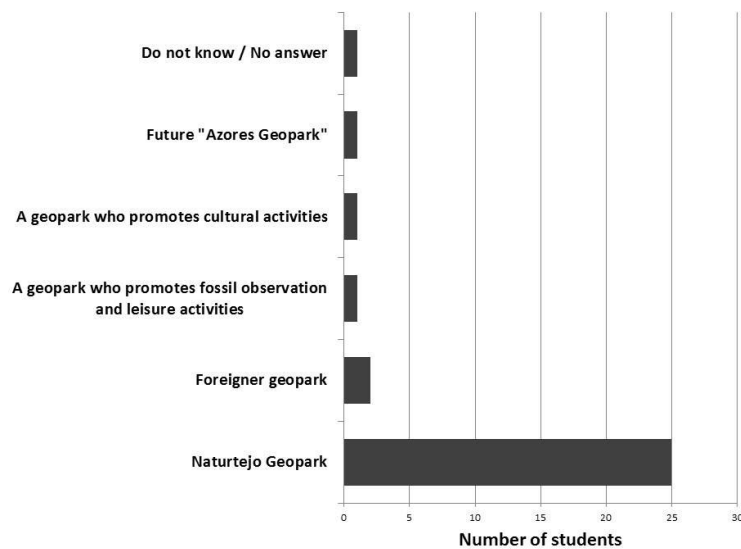


Fig. 3. Geoparks which students are interested in visiting after the intervention (Tomaz, 2011).

THE TROODOS MOUNTAIN, AN UNIQUE GEOSITE OF CYPRUS GEOLOGICAL HERITAGE AND A PROPOSED GEOPARK

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Keywords: *Sea-floor spreading, Oceanic crust, Troodos ophiolite, Massive sulphide deposits, Cyprus*

An European funded project titled "Geotourism and local development: Itanos Mount (Crete) and Mount Troodos (Cyprus)" is currently being implemented within the frame of the European Territorial Cooperation Programme Greece-Cyprus, 2007-2013. The project aims at (i) promoting and protecting the unique geotopes of the two areas, (ii) enhancing geotourism and (iii) implementing all necessary steps for nominating the two geosites for membership of the European Geoparks Network. The cooperation between two mountainous communities of Crete and Cyprus are thus promoted through this project. The ultimate aim is to ensure sustainable development of the areas under study, promote these areas as an education medium for visitors and protect the targeted geosites with special concern to rural economy.

The uplift of the Troodos Mountain, as a result of a series of complex geological processes, gave birth to the island of Cyprus which represents worldwide the better model for understanding the formation of oceanic crust. The geological processes involved are so complex that make it difficult for ordinary visitors to imagine that the densely forested summit of Troodos was once the deepest layer of a slice of oceanic crust deriving from the upper mantle of the Earth that was formed 8,000 meters below sea level.

The geology in the proposed Troodos geopark represents an unique monument of world geological heritage. It is a fragment of a complete sequence of oceanic crust (chemical sediments, volcanic rocks, sheeted dykes, plutonic rocks and mantle rocks) and it is considered as one of the best preserved on Earth. Due to the excellent preservation of the Troodos rocks, their stratigraphic completeness and accessibility, it is the most studied ophiolite worldwide. Significantly, the Troodos ophiolite has played a major role in the development of the theory on the genesis of ophiolites. Geoscientists studying the well preserved and exposed rocks of the Troodos ophiolite have the opportunity to understand the processes that took place 92 million years ago at the bottom of the Tethys Ocean. More importantly, geologists can use the Troodos ophiolite in order to explain Earth processes taking place today during the formation of new oceanic crust.

Closely associated with the Troodos ophiolite are mineral deposits such as chromite, asbestos, massive sulphides and uranium. These minerals have played a significant role in the economic and social development of the island. As the history of mining and mineral industry goes back to prehistoric times, the cultural and archaeological heritage of Cyprus is evident all over the island. Cyprus was probably one of the earliest producers of copper derived by the melting of sulphides, since the sulphide deposits have been discovered and exploited since antiquity. The most important evidence for the ancient mining activity are the 100 scattered ancient copper slag heaps, tools, galleries, historical references and ancient shipwrecks loaded with Cypriot copper ingots. Cyprus rapidly became one of the biggest copper producer and export centres in antiquity and its name became synonymous with copper. In modern times the intensive exploitation of rich and massive deposits of copper, pyrite, chromite and asbestos stopped in the late 80^s. Today, only the Skouriotissa Mine is still active where metallic copper is produced from the sulphide deposits with the application of bioleaching and hydrometallurgy. These sulphide deposits are known as "Cyprus-type" deposits and similar ones are presently being formed in the Pacific and Indian Oceans spreading centers.

The mineral rich rocks and soils of the Troodos mountains host remarkable natural flora that grows in habitats created by the special geological substrate, topography and climatic conditions. The area of the proposed Geopark is the biotope of Cyprus, with the largest number of rare and protected habitats of the island, such as the unique natural forests of black pine, the Troodos serpentinophilous grasslands, the natural forests of endemic junipers and golden oaks, the peat grasslands and the Cyprus' cedar forests.

For the reasons mentioned above, it is strongly believed that the area fulfills all necessary criteria for joining the European Geoparks Network, aiming to ensure the protection of geossites and the sustainable development of the region, by offering the residents of the mountains substantial prospects in geotourism and providing conditions to sustain their lives in their local communities.

GEO-TRAILS IN THE ORDOVICIAN OF PORTUGAL

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Keywords: *Ordovician; geo-trails; geodiversity; environmental education; geotourism*

Some north to south geo-trails have been established in the Ordovician of Portugal to reveal geological heritage. There are examples of such in the Douro Internacional Natural Park, or in Beja–Barrancos. However, we will emphasize the work developed in three areas where strategies involving geoconservation have been applied since the 1980's. In Valongo Palaeozoic Park, in Geological Interpretation Center of Canelas (Arouca Global Geopark) and in Penha Garcia Ichnological Park (Naturtejo Global Geopark) there are Interpretative Circuits with implemented geo-trails that allow the observation and interpretation of different particular aspects of the Ordovician of Portugal.

The Valongo Palaeozoic Park, a partnership between the Faculty of Sciences of the University of Porto and the Municipality of Valongo, has since 1998 been an educative and environmental resource, where the geology advertising and awareness of the natural environment is addressed for schools and for the general public (Couto, 2005). The interpretative circuit has three footpaths trails (green, red and yellow trails) that include tracks in the Ordovician showing different aspects of geodiversity (Fig. 1a). More recently the Municipality of Valongo established an “ecological corridor” gaining the green geo-trail of Palaeozoic Park and linking the urban area to the outcrop. The geo-trails cover rocks of Palaeozoic age and make it possible to observe the variation in sedimentary environments (marine and continental) from nearly 540 to 300 million years ago. Some Ordovician lithologies provide evidence, among other, for the existence of submarine volcanism during the Lower Ordovician, the great biodiversity in the Middle Ordovician and of the great glaciation that occurred in the Upper Ordovician. Gold exploited by Romans is in great part related to volcanism of Lower Ordovician. Thus, the geomining heritage can be also be related with the period of Ordovician history. Evidences of Roman mine works can be observed along the different trails. In red geo-trail, Fojo das Pombas, a significant Roman mine can be visited. Interesting geomorphologic and tectonic aspects can also be observed along the trails. Valongo Anticline is a significant geologic structure that extends for about 50 km from north Valongo to Arouca having suffered 350 million years of erosion along to create a classic case of relief inversion as evidenced by Ordovician lithologies.

Geological Interpretation Center of Canelas (GICC) is situated in the heart of the rocks of the Paleozoic Era, more precisely within Ordovician. The fossils of the so called "Pedreira do Valério", are internationally famous particularly for the giant trilobites (Sá & Valério, 2005), and were studied initially by Décio Thadeu during the 1950's. The resumption of exploration in 1988 allowed the collection of thousands of specimens, the most emblematic are those displayed since 2006 in the GICC. The opening of this private space to the public was complemented by the creation of an approximately 5km circular footpath, called the "Route of the Palaeozoic." This trail allows visitors to walk through several episodes of Earth's geological history (Fig. 1b). They also learn about the "louseira" quarrying at different periods over nearly two centuries, when fossils never posed a barrier to commercial activities. Now the giant trilobite fossils, which have been trapped in the slate for 465 million years, have become a tourist attraction. This trail, with several geological stops, highlights also a number of historical and cultural sites, which include the exploitation of gold from the Roman "Gralheira d'Água" mine. There is evidence of the use of fire for breaking up the veins, as well as the existence nearby of a primitive gravity ore wash. Besides GICC and Gralheira d'Água three more sites are included in the geosites inventory of Arouca Geopark (Upper Ordovician glaciomarine diamictites, Lower Silurian graptolites and Carboniferous conglomerates). The "Route of the Paleozoic" is of great

interest to students at a more advanced levels of education, which came successfully to fill a priceless asset for GICC activity. It is estimated that about half of a total 10000 visitors of CIGC opt to follow this trail annually.

Among the trails which offer an interpretation of the Ordovician in Naturtejo Global Geopark (Secrets of Almourão valley, Schist Path of the Griffon Vulture Flight and Orvalho Geotrail) the Fossils Route is the most visited and best suited for educational activities (Rodrigues & Neto de Carvalho, 2009). A circular path paved with local quartzite was created by the local community in the early eighties to facilitate the visit to the watermills and the legendary “painted snakes”. The “Fossils Route” was formally established in 2003 according to the international rules for walking trails. As the structural axis for disclosing **Penha Garcia Ichnological Park**, this 3 km long circuit starts and finishes in the medieval part of Penha Garcia village. The viewpoints of the Mother Church and the Castle prepare the visitor to dive in to the Ordovician sea. By crossing the major part of the Armorican Quartzite Formation the trail exposes the different sub-environments that were present during deposition of the sands and mud in the marine realm at this stage. Dozens of different primordial habits are interpreted from well preserved trace fossil assemblages including different approaches to feeding from juvenile (meraspid) to giant trilobites. Within a short walk there is so much to see in the rocky gorge of the Ponsul river: different physical and biogenic sedimentary structures typical of sandflats in barrier-island systems, curious folds resulting from fault activity during the Variscan Orogeny, vertical bedding planes equipped for climbing, watermills prepared for milling flour and a traditional bakery with fresh bread always available. The trail also leads to the Pego swimming area, carefully cultivated gardens along the river and even a bog in Mediterranean-type climate with dozens of minute species of plants and insects. 11000 visitors enjoy the “Fossils Route” every year, by just undertaking a short trek or by participating in dozens of adventure sports activities and cultural events especially organized by active tourism companies, such as Trilobite.Aventura or the local community with support of the Municipality of Idanha-a-Nova (Fig. 1c).

Apart from regular self-guided visits, guided tours for schools (students at different educational levels) and for the general public, formation courses for teachers and national and international scientific meetings and outreach activities have been developed in these areas involving the geo-trails.



Fig. 1 – Geo-trails in the Ordovician of Portugal: a) Green Geotrail; b) Palaeozoic Route; c) Fossils Route.

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TRANSLATION AS A COMMUNICATION TOOL BETWEEN THE WORLD GEOPARKS.

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Keywords: *Translation, communication, Geoparks.*

Globalization is increasingly bringing people of different parts of the world increasing need for communication. This situation is not different in the Global Geoparks Network (GGN).

As one of the few member of the Global Geoparks Network that uses the Portuguese language as their native language, the Araripe Geopark had to develop a strategy to be able to communicate better with all the geoparks around the world, including the aspiring Geoparks in Latin America. This strategy is based on the presence of a communications team that works full time on the project. This team includes professionals in the translation area, being a translator of Spanish and another of English language to get informed of everything that happens in all the world geoparks and also keep them all informed about the Araripe Geopark.

Also the translation team works in the region with some projects like English courses for people who works with tourism in the territory of the Araripe, helping them with the development of their business and also the project Geopark

For this purpose, the promotional materials provided by the Araripe Geopark include final versions in English and Spanish in order to strengthen relations with all Geoparks around the world.



Figure1. The new website of the Araripe Geopark.

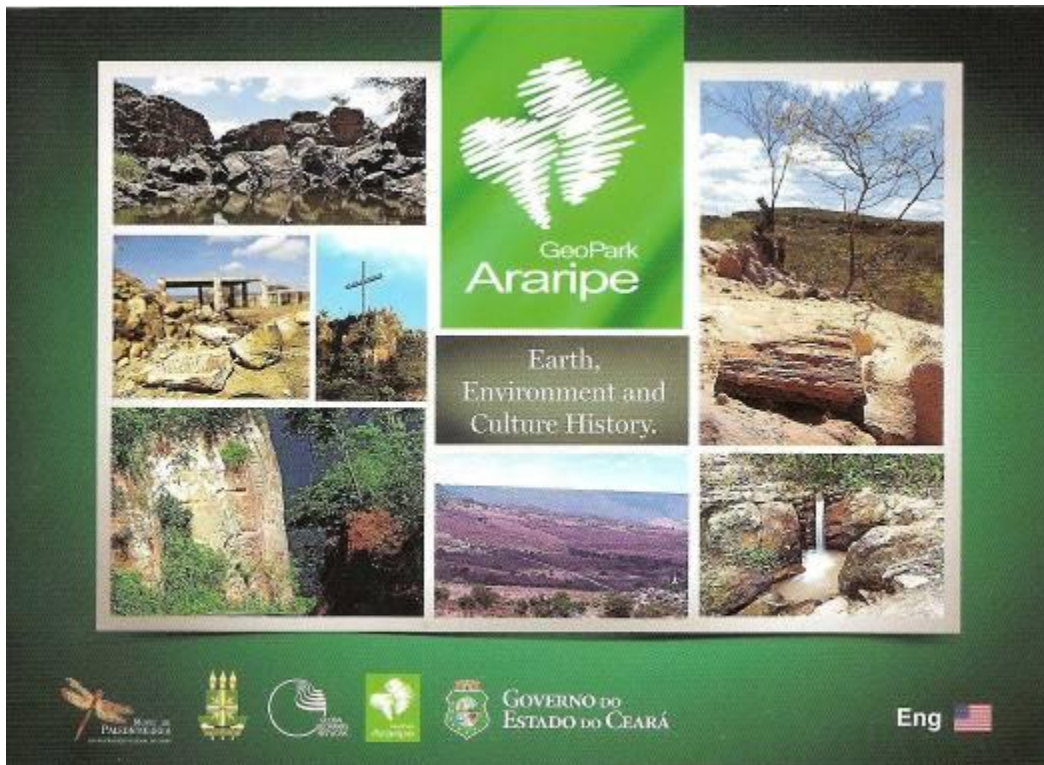


Fig. 2. Araripe Geopark disclosure book.

GEOPARK ODSHERRED – CANDIDATE TO BECOME THE FIRST GEOPARK IN DENMARK

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Keywords: *Weichsel Glaciation, Holocene, Rural Development and Local Art*

Odsherred Municipality of eastern Denmark covers 355 km² and houses a multitude of significant geological features. The dominant geological phenomena relate to the late glacial advances in the termination of the Weichsel Glaciation (17-18.000 y BP) during which glacial series of ground moraines, terminal moraine ridges and sandur outwash plains developed. During the Holocene the glacial landforms were partly submerged by the sea, followed by land uplift. A number of coastal landforms associated with erosion, transport and deposition have developed.

The main features of Odsherred comprise the very well developed and visible terminal moraines and their associated ground moraines. The associated outwash plains are partly submerged today. The best developed terminal moraines are more than 100 m high, rather steep and very distinct landscape features, hence a classic object of studies in the Weichselian landscapes of northern Europe and in many ways the cradle of glacial landform theory of Denmark.

The glacial core of the Odsherred peninsula is almost completely surrounded by sea – to the east flanked by calm fjord waters, to the west and to the north exposed are to the more open sea of Kattegat. The coastal erosion and deposition in the relatively easily erodible glacial deposits in combination with relative land uplift have resulted in a very strong variation between erosional and depositional features, including cliffs, beach ridges and barrier islands with associated coastal lagoons, and marine terraces of beach ridges alternating with swales, spits, bars and tombolos. Some ancient lagoons have developed into extensive peat bogs. A remarkable feature of the landscape is the land reclamations of the 19th and 20th centuries. The largest (55 km²) comprise the partly reclaimed Lammefjord ground moraine, leaving the former seafloor of more than 7 m below sea level dry.

The human impact on the Odsherred landscape has a long and complex history, since the Neolithic people have inhabited the land, and shaped the landscape, usually converging neatly with the various geological landforms. A large number of ancient monuments; burial mounds and monoliths, are distributed in the glacial landscape. The rural settlement pattern of the 18th and 19th century is still clearly visible in the landscape, and the 20th century recreation culture of the welfare society made an impression on the coastal landscape; most notably by colonies of summer houses.

The development of the cultural landscape of Odsherred is therefore strongly connected to the glacial and post-glacial geology. The close connection between geology and cultural history is visible in a large number of sectors extending from local art to local food production.

Already 200 years ago the first landscape painters came to the region inspired by the landscapes of rich contrast and high aesthetic beauty. In the 1930's landscape painters developed an artists' colony – which is now one of four famous artists' colonies in Denmark. Contemporary artists remain strongly attached to Odsherred. As a new and modern expression, the multi-artist Olafur Eliasson, who grew up in Odsherred, is currently working on a huge land art project.

To strengthen the local framework for place-bound growth, employment and skills – mainly in the tourism sector, a number of projects have been initiated. A notable example is the Medieval

Dragsholm Castle, whose owner will establish a food laboratory (Food Lab) training and development center concentrating on Nordic gastronomy. The food laboratory will be coordinated with the Noma Restaurant of Copenhagen, considered by Restaurant Magazine in 2011 and 2012 as the best of the *World's 50 Best Restaurants* organized by Restaurant Magazine.

Odsherred Municipality and partners have been working on the Geopark-project since 2005. In 2009 the project were adopted in the Municipality Plan and from 2011 the City Council and Region Zealand subsidized the Geopark-project with a total of € 255.000 during the three year period from 2011-13.

At the moment the Municipality of Odsherred is implementing a new organization for business and tourism; "Developing Odsherred". This body considers the idea of a geopark as the link between business, tourism, the public authorities and the citizens within the municipality.

The plan for the GeoPark Odsherred project in terms of international Geopark status, is to apply for admission of The European Geoparks Network and GGN in 2013 and hopefully in 2014 be acknowledged as a European Geopark.

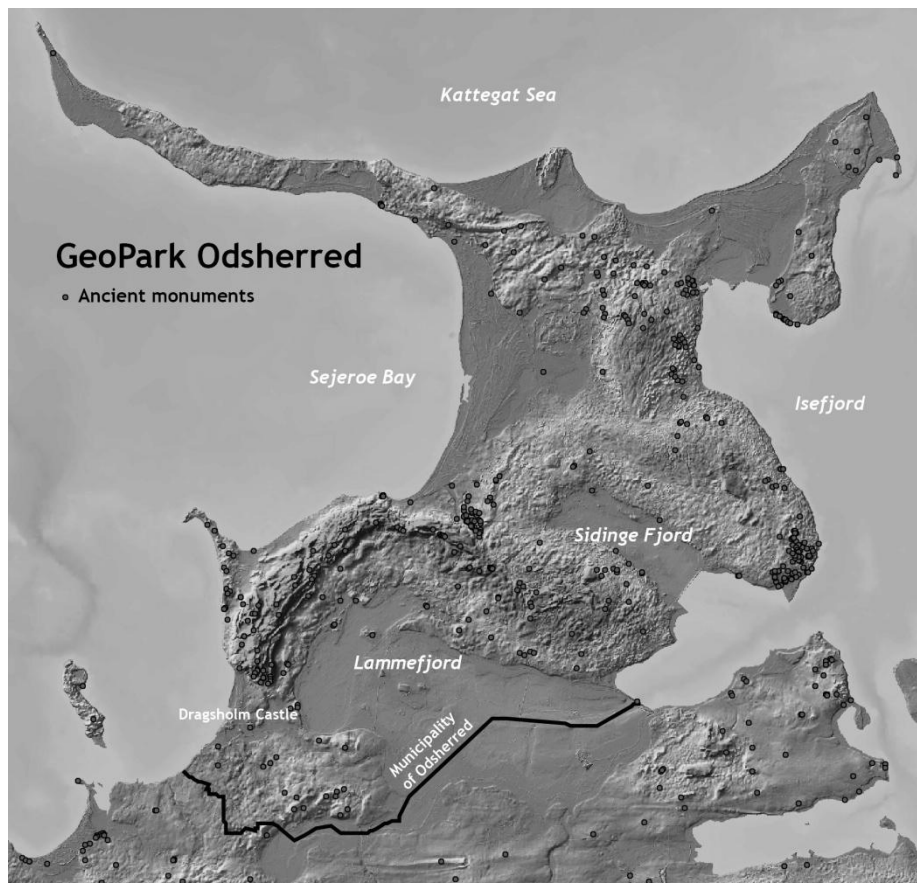


Fig.1. Map of GeoPark Odsherred.

CHALLENGES FOR A GEOCONSERVATION STRATEGY OF THE PALAEOLOGICAL HERITAGE IN ARARIPE GEOPARK (CEARÁ, NE BRAZIL)

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Keywords: *palaeontological heritage; threats; geoconservation; geopark araripe;*

The Araripe Geopark is located in the southern part of Ceará State in northeastern Brazil (figure 1). With an area of 3,796 km² it is almost entirely situated in the Araripe sedimentary basin and it integrates the municipalities of Barbalha, Crato, Juazeiro do Norte, Missão Velha, Nova Olinda, and Santana do Cariri. The Araripe Geopark was the first geopark of the American continent to be included in 2006 in the Global Geoparks Network, with the support of the Government of the Ceará State, which considers it as an important socio-economical development project.

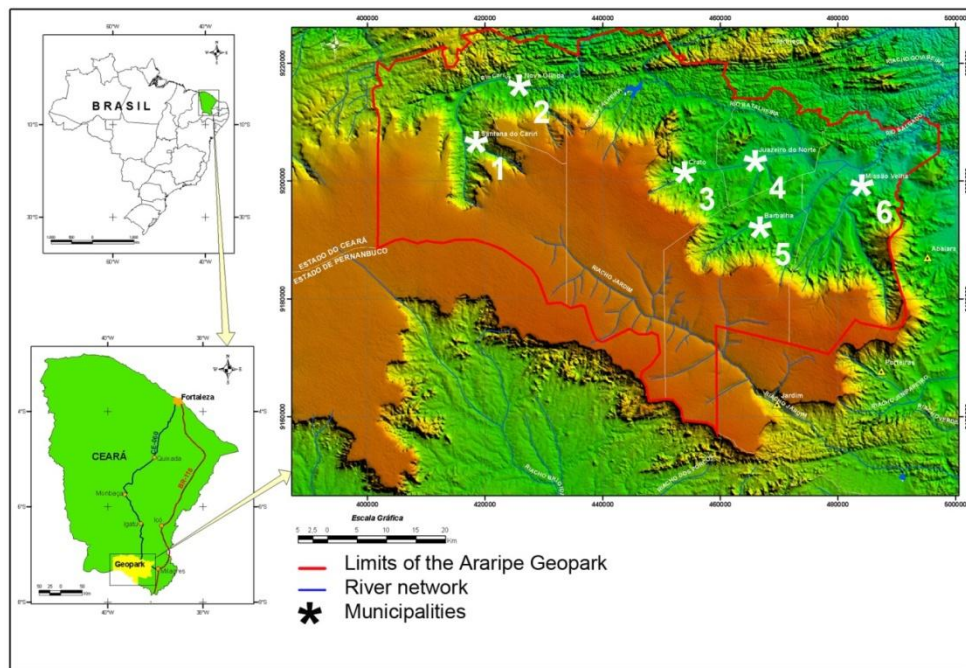


Fig.1. Location of the Araripe Geopark. 1- Santana do Cariri; 2- Nova Olinda; 3- Crato; 4- Juazeiro do Norte; 5- Barbalha; 6- Missão Velha (modified from Geopark Araripe, 2010).

Due to the international relevance of Lower Cretaceous palaeontological record, the Araripe Geopark is well known worldwide, mainly for the exceptional preservation of fossils occurring in the famous Santana Formation, namely plants, arthropods, molluscs, fishes, amphibians, pterosaurs and birds' feathers, all typical of a lower lacustrine sequence, together with an upper estuarine sequence with outstanding fossils of plants, arthropods, molluscs, echinoids, fishes, theropods dinosaurs and a variety of pterosaurs (Carvalho & Santos, 2005).

Unfortunately, there is a continuous loss of this palaeontological heritage in the whole Araripe region due to a set of interconnected factors that strongly interfere with the implementation of a geoconservation strategy. A symbiotic relationship can be established between illegal collecting and fossil selling. This relationship is mutually beneficial for both collectors and sellers, but at the same time is fatal to the conservation of the palaeontological heritage and its scientific and public use. On

one hand the involvement of limestone quarry workers in the fossil collecting is hard to stop due to their low salaries, low socio-educational levels, as well as inexistence of sense of pride for this rich and distinct natural heritage. On the other hand, the high scientific significance and aesthetic beauty of fossils, the continuous demand of sellers, and the inefficacy of the supervising authorities are factors that contribute to the illegal trade of fossils.

The protection of fossils has paramount importance to Araripe Geopark managers but unfortunately some of the foreseen measures are not possible to be implemented by the geopark alone because the solution depends on federal, state, and local institutions. Nevertheless, the geopark can do an important work with local communities especially in what concerns formal and non-formal education, which is the main aim of this work.

The dialogue between the scientific community, population, mining companies, and local supervising authorities must be encouraged and this can be achieved through the implementation of a suitable holistic education strategy.

The slogan of the 11th European Geoparks Conference (Arouca Geopark, 2012) is "a contribution for a smart, sustainable and inclusive growth!", which can inspire the strategy for the promotion of the palaeontological heritage conservation in the Araripe Geopark. The actions in this strategy can encourage a "smart growth" because they include formal education activities and the engagement of teachers, as well as the promotion and dissemination of palaeontological heritage in the local communities. The "inclusive growth" can be considered by the efforts of joining the scientific community, population, mining companies, and local supervising authorities. These activities can contribute to a "sustainable growth" through the development of the tourism industry in the region but safeguarding the value of the palaeontological heritage.

This strategy that will be proposed to the Araripe Geopark managers is applicable in the territory but also in other fossiliferous areas of Brazil and in other countries.

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GEOTOURS AND THE DEVELOPMENT OF RURAL AREAS IN THE AZORES ISLANDS

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Keywords: *geotourism, culture, rural development*

The Azores archipelago, a Portuguese Autonomous Region, is composed by nine islands and some islets, located in the North Atlantic, on the triple junction between the North American, Eurasian and African (or Nubian) plates.

The islands, due to its volcanic origin, exhibit a wide range of forms, reliefs and structures that resulted from the dynamics of the eruptions and the subsequent action of weathering and erosion. Those factors, together with the insular isolation and the atlantic weather, created distinctive ecological conditions. The Azores geodiversity represents elements closely linked to the dynamics of Planet Earth, in particular, the volcanism and geotectonic. The Azorean landscape displays different types of volcanoes, hydrothermal fields, volcanic ridges, volcanic lakes, black sand beaches, lava deltas and volcanic caves, among others.

Since the early days of settlement of the islands (in the fifteenth century), the Azorean people have a strong connection with “their” volcanoes, watching several episodes of volcanic activity and earthquakes. Therefore, the Azorean culture is closely linked to the volcanoes, namely in festivities and architecture. Given the strong Catholic faith of the inhabitants and the lack of knowledge about these catastrophic natural events, in a scientific point of view, the Azoreans have created religious events in order to calm down the wrath of God such as processions, pilgrimages, the Holy Spirit festivities, among others (Fig. 1). In the architecture, it is possible to see old manor houses, monasteries, churches and fortresses decorated with carved volcanic rocks (especially ignimbrites, trachytes and basalts) more accessible in the surroundings and easier to work. The volcanoes-culture strengthen relationship is also possible to observe on the stone walls that divide some terrains, through the enjoyment of thermal baths (Fig. 2), the local gastronomy, namely the famous Azorean dish “Cozido das Furnas” boiled taking the advantages of the geothermal soil or also the different types of mineral waters. These natural landscapes and the rich Azorean culture, which fascinates local population and visitors, are the starting point for the development of geotourism, that is based on sustainability and whose objectives includes the promotion of geodiversity and geological heritage and the appreciation of cultural and environmental aspects of a site.

Although the high geotouristic potential aforementioned, many Azorean islands are still poorly developed, especially smallest rural communities. For this purpose, it is already being implemented a set of “Geotours in Rural Areas” as a contribution to their development and based on: i) a better knowledge about the geodiversity existing in these areas; ii) the promotion of several leisure and outdoor activities (e.g. hiking, geocaching, biking, climbing, “coastering”); iii) the creation of synergies with regional tourism associations, tourist animation companies, restaurants and rural lodgings, as well as with local museums and exhibition centres, among others.

In this moment, there are fifteen geotours implemented in all the islands, integrated at the Live Science national program, which develop several activities during the summer with the purpose to integrate the general public with science. These activities provide geological interpretation of some geosites of the

islands through thematic activities like walking trails, boat trips to interpret the coastal geology, visits to volcanic caves, museums and interpretative centres, urban geotours. Besides these summer georoutes, there are being created others mainly to Santa Maria island and to the Western part of São Miguel island, we predict that these ones will start to be implemented at the end of 2012.

With the implementation of such Rural Geotours it is intended to increase the number of visitors in rural areas and for longer periods of time, and thus allow higher revenues for restaurants and rural lodgings, along with a better promotion of the natural and cultural heritage of the territory. All these factors will contribute, directly or indirectly, to: i) an improvement of the infrastructures and services; ii) the establishment and/or increase of jobs; iii) the possibility of implementing strategies for conservation of the natural and cultural heritage; iv) the strengthening of the cultural identity of the populations, and v) the maintenance or improvement of traditional economic activities (e.g. agriculture and handicraft).



Fig. 1. Biggest Azorean religious festivity (Sr. Santo Cristo dos Milagres, São Miguel island).



Fig. 2. Thermal bath at Caldeira Velha (São Miguel island).



Fig. 3. Geotours at São Miguel island and boat trip to discover and interpret the coastal geology of Graciosa island.

WINDOWS INTO THE PAST AND MUCH MORE... THE GEOTOPES OF THE YEAR IN THE GLOBAL AND EUROPEAN GEOPARK BERGSTRASSE-ODENWALD

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Keywords : *Geotopes, geotope of the year, framework, public relations, well-known event, geo-tradition*

Geotopes are special windows into the past of our planet. Communicating these windows to the public opens a broad chance to interest and fascinate the people.

In relation to the “Day of the Geotopes”, which is a German-wide event, the Geopark Bergstrasse-Odenwald celebrates each year one extraordinary Geotope as “Geotope of the year”.

The selected geotope has to fulfill a special combination of geological requirements: Time, lithology, genesis, environment, and uniqueness. Additionally, the geotope requires a connection to nature, local history or historical economy. Thus, it reflects our holistic approach of Earth history, nature and culture.

The official celebration during the “Day of the Geotopes” is connected with a ceremony, where State Secretaries, scientists, universities, politicians, cooperation partners, and local stakeholders are invited to give sort talks, followed by an interdisciplinary field trip, which shows the various aspects of the Geotope.

Related to the ceremony, the Geopark presents an official certificate to the local partners, a geotope brochure, and a geotope poster. Accompanied, each “Geotope of the year” receives a presence on the Geopark webpage.

An elaborated framework of preparation, organization and public relations offered by the Geopark ensures, that the event is highly visible in the media, and that the “Geotope of the year” has turned out to become a well-known and attractive event each year.

The annual presentation of the “Geotope of the year” is one of the most successful geo-traditions, which has been implemented by the Geopark.

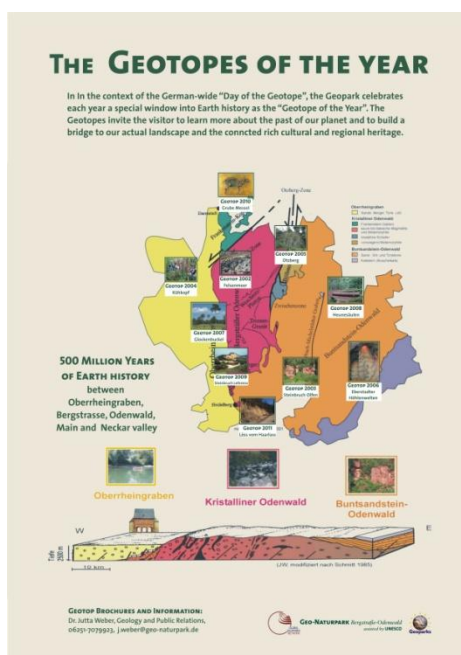


Fig. 1 Overview poster of the “Geotopes of the Year“.

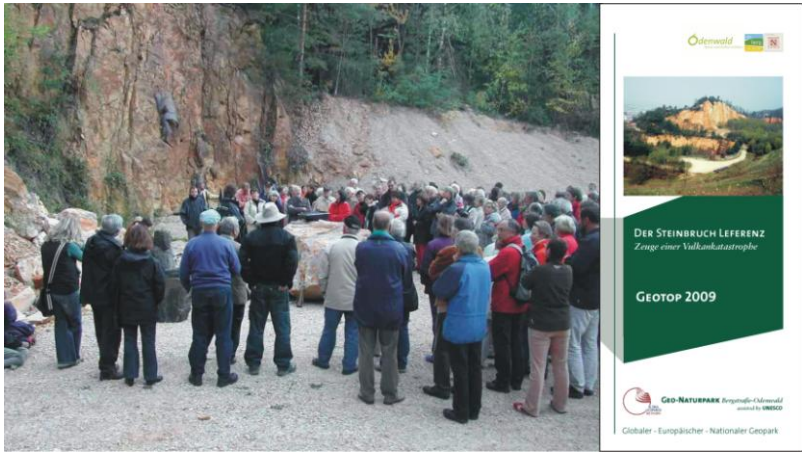


Fig. 2 Presentation of the “Geotope of the Year 2009”: Field trip and Geotope brochure.

SUSTAINABILITY AT A MASS TOURISM “HONEYPOT”

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Keywords: *Sustainable tourism, geotourism, Cliffs of Moher, Burren,*

The Cliffs of Moher lie on the west coast of Ireland, extending for 8 kilometres along the Atlantic seaboard and rising at the highest point to 214 metres. Contrary to information published in many guidebooks they are not the tallest cliffs in Europe, nor even on the island of Ireland. But as nearly one million visitors each year attest, they are one of the most spectacular sights that one can ever see.

Perhaps their popularity is increased by easy access; located close to a regional road, the viewing area with the vista of a rolling stretch of five headlands stretching out to the south can be reached without difficulty and hence has been visited since the early days of tourism in Ireland. In 1835 local landowner Cornelius O’Brien built a gothic tower near the highest point for the sole purpose of providing a viewing point for the visitors that were already flocking to see this iconic panorama.

The cliffs are formed from rocks of the Upper Carboniferous Period, almost 320 million years ago. Bands of Namurian sandstone, siltstone and shale are exposed in a spectacular fashion and here one can study an example of a sedimentary basin normally only visible under the sea. The rock layers are rich in fossils and geologists consider the area one of the world’s foremost natural laboratories for the study of deltaic deposition in deep water systems. Moher or Liscannor slate was quarried at the cliff edge into the early 20th century and many of the flagstones were exported to Britain where today they can be seen at the Royal Mint in London and St Georges Hall in Liverpool.

Long before the impact of quarrying and tourism, human activity at the Cliffs of Moher was well established. The name comes from the ancient Irish language word for ruined fort “Mohtar” and refers to a 1st century BC fort that stood at Hags Head near the current location of the Napoleonic signal tower built in 1803. The legends and folklore of the locality include many tales about the cliffs and the fantastic formations that ocean and climate have carved from the rock.

Humans are not the only visitors to the Cliffs of Moher; during the nesting season they play home to more than 30,000 pairs of nesting seabirds and they are a Special Protected Area under both EU and Irish wildlife legislation. Internationally important numbers of both guillemot and razorbill can be found at this, the most significant seabird nesting colony on the mainland of Ireland. Other protected species include Puffin, Kittiwake, Fulmar, Shag & Black backed Gull. Marine wildlife like grey seal, dolphins, basking sharks, sea otters and minke and humpback whales can be spotted.

Tourists from all over the globe come in great numbers to see this remarkable natural heritage, the location is the most visited natural site in Ireland. In the late 1980s approx.. 250,000 visitors a year came to the Cliffs of Moher. By 2001 this number had risen to 600,000 and by 2006 to over 900,000. Every guidebook, travel brochure and documentary on Ireland shows images of the cliffs. Popularity brought with it challenges and threats to the natural environment. As at any site of natural heritage, the risk is that mass tourism impacts negatively on that which the tourists are coming to see.

In the 1990s and early 2000s these negative impacts were undeniably at work at the Cliffs of Moher. Visitor facilities onsite were woefully inadequate. No interpretation was provided for those who wished to do more than capture a holiday snapshot. Crowding, traffic congestion and pollution, littering, inadequate sewage facilities and haphazard casual trading were evident. Vast numbers of tourists clambering out to the extreme cliff edge led to increased erosion, habitat damage, reductions in bird numbers and substantial safety issues. Lack of visitor management was causing a real danger to the environment and visitor safety. The net result was a negative impact on the natural environment and a reduction in the quality of the visitors’ experience. The 2006 edition of the Lonely Planet guidebook referred, not unfairly, to the Cliffs of Moher as “a sightseeing circus”.

Fortunately however, by this time the owners of the site, local authority Clare County Council, was close to delivering on their strategy to provide state of the art facilities, interpretation and visitor management at this iconic location. A €31.5million construction project with a complex twenty year development history had finally broken ground at the site in summer of 2005. Over a period of 18 months construction of an eco-friendly underground visitor centre proceeded along with development of viewing areas, steps and cliff edge pathways and an ecological reconstruction of the damaged cliff edge habitats. A waste treatment plant was included onsite; parking areas for cars and coaches were reoriented to reduce visual impact and renewable energy sources for the visitor centre were provided.

To complement the built environment a new visitor management and education programme has been developed. Onsite staff provide visitor support, education and management as well as safety, first aid and conservation measures. The visitor centre, housed beneath the grassy hillside contains state of the art visitor facilities including a first aid centre, baggage store, toilets and all the usual commercial facilities such as gift shops & cafes. But the focal point of the cave-like visitor centre is the central dome and theatre space which houses an exhibition providing interpretation and education on the many aspects of the Cliffs of Moher.

In addition to developing facilities, interpretation and visitor management at the Cliffs of Moher that live up to nature's gift, the motivation for Clare County Council included a desire to see a greater economic benefit for the county from the tourism honeypot of the Cliffs. Since the new visitor experience opened in February 2007 average visitor dwell time at the Cliffs has seen an increase of 28% and the number of visitors with an overnight stay in the county has increased by 18%.

Education visits to the site have increased dramatically with over 15,000 student and school and university tour visits in 2008 with many more visitors enjoying guided tours and talks from Rangers and members of the Education team. Conservation measures including wildlife monitoring and recording of seismic activity have been undertaken by the Rangers in cooperation with organizations such as Birdwatch Ireland, Clare Biodiversity office and the Geological Survey of Ireland.

The Cliffs of Moher Visitor Experience has been closely involved with the Burren Connect project that has been instrumental in many of the initiatives in sustainable tourism in the region and who managed the application for Geopark membership. The Cliffs organisation is a leading member of the pioneering Burren Ecotourism Network of almost 40 tourism businesses in the region that are seeking to promote the Burren as a premier ecotourism destination. The network was nurtured and incubated by Burren Connect. The businesses network extensively in product development, cooperative marketing, conservation activity and sharing of best practice as well as actively promoting the other businesses to our own customers onsite.

The awarding of European Geopark membership to the Burren & Cliffs of Moher in October 2011 can be seen as recognition of the approach taken at the Cliffs of Moher as well as of the initiatives pioneered throughout the Burren as part of the Burren Connect project. The Burren and Cliffs of Moher Geopark is now providing visitors, businesses and the local community with a template for sustainable tourism that includes a high degree of cooperation, collaboration and networking.



Fig. 1 Visitors enjoying a Guided Nature Walk at the Cliffs of Moher.

THE ICE AGE IN MAGMA GEOPARK

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Keywords: *Glacial erratics; esker; wave-cut platform; moraine; rock fall; education, sustainable growth.*

The solid rocks in Magma Geopark have ages between 1.600 and 600 million years. Most of them were formed in the root zone of an ancient mountain chain like the modern Himalayas. These mountains have gradually been eroded away as the land has risen at an average rate of 1 cm per 500 years. The landscape in Magma Geopark was greatly influenced during the Ice Ages. The entire Magma Geopark area was covered by ice during the last Ice Age (Weichselian) that lasted from 117.000 until 11.500 years ago.

Glacial erratics, wave-cut platforms, moraines and rock falls are amongst the features formed as a result of glaciation and are the subjects of Geopark localities. Glacial erratics at Mysinghållå are piled up in such a way that they provide a hiding place that was used by freedom fighters during the 2nd World War. St. Olav's Serpent is a winding ridge that was formed in a tunnel filled by melt water under a glacier – a kind of moraine known as an esker. On the coast at Brufjell there is a wave-cut platform and several caves that were formed about 6000 years ago (during the Stone Age). Since then the coastal area has risen by about 10 meters in response to removal of the weight of the ice. During the ice age, deep valleys were filled with ice that supported the valley walls and when the ice melted there were many rock falls. The rock fall at Gloppedal produced one of the largest screes in Europe.

The features from the last Ice Age is easy processes to explain to the public. They are very visible, touchable and mainly made by physical explainable processes. They have an important role of the interpretation of the area and are therefor used in several projects that Magma Geopark are running or participate in, to make sustainable growth both commercial as to raise the awareness of Geopark localities. They have a part in the Nordic Geo Guide School (NGGS) curricula, in Treasure Hunt games (THG) for students and will be important in packages to tourists in the upcoming project Geoparks and Geotourism Northern Routs (GEO2NOR). The NGGS are a project that develop and run a course for Geopark guides in knowledge of the area and dissemination technics. Partners are Katla Geopark Iceland and Silurian Geopark project, Estonia. THG are a project where we are making educational games downloadable for smartphones that can be connected to the national and local curricula or for visiting tourists. Partners are Locatify, Iceland, Katla Geopark Iceland and Silurian Geopark project, Estonia. GEO2NOR is a project that shall brand the geoparks up North making combinations of 3-days packages that can be combined and making it possible to visit two geoparks in a week. Partners are Shetland Geopark, Scotland, Katla Geopark, Iceland, Stonehammer Geopark, Canada and Magma Geopark.



Fig.1 This winding ridge, known locally as St. Olav's Serpent, is a grass-covered esker. It consists of moraine material deposited in a water-filled tunnel that flowed under a glacier.

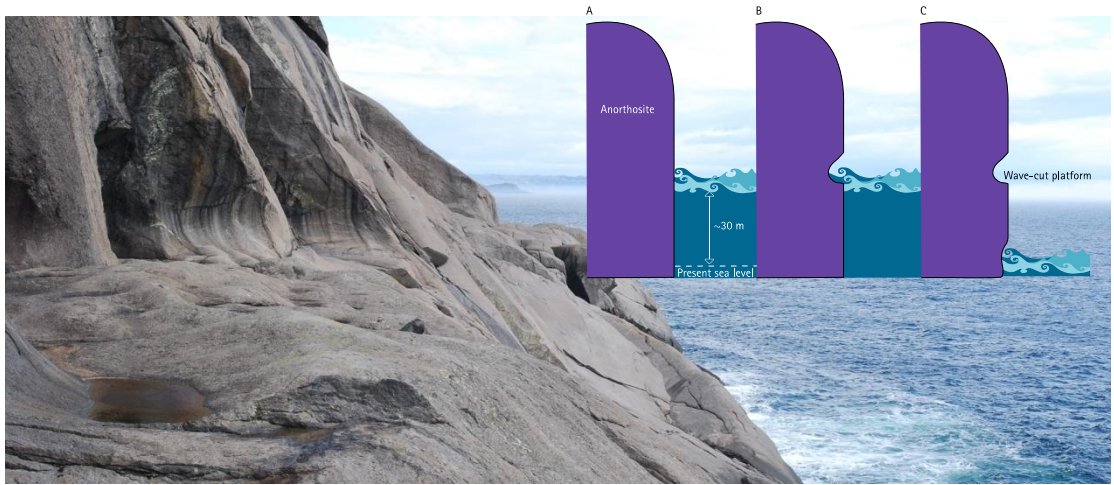


Fig.2 This wave-cut platform and caves on the coast at Brufjell were carved into massive anorthosite rock about 6000 years ago when sea level was several meters higher than today.



Fig.3. Visiting a glacier in Katla Geopark at a Nordic Geo Guide meeting.

AN EXPEDITION IN THE ASPIRING GEOPARK THE HONDSRUG (THE NETHERLANDS)

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Keywords: *Ice age, Geotourism, app,*

The first idea of becoming a Geopark exists already for four 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 off the project.

The Hondsrug is an area off 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).

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.

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.

In this presentation we will give you a more detailed description about how visitors can experience the 'expeditions' of the Hondsrug area.

This year we will prepare our application to become a member of the European Geopark Network. We already made progress in our aim to become a fully functioning Geopark.

CULTURAL AND ARCHAEOLOGICAL HERITAGE OF THE PARYS COPPER MINE, ANGESLEY, NORTH WALES.

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Keywords: *mining, industrial archaeology, genealogy, Anglesey*

GeoMôn is a partner in the cross border Metal Links project funded under the Interreg programme; this paper will outline the work carried out as part of this collaborative project to uncover the cultural and archaeological heritage left by mining in Anglesey, one of the four areas being compared under this project.

Parys Mountain is predominately a copper mineralized zone but there are also significant deposits of lead and zinc, as well as traces of silver and other valuable metals. The mine opened in 1768 after a chance discovery reputedly due to discolouration of the soil and of water seeping from the hillside. It rapidly became the world's largest copper mine and made the fortunes of local landowning families. The mine was managed in association with some of the Cornish copper mines and developed sufficient importance that it claimed to control the world copper price and supply.

This major mining development took place in a sparsely populated rural area; the impact on local communities must have been dramatic. We know that the area today (figure 1) is a scarred landscape with extensive spoil heaps, acid mine drainage affecting several streams and scattered ruins of mine buildings. What was it like in operation? Sulphide ores were roasted on site and then leached of their copper; the fumes of sulphur dioxide must have been choking and polluted the area around. The incoming of miners to work the mine and develop its associated industries must have been like the archetypal "gold rush"

The project is investigating the origin of the miners who came to work the mine, the impact they had on the local community and what legacy they left behind when the mine closed. This paper will show some of the work examining local records of population changes, the growth of the mining town and the development of new harbour with ship building industries that accompanied the growth of the mine, and of the subsequent decline and depopulation after the mine closed. However, the ship building industry continued.



Fig.1. Parys Copper Mine, a derelict wasteland of mine spoil – or a wealth of industrial and archaeological heritage?

DEVELOPING AN INTEGRATED GEO-CULTURAL TRAIL IN WALES, UK

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Keywords: *geotrail, culture, Anglesey*

A five mile coastal walk with a variety of information points is being developed to link the geology and landscape to the economic history of the area through a mixture of quarries, lime-kilns, brickworks and the harbour. The cultural aspects relate to the development of the harbour and the town, but also to the adjacent ancient parish where the church commemorates the shipwreck of early Christian missionary to Ireland, St Patrick, and the time he spent living in a cave in the cliffs. The cave is a direct consequence of the geology, for although these rocks are Precambrian metamorphics, they contain large blocks of limestone.

The St Patrick walk will incorporate education, heritage and culture contents, passing through the local community. In detail it will include:

1. A 5 mile walk starting at the western end of Cemaes Bay on the village Green adjacent to the coastal path.
2. There will be an educational section with a rock walk of boulders from each geological period with a small plaque attached telling its name, place where was found and age. The rocks will be placed in measured distances apart, depending on the length of each geological period.
3. An information board will explain the amazing dykes seen adjacent to the green and explain their origin, either one or two rock tables will be placed on the green for children to work on when studying the dykes, or visitors to admire the views.
4. Optional extension through the town following old railway line to brickworks.
5. The two lime kilns on the walk in Gadlys Quarry and at Llanbadrig will have a small plaque explaining their purpose and how they functioned.
6. An information board will explain the geology of the melange (fig.1 world type locality)



Fig.1. The type locality at which the term “melange” was first used.

on Llanbadrig point, the Dalai Lama connection and the story of St Patrick incorporating the church, cave, well. Icthus and serpent stones in the church. We would like a small plaque on the Dalai Lama seat.

7. The path to the viewpoint above the cave will be levelled sufficiently to be safe and the breaches in the rock above the cave filled with a part-wall to make it safe. Another access gate from the NT car park will lead onto the path to the kiln and viewpoint, and a rock table and benches inserted in the grassed area of the car park near to the information board previously mentioned.
8. A display about the St Patrick connection will be made and placed in the heritage centre in Cemaes to encourage visitors to go there thus helping the local economy. We would also like a film made of the St Patrick connection, also to be shown in the heritage centre, with some input on the Irish shrines to him as well provided by Irish people and try to involve them in the festival.
9. Investigate twinning Llanbadrig with one of the Irish shrine towns.
10. A booklet of the importance of the geology, culture and heritage of the area will be produced and a brief flyer with a map locating the points of interest on the walk will be produced
11. We would like to include smart phone apps but this is dependent on the quality of mobile phone coverage in this remote coastal area.

The project is currently in detailed planning stage, we have some of the funding in place and more promised. Most importantly we have the support and involvement of the local community and the local government, together with land owners and regulatory authorities. We hope to complete the project within 2 years.

GEOTOURISM POTENCIAL OF SEMNAN DESERT AND THE DEVELOPING AN ASPIRING GEOPARK (CENTRAL IRAN)

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Keywords: *Geotourism, Semnan desert, Aspiring Geopark Central Iran.*

The role and importance of tourism and naturalism especially geotourism has a special position within interested people in the World. Iran having very much potency in all fields of tourism especially geotourism can be treated as a pattern in this field within countries of the region. Now, Iran has taken positive and valuable steps by creating geopark of Queshm Island, but natural potency of Iran has provided this facilities so that we do our task seriously which is to protect 4 milliard years' history of the earth. In this direction, central Iran, which most of it has located in Semnan province, have many beautiful landscapes of geotourism and these attractions, in separate geosites for providing an important geopark in central Iran, can be an important factor for constant development in historical region of Semnan which the writer has named it as heart of central Iran in his other papers. Semnan Province, in addition to these geotourism attractions, has a good historical record along with beautiful cultural and tourism monuments which are important for creating geoparks. Therefore, central Iran and Semnan Province with aforesaid historical background and natural potency have suitable tendency to create geopark in this region to protect 4 milliard years' history of the earth.



Fig 1- Abdul Abad fault(Noah's ship – a name that is given by professor Moshiri).

Table 1- the rate of entrance tourists of Semnan for visit of interesting places (Zandmoghadamm, 2008)

	Historic monuments	museums	location season	year
30300	21600	8700	spring	2006
61000	12800	48200	summer	
45783	38456	7327	Autumn	
53238	44321	8917	Winter	
190321	117177	73144	Year total	
220801	187256	33545	spring	2007
154602	141000	13602	summer	
5770	2520	3250	Autumn	
4780	1830	2950	Winter	
385953	332606	53347	Year total	
576274	449783	126491	total	Grand Total

Source: Statistics, Cultural Heritage and Tourism Organization of Semnan Province

GLOBAL GEOARKS IN CHINA

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Keywords: Chinese global geoparks, characteristics, achievements, problems

In China, from 2004 to the present, there are 26 global geoparks (see the table 1 below), which are distributed in 17 provinces. China is one of the earliest countries which join the Global Geoparks Network. With the unique geological background and geographical environment in the continent, there are extremely rich and rare geological phenomena and geoheritages, which provide the excellent condition for the establishment of global geoparks in China. At the same time, the high attention of Chinese government and the active participation of stakeholders are also extremely important to promote the development of global geoparks in China. With the establishing of Chinese global geoparks, the geological heritage conservation and geo-tourism attracts more attention from governments and the public. The global geopark is a valuable attempt by highlighting the potential for interaction between socio-economic development and conservation of the natural environment.

The global geoparks have different geoheritages and special landscapes, the main characteristics were concluded (see the table 1 below). Through the comprehensive analysis of the global geoparks, the types were summarized as follows, stratigraphy, structural geology, paleontology, geomorphology, environmental geology and geohazards. The kind of geomorphology can be subdivided into karst landform, volcanic landform, granite landform, glacial landform, sandstone landform, desert landform, Danxia landform, Yuntai landform (see the table 1 below). Chinese global geoparks covered the most kinds of geoparks and highlight the most significant geoheritage sites. The most important geoheritages can be found in the global geoparks.

Based on the updated statistics in 2011, the achievements of 24 global geoparks in China are as follows. Visitors to the geoparks reached 101.72 million person-time. The comprehensive income of tourism in the geoparks attained 66.93 billion RMB. 28025 people have got permanent jobs and more than 5000 part-time jobs in the global geoparks. 230 categories of popular scientific and handout books were published. 24 geo-museums and 7000 patches of explanation boards were built in the geoparks. More than 200 scientific activities were held, among them 20 times especially for children. The geoparks established cooperative relationship with global geoparks in other countries. The important geo-heritage sites and natural eco-environment among the geoparks were protected effectively, which more than 17000 km² area is under protection.

The objectives of Chinese global geoparks are conservation of geoheritages, popularization of geosciences and development of geotourism. Before the establishment of the geoparks, tourists went there for leisure, who don't know the interesting story of the earth instead of unfounded myths and legends. Through the interpretation system and tour-guide, the geoparks play important role in scientific literacy when the geotourism got fast development. As the geoparks provided more jobs and promoted the tourism, there are bound up with community and the local people and the geoparks. The geoparks are being paid more attention to by the public in China.

Above all, the geoparks boosted the local socio-economic development, and improved the people's understanding of geo-history and global change tendency. The geoparks bring tangible to local people by boosting economic development and creating more employment opportunities. The scientific literacy among the public got promoted.

Table 1. The area, type and main geoheritage features of 26 global geoparks in China.

No.	Name of geoparks	Area /Km ²	Type of geoheritage	Main features of geoheritage
1	Huangshan	154	Granite landform	Granite peak-clusters, stone columns, deep valleys, fairy stones, hot spring
2	Lushan	500	Glacial landform Tectonic geological relics	Glacial horn, cirque, cellar, valley, moraine, erratic boulder, and outwash. Extensional tectonics of metamorphic core complexes, fault-block mountain.
3	Yuntaishan	556	Yuntai landform	Tectonic cuesta, fault cliff, deep valley, waterfall and spring.
4	Shilin	400	Karst landform	Karst stone-forests, valleys, depressions, ridges, slopes, hillocks, pinnacle

5	Danxiashan	290	Danxia landform	Landform of red continental clastic rocks, red cliffs, table mountains, stone peaks and columns, naming site of Danxia landform
6	Zhangjiajie	398	Sandstone peak-forest landform	Quartz sandstone peak-forests, more than 3000 peak-columns, the most 400 m high.
7	Wudalianchi	720	Volcanic landform Hot spring	14 volcanoes, volcanic cones, volcanic dammed lakes, fumarole cones, lava platforms, lava tunnels, lava hillocks etc.
8	Songshan	450.12	Geotectonic relics Strata profiles	3 stratigraphic angular unconformities in Precambrian. Strata in Archean era, Proterozoic era, Paleozoic era, Mesozoic era and Cenozoic era.
9	Yandangshan	294.6	Igneous petrological relics	Large caldera and edifice in Lower Cretaceous period, whole process from eruption to collapse caldera to reactivation and eruption again. Peaks, caves and waterfalls.
10	Hexigten	1343.8	Granite, Glacial and Volcanic landforms	Granite stone-forests, Quaternary glacial potholes, volcanic cones and craters
11	Xingwen	130.51	Karst landform	Karst peak-clusters, dolines, caves, stone-forests, grooves and clints, gorges and waterfalls.
12	Taining	492.5	Danxia landform	Red cliffs, caves, gorges and water landscapes, volcanic and structural landform.
13	Taishan	129.63	Precambrian relics Stratum in Cambrian	Regional stratotype profiles in Upper Archean era, Lower Proterozoic era, Cambrian period and Lower Ordovician period. Fossils in Lower Paleozoic era. Neotectonism and landform.
14	Wangwushan- Daimeishan	986	Paleogeographical and Strata relics	Strata in platform, paleoceanographical environment in Middle Proterozoic era and Paleozoic era. Gorges, peak-clusters and water landscapes
15	Leiqiong	405.88	Volcanic landform	101 volcanoes in Quaternary, maar lakes, maar volcanoes, lava cones, clastic cones and complex cones. Marine erosion landform in basalt.
16	Fangshan	953.95	Karst landform Paleoanthropological relics	Karst peak-clusters and gorges, more than 100 caves. Homo erectus pekinensis, Peking man
17	Jingbohu	1400	Volcanic landform Granite landform	16 volcanic cones, lava platforms and volcanic dammed lakes. Granite peaks, cliffs and gorges, stone mushrooms and potholes
18	Funiushan	954.35	Fossils Geotectonic heritages Granite landform	Oolithias of Dinosaurs. Orogenic belt of Qingling. Granite peak-clusters, peak-forests, stone columns.
19	Longhushan	996.63	Danxia landform	Danxia landform of youth, mature and old age. Red peak-clusters and peak-forests, mesa and stone columns.
20	Zigong	56.62	Fossils	Few kinds of Dinosaurs, woodstone, stratum in Jurassic period.
21	Alax	802.58	Deserts and wind erosion landform	Desert landscapes of Tengger and Badan-Jilin, sand hills and the sing sands phenomenon, lakes in desert. Granite erosion landform.
22	Qinling	1074.8	Geotectonic heritages Geohazard relics Glacial landform	Orogenic belt of Qinling, basin-range tectonics and block landform. Collapse bodies of ancient earthquake. Quaternary moraines and landforms in Taibaishan. Homo erectus lantianensis.
23	Leye-Fenshan	930	Karst landform	Karst doline group in Leye, caves in Fengshan. Karst windows, peak-clusters, depressions, poljes and underground river systems.
24	Ningde	2660	Granite landform Volcanic landform	Miarolitic granites landform and landscapes. Bimodal volcanic landform in Late Mesozoic era. Igneous platform by river erosion.
25	Hongkong	50	Volcanic landform Sedimentary Rock	The columns of the acidic silica-rich rhyolitic volcanic rock. Stratigraphy from 400 Ma to 5.5 Ma B.P. in New Territories. Marine erosion landform.
26	Tianzhushan	413.14	Granite peak- forest UHP metamorphic belt	The granite landform compose of majestic peaks, grotesque rocks, precipitous cliffs, beautiful ridges and tranquil caves. Dabie - Sulu UHP metamorphic belt. Tanlu fault belt

We should pay more attention to some problems below. i) protection of the important geohéritages in the geoparks, ii) the geoparks' sustainable development, iii) research and management in the geoparks, iv) the promotion of popularization and education in geoparks, v) laws and regularities on geopark.

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COMMUNITY SUPPORT AND INVOLVEMENT: KEYS TO PROMOTE SUSTAINABLE DEVELOPMENT OF GEOPARKS

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Keywords: *Sustainable Development Community Support and Involvement*

Sustainable development is one of the three main objectives of geoparks. China has the world's largest numbers of both national and global geoparks. The understanding of community involvement in the sustainable development of Chinese geoparks can be used to assess the effectiveness of application of geopark as a tool to enhance sustainable development. This paper investigates the various forms of participation of local residents in the establishment and management of Chinese geoparks by using Sanqingshan National Geopark as a case example. Personal interviews and focus group meetings were conducted to assess the types, forms and time of involvement the community had undertaken after the establishment of national geopark. Results show that such participation has initiated positive cyclical impacts with the application of geopark concept. To enhance involvement in the establishment and management of geopark, educational materials are distributed and special training and lectures are organized for local residents. Annual meetings are also regularly held to better understand their views and demands. The improvement in the livelihood in forms of better housing, education, transportation, medical and other welfares as a result of effective sustainable development of geopark apparently incites support and encourages further participation and involvement by local communities, particularly in the area of sustainable development. It has reaffirmed that successful development is impossible without working closely together with local people in achieving mutual benefits and prosperity in geoparks.



Fig.1.Oriental Goddess(Pictographic Stone of Mt.Sanqingshan,China).

ENVIRONMENTAL EDUCATION IN ADAMELLO BRENTA GEOPARK

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Keywords: *environmental education, curriculum, geology.*

The Adamello Brenta Nature Park has been recognized in 2008 as European and Global Geopark under the auspices of Unesco, thanks to the peculiarities of its geological heritage, the policy of sustainable development implemented through the European Charter for Sustainable Tourism, the activities of environmental education, training and scientific research. In this historical moment we must pay more attention to environmental problems. Western world people are intensely looking for economical security and development. At the same time they are being more and more aware of the natural system stability and the end of the environmental resources. We can look with hope at the future because the new generations can be sensitized about these problems in order to find solutions to make life on earth better for humanity and every living being.

Adamello Brenta Nature Geopark (Abg) has been working since its birth to promote environmental education that is one of its main aims. Moreover it has to improve research, organization, maintenance and supervision of its area to become an example of a good and sustainable territory management. These actions are educational for local people, visitors and politicians.

Abg develops many educational projects, even if the results of environmental education are not immediately visible and is something like sowing and hoping to get a good product. The goal of the educational projects addressed to schools is to improve students' scientific and naturalistic knowledge but, above all, to promote the respect for nature and its stability for the future Earth benefit. Each project consists of outdoor activities giving an opportunity to hundreds of young people to experience fun and educational activities.

Abg organizes its educational activities according to the Ministry of Education proposals on environmental education in order to satisfy schools needs and goals. All considered, Abg submits its projects mainly to schools located in the Park's territory. This way it becomes a local organisation which can make the schools' curricula more complete, building a path for the education of young people in order to respect the environment, mother earth, and to implement "good behaviour rules" in daily life.

More than thirty educational projects have been created, focusing on different environmental features of the Abg, among which geology and geomorphology are well developed. Most of the projects consist of two indoor meetings and one outdoor in the Geopark. Projects are different depending on the age of the students, focused mainly on playing activities for Primary school, and on scientific and environmental aspects for Secondary school.

Every year Abg sends informative material to schools promoting its environmental education proposals (letters, CD, leaflets). It's very important to maintain a constant connection between schools, teachers, environmental operators and park institution to make educational projects better every year.

The Abg has developed an agreement to improve environmental educational activities. This agreement provides a path for children from primary to secondary school, with the participation in environmental projects every school year. These projects are created by Park Environmental Education staff in collaboration with teachers following the school programs, and they define a "vertical curriculum of environmental education". Nine "Comprehensive Institutes" (Primary and Secondary school) located in the Abg area – 6000 students - subscribed the agreement, accepting to participate every year, during the eighth year of primary and secondary school, in the educational projects (vertical curriculum) planned with teachers.

Every student receives the “Park Identity Card” (Fig.1.), where the Park environmental educator will put a stamp for each Park project. In addition students receive a “title” every year which shows the raising knowledge acquired in environmental and scientific field.



Fig.1. Identity card for children from primary to secondary school.

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