The Global Geoparks Network, in collaboration with the UNESCO Global Geoparks Secretariat, celebrates International Geodiversity Day 2022. All UNESCO Global Geoparks, their partners and stakeholders are invited to join the campaign to raise awareness of the value of Geodiversity in unique territories with Geological Heritage Sites of International significance and as custodians of the Memory of the Earth!

The 6th of October 2022 is the world’s first celebration of the International Geodiversity Day. It is an annual global celebration which was approved by the 22nd of November 2021 by 193 Member States during the 41st UNESCO General Conference following a proposal from 109 international states.

The Global Geoparks Network, in collaboration with the UNESCO Global Geoparks Secretariat, invites you to discover the uniqueness of the UNESCO Global Geoparks' geodiversity through the following activities coordinated by the Global Geoparks Network to celebrate the world's first International Geodiversity Day on the 6th of October 2022.

● Explore the geodiversity of UNESCO Global Geoparks in this GGN new publication "Geodiversity in UNESCO Global Geoparks" in which articles on the geodiversity of UNESCO Global Geoparks can be found.

The Global Geoparks Network on the 6th of October 2022 invites you to discover the uniqueness of the UNESCO Global Geoparks' geodiversity through the following activities coordinated by the Global Geoparks Network to celebrate the world’s first International Geodiversity Day on the 6th of October 2022.

● Join the Global Geoparks Network Facebook page and discover the five most important Geological Heritage Sites in each of the 177 UNESCO Global Geoparks from 46 countries.

https://www.facebook.com/globalgeoparksnetwork

The Global Geoparks Network social media campaign includes a variety of promotion ban-

ers as well as posters.

● The Global Geoparks Network social media campaign also promoted field activities organized by UNESCO Global Geoparks to celebrate the first International Geodiversity Day by providing schools, local inhabitants and visitors to engage with and understand the value of geodiversity in their territory.

● Connect to the following YouTube link and watch the digital event organized by the Global Geoparks Network in collaboration with the UNESCO Global Geoparks Secretariat for the celebration of the International Geodiversity Day on the 6th of October 2022:

https://www.youtube.com/channel/UCUghhLY2w-eBMYHoaj6GjB8q

During this event the UNESCO and Global Geoparks Network Grant for Africa, the Arab States and for the Small Island Developing States was announced.

● Explore the geodiversity of UNESCO Global Geoparks in this GGN new publication “Geodiversity in UNESCO Global Geoparks” in which articles with photos of the various significant geosites in UNESCO Global Geoparks are presented.

Let’s make the International Geodiversity Day a great moment for all Geoparks and their communities!
Azores UGGp, Portugal - Europe

Nine Islands - One Geopark: Where geodiversity becomes identity

The Azores UNESCO Global Geopark’s (UGGP) territory is composed of nine islands and several islets that emerged from the Atlantic Ocean’s seabed, through the process of volcanic activity. This activity is strongly connected to the geodynamic context present in this region of the globe, and is affected by the existence of the Mid-Atlantic Ridge.

Despite the volcanic origin of the archipelago, all the islands present a unique and distinguished geodiversity. The different types of volcanic activity contribute to the variety of landscapes and volcanic products that result either from an acidic or basic composition, with eruptions ranging from explosive to effusive thus resulting in various volcanic forms and deposits.

The Azores UNESCO Global Geopark is an authentic mosaic of volcanic geodiversity, which allows us to tell the story of this territory, the story of Azoreans, a story that started around 6 million years ago, with the volcanic formation of these islands. The volcanic substrate, isolated in the middle of the Atlantic Ocean, became the stage for life, allowing the appearance of a unique biodiversity represented by native and endemic species. As a consequence of time, the inhospitable volcanic landscapes became inviting for humans, providing fertile soils, geothermal resources and magnificent landscapes. Despite several historical eruptions and earthquakes witnessed by Azoreans, this geological setting has become the essence of their identity and is represented in the traditions and religious practices existing in all islands.

The azorean geodiversity is part of Azoreans’ life and cannot be dissociated from the people. Unique coastal landscapes, calderas, small and large volcanoes, lagoons and waterfalls, emblematic prismatic joints, magnificent volcanic caves represented by lava tubes and volcanic pits with a unique fauna, lava fields flourishing with vineyards, the telluric heat in the form of fumaroles and hot springs, ruins of lighthouses, churches and houses that are testimonies to recent eruptions and earthquakes.

It is the role of the Azores UNESCO Global Geopark to preserve the identity of the archipelago through the promotion and conservation of its geodiversity. Protecting them through geosites. Protecting them through geosites and geoparks is of the utmost importance, as the different types of volcanic activity contribute to the variety of landscapes and volcanic products that result either from an acidic or basic composition, with eruptions ranging from explosive to effusive thus resulting in various volcanic forms and deposits.

The Azores UNESCO Global Geopark is an authentic mosaic of volcanic geodiversity, which allows us to tell the story of this territory, the story of Azoreans, a story that started around 6 million years ago, with the volcanic formation of these islands. The volcanic substrate, isolated in the middle of the Atlantic Ocean, became the stage for life, allowing the appearance of a unique biodiversity represented by native and endemic species. As a consequence of time, the inhospitable volcanic landscapes became inviting for humans, providing fertile soils, geothermal resources and magnificent landscapes. Despite several historical eruptions and earthquakes witnessed by Azoreans, this geological setting has become the essence of their identity and is represented in the traditions and religious practices existing in all islands.

The Azores UNESCO Global Geopark’s (UGGP) territory is composed of nine islands and several islets that emerged from the Atlantic Ocean’s seabed, through the process of volcanic activity. This activity is strongly connected to the geodynamic context present in this region of the globe, and is affected by the existence of the Mid-Atlantic Ridge.

Despite the volcanic origin of the archipelago, all the islands present a unique and distinguished geodiversity. The different types of volcanic activity contribute to the variety of landscapes and volcanic products that result either from an acidic or basic composition, with eruptions ranging from explosive to effusive thus resulting in various volcanic forms and deposits.

The Azores UNESCO Global Geopark is an authentic mosaic of volcanic geodiversity, which allows us to tell the story of this territory, the story of Azoreans, a story that started around 6 million years ago, with the volcanic formation of these islands. The volcanic substrate, isolated in the middle of the Atlantic Ocean, became the stage for life, allowing the appearance of a unique biodiversity represented by native and endemic species. As a consequence of time, the inhospitable volcanic landscapes became inviting for humans, providing fertile soils, geothermal resources and magnificent landscapes. Despite several historical eruptions and earthquakes witnessed by Azoreans, this geological setting has become the essence of their identity and is represented in the traditions and religious practices existing in all islands.

The Azores UNESCO Global Geopark’s (UGGP) territory is composed of nine islands and several islets that emerged from the Atlantic Ocean’s seabed, through the process of volcanic activity. This activity is strongly connected to the geodynamic context present in this region of the globe, and is affected by the existence of the Mid-Atlantic Ridge.

Despite the volcanic origin of the archipelago, all the islands present a unique and distinguished geodiversity. The different types of volcanic activity contribute to the variety of landscapes and volcanic products that result either from an acidic or basic composition, with eruptions ranging from explosive to effusive thus resulting in various volcanic forms and deposits.

The Azores UNESCO Global Geopark is an authentic mosaic of volcanic geodiversity, which allows us to tell the story of this territory, the story of Azoreans, a story that started around 6 million years ago, with the volcanic formation of these islands. The volcanic substrate, isolated in the middle of the Atlantic Ocean, became the stage for life, allowing the appearance of a unique biodiversity represented by native and endemic species. As a consequence of time, the inhospitable volcanic landscapes became inviting for humans, providing fertile soils, geothermal resources and magnificent landscapes. Despite several historical eruptions and earthquakes witnessed by Azoreans, this geological setting has become the essence of their identity and is represented in the traditions and religious practices existing in all islands.

The Azores UNESCO Global Geopark’s (UGGP) territory is composed of nine islands and several islets that emerged from the Atlantic Ocean’s seabed, through the process of volcanic activity. This activity is strongly connected to the geodynamic context present in this region of the globe, and is affected by the existence of the Mid-Atlantic Ridge.

Despite the volcanic origin of the archipelago, all the islands present a unique and distinguished geodiversity. The different types of volcanic activity contribute to the variety of landscapes and volcanic products that result either from an acidic or basic composition, with eruptions ranging from explosive to effusive thus resulting in various volcanic forms and deposits.
Arxan UGGp, China - Asia

Geodiversity in Arxan Geopark

Arxan UNESCO Global Geopark (Arxan UGGp) is located at the point where the eastern Tianshan-Xing’an fold zone amalgamates with the Daxing’anling giant uplift belt of the Cathaysian tectonic system. It is a topographic boundary zone in China and a crustal section of the Cathaysian tectonic system. It is a topographic boundary zone in China and a crustal section of the Cathaysian tectonic system. Arxan UGGp includes a wide range of volcanic, lava flows, and volcanicogenic lakes. Powerful, primarily alkaline basaltic eruptions left 46 volcanic structures and lava platforms on both sides of the Arxan River. Many lava landforms mentioned in volcanology literature or pictorials can be found well preserved in this area. In particular, the turtleback lava structure is the only large-scale, well-developed example left 46 volcanic structures and lava platforms. In a 40 km² area of Shitanlindakitten, there are 76 springs that are evenly distributed.

Moreover, in a 40 km² area of Shitanlindakitten, there are 76 springs that are evenly distributed. In particular, the turtleback lava structure is the only large-scale, well-developed example left 46 volcanic structures and lava platforms. In a 40 km² area of Shitanlindakitten, there are 76 springs that are evenly distributed. In particular, the turtleback lava structure is the only large-scale, well-developed example left 46 volcanic structures and lava platforms. In a 40 km² area of Shitanlindakitten, there are 76 springs that are evenly distributed.

The Geodiversity concept strengthens disaster resilience in Koki Nagata, Aso Geopark

Kumamoto Earthquake

Aso UGGp experienced a series of magnitude 6 and magnitude 7 earthquakes in 2016. It was the first time in Japan’s recorded history that an intensity of 7 was recorded in a series of seismic activity. The Kumamoto earthquake caused significant damage, with 273 people killed and approximately 200,000 people forced to live in evacuation centres throughout Kumamoto Prefecture. Based on excavating trenches Toda et al. (2019) point out the activity on the Futagawa fault that caused this earthquake may have occurred about once every 2,000 years.

Aso UGGp includes a wide range of volcanic, lava flows, and volcanicogenic lakes. Powerful, primarily alkaline basaltic eruptions left 46 volcanic structures and lava platforms on both sides of the Arxan River. Many lava landforms mentioned in volcanology literature or pictorials can be found well preserved in this area. In particular, the turtleback lava structure is the only large-scale, well-developed example left 46 volcanic structures and lava platforms.

Anxiety immediately after the quake

Immediately after the earthquake, many residents commented, “I wondered why this happened,” and “I thought there would never be a major earthquake in Aso”. They spent their time in the elementary school where they were evacuated, frightened by aftershocks without any information about the current situation.

On the other hand, Natsuko Kodama, a Geopark staff member at the time, said “I felt this earthquake is the movement of the Earth. I had never learned about Earth science, but I naturally accepted the geological characteristics and geological processes of Aso caldera through my involvement in the Geopark programme”. She said that even immediately after the earthquake, she did not panic in terms of “why did something so terrible happen? so, I was easily able to switch my mind to recovery and how I should respond to this disaster.”

Geodiversity and Disaster Mitigation

This Aso UGGp staff’s experience suggests that the Geopark programme and the concept of geodiversity may be able to reduce anxiety in the immediate aftermath of an earthquake. Geodiversity is a dynamic concept that not only describes the elements in of Non-Living Nature, but also encompasses its processes, and how I should respond to this disaster. "I can't believe this happened".

Koki Nagata, koki@aso-geopark.jp

Parco del Beigua, UGGp, Italy - Europe

Geodiversity meets biodiversity and culture in Beigua Geopark

The Block fields.
(Photo by Roberto Guaschino)

A Geopark with its feet in the sea. The 12 km flat walk that connects Varazze to Arenzano, can be explored on foot or by bicycle all year round, was once a railway track overlooking the sea. Here 250 million years ago there was an oceanic seabed, consisting of ophiolites, metagabbro and serpentinites, which the locals simply call gianchi (whites) and neigri (blacks).

A Geopark with its heart in the mountains. Walking along the Alta Via dei Monti Liguri, a trail with a spectacular terrace overlooking the sea, you can reach the blockfield, a vast accumulation of rocky blocks, evidence of ancient geomorphological processes. The Faiallo Pass, a stopping point along the Alta Via, is a perfect place to start a hike towards the wild Cercina Valley, through rock pinnacles and hidden lakes. The mountains that line the coast are well-known areas where birdwatchers can observe migrating birds heading for their nests.

Not far away you can find the wild scenery of the Masone Valley the Snake Waterfall has carved a deep canyon, with rugged rock forms reflected in little lakes. In the nearby village of Campo Ligure a castle dominates the tangle of narrow alleyways and streets overlooked by many workshops producing filigree, the precious arabesques of thin threads of gold and silver. Not to be missed, a geological treasure hidden in the Mason Valley the Snake Waterfall situated between dark green rocks, serpentinites and serpentinite schists.

Winter time in Beigua Geopark.
(Photo by Marco Borsali)

On the outskirts of the village of Sassello the Deiva Forest is crossed by a network of paths to explore either on foot, by mountain bike or on horseback, and in winter with snowshoes. It is a perfect place to admire the autumn leaf colour. Heading towards Monte Beigua you can find the Lainone peat bog, a precious wetland which hosts the habitat for insectivorous plants such as Drosera nutans.

A Geopark of contrasts. In the quiet landscape of the Tiglieto Plain lies the 900 years old Cistercian Abbey, which preserves within its walls the stories of the medieval period. Not far away you can find the wild scenery of Val Gargassa in Rossiglione where, between rough conglomerate walls, the rushing torrent has carved a deep canyon, with rugged rock forms reflected in little lakes.

Deiva Forest is crossed by a network of paths to explore either on foot, by mountain bike or on horseback, and in winter with snowshoes. It is a perfect place to admire the autumn leaf colour. Heading towards Monte Beigua you can find the Lainone peat bog, a precious wetland which hosts the habitat for insectivorous plants such as Drosera nutans.

A Geopark of contrasts. In the quiet landscape of the Tiglieto Plain lies the 900 years old Cistercian Abbey, which preserves within its walls the stories of the medieval period. Not far away you can find the wild scenery of Val Gargassa in Rossiglione where, between rough conglomerate walls, the rushing torrent has carved a deep canyon, with rugged rock forms reflected in little lakes.

Hruboskalské Rock Town
The most extensive rock city in the Bohemian Paradise, formed by quartz block sandstones, includes hundreds of rock massifs and individual towers that reach a height of up to 60 m. The foundations of the rock city were created in the younger Pleistocene, while the honescombs, rock ridges, cavities and windows were created during the Holocene.

Trosky Volcanic Cones.

The UNESCO Bohemian Paradise Geopark possesses a wide range of geological and geomorphological phenomena as well as locations with significant palaeontological, archaeological and mineralogical attributes. The Geopark is situated in an area where three different geological features meet: the Bohemian Cretaceous Basin, Železný Brod Crystalline Complex and the Krkonoše Piedmont Basin creating the remarkable diversity of the Geopark’s outstanding geology and wildlife. The landscape has a rich cultural and natural heritage and is an excellent example of the influence and importance of both the natural environment and natural resources for the economic and cultural development of the local inhabitants.

Over hundreds of millions of years, the area of the Geopark was repeatedly flooded by seas and was situated at the bottom of lakes. It was also a volcanically active on several occasions. As a result of these processes a landscape full of wild rocks, volcanoes, karst phenomena, rivers, romantic valleys, forests, meadows and lakes evolved.

Hruboskalské Rock Town
The most extensive rock city in the Bohemian Paradise, formed by quartz block sandstones, includes hundreds of rock massifs and individual towers that reach a height of up to 60 m. The foundations of the rock city were created in the younger Pleistocene, while the honescombs, rock ridges, cavities and windows were created during the Holocene.

Trosky Volcanic Cones.

The most famous symbol of the Bohemian Paradise. The erosional remains of a cinder cone of a volcano that was active 16.5 million years ago. Erosion has exposed the volcano’s double feeding channel formed by basaltite. On both peaks and between the volcanic cones lie the remains of a castle from the 14th century.

Kozákov (744 m.)
This hill is a geologically and mineralogically significant location with many outcrops on the slopes. Permian, Cretaceous and Neogene rocks contribute to its geology. The most common rocks consist of Permian andesitoids (melaphyres). Today, these are exposed mainly on the southern slope of Kozákov. In the veins and amygdales there are gem varieties of quartz (agate, jasper, chalcedony, amethyst, kashlong opal etc.). Other minerals include zeolites and calcite minerals. On the western slope, the Permain andesitoids are overlain by siliceous sandstones of the Peruc and Korycan with remains of plants and bivalve impressions. These rocks form a tectonically uplifted block. Palaeozoic dolomites are associated with remarkable pseudokarst features and archaeologically important caves. The top part of Kozákov and part of its eastern and northern slopes are made up of Neogene basalt Kozákov as a mineralogical locality was already known to artists in the early Middle Ages, when local jasper was mainly used. Ornaments and reliefs made from it can be found on artefacts in collections across Europe.

Blanka Nedvedicka, info@geoparkceskyraj.cz
Burren and Cliffs of Moher UGGp,
Ireland - Europe

Geodiversity in the Burren and Cliffs of Moher Geopark

The Burren and Cliffs of Moher (UGGp) is located in County Clare on the west coast of Ireland and is famous for its landscape formed on Carboniferous sedimentary rocks. The main area of the Geopark is dominated by large areas of exposed Lower Carboniferous (Mississippian) limestone and the extensive karst features developed on and below the limestone surface. Overlying the limestone is a thick sequence of Upper Carboniferous (Pennsylvanian) sandstones, siltstones and shales, most dramatically exposed along the world-famous Cliffs of Moher.

The area of exposed limestone is known as the Burren (meaning ‘rocky place’ in Irish), an area of gentle hills and valleys that have been inhabited by farmers for 6,000 years. The limestone was formed in a shallow tropical sea close to the equator 330 million years ago and is one of the best places to see this is the Burren National Park Geosite.

Our most iconic Geosite is the Cliffs of Moher, a coastal cliff section that extends for 9km between Doolin and Hags Head. This sheer cliff section exposes gently dipping beds of sandstone, siltstone and shale which can be viewed along a coastal path all year round or from below by boat during the tourist season. The sediments of the Cliffs of Moher were originally deposited by large rivers depositing sediment offshore that formed a series of deltas. This mixing of fresh and marine water is reflected in the fossils which include a mixture of terrestrial and oceanic microfossils. In addition, local family-owned quarries extract Moher Flagstones which contain impressive trace fossils. The surface and subsurface of the Burren limestone has been extensively affected by water, which dissolves limestone. This has produced a karst environment and the effect of water varies from producing small surface pits and hollows to extensive cave systems with well-developed stalactites. The presence of well-developed joints in the limestone has led to the development of clints and grikes and limestone pavement. Doolin Cave Geosite is a family-run show cave experience which has one of the longest (7m) free-hanging stalactites in Europe.

Dr. Eamon Doyle, edoyle@clarecoco.ie

The crowning glory of the Geopark, the phosphatiferous limestone provides a window into the evolution of the climate during very specific periods of the geological time scale. ‘Phosphate holes’, exploited for a short period at the end of the 19th century, contained the fossilized bones of mammals, reptiles and birds, seeds, flowers, insects, myriapods etc. From these precious fossils, palaeontologists can recreate the disappeared world of a tropical landscape and finally the present day landscapes. The site of the Cantonsaurus was discovered, a specificity that is almost unique in the world. The expression of some 30 million years of the continuous evolution of species and climate in the Causses du Quercy!

There is very little surface water on the cause. Streams on the impermeable soil infiltrate the limestone where they reach the cause. They continue their journey below ground where after travelling through the depths of the karst landscape, the subterranean streams resurface forming pools of clear water. These fascinating deep pools are known as emergences. These are much favoured by cave divers who explore the flooded underground galleries.

However, they provide a habitat for a whole range of small creatures that favour damp environments and contribute to the biological diversity of the cause including salamanders, newts, dragonflies etc. Whenever water flows intermittently or permanently on the surface, mills transform the flow of water into a mechanical force, as at the Moulin du Saut mill, built on the Alzou River in the 18th century. The Causses du Quercy UNESCO Global Geopark aims to give everyone the opportunity to travel through time and to discover it’s geological eras, civilisations and rich biodiversity.

Vincent Biot, vincent@parc-causses-du-quercy.org
Emeline Villemeur, emeline@parc-causses-du-quercy.org
Philipe Andlauer, philipe@parc-causses-du-quercy.org
The well-formed pillows in pillow lavas range in length from 50cm to 180cm in the Chablais UGGp. Part of an ophiolitic unit dating back to the Jurassic, these rocks are rarely preserved in the geological record. Today they are found at an elevation of 2000m - despite the fact that they were formed in the depths of an ancient ocean. (© F Tognetto).

Lake Vallon, Bellevaux is a new feature in the landscape formed by a large, slow-moving mudflow that dammed the River Brevon. Today the foundations of destroyed buildings and drowned trees are exposed in the lake. (© SIAC - A. Berger).

The exceptional geodiversity of the Chablais UGGp is archived in 85 contrasting geosites. These chapters of Earth history recount the formation of the Alps and the last great glaciation and are intimately linked to its exceptional local flora and fauna, and rich human story.

Today’s peaceful mountain summits of the southern Chablais UGGp belie their restless past. Under the slopes of one of the world’s largest ski areas lie rare alpine ophiolites1 that include well preserved pillow lavas and rocks known as halite-clastites (angular fragments of volcanic glass). The oceanic ensemble at the Tete du Vairage is dated at more than 168 million years old and tells of the subduction of an ancient ocean and subsequent formation of the Alps.

In the Ardoisières Valley, Morzine, an important slate mining tradition continues to this day. A platy limestone (not a true slate) is worked using methods passed from father to son over generations. (© SIAC, S. Justice).

Chablais UGGp, France - Europe

From Great Glaciations to the Building of Mountains, Travel Through Time in the Chablais UGGp

The famous geosite Cave of the Lakes, developed along a NW-SE oriented fault line from the rich and impressive speleothems found in part of the cave, the most impressive feature is the presence of 13 successive and terraced underground lakes located at different levels, that were formed due to the slow flow and stagnation of water, resulting in the formation of calcite walls (gours or rimstones) which are still growing. Excavations that occurred in the first section of the cave found rich archaeological and palaeoanthropological remains of Neolithic age showing that the cave was inhabited since 5650 BC.

Chelmos Vouraikos UGGp, Greece - Europe

The rocks, the mountains and the myths...
Colca and Andagua volcanoes UGGp, Perú - S. America

Geodiversity highlights in Colca de Andagua Geopark

Volcanoes in Andagua Valley. Andagua Volcanoes Valley. A Group of monogenetic volcanoes that extends into the Orizapampa-Andagua Valley, Arequipa, southern Perú. Fiftyfive kilometres of lava flows from the Upper Pliocene, Holocene and the historical epoch. Scoria and cinder cones, dark basaltic lava flows, fluvial lavas and lava domes fill a river valley forming canyons, waterfalls and lagoons. Complex structures in Jurassic strata of the Suncas Hill. Complex chevron folds and faults in Jurassic grey sandstone and black shale strata of the Puente Formation, near the mouth of the Marmococha River in the Colca River Canyon, a didactic example of the multiple tectonic phases of the Andean orogeny. Mismi Mountain, sacred mountain and headwaters of the Amazon River. A volcanic structure formed during the Middle Miocene (12-5 million years ago), where the Mismi snow mountain (5,597 m above sea level) stands out as part of the Chila mountain range, and creates a drainage divide. The thaw of ice and snow on the North Slope created the Apatheta ravine, part of a network that contributes to the Amazon River, flowing towards the Atlantic Ocean traveling 7,110 km and making it the longest river on the planet. The snow melt also allows the development of agriculture on the right bank of the Colca, a sacred mountain revered by the Collagua culture to this day. Landslides in Colca Valley on palaeolake deposits from 600 thousand years ago. Lacustrine sediments of the Colca Formation, deposited in a "palaeolake", formed due to the closure caused by the collapse of the northern flank of the Hualca Hualca volcano approximately 600 thousand years ago. Populations on both margins of the valley created pre-Hispanic agricultural platforms and roads and settled on these deposits. Madrigal, Lari, Maca, Achoma, Ichupampa and Yanque, are affected by landslides, such as the landslide that recently occurred in the year 2020 in Achoma that affected platforms and the tourist infrastructure. Colca Canyon. The canyon section of the Colca River in the Central Andes, south of the Nasca ridge, southern Perú is 100 km in length, has a difference in altitude of 1,800 m and mountain ecosystems between altitudes of 2,950 m and 1,150 m. It cuts through Proterozoic metamorphic basement rocks. Upper Jurassic-Cretaceous sedimentary sequences, fossiliferous deposits and Palaeeogene-Neogene volcanic and intrusive rocks. This is a geologically active zone with faults and folds associated with Andean Tectonics, strato volcanoes, lava fields and Plio-quaternary monogenetic cones formed during the last two million years, active neotectonic faults, hot springs and impressive landscapes.

Yammi Ramirez, yammi.ramirez@gmail.com
Bilbeto Zavala, bilbeto@ingemmet.gob.pe
Karin Tosto, nirak_rb@gmail.com

Cuilcagh Mountain Offering a near complete sequence of Carboniferous-age sediments, over 200 million years old. Cuilcagh Mountain provides excellent opportunities for studying a great variety of depositional settings, including marine, supratidal and deltaic environments.

Cuilcagh Lakelands UGGp has nearly 900 million years of geological history and charts the journey of the island of Ireland, from its location as a divided landmass on two separate continents in the southern hemisphere, to its present absolute location at approximately 54°N. The variegated landscapes of the Cuilcagh Lakelands UGGp are an expression of the area’s diverse geological history in an unspoilt corner of the Irish countryside, with the most significant geological highlights presented below.

The area is dominated by its Carboniferous geology, consisting of sedimentary rocks of late Viséan to early Namurian age deposited in a wide range of marine, supratidal and deltaic environments. The horizontal stratigraphy underlies the upland areas of Cuilcagh Lakelands UGGp, now dissected by glacially carved valleys leaving behind plateau-topped mountains and hills. The highest point of these is Cuilcagh Mountain at 665m, with a near complete sequence of the Carboniferous Leitrim Group spanning over 8 million years. This is one of very few exposures of this age that display such a wide variety of lithologies and fossil assemblages. The numerous exposures provide outstanding examples on which to base the principles of, and on which to demonstrate the interaction between litho- and biostratigraphy.

Cuilcagh Lakelands UGGp is best known for its Carboniferous limestone. Its presence has led to the development of an extensive upland karst with glacially modified karst, pre- and postglacial karst, surface and underground karstification, and complex hydrological catchments. The Marble Arch cave system and the associated karst in its catchment are widely regarded as one of the finest examples of a mature karst landscape in the UK and Ireland with a catchment of approximately 2.7km², and over 100km of explored passages.

Although rarely seen at the surface, Palaeogene dykes have had a profound impact on the hydrology of the area and are an important part of the geological heritage associated with the opening of the North Atlantic in the early Palaeogene Period. One of these dykes, the Cuilcagh Dyke, is unique in Ireland in having both normal and reverse magnetic polarity anomalies. The Kingscourt-Donegal dyke swarm and the smaller Eime dyke swarm form part of the much larger North Atlantic Palaeogene igneous Province.

The bedrock that makes up the Cuilcagh Lakelands UGGp was sculpted and moulded during the Quaternary Period by repeated glaciations. These are responsible for both erosive and depositional glacial landforms including U-shaped valleys, drumlins and glacial erratics. Some of the most important glacial features, however, are seen at Lough Oughter set within a field of ribbed moraines. The entire field includes over 3,000 glacial features, but this subset covers an area of 1180m², containing approximately 160 individual features, and includes some of the largest individual ribbed moraines found anywhere in the world.

Kirin Lemon, klenn@opsg.ie
Martina O’Neill, martina.oenhill@fermanagh.com,
Graeme O’Connor, g.oconnor@alvancocoro.ie
**Geoparks**

**The Danube flows through Djerdap Geopark**

The geodiversity of the Djerdap Geopark area is very diverse and apart from geological sites, there are also morphological features, dominated by the Djerdap gorge, the longest elbow in Europe. The Djerdap gorge stretches from the Fortress “Golubački grad” downstream to the Fortress “Golubački grad” downstream. The Moravina and the Danube rivers have formed the gorge during a long period of continuous erosion and downstream into the mountainous massif of the Carpathians. Along the gorge, the remains of a succession of river terraces mark nine stages of incision phases of the river terrace.

Tectonic events in the region, which is part of the Carpathian arc, are reflected in the recent structural pattern and numerous longitudinal structural zones. Two ranges of nappes, named Gheticum and Krainicum, are the outstanding tectonic structures. The Homolje crystalline massif, Poreč and Miroč units are three minor structural pattern and numerous longitudinal structures. The oldest rocks are found in the crystalline massif of Homolje which is composed of two Proterozoic rock complexes. The lower complex consists of plagioclase gneisses tectonically and asymmetrically covered by different schists. The Miroč unit also contains chloritic/sericitic and actinolitic schists, and Precambrian to Ordovician gneisses. These are transgressively overlain by Silurian/Devonian sandstones, argilitic schists and limestones exceeding 250 metres in thickness and Lower Carboniferous limestones and conglomerates including porphyry and rhyolite. Near Brnjica, the Palaeozoic complex is broken by a large mass of granite and granodiorite, which has been exploited for almost a century. In the area of Left River, there are outcrops of black phyllites of Carboniferous age, which are of scientific importance for the study of the Palaeozoic complex of the southern Carpathians. The Palaeozoic complex terminates in Permian red sandstones that extend as a narrow zone along Poreč Bay and upstream, along the left bank of the Poreč river. The Permian red sandstones are overlain by Liassic limestones with alternating flabby and cherty limestones and marls with an abundance of ammonites. In these landscapes of unusual beauty, we can also find channels through which we now imagine the flow of lava or remains of volcanic tubes, some of which are well preserved and accessible to visitors.

Ramón Casillas Ruiz, rca@ull.edu.es
Yurena Pérez Candelaño, yperez@elhierro.es
Cristina Ferro Fernández, crifernandez@gmail.com

**El Hierro UGGp, Spain - Europe**

**The Geodiversity of El Hierro Geopark**

Over 1.2 million years ago, the Island of El Hierro emerged from the ocean after a long history of submarine growth on the surface of the oceanic crust of the African plate. There have been five volcanic edifices in its history. Titer, El Golfo-Las Playas and the three ridges or rifts.

El Hierro emerged from the ocean after a long history of submarine growth on the surface of the oceanic crust of the African plate. The instability of the El Golfo-Las Playas volcanic edifice and the rifts, due mainly to its excessive growth and the accumulation of volcanic material, initiated gravitational mega-landslides that produced large deposits of rocky avalanches on the ocean floor. As a result, the island has three impressive amphitheater like escarpments which are called “cordel lavas” or “guts”. These very fluid lavas, extruded from fissures and “hornitos” at high temperatures, could travel over distances of several kilometres.

In these landscapes of unusual beauty, we can also find channels through which we now imagine the flow of lava or remains of volcanic tubes, some of which are well preserved and accessible to visitors.

Ramon Casillas Ruiz, rca@ull.edu.es
Yurena Pérez Candelaño, yperrez@elhierro.es
Cristina Ferro Fernández, crifernandez@gmail.com

Dušan Mijović, duusan.mijovic@npdjerdap.rs

Cristina Ferro Fernández, crisferrfer@gmail.com

**Los Negros Beach Cliffs. A basaltic pyroclastic cone with its feeding dike sectioned by the cliff.**

**El Golfo Valley. An amphitheater formed by a mega-landslide.**

Kladušnica terrace, river terrace sediments, one of the incision phases of the Danube River in the Southern Carpathians’ rim.
English Riviera UGGp, UK - Europe
From geological pioneers to UNESCO Global Geopark recognition

The geologic history of the Geopark Grevena-Kozani spans a billion years. Its oldest rocks are the oldest in Greece and include granodiorites and their metasedimentary hosts that were formed within the ancient Amazonian Craton. These merged into the greater continent of Pangea along with proto-continents of Europe and Africa ~300 million years ago. The rifting of Pangea (~250 million years ago in the mid-Triassic) is shown within rock formations of the Geopark. These include early oceanic abyssal cherts and manganese-rich carbonate, and volcanic ash. Continued rifting created the new Tethyan Ocean tectonic plate. The Tethys crust is preserved as the Vourinos Ophiolite (middle-Jurassic), a remnant of the Tethys oceanic crust.

The geologic history of the Geopark Grevena-Kozani spans a billion years. Its oldest rocks are the oldest in Greece and include granodiorites and their metasedimentary hosts that were formed within the ancient Amazonian Craton. These merged into the greater continent of Pangea along with proto-continents of Europe and Africa ~300 million years ago. The rifting of Pangea (~250 million years ago in the mid-Triassic) is shown within rock formations of the Geopark. These include early oceanic abyssal cherts and manganese-rich carbonate, and volcanic ash. Continued rifting created the new Tethyan Ocean tectonic plate. The Tethys crust is preserved as the Vourinos Ophiolite (middle-Jurassic). This contains a complete lithospheric section extending from peridotite rocks of the upper mantle, through ocean crust magma chambers, the dike swarms which fed the sub-marine volcanoes at the oceanic spreading centre, and the overlying sediment-covered, ocean floor. The Vourinos Ophiolite was emplaced over the European tectonic plate in the late Jurassic. During the time interval leading to our recent past, the subsurface movement of these tectonic plates created the mountainous regions of the Pindos. These show scarring by glaciers in the ice ages, together with the formation of periglacial lakes and cataclysmic canyons throughout the terrain of the Geopark. Some of the youngest rocks in Greece include formations of colloviul deposits and palaeosols, some of which were partially buried and partially eroded creating “hoodoo” rock spires.

Anna Mpatsi, geoparkgrevenakozani@anko.gr
Dina Gikas, geoparkgrevenakozani@anko.gr

The Vourinos Ophiolite (middle-Jurassic), a remnant of the Tethys oceanic crust.

Grevena-Kozani UGGp, Greece - Europe
Geodiversity in Geopark
Grevena-Kozani

Exploring Kents Cavern.
The Holy Cross Mountains UGGp, Poland - Europe

From the Cambrian sea to the lowest mountains in the Holy Cross Mountains Geopark

The geological history of the Świętokrzyski (Holy Cross Mts.) UNESCO Global Geopark, Poland, recorded in the sedimentary rocks and fossils, dates back almost 540 million years. This story began at the bottom of the Cambrian sea and its subsequent chapters, up to the Quaternary. A particularly rich geological record is associated with the Devonian. It was during this period of the Earth’s history that the area of today’s Holy Cross Mountains (including the Holy Cross Mts. UGGp) was located in the equatorial zone, on the shelf of the Laurussia continent, occupied by a shallow tropical sea. Huge masses of sediment mixed with the remains of thermophilic reef organisms gave rise to thick layers of limestone rich in fossils. These rocks are now perfectly visible in many geosites, especially in the former quarries (Kadzielnia, Zalejowa, Czennowa Góra, Chelosiowa Jama and Ślišhowice). Numerous karst forms, including caves, testify to the intensive dissolution of carbonate rocks by water in the subtropical climate of the Permian, Triassic, Palaeogene and Neogene. If you want to experience emotions in communing with the underground world, it is best to visit the Raj (Paradise) Cave, considered one of the most beautiful caves in Poland. The richness and variety of the dripstones in this cave delight every visitor. The clayey deposits in the Paradise Cave contain a unique record of the ice age. It is from here that the remains of two Neanderthal encampments dating back 50,000 years have been described. This brings us to the last chapter in the history of the Geopark, in which the relationship between humans and nature developed. This relationship is recorded in the form of stone tools and numerous remains of historical ore mining and quarrying. The material testimony of this history contains numerous examples of the use of rocks in the local architecture, in particular the Zamkowa Hill with the remains of a medieval castle in Chęciny, which is the cultural and landscape symbol of the Geopark.

Michał Poros, michal.poros@geopark.pl

Photograph showing the typical geomorphological feature of the High Island Formation. The hexagonal rock columns are well exposed along the long meandering coastlines and numerous islands. The shores at High Island are rimmed with steep sea cliffs. At some sites, the columns stand up to 100 m above sea level.

With no natural barriers to offer protection, the east-facing coasts and islands meeting the sea fall victim to persistent wind and wave erosion. In this setting, the hexagonal rock columns are typically exposed in their true glory integrated with a wide range of coastal erosion landforms and breath-taking vistas.

Rugose coral from Upper Devonian of Wietrzna geosite. (Photo by Ł. Zarzycki)

Słonówka geosite a former quarry with exposures of folded Devonian rocks. (Photo by M. Poros)

At High Island Reservoir East Dam, the hexagonal columns display a combination of geological features and interesting geological stories, where the S-shaped deformation was intruded by a mafic dyke.

Michał Poros, michal.poros@geopark.pl

Hong Kong UGGp, China - Asia

Spectacular rhyolitic columnar rock formation of Hong Kong Geopark

The formation is the relic of an early Cretaceous supervolcano which produced a massive amount of volcanic material. Columnar joints were developed by thermal contraction in the volcanic materials deposited within the caldera. Widely exposed along the long meandering coastlines and numerous islands in the east part of Hong Kong, this formation is integrated with diverse coastal erosion landforms, such as sea cliffs, sea notches, sea caves and sea arches. Together, they make up Hong Kong UNESCO Global Geopark’s most iconic geomorphological landscapes and world-class geo-wonders.

NG Sin-pan, alvin_sp_ng@afcd.gov.hk
CHAN Yu-nam, yn_chan@afcd.gov.hk

Spectacular rhyolitic columnar rock formation of Hong Kong UNESCO Global Geopark, China - Asia. Photograph by NG Sin-pan, alvin_sp_ng@afcd.gov.hk. CHAN Yu-nam, yn_chan@afcd.gov.hk.

With no natural barriers to offer protection, the east-facing coasts and islands meeting the sea fall victim to persistent wind and wave erosion. In this setting, the hexagonal rock columns are typically exposed in their true glory integrated with a wide range of coastal erosion landforms and breath-taking vistas.
Huanggang Dabieshan UGGp, China - Asia

Magnificent Geosites within Huanggang Dabieshan Geopark

The TTG rock series, which are composed of tonalite (T), trondhjemite (T) and granodiorite (G), represents the abyssal and intrusive granitic complex of an ancient continental nucleus 2,500 million years ago. The origin and cause of the TTG rock series are of great significance in understanding the evolution, accretion and reconstruction of the Earth’s crust.

Eclogite is a kind of metamorphic rock formed within an ultrahigh pressure environment between 2.0 - 3.0 GPa (gigapascals). The rocks are composed mainly of garnet and omphacite, coesite and micro diamonds. It is the product of subduction during the collision of the North China Plate and Yangtze Plate during the Indonesian period 257-205 million years ago. Musidian (rock) Formation - Basic ultrabasic rocks, the combination of oceanic crustal material below the greenstone belt, is the product of syn-sedimentary igneous rock intrusion during the formation of the greenstone belt. The rock is mainly amphibolite, the centres of some components consist of amphibole pyroxenite or pyroxenite. Epidote is in common use a primary process and adammellite of the Shengli gneissic granite suite is widely distributed in this setting. Strong migmatization, banded migmatite generally occurs interlaminated with a mass of granite or felsic veins, a small amount of pyrite appears in a fractured lattice. Mesozoic granites are well developed in Huanggang Dabieshan UGGp. There are significant geosites in the Karawanken-Karavanke UNESCO Global Geopark, the following are outstanding:

- The deposit of Carnian crinoids in the valley of the Helena stream (Črna na Koroškem), which is one of the highest free-falling waterfalls in Europe which also features red limestone rich in ammonite aptychi, remains of echinoderms and other fossils.
- The coal mine in Leše (Prevalje), one of the largest and most modern coal mines of Europe that was still operating at the end of the 20th century.
- The Periadriatic fault system, one of the most important elements in the collision between the Adriatic lithospheric microplate and the Eurasian lithospheric plate.
- The Obir Driftstone Caves (Bad Eisenkappel/Zelesna Kapla), the most beautiful natural driftstone caves in Austria, which were discovered completely by chance while excavating lead and zinc ore.
- The slopes of dark-grey pillowy lava in the Obir Gorge (Bad Eisenkappel/Zelesna Kapla) and volcanic rocks at Smrekovec (Črna na Korotkem), which are proud of former volcanic activity in the area.
The Drumbabót geosite is a remarkable geosite in Katla Geopark that not many are aware of. At first glance, the geosite looks just like a normal, sandy riverbank. Once you have a closer look, however, the magic of this place comes to light, and one of the most important geothermal sites in Iceland is revealed. The site itself was exposed in 1990, when erosion caused by flooding in the River Ivera revealed numerous, well-preserved tree stumps. The area where the stumps are found covers about 25 hectares and all the stumps that have been studied are examples of birdch trees (Betula pubescens). They all tilt slightly towards the west or south-west, but are unbroken, and the bark on many of the trees is remarkably well preserved with no observable damage. The trees are believed to have been about 60-100 years of age when they died.

Three volcanic systems are close to the site, Tindfjallajökull to the north-east, Katla to the east and Eyjafjallajökull to the south-east. All three systems have an ice-covered central volcano that can cause a glacial outburst flood (jökulhlaup) during events that lead to erosion, such as weather, wind, river floods, and sub-glacial eruptions. At least eleven glacial outburst floods are known to have crossed the area, some caused by volcanic activity from Eyjafjallajökull which show the deposits of the ice-covered central volcano that can cause a glacial outburst flood (jökulhlaup) during events that lead to erosion, such as weather, wind, river floods, and sub-glacial eruptions. At least eleven glacial outburst floods are known to have crossed the area, some caused by volcanic activity from Eyjafjallajökull.

The uniqueness and preservation of Drumbabót is clearly remarkable, and thus the geothermal value of the site is very high as it is the only known palaeo-forest in Iceland to have been destroyed by a glacial outburst flood. The protection of the site itself is, however, a challenge. Firstly, due to events that lead to erosion, such as weather, wind, migrating river paths and flooding, and secondly due to pressure from tourism. The Geopark, along with other agencies in Iceland and the landowners, are working on further legal protection for the site which will hopefully lead to better preservation of the site for future generations and contribute to the understanding of this remarkable geosite.

The exact year when the trees died has recently been identified by using dendrochronology. In the year 775 there was a large solar flare that caused an increase in tree growth, identifiable in the tree-rings of the stumps found at Drumbabót. The year that the trees died, 822-823 AD, can be calculated from the number of tree-rings found in the stumps. C-14 dating of both the soil layer and the stumps has yielded similar results.

The upper part of the stumps is well-preserved at Drumbabót. Most of the stumps still have some bark preserved at the base, but the upper part of the stumps is already eroding away.

The trees at Drumbabót have caused the destruction of the birch woodland. The flooding probably caused a rise in the groundwater table, ultimately drowning the birch trees since their roots cannot survive submerged in water. Analysis of the sediments transported by the flood indicates that it originated from Katla Volcano. The year the trees died has recently been identified by using dendrochronology. In the year 775 there was a large solar flare that caused an increase in tree growth, identifiable in the tree-rings of the stumps found at Drumbabót. The year that the trees died, 822-823 AD, can be calculated from the number of tree-rings found in the stumps. C-14 dating of both the soil layer and the stumps has yielded similar results.

The trees at Drumbabót have caused the destruction of the birch woodland. The flooding probably caused a rise in the groundwater table, ultimately drowning the birch trees since their roots cannot survive submerged in water. Analysis of the sediments transported by the flood indicates that it originated from Katla Volcano. The year the trees died has recently been identified by using dendrochronology. In the year 775 there was a large solar flare that caused an increase in tree growth, identifiable in the tree-rings of the stumps found at Drumbabót. The year that the trees died, 822-823 AD, can be calculated from the number of tree-rings found in the stumps. C-14 dating of both the soil layer and the stumps has yielded similar results.

The uniqueness and preservation of Drumbabót is clearly remarkable, and thus the geothermal value of the site is very high as it is the only known palaeo-forest in Iceland to have been destroyed by a glacial outburst flood. The protection of the site itself is, however, a challenge. Firstly, due to events that lead to erosion, such as weather, wind, migrating river paths and flooding, and secondly due to pressure from tourism. The Geopark, along with other agencies in Iceland and the landowners, are working on further legal protection for the site which will hopefully lead to better preservation of the site for future generations and contribute to the understanding of this remarkable geosite.
Lauhanvuori hill in Western Finland is an area of high geodiversity. The hill, rising 231 m above sea level, is one of the few inselbergs in the Fennoscandian shield and it hosts a wide range of geological formations within an area of approximately 60 km². The geodiversity is, however, veiled by the size of the area and the nature of the formations. Lauhanvuori has been protected as a National Park since 1982 largely due to its geological diversity.

The bedrock in Lauhanvuori consists of a 1.9-billion-year-old porphyritic granite, representing the deep roots of the ancient Svecofennian mountain range. The intrusion is one of the largest Svecofennian granite intrusions. The surface of the granite is deeply weathered, and fresh rock can mainly be seen in the tors on lower parts of the hill. Much of the 10 km thick weathering and erosion occurred during Proterozoic times and the land surface level in the lower part of the hill represents the Sub-Cambrian peneplane.

The bedrock is covered by a sandstone formation with a maximum thickness of several tens of metres. Trace fossil evidence suggests an Ediacaran maximum age, but a reliable minimum age is yet to be established. Only a few outcrops of the sandstone are known. However, boulder fields situated in the perimeter of the sandstone layer provide excellent exposures of the rock and associated sedimentary structures. The Sandstone of Lauhanvuori was used as raw material in the millstone industry in the 19th century.

Above the sandstone lies a several tens of metres thick Quaternary soil with layers representing several glacial events during the Pleistocene. The surface of the hill, which was winnowed to sand and gravel, creates an exceptionally large catchment area for perched ground water. This has produced a diverse wetland system on the lower flanks of the gently sloping hillside, including springs, seepage surfaces, seasonal wetlands, lakes, a variety of different mires and streams. The waters of Lauhanvuori are home to wild brown trout (Salmo trutta).

The summit of Lauhanvuori is covered by till formed during the Weichselian glaciation. The soil is rich in fine particles and nutrients and the summit area hosts a lusher vegetation than the slopes. The summit area has been known as a good place to cultivate potatoes in the past due to the absence of summer frost. Geodiversity and its connection to both biological and cultural diversity in Lauhanvuori is easily explored at geosites along the trail network of the National Park. The area is managed by Metsähallitus, Parks and Wildlife, an important partner of Lauhanvuori - Hämeenkangas UNESCO Global Geopark.

Lesvos Island UGGp, Greece - Europe
Geodiversity in Lesvos Island Geopark

The long geological history of Lesvos Island UNESCO Global Geopark is reflected by its complex geological structure and the large number of geosites, such as volcanoes, hot springs, important fossiliferous sites, faults, waterfalls and coastal landforms, which are significant evidence of the geological history of the Aegean area over the last 300 million years. Western Lesvos is dominated by the Petrified Forest, characterized as a ‘Protected Natural Monument’. It is one of the finest and rarest geosites in the world. Remains of fossil plants, declared as a Protected Natural Monument, have been found in many localities on the western part of Lesvos Island. The fossilized plants in Lesvos are the silicified remains of a sub-tropical forest that existed on the north-west part of the island 20 million years ago.

The preservation of the Petrified Forest is closely linked with volcanic activity in the Northern Aegean region during the Lower Miocene approximately 20 million years ago. At this time the forest was buried during a volcanic eruption by ash and lava. The large number of standing petrified trunks in growth position with their root systems intact is characteristic of an autochthonous petrified forest. Systematic excavations in the parks of the Petrified Forest have revealed unique fossils which form archives of the Earth’s history and the evolution of the life of the past. They are also indicators of the climatic conditions, the palaearctic environment and the palaearctic geography of the Aegean.

Konstantina Bentana, Nickolas Zouros, Ilias Valekos, lesvospg@otenet.gr
The Longhushan UGGp (UNESCO Global Geopark), covering an area of 996.63 km², is situated on the northern piedmont of the Wuyi Mountain Range in the northeast of Jiangxi Province, southeast China. It boasts spectacular Danxia landforms, eye-catching peaks and unusually-shaped rocks, such as the Fairy Maiden Rock, Elephant Trunk Hill, and Turtle Rock. The geodiversity of the Geopark feature Danxia landforms, as well as volcanic landforms, sedimentary structures and type sections. The Longhushan UGGp is the birthplace of Chinese Taoism which has had a profound influence on Chinese culture and even on current Chinese society. The Longhushan UGGp is famous for Danxia landforms, the Cradle of Taoism and the cliff burial culture of the Spring-Autumn Period.

The Geopark is located on the Beihai-Sha River by the coastal sea, covering an area of 996.63 km², is an area of fantastic natural beauty and is a part of the Danxia landform. The Danxia landform is the main landscape resource in the Geopark, with an area of 4/5 of the total area of the Geopark. There are a complete series of Danxia landforms ranging from juvenile through mature to mature stages in the Geopark. The Danxia landform is the main landscape resource in the Geopark, with an area of 4/5 of the total area of the Geopark. There are a complete series of Danxia landforms ranging from juvenile through mature to mature stages in the Geopark. These consist of Danxia peak clusters with flat tops and steep faces, hoodoos and mesas with round tops, and co-existing Danxia peak clusters, hoodoos, isolated peaks and kopjes, respectively. Mature stage Danxia landforms predominate in the Geopark, especially those in the late maturity stage which are typical. It reflects the full information of the Danxia landform’s evolution. Tectonic erosion is the main reason for their formation; other processes such as current scour and erosion, corrosion, collapse, illuviation, and corrosive weathering and collapse also play a part. There are 23 types of landform including stone castles, red walls and cliffs, hoodoos, Danxia peak clusters, stone girders, stone walls, hoodoo columns and caves.

Fang Ren, Jieting Fan, 23270643@qq.com

The Lushan block mountain, formerly interpreted as an h rush fault block mountain bounded by normal faults, is reinterpreted in the recent investigation by Han et al (2021) as an extrusion structure bounded by a low angle normal fault in the west (Xingzi fault) and a reverse fault in the east (Xingzi fault), each dip in a NW direction. Mt. Lushan is situated on the upthrown footwall sides of the boundary faults which define a wedge-shaped structure with a normal fault at the top and a thrust fault at the base. The estimated 15 - 35 million years required to erode the hanging wall of the Xingzi fault to its present level suggest that Mt. Lushan was uplifted during the Miocene Epoch. The uplift is attributed to the generation of the vertical extrusion structure in a tectonic compressional regime in response to Pacific plate movement.

About 5 million years ago, during the Quaternary Glaciations Period, thick ice covered the high peaks of Lushan. This ice moved downwards shaping different landforms on its way. U valleys, hanging valleys, cirques, and hem peaks. The present-day Ruqin and Luli lakes were firn basins. There are many interesting phenomena in Lushan connected with its geological history. For example, the mountain’s delicious potatoes and fragrant clouds and fog tea are products of the geochemical characteristics of its soils. The sweet water mountain springs together with many Chinese medicinal herbs are products of Lushan’s unique geology.

About 3 million years ago, during the Quaternary Glaciation Period, thick ice covered the high peaks of Lushan. The long and rich geological history has brought us extraordinary plants and landscapes. Lushan is truly a living geological textbook!

Reference:

Fujin Lake in Autumn.
Maestrazgo UGGp, Spain - Europe
Singular Geological Elements of the Maestrazgo Geopark

Geological map with Geosites of the Maestrazgo UGGp (Spain) in the eastern part of the NW-SE Iberian Mountain Range that link up with the Catalanides at their eastern and southern extremes, through the Maestrazgo area.

Within the Aragonese western branch of the Iberian Mountain Range, formed during the Alpine geohistorical heritage of the Maestrazgo UNESCO Global Geopark (UGGp) is composed of a great variety of remarkable geological elements. It is essential that the variety of landscapes, rocks, minerals, fossils and geological formations within the Geopark are preserved as part of the natural wealth of our planet Earth.

The destruction of the heritage is irreversible and represents the loss of a part of the Earth’s memory. Therefore, the research, conservation and dissemination of this heritage is the responsibility of the Maestrazgo Geopark and has been promoted for some time. With more than two decades as a Geopark, its origin dates back to 2000, when four European territories including Maestrazgo agreed to create the European Geoparks Network (EGN) as a system to promote regional development through unique geological resources throughout the ages. Today’s ease of communication, preservation and location of the deposits plunges us into the ecological and climatic history of the Earth. Our Jurassic and Cretaceous limestones are part of our identity, but we share them with other geoparks where they are also a part of the landscapes of the Chablais UNESCO Global Geopark or the Causses du Quercy UGGp. We also have our ochre sands, as in the Luberon UNESCO Global Geopark. Our molasse rock sequence shares the same origin as that of the Haute-Provence UNESCO Global Geopark.

Linking outcrops of the same age or of the same origin across the nation, Europe or the world can give meaning and connection to all the peregrinations of our fellow inhabitants on our territories. The creation of a support or a shared information base would allow each geopark to be more efficient and visible. It would enable the UNESCO Global Geopark to be a key player in the reconnection of the links between man and the Earth.

Christophe Lansigu, clansigu@parcdesbauges.com

Geodiversity is a great way of getting the public interested in geo-heritage and what it tells us about our world. It helps us to appreciate the richness of landscapes and to understand the uses and scarcity of mineral resources.

Its revelation can thus help us to reconnect Man and Earth, as the motto of the geoparks enjoins us to do. It is a sensitive, aesthetic and emotional approach that can help us to bring the public to an understanding of the dynamics and resources that the Earth offers us.

For the Massif des Bauges UNESCO Global Geopark, the Geodiversity Day initiative is also an opportunity for better collaboration between UNESCO Global Geoparks and to be more effective in our joint or individual communications. It is a question of positioning our Geopark in its entirety, showing that we are a particular witness of a unique history; that our rocks, of the same age or type, are found in different territories and bear witness to one and the same history. Man has had similar uses for mineral resources throughout the ages. Today’s ease of trade and globalization have made us lose sight of this link with these resources, with the origin, the specificity and often the rarity of these resources.

The exploitation and transformation of iron plunges us into the human history of our territory. But to interest the public in the origin and location of the deposits plunges us into the geological and climatic history of the Earth.

Our Jurassic and Cretaceous limestones are part of our identity, but we share them with other geoparks where they are also a part of the landscapes of the Chablais UNESCO Global Geopark or the Causses du Quercy UGGp. We also have our ochre sands, as in the Luberon UNESCO Global Geopark. Our molasse rock sequence shares the same origin as that of the Haute-Provence UNESCO Global Geopark.

Linking outcrops of the same age or of the same origin across the nation, Europe or the world can give meaning and connection to all the peregrinations of our fellow inhabitants on our territories. The creation of a support or a shared information base would allow each geopark to be more efficient and visible. It would enable the UNESCO Global Geopark to be a key player in the reconnection of the links between man and the Earth.

Christophe Lansigu, clansigu@parcdesbauges.com

The Pitarque River Natural Monument works as an enormous underground reservoir where the main spring flow rate can reach up to 1,500 litres per second. It is one of the four Natural Monuments according with the Natural Network of Aragon (Government of Aragon).

(info by Nebulosa Gràfics & Porque Cultural Maestrazgo).

The medieval village of Alby-sur-Chéran, built with Miocene molasses.

(trans by Milimétrage).

We are referring to a Geopark with a huge geodiversity that includes two Geosites of International Relevance according to the Global Geosites Programme of the Geological Survey of Spain (IGME). These include the Jurassic-Cretaceous dinosaur sites in Galve (FC006) and the Mesoicoenese series of Güímar Range in the Red Aragon Area (MD2049) which includes seven stratotype sections.

The presence of 16 new genera and more than 100 new fossil species discovered and described within the Maestrazgo UGGp territory deserves special mention. These include the first new dinosaur, Aragonosaurus ischiatricus, described from Galve and Trachyaxis turbaensis, the first Mesoicoenese turtle described from Gargallo. The long list of palaeontological sites associated with dinosaurs includes 76 catalogued palaeontological sites, six of which are protected as Assets of Cultural Interest (BIC).

As a supplement, this Geopark has a large number of Assets of Cultural Value including 10 historical Sites, 21 monuments and more than 600 archeological sites. Six of the Rock-Art Sites are part of the UNESCO World Heritage Designation (Rock Art of the Mediterranean Basin on the Iberian Peninsula, 1998). Moreover, there are two items included within the UNESCO Intangible Cultural Heritage List in the Geopark. These are the Art of dyestone walling, knowledge and techniques and the Tamboradas drum-playing rituals.

Luís Mampel Laboira, mampel@fundaciondinopolis.org Angel Hernández Sesé, info@geoparquemaestrazgo.com

The Goediversity Day 2022 poster for the Maestrazgo UGGp contains 71 Geosites of interest for different disciplines of geology, such as palaeontology, stratigraphy, tectonics, geomorphology, petrology or mineralogy among others.

The medieval village of Alby-sur-Chéran, built with Miocene molasses.

(trans by Milimétrage).
The Geodiversity of Mëllerdall Geopark

The Luxembourg UNESCO Global Geopark is located in the east of the Grand Duchy of Luxembourg and on the NE rim of the Paris Basin. The region's sedimentary rocks were deposited from the Early Triassic to the Lower Jurassic in a depression between the London-Brabant Massif and the Rhenish Massif. An alternation of sandstones, marls, dolomites and limestones of total about 500 m in thickness was deposited in continental and shallow marine environments.

The up to 100 m thick Lower Jurassic sandstone body of the Luxembourg Sandstone forms one of the most impressive sandstone landscapes in western Europe. It developed during the Hettangian and Sinemurian as a tidal-influenced shoreface sandwave complex in a shallow-marine environment in the vicinity of the coastline of the Ardennes mainland. It is a quartz sandstone with rocks with orbicular structures. Both the orbicular structures and the intervening matrix consist of rhyolite with the same composition. How- ever, the formation process has not yet been clearly identified. Since this is a globally unidentified rock type, it is expected that, with continued research, this will become another world-famous attraction.

The Mudeungsan Geopark, located in the southwestern Korean Peninsula, shows a wide range of geological periods from the Precambrian Period to the Cenozoic Era, and includes various geosites such as colurnar joints, a dinosaur fossil site, periglacial sites, and mixed geology-culture sites. The major geosites of the Geopark, Mudeungsan Mountain, which formed during late Cretaceous (87-85 million years ago) are well-known for the globally rare, large-scale columnar structures with widths of up to ~7 metres. Most of the columnar jointed colurnar colonies are broadly distributed in the upper region of the Mudeungsan Mountain (>750 metres above sea level) and are composed of dacitic tuff (defined as Cretaceous ‘Mudeungsan Tuff’, Lim et al, 2015). In addition to the volcanic structures, the Seoyu-ri Dinosaur Fossil Site has the most extensive and diverse theropod trackways in South Korea. One unique trackway shows that theropods increased their stride lengths to achieve maximum speed when running (Bo Seong K. and Huh M. 2010).

Recently, fossil footprints proving that pterosaurs lived in groups were also discovered here for the first time in the world (Jung et al. 2022). A series of prone and leaning statues of Buddha in Unjusa Temple show weathered structures of the well-stratified pyroclastics, reflecting ordinary people’s religion during the Late Chosun Dynasty (14th century). In addition, the Hwasun Dolmen Site, designated as a World Heritage Site by UNESCO in 2000, has 596 Dolmens made from welded tuff. This site is useful to reveal the prehistoric burial cultures in the southern Korean Peninsula.

In addition, interesting geosites were newly discovered during the process of continuous research to identify the geological value of the Mudeungsan Geopark. One of these is a site, in the middle of Chuwolsan Mountain located in Damyang County, with rocks with orbicular structures. The orbicular structures and the intervening matrix consist of rhyolite with the same composition. However, the formation process has not yet been clearly identified.

References

Seoyu-ri Dinosaur Fossil Site has the most extensive and diverse theropod trackways in South Korea. The Mudeungsan Geopark, located in the southwestern Korean Peninsula, shows a wide range of geological periods from the Precambrian Period to the Cenozoic Era, and includes various geosites such as colurnar joints, a dinosaur fossil site, periglacial sites, and mixed geology-culture sites. The major geosites of the Geopark, Mudeungsan Mountain, which formed during late Cretaceous (87-85 million years ago) are well-known for the globally rare, large-scale columnar structures with widths of up to ~7 metres. Most of the columnar jointed colurnar colonies are broadly distributed in the upper region of the Mudeungsan Mountain (>750 metres above sea level) and are composed of dacitic tuff (defined as Cretaceous ‘Mudeungsan Tuff’, Lim et al, 2015). In addition to the volcanic structures, the Seoyu-ri Dinosaur Fossil Site has the most extensive and diverse theropod trackways in South Korea. One unique trackway shows that theropods increased their stride lengths to achieve maximum speed when running (Bo Seong K. and Huh M. 2010).

Recently, fossil footprints proving that pterosaurs lived in groups were also discovered here for the first time in the world (Jung et al. 2022). A series of prone and leaning statues of Buddha in Unjusa Temple show weathered structures of the well-stratified pyroclastics, reflecting ordinary people’s religion during the Late Chosun Dynasty (14th century). In addition, the Hwasun Dolmen Site, designated as a World Heritage Site by UNESCO in 2000, has 596 Dolmens made from welded tuff. This site is useful to reveal the prehistoric burial cultures in the southern Korean Peninsula.

In addition, interesting geosites were newly discovered during the process of continuous research to identify the geological value of the Mudeungsan Geopark. One of these is a site, in the middle of Chuwolsan Mountain located in Damyang County, with rocks with orbicular structures. The orbicular structures and the intervening matrix consist of rhyolite with the same composition. However, the formation process has not yet been clearly identified.

References
Ningde UGGp, China - Asia
Characteristics of typical geological heritage in Ningde Geopark

The miarolitic granite-dominated Taimu Mountain is characterized by thousands of fantastic peaks, rocks and caves. The towering peaks are rugged and steep; stone eggs are are similar in shape to human beings or to other objects; corridor-or fault-style caves originating from rock fall and accumulation are all sealed within and intersect one another. The flow-erosion-induced vertical rock fissures on the cliff walls are magnificent.

The riverbed of the Baishuiyang River is wide and flat with a length of 2 km. It is composed of bedrocks. The river is divided into upper, middle and lower parts. The middle part which is 182 metres in width forms a vast shallow water square with an area of near 40,000 m² and is a wonderful place to enjoy the river and the water.

Flow erosion-generated caves and potholes are well developed in granites in the river valleys of the Baishuiyang River. The Early Mesozoic strata and volcanic rocks in the area have the diagnostic igneous rocks and various axial volcanic structures. Therefore these rocks are characterized by huge size. They range from a few metres to more than 250 metres wide and from a few metres to several hundred metres high. Some of these rocks are surrounded with large, continuous caves, the largest of which is 500 metres long and 100 metres wide. Some of these caves are houses, as they are rich in minerals and water, and are thus very popular with visitors.

Non nuoc Cao Bang UGGp, Viet Nam - Asia
Geodiversity in Non Nuoc Cao Bang Geopark

Non nuoc Cao Bang Geopark is located in the north of Vietnam and covers a total area of 3,683 km². The Geopark is characterized by its complex geology and diverse mineral resources. In the Geopark, evidence for the geological periods Cambrian, Devonian, Carboniferous, Permian, Triassic, Cretaceous, Neogene and Quaternary were discovered. Approximately 2,000 km² of the Geopark is a limestone area that was an ancient ocean hundreds of millions of years ago. Different karst landscapes represent a full cycle of karst evolution from the beginning to the senescent phase. Karst landscapes representing the nature and senescent phases including karst ranges, peak-cluster depressions, karst cones, tower karst, karst fields, etc. Other areas of Non nuoc Cao Bang Geopark, including terrigenous sedimentary rocks and magmatic intrusive-volcanic rocks, are also equal in variety and outstanding. They represent a long and complex geological history with numerous sedimentary disruptions, extinction events, the preservation of endemic palaeo-species, and magmatic-intrusive events associated with hydrothermal mineralization.

Different fossils were also found in the Geopark such as ancient corals in Nguyen Binh district, ammonites in Luong Luong, Ha Quang district, brachiopods in Minh Long, Ha Lang district, etc. These fossils are evidence of a long-lasting geological process in the area of an ancient ocean that experienced periods of uplift. They are fossils of marine organisms living in a shallow sea under a hot climate therefore these fossils are valuable indicators of the geographical-geological conditions relating to an area of the Earth's crust.

Another feature that plays an important role in the geological evolution in Non nuoc Cao Bang UGGp is the evidence for fault activity in Cao Bang - Tien Yen deep fault. This fault is auxiliary to the well-known deep Red River fault zone, which is a manifestation of the collision between the Indian Plate and Eurasian Plate in South China and North Vietnam. Along this fault in Northeast Vietnam, including Cao Bang, the separation in the Earth crusts, 260-230 million years ago formed new oceans, together with orogeny and mineralization processes. The lateral movement along the Cao Bang – Tien Yen fault 56-5.33 million years ago triggered the appearance of a series of major lakes with alluvial fans, river mouths and swamps. The faulting also resulted in the formation of spectacular karst caves and waterfalls, such as Thang Hen lake system with turlough phenomenon, Nguom Ngao cave, DOL cave, and Ban Gioc waterfall, etc.

Ly, Doan Thi, caobanggeoparkvietnam@gmail.com

Ban Gioc waterfall
Phong Nam karst landscape
The main geological features of international value in the Salpausselkä UNESCO Global Geopark are the outstanding glaciofluvial landforms, which rest on a nearly 2 billion years old bedrock. The Salpausselkä ice-marginal ridges represent the best-known geological heritage of Finland and hold a record of the prehistoric climate change during the Younger Dryas period, which occurred around 12,800 – 11,600 years ago, at the end of the last Ice Age. The natural historical importance of the Salpausselkä ridges is immense, as they are exceptionally well developed and reveal the continuous ice-marginal positions of the Younger Dryas period, a system of ice-contact deltas and other ice-marginal deposits. Together with the long, distinct feeding esker chains the salpausselkä ridges form a unique example of glaciofluvial landforms within the Geopark area. These landforms consist mainly of sand and gravel transported, sorted and deposited in the ice sheet and its meltwaters. The ancient bedrock can be seen in many places as impressive outcrops. This scenic landscape created by water tells a story of the power of water in shaping our environment, both in its liquid and solid phase. The Salpausselkä Geopark highlights that the landscape is also a significant source of water. The massive glaciofluvial landforms of the area are vitally important for their abundant, renewable reserves of groundwater, which can be enjoyed as naturally high-quality drinking water. All of the tap water in the area comes from groundwater which is also an important natural resource for the region’s strong food and beverage industry.

Furthermore, the southern part of Finland’s second largest lake Päijänne, which is situated in the Geopark, is the main water source for over a million people in the capital area. Protecting the valuable water resources is a major theme in the Geopark. The hundreds of lakes within the Geopark area, along with the forest-covered ridges and hills, offer stunningly beautiful views and ideal surroundings for recreation, exploring nature, outdoor activities and geotourism. The key geological features and elements of the landscape, the ancient bedrock, the glaciofluvial landforms, the bodies of water, can all be seen and experienced at easily accessible sites. The distances from one attraction to another are short, and several geosites are situated along well-maintained marked trails. Waterways connect the whole area, providing excellent opportunities for paddling and boating. Many of the geosites are located within or close to the city and municipal centres and are accompanied by aspects and sites of rich natural and cultural heritage.

Kati Komulainen, kati.komulainen@lahtiregion.fi, Tapio Kananmäki, tapio.kananmaki@gtk.fi, Jukka-Pekka Palmu, jukka-pekka.palmu@gtk.fi

As the unique peak forest is formed by “Sanqingshan-style granite” which forms landforms easily and differs from other granite landforms in the world, it is named as the “Sanqingshan-style peak forest”. The differences between the Sanqingshan-style peak forest and others are as follows:

• High granite peaks or columns with crests on the top are densely distributed in a relatively small area, forming a unique granite peak forest.
• There are a range of small stone cones and cliffs on the tops of granite peaks or columns.
• The area contains a variety of micro-landforms with remarkable odd-shape rocks.
• Granite landforms are combined with unique varieties of vegetation, clouds and mists creating a natural wonder.
• Granite landforms show vertical and regional zoning controlled by shape, location and tectonics.

It shows that “Sanqingshan-style peak forest” is controlled by the shape, and location of a rock mass, cut by shallow structures and eroded by runoff. As a result, Sanqingshan Geopark is called a natural museum and textbook of granite geology and geomorphology.

Due to the “Sanqingshan-style peak forest”, the Geopark comprises an outstanding assemblage of landforms of varying scales. The area is important because its geomorphic features are abundant, diverse and of high quality. Particularly special is the high concentration of granite micro-landforms, many of which are remarkably sculptured by natural processes. The landforms are of nine different types, known as overlapping peaks, peak walls, peak clusters, stone forests, peak pillars, cliffs, gorges and odd-shape rocks. The central park of 2,800 hectares includes 48 individual peaks, 89 odd-shape rocks, and 361 individual landforms of note.

Management Committee of Sanqingshan Geopark, sjggyspy@163.com

The hundreds of lakes within the Geopark area, along with the forest-covered ridges and hills, offer stunningly beautiful views and ideal surroundings for recreation, exploring nature, outdoor activities and geotourism.
The Seridó UGGp

Geodiversity that frames the Brazilian ‘sertão’

Located at the Mina Brejui Geosite is one of the largest in South America. The exploration of this ore promoted, even in the 1940s, the strong economic development in the region. Currently, mining activity continues, but the creation of a theme park and the inclusion of the geosite in the Seridó UGGp show that tourist and educational activities can also generate income.

The geodiversity of Seridó UGGp also contains a record of one of the most recent examples of volcanic activity on the South American Platform. In the Vale Volcânico Geosite, the main highlight is the occurrence of disjointed units columnar basalt with different angles of dip, ranging from horizontal to inclined, together with peridotite nodules. The volcanism that generated these structures is dated to 25 million years.

Mountains, hills, plains, depressions and valleys are some of the features represented in the landscape, and are all elements of the geodiversity. They are the products of the Earth’s natural processes and tell the story of millions of years of evolution. In addition to being an important component of nature, the geodiversity of the Seridó UGGp territory is a source of inspiration for its population, and its artists. It provides data for researchers from different disciplines and brings the community closer to its surroundings. It is not by chance that this ‘sertão’ community visits geosites and learns from nature the importance of its abiotic elements. This territory, therefore, has a unique geodiversity, to be celebrated and known by all visitors, researchers and interested parties.

Training activity for teachers at Cachoeira dos Fundões Geosite, municipality of Currais Novos.

(Marcs Antonio Lelio de Nascimento, marcos.lello@ufm.br, Madone Follina Nobre da Silva, nifer.mnt@gmail.com, Maria Cristina Santos Souza Dias, nariaascasd@gmail.com, Janaina Luciana de Medeiros, janaina_ufm_taiarana@hotmail.com, Silas Samuel dos Santos Costa, silas.costa.105@ufm.edu.br)

Large Variscan folds in the Lardana Massif.

Twenty-five million year old basaltic columnar jointing in the Vale Volcânico Geosite, Cerro Corá municipality.

(Silas Costa)

Large Variscan folds in the Lardana Massif.

In the heart of the Spanish Pyrenees, Sobrarbe-Pirineos UNESCO Global Geopark is the wildest part of the mountain chain.

While the northern area contains several high peaks, dozens of them over 3000 m above sea level, the south is composed of mild Mediterranean sierras. If there is anything characteristic about our Geopark it is its geodiversity.

From the Cambrian to Holocene, 550 million years gaze at us from our mountains. Many different types of rocks are present in the territory: exceptional sedimentary rocks include limestones and turbidites. The oldest rocks are mainly metamorphic and igneous in origin, created during the Palaeozoic at sites far removed from their present geographic position. But even now, inside the caves and in springs, new rocks such as speleothems and tufas are forming.

The Pyrenees are not the only footprint of plate tectonics in the area. The remnants of thalts can be seen in the highest mountains, such as the Lardana Massif (3375 m). The whole territory was heavily deformed and uplifted during the Pyrenean orogeny, when Sobrarbe emerged from the former Pyrenean Sea. From the deepest sea floors to the continental fluvial deposits, the whole sedimentary record involves the erosion of the Sobrarbe-Pirineos. In addition a diverse set of tectonic structures reveals the evolution of the mountain chain, sometimes with unexpected folds like the large north-south anticlines, perpendicular to the main Pyrenean structures.

Due to intense erosion we can enjoy incredible rock exposures revealing the architecture of these mountains, together with a wide variety of landforms.

The highest areas are the kingdom of glacial features. Here the stories about the enormous glaciers that shaped the landscape during the Quaternary are revealed. Now, only two glaciers still survive in Sobrarbe’s mountains. The still active periglacial and karstic processes are represented in different ways by rock glaciers, ice caves, and especially in three more than one kilometre deep endokarstic systems. The fluvial network expresses the relief of the whole Geopark. Large rivers, like the Cinca and Ara, with beautiful braided sections, are the main arteries. In addition, a myriad of small tributaries form hidden gems inside the mountains.

An awesome geodiversity to enjoy and protect!

(Arnchel Belmonte Ribas, arnchelmonte@educa.aragon.es)
Swabian Alb UGGp, Germany - Europe

From Jurassic sediments to Karst phenomena, from volcanism to meteor impacts – the Geodiversity of the Swabian Alb Geopark

The Swabian Alb has an exciting Earth History, which produced the high geodiversity of the area and which can be experienced within the UNESCO Global Geopark. During the Jurassic, 201 to 145 Million years ago, the area was covered by a tropical sea, where sediments were deposited. The resulting sedimentary rocks are the foundation of today’s landscape and offer insights into our planet’s past. In Holzmaden, famous for the Posidonia slate, ichthyosaurs and other marine lifeforms tell the story of the Lower Jurassic period, which can be admired in a local museum but also in museums around the world, e. g. in the Natural History Museum in Stockholm. At Nupplingen, the world-famous fossils of the so-called Angel-sharks, of ammonites and of a giant dragonfly tell the story of the Upper Jurassic lagoon. Similarly, the corals in the Riffmuseum in Gerstetten let you explore the Upper Jurassic underwater world.

In the Tertiary period, volcanic activity in the area of today’s communities Ulrich and Kirchheim u. Teck led to the volcanic phenomena visible in the landscape. The Randecker Maar created two craters, the smaller one is located within the Swabian Alb UNESCO Global Geopark, the larger crater was designated as Ries UNESCO Global Geopark in 2022. In the Steinheim Basin, the central mound illustrates the dynamics of an impact event. Later, a lake formed within the crater. The fossil snails that originally lived in the Steinheim lake provide insights into evolutionary processes. It was here that Milgerdorf found evidence for Darwin’s theory of evolution.

Visitors can further experience the karst landscape of the Swabian Alb. The limestone, originally deposited in the Jurassic sea, is subjected to karst processes so that a wide variety of geostites attract visitors. In twelve show caves, visitors can marvel about the size of these cavities and their richness in dripstones. At karst springs, people gaze in awe at the striking blue colour of the water. While a simple physical phenomenon – light scattering from the small particles dissolved in the water with the blue components dominating – is proposed as the cause, the bright blue colour still magically attracts visitors. Dolines and dry valleys also illustrate how water contributes to the geodiversity of the UNESCO Global Geopark.

Gaoligongshan UGGp, China - Asia

Geodiversity in Taishan Geopark

Taishan UNESCO Global Geopark is located in central-western Shandong Province, China. Taishan, covering an area of 418.36 km² was approved as a Global Geopark in 2006. During the past 2.8 billion years, Taishan has experienced a series of dynamic and violent geological processes. Tectonic movements during the past 30 million years have played a decisive role in shaping the natural landscapes of Taishan. It is a classic area with the longest history of Early Precambrian Geological Research and the richest geological phenomena in China. It is the standard area for the Archaean Palaeoproterozoic geological evolution in North China.

Due to its unique geotectonic position and the influence of tectonic movement there are many typical and peculiar geological and geomorphic features in Taishan. The Geopark is of great national and even international geological significance, including the Precambrian geology, a standard Cambrian sequence, neo-tectonic movements and its geomorphology. It is a natural geoscience museum.

3. Tectonic relic
The geological structure of Taishan is very complex and involves the formation of folds and faults. There are structures which formed during the Precambrian, Mesozoic and Cenozoic. Younger structures are superimposed on and transformed older tectonic structures producing an extremely complex structural pattern. In the diabase porphyry vein of Taishan, there are many horizontal rock cylinders of different sizes. In cross-section each cylinder is composed of many concentric rings and a core, which is called the “barrel structure”. Globally this is a rare phenomenon.

4. Hydrogeological relics
The hydrogeological relics of Taishan are very diverse, involving rivers, lakes, ponds, waterfalls, springs and other features.

5. Geological and geomorphic relics
Under the influence of tectonic movement, erosion and features associated with downslope movement are prominent creating an undulating terrain with large contrasts in elevation. These created the majestic mountain scenery of Taishan, with a variety of eroded landforms and a number of amazing natural landscapes.

Ding Hailiang, tbdag@163.com
TERRA.vita UGGp, Germany - Europe

Coal swamp, dinosaur island, shark sea – the high diversity of palaeo-environments in the TERRA.vita Geopark

In the UNESCO Global Geopark TERRA.vita, the past 300 million years of Earth’s history are almost continuously exposed in an area of just 1,550 km² in the Northwest of Germany. TERRA.vita is a sedimentological Geopark, that was shaped by tectonic and glaciogenic processes and is characterized by unique palaeontological features. In each epoch of the Geopark’s geological history unique paleo-ecosystems existed, that have been preserved as rocks and fossils. This special geology can be experienced at numerous geosites, in guided tours, on hiking and cycling trails or in museums. These are TERRA.vita’s main highlights for guided tours, on hiking and cycling trails or in museums. Tobias Fischer, Tobias.Fischer@Lkos.de

The sedimentary rocks at Piesberg contain many fossils, such as this extinct tree-like horsetail Asterophyllites. (Photo by A. Leipner).

The Dinosaur Tracks of Bad Essen-Barkhausen are the first Upper Jurassic sauroped tracks described worldwide and the first Upper Jurassic theropod tracks found in Central Europe. (Photo by T. Fischer).

Herds of sauropods wading through shallow water along the beach, single theropods hunting and marine reptiles swimming in the sea – the TERRA.vita area was an island ruled by dinosaurs in the Jurassic. The Dinosaur Track site Bad Essen-Barkhausen is an abandoned quarry, where visitors can view dinosaur footprints. A copy of the skull of the theropod Wehenvenator, the “hunter from Wehen Hills”, is displayed at the TERRA.vita Information Pavilion in Bad Iburg.

The Pyrenees’ collision triggered the uplift of mountains in the TERRA.vita area, a geothermal event, and the deposition of sand- and lime-stones in a tropical sea during the Cretaceous. The weathering of the sandstone produced the bizarre formations in the Dörenthe Cliffs. The limestones can be best viewed along the Dyckerhoff Nature and Geotrail in Lengerich. Ammonites as large as truck wheels and other fossils are displayed in the Hermathena Birgelolithaus and in the National History Museum in Bielefeld. Sharks ruled the primordial North Sea during the Palaeozoic and their remains are displayed in the LWL Museum of Natural History in Münster.

Dry, almost and caused conditions caused the Triassic limestone mullfolds of the Mid-Trias to evaporate regularly. Yet they were full of life. Numerous ichnofossils can be viewed in the rock faces of the Silbereise Visitor Gallery and in the Botanical Garden of Osnabrück University.

Geoparks of palaeo-environments shark sea – the high diversity of palaeo-environments in the TERRA.vita Geopark

The Pyrenees’ collision triggered the uplift of mountains in the TERRA.vita area, a geothermal event, and the deposition of sand- and lime-stones in a tropical sea during the Cretaceous. The weathering of the sandstone produced the bizarre formations in the Dörenthe Cliffs. The limestones can be best viewed along the Dyckerhoff Nature and Geotrail in Lengerich. Ammonites as large as truck wheels and other fossils are displayed in the Hermathena Birgelolithaus and in the National History Museum in Bielefeld. Sharks ruled the primordial North Sea during the Palaeozoic and their remains are displayed in the LWL Museum of Natural History in Münster.

Dry, almost and caused conditions caused the Triassic limestone mullfolds of the Mid-Trias to evaporate regularly. Yet they were full of life. Numerous ichnofossils can be viewed in the rock faces of the Silbereise Visitor Gallery and in the Botanical Garden of Osnabrück University.
Troodos UGGp, Cyprus - Europe
A unique geodiversity from a unique mountain in Troodos Geopark

Mount Olympus, which consists of mantle rocks that were created several kilometres below sea level and now are exposed at an elevation of up to 1,952 m,
- the highest historic asbestos mine in Europe in serpentinite, chromite deposits with mining galleries in dunite (an olivine-rich igneous plutonic rock),
- outcrops of plutonic rocks which in places were intruded by younger dykes indicating the existence of multiple magma chambers during the creation of the TOC,
- outcrops of extensive parallel dyke landscapes that comprise the most irreplaceable evidence of ocean seafloor spreading,
- rotated and epizonalised dykes, spectacular landscapes of pillow lavas and basa flows,
- outcrops of “Cyprien-type” massive sulphide deposits with ancient and recent mining galleries as well asumber in the pillow lavas which were created by ascending metal-rich hydrothermal fluids in the form of black smokers,
- spreading centre graben valleys and a fossilized transform fault.

Those unique geological elements constitute an important and diverse Geopark with a significant contribution to a better understanding of the evolution of the oceans and our planet in general, and has established Cyprus as a geological model for geoscientists around the world.

In the TUGGp Visitor Centre, located in the old renovated elementary school of the rehabilitated Asbestos Mine, visitors are informed about this unique geodiversity through a detailed tour of the museum. It includes informative panels, maquettes, touch screens, stereomicroscopes, functioning seismographs, educational interactive games, videos and animations, a documentary film, rock and mineral exhibits and replicas of an ancient copper ingot, a furnace and a mine gallery from the last century.

Through the “Seismology Corner”, the “Kids’ Room” and the “Natural Heritage Room” students can learn about plate tectonics, faults, earthquakes, seismometers, seismology techniques, geology and how the Troodos ophiolite complex has been created and uplifted to its present position.

Seize the opportunity to visit the geosites of the TUGGp, which are ready to share with you the story and the secrets of their great journey for a unique one in a lifetime experience.

Dr Efthymios Tsiolakis and Dr Vasilis Symeou, esiolakis@geol.moa.gov.cy

Yuntaishan UGGp, China - Asia

Geological Characteristics of Yuntaishan Geopark

Yuntaishan UNESCO Global Geopark, China (hereafter referred to as Yuntaishan UGGp) is one of the first group of Global Geopark Network Members approved by UNESCO in 2004. It is located at the southern foot of Taihang Mountain, north of Jiaozuo City, with an area of 556 km². It is an all-inclusive Geopark which combines scientific and aesthetic values. The landscapes are defined mainly by the geology and geomorphology of the valley structure and partially by the natural ecosystem and cultural landscapes. Yuntaishan UGGp has five typical geotourism routes. These are the Yuntaishan Geotourism Route, the Qingshan Geotourism Route, the Shennongshao Geotourism Route, the Qingshanxia Geotourism Route and the Fenglinxia Geotourism Route. All the landscapes in these five geotourism routes include splendid views with beautiful water features and mountains that are typical for southern China.

Hongsixia Valley, was formed in an area subjected to a one-billion-year succession of orogenic movements and water erosion. From 2.6 million years, the zigzag shaped Hongsixia Valley was formed by river erosion along two groups of fractures in the red quartz sandstones. It is about 1.5 km long, several metres to dozens of metres wide and over 60 m deep. The rock, which owes its red colour to the oxidation of iron-bearing minerals, creates the fabulous valley with red cliffs and crystal clear water.

The Whale Bay is a unique landform created by a long period of river erosion in an area controlled by north-south extensional zones and subordinate east-west faults. The Dragon Ridge Great Wall is a ridge between two gorges, with a length of 11.5 m, a height of 100-200 m and width of several metres to tens of metres. It is composed of limestone, which was cut into blocks of different sizes along two sets of vertical joints. It’s like a stone wall of piled up giant stones, a natural great wall.

Wang Haonan, yongixm@126.com
Zhangye UGGp, China - Asia
Rainbow Mountains on the Silk Road

Zhangye Geopark is situated in Zhangye City, Gansu Province, China, covering an area of 1,289.71 km². Geographically, Zhangye Geopark is located on the boundary between the Qinghai-Tibet Plateau and the Inner Mongolian Plateau, the middle section of the northern slope of Qilian Mountains, and the transitional zone from Qilian Mountains to Hexi Corridor. Zhangye Geopark also lies on the ancient Silk Road, a fortuitous geographic advantage which resulted from the integration of eastern and western cultures. Consequently, in addition to its rich geodiversity, Zhangye Geopark also has a special cultural heritage.

Caiqiu (Colourful Hills) is one of characteristics in Zhangye Geopark. Caiqiu is composed of Early Cretaceous mudstone and silty mudstone which was deposited in a lake during the Cretaceous Period. Due to different minerals in rocks, Caiqiu shows marvelously varied colors. Caiqiu is also well-known as the Rainbow Mountains of China.

Binggou Danxia is another distinct feature in Zhangye Geopark. The red conglomeratic strata are preserved in this area, with various Danxia landforms, featured by the round tops, prominent ridges, steep cliffs and gentle slopes. The different stages in the development of the Danxia landforms range from the initial narrow valleys and narrow ravines in initial stages of development, via rock walls, peak clusters and forests in the mature stage, to the residual peaks and pillars of the terminal stage.

The Chinese Yugur Customs Corridor is located in the centre of the Geopark. The Corridor connects the geological history and Yugur ethnic minority culture. The landscape here marks the uplift of the Qinghai-Tibet Plateau during the Cenozoic Era. The Corridor, located in the western part of China, is a natural ecological and cultural zone integrating a geoharmony of glaciers, snow-covered peaks, primary forest, natural grassland, lakes, and wetlands, waterfalls and rivers, gorges and local minority customs.

Kanbula Geopark is located in the Huangnan Tibetan Autonomous Prefecture of Qinghai Province of the People’s Republic of China. Its geographic coordinates are 101°38’02”-102°11’05” E, 35°00’14”-36°10’12” N, with a total area of 3,136.95 km². It is separated by approximately 1,350 km from the capital Beijing and by 100 km from Xining. The Geopark is located in the northeast margin of the Qinghai-Tibet Plateau, the south bank of the upper reaches of the Yellow River, and the eastern foot of Shenbao-Xiaqiong Snow Mountain. In terms of climate, it is characterized by a cool and semi-arid climate on a plateau, with long windy winters, short and cool summers, and distinct dry and wet seasons, with long periods of sunshine and high rates of evaporation.

Kanbula Geopark is located at the junction of three orogenic belts: West Qilian, South Qilian and East Kunlun. It belongs to the transition zone of the Zeku foreland basin of West Qiling and magmatic arc of south Qilian. The unique geographical location and complicated geological processes have created the Geopark’s rich and distinctive geological heritage. Kanbula Geopark, as a comprehensive Geopark, integrates the Maixiu ancient volcanic group, the profile of Triassic strata at Longwu River, the Danxia landform, the Yellow River, and the sandstone group along the Yellow River, the ophiolite at Longwu Canyon, the Danxia landform, medium and small-sized geological structures, and scenic river landforms etc. The globally exceptional ancient volcanic group of the Maixiu region, formed in a central-fissure eruption in the Qinghai-Tibet Plateau intraplate. It is the largest and best preserved volcanic group, with numerous volcanic features in the Qinghai-Tibet Plateau which formed in the Mesozoic Era. The Triassic strata sequence at Longwu River, with a thickness of nearly ten thousand metres, records the palaeogeographic evolution of Indosinian sedimentary rocks of the central orogenic belt in the tectonic junction area of Qilian Mountains, Qilian Mountains and Kunlun Mountains. The Yellow River is the fifth longest river in the world and the second longest river in China. It serves as an ideal location for regional science and highly valuable for popularization of science. In addition, The Yellow River is the fifth longest river in the world and the second longest river in China. It serves as an ideal location for popularization of science and highly valuable for regional science.
**What is a UNESCO Global Geopark?**

UNESCO Global Geoparks are single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development. A UNESCO Global Geopark uses its geological heritage, in connection with all other aspects of the area’s natural and cultural heritage, to enhance awareness and understanding of key issues facing society, such as using our earth’s resources sustainably, mitigating the effects of climate change and reducing natural disasters-related risks.

By raising awareness of the importance of the area’s geological heritage in history and society today, UNESCO Global Geoparks give local people a sense of pride in their region and strengthen their identification with the area.

The creation of innovative local enterprises, new jobs and high quality training courses is stimulated as new sources of revenue are generated through geotourism, while the geological resources of the area are protected.

At present, there are 177 UNESCO Global Geoparks in 46 countries. All the UNESCO Global Geoparks are institutional members of the Global Geoparks Network.

**Global Geoparks Network**

The Global Geoparks Network (GGN) is a non-profit and a non-governmental organisation. It was initially founded in 2004 as an international partnership developed under the umbrella of UNESCO, and was officially registered as an association in 2014 subject to French law. The Global Geoparks Network is the official partner of UNESCO for the operation of the UNESCO Global Geoparks.

Networking and collaboration among Global Geoparks is an important component of the Global Geoparks Network.

The four GGN Regional Geoparks Networks are the Asia Pacific Geoparks Network (APGN), the European Geoparks Network (EGN), the Latin America and Caribbean Geoparks Network (GeoLAC) and the African UNESCO Global Geoparks Network (AUGGN).

[www.globalgeoparksnetwork.org](http://www.globalgeoparksnetwork.org)
[www.visitgeoparks.org](http://www.visitgeoparks.org)
### List of UNESCO Global Geoparks

<table>
<thead>
<tr>
<th>Geoparks</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>51. Xiangxi UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>51. Yimengshan UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>49. Huanggang Dabieshan UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>47. Keketuohai UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>45. Zhijindong Cave UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>43. Dali-Cangshan UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>42. Mount Kunlun UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>41. Yanqing UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>38. Hong Kong UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>36. Leye Fengshan UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>35. Ningde UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>34. Qinling Zhongnanshan UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>33. Alxa Desert UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>32. Longhushan UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>31. Zigong UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>29. Fangshan UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>28. Wangwushan-Daimenjishan UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>27. Taishan UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>26. Leiyu Fengshan UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>25. Jiangshun UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>24. Yandangshan UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>23. Minghu UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>22. Taining UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>21. Hexiugen UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>20. Lushan UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>19. Huangshan UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>18. Shilin UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>17. Songshan UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>16. Wudalianchi UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>15. Yuntaishan UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>14. Zhangjiajie UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>13. Danxiashan UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>12. Kütralkura UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>11. Discovery UNESCO Global Geopark</td>
<td>China</td>
</tr>
<tr>
<td>10. Cliffs of Fundy UNESCO Global Geopark</td>
<td>Canada</td>
</tr>
<tr>
<td>9. Percé UNESCO Global Geopark</td>
<td>Canada</td>
</tr>
<tr>
<td>8. Tumbler Ridge UNESCO Global Geopark</td>
<td>Canada</td>
</tr>
<tr>
<td>7. Stonehammer UNESCO Global Geopark</td>
<td>Canada</td>
</tr>
<tr>
<td>6. Southern Canyons Pathways UNESCO Global Geopark</td>
<td>Canada</td>
</tr>
<tr>
<td>4. Araripe UNESCO Global Geopark</td>
<td>Brazil</td>
</tr>
<tr>
<td>3. Famenne-Ardenne UNESCO Global Geopark</td>
<td>Belgium</td>
</tr>
<tr>
<td>2. Ore of the Alps UNESCO Global Geopark</td>
<td>Switzerland</td>
</tr>
<tr>
<td>1. Styrian Eisenwurzen UNESCO Global Geopark</td>
<td>Austria/Slovenia</td>
</tr>
<tr>
<td>5. Serrad UNESCO Global Geopark</td>
<td>Austria</td>
</tr>
<tr>
<td>4. Ararpe UNESCO Global Geopark</td>
<td>Belgium</td>
</tr>
<tr>
<td>3. Farniente-Ardenne UNESCO Global Geopark</td>
<td>Belgium</td>
</tr>
<tr>
<td>2. Ore of the Alps UNESCO Global Geopark</td>
<td>Switzerland</td>
</tr>
<tr>
<td>1. Styrian Eisenwurzen UNESCO Global Geopark</td>
<td>Austria/Slovenia</td>
</tr>
</tbody>
</table>
How Geoparks can contribute to the International Geodiversity Day?

Watch the video and find exceptional examples of the UNESCO Global Geoparks’ rich geodiversity

https://globalgeoparksnetwork.org/?page_id=2934