

# OX<sup>2025</sup>GVC

Oxford Geoheritage Virtual Conference

## OXFORD GEOHERITAGE VIRTUAL CONFERENCE ABSTRACT VOLUME

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### Keynote Speakers:

**Maria da Glória Motta Garcia**, Associate Professor, University of São Paulo  
*Geoconservation in the Amazon: challenges, opportunities and community involvement*  
Day: Wednesday      Time: 14:00 GMT

**Nathan Fox**, Schmidt AI in Science Fellow, University of Michigan  
*Artificial Intelligence for Geodiversity Research and Practice: Innovations, Applications, and Challenges*  
Day: Tuesday      Time: 16:20 GMT

# GEOSITE RECOGNITION WITH QUANTITATIVE AND QUALITATIVE-QUANTITATIVE METHODS OF GEODIVERSITY ASSESSMENT ON THE TERRITORY OF NOVOHRAD-NÓGRAD UNESCO GLOBAL GEOPARK

Presenting Author: *Vladyslav Zakharovskiy*, School of Agriculture and Environment, Massey University, Palmerston North 4474, New Zealand

Email: [v.zakharovskiy@massey.ac.nz](mailto:v.zakharovskiy@massey.ac.nz)

Presentation Style: *Flash Talk*

Day: *Monday*

Time: *14:05 GMT*

Co-Authors:

*Márton Pál*, ELTE Eötvös Loránd University, Institute of Cartography and Geoinformatics, Pázmány Péter prom. 1/A., 1117, Budapest, Hungary

*Károly Németh*, Lithosphere Physics Group, Institute of Earth Physics and Space Science, 9400 Sopron, Hungary; 4. National Earthquakes and Volcanoes Program, Saudi Geological Survey, Jeddah 21514, Saudi Arabia

## ABSTRACT

Geodiversity assessment represents an emerging and rapidly evolving tool for identifying areas with geological, geomorphological, cultural, and other abiotic values within specific spatio-temporal scales, collectively termed geoh heritage. At the current stage of geodiversity assessment development, researchers employ varying approaches and values, primarily designed to achieve their specific objectives (e.g., basic and thematic mapping, identification of natural resources, or geoeducation hotspots) and reflect their areas of expertise. Consequently, methodologies for geodiversity assessments are tailored for diverse purposes, regions, and datasets. Regardless of the differences in these methods, they ultimately identify hotspots that can be compared when models are applied to the same region. This study compares quantitative and qualitative-quantitative models within the Novohrad-Nógrad UNESCO Global Geopark territory in the state frontier between Hungary and Slovakia. The models employ different approaches and types of data. The quantitative model is primarily used for establishing geoparks and recognizing diversity in the location, while the qualitative-quantitative model is developed for geosite recognition in areas with limited data. In the quantitative model, the count of units for six sub-indices (geology, landforms, soils, hydrology, minerals, and fossil occurrence) is used, where locations with a large number of units are identified as hotspots. Conversely, the qualitative-quantitative methodology evaluates three geodiversity elements (geological, geomorphological, and hydrological) according to an 8-point system, with hotspots being locations with higher values for each element. The results of both models are then rearranged into a 5-point ranking system using the same 6.25 km<sup>2</sup> grid for the geopark region. The models are compared to understand their rate of similarities. To test their effectiveness for geosite recognition, the territory of Novohrad-Nógrad UNESCO Global Geopark, which contains 85 globally recognized geosites, was used. The test concluded that the quantitative model identifies a higher number of geosites but with lower accuracy compared to the qualitative-quantitative model.

# **DIVERSITY HOTSPOTS: A TOOL FOR ESTABLISHING GEOCONSERVATION PRIORITIES. CASE STUDY IN TUY AN DISTRICT AND SONG CAU TOWN, PHU YEN PROVINCE, VIETNAM**

Presenting Author: **Hoang Thi Phuong Chi**, *Faculty of Environment, University of Science, Vietnam National University, Ho Chi Minh City, Vietnam*

Email: [htpchi@hcmus.edu.vn](mailto:htpchi@hcmus.edu.vn)

Presentation Style: *Flash Talk*

Day: *Monday*

Time: *14:10 GMT*

Co-Authors:

*Ho Ngoc Giau, Faculty of Environment, University of Science, Vietnam National University, Ho Chi Minh City, Vietnam*

## **ABSTRACT**

Geoconservation is part of a strategic, holistic, and integrated strategy to preserve the natural environment. The concept of "geodiversity hotspots" developed as a result of identifying areas with high geodiversity that are threatened by both natural and anthropogenic factors, with the goal of providing geographical data on geoconservation priorities. As part of the geoconservation strategy, geodiversity hotspots would help local managers: (1) identify geographically significant areas to suggest new geosites; (2) zone and categorize areas with geoheritage sites; and (3) give managers a foundation for determining the degree of conservation and protection. This study was carried out in Tuy An District and Song Cau Town, Phu Yen Province, a high-geodiversity location on Vietnam's South Central Coast. The creation of maps for the geodiversity index and the threat index was one aspect of the quantitative methodology that was employed. The geodiversity index is calculated by adding two indices: geological diversity and geomorphological diversity. The threat index is calculated by adding two indices: land use types and natural and anthropogenic risks. According to the evaluation's findings, Tuy An District's northern and eastern regions—which are home to several important geosites such as O Loan Lagoon, Hon Yen Isle, and Da Dia Reef Cape—are primarily home to geodiversity hotspots. Although the concept of geodiversity is still relatively new in Vietnam, it has the potential to grow significantly in the future provided conservation and sustainable development are given more attention.

# **BEYOND SCIENCE: A QUALITATIVE METHODOLOGY FOR GEOLOGICAL HERITAGE VALUATION IN COLOMBIA**

Presenting Author: *Marianela Vargas-Anaya, Servicio Geológico Colombiano*

Email: *nelaknela@gmail.com*

Presentation Style: *Flash Talk*

Day: *Monday*

Time: *14:15 GMT*

Co-Authors:

## **ABSTRACT**

The assessment of geological heritage is a crucial step in conservation and management strategies. International organizations such as the International Union of Geological Sciences (IUGS) and the International Union for Conservation of Nature (IUCN) have established guidelines to evaluate sites of geological significance. However, existing methodologies often emphasize scientific aspects, leaving cultural values underexplored. This study presents a new qualitative methodology for geological heritage assessment, integrating scientific, educational, and cultural dimensions. The approach follows an international framework while adapting to national contexts, ensuring a comprehensive valuation process. The innovative aspect of this methodology lies in the criteria proposed for cultural value assessment, which consider association of the sites with historical processes, artistic references, landscapes, symbolic aspects and territorial appropriation. This methodology has been applied to at least 20 geodiversity sites across Colombia and has been used as a basis for submitting sites to international bodies such as IUGS and UNESCO. By incorporating these elements, the methodology fosters a more holistic understanding of geological heritage, highlighting its role in shaping identities and narratives beyond its scientific importance. This approach aims to support decision-making processes in heritage conservation and strengthen the link between geosciences and society.

# CONSERVING GEOHERITAGE SITES FOR GEOPARK DEVELOPMENT AND GEOTOURISM PROMOTION IN LADAKH, INDIA.

Presenting Author: **Mohd Ilyas**, *Department of Geology, University of Ladakh, UT Ladakh, 194101, India.*

Email: *ilyasladakh978@gmail.com*

Presentation Style: *Flash Talk*

Day: *Monday*

Time: *14:20 GMT*

Co-Authors:

*Sandipan Mukherjee, G.B. Pant National Institute of Himalayan Environment, Ladakh regional Centre, Leh 194101, Ladakh UT, India.*

*Purushottam Kumar Garg, G.B. Pant National Institute of Himalayan Environment, Ladakh regional Centre, Leh 194101, Ladakh UT, India*

*Ritesh Arya, IndianGeoparks, India.*

*Ravi Kumar Vundavalli, IndianGeoparks, Salim Ahmed, LadakhGeoparks, Tajalli Mohiuddin Malik LadakhGeoparks, Kunzang Dolma LadakhGeoparks, Rigzin Wangdus, LadakhGeoparks,*

## ABSTRACT

Ladakh is home to a wide range of rocks, minerals, and unique fossil assemblages that have developed over millions of years. As well as Ladakh is real gift from nature and Geoheritage site is majestic creation by nature but Geological conservation is a neglected topic in Ladakh. On the one hand the people of Ladakh are participating in protest and a "climate fast" in an effort to raise awareness of the region's vulnerable ecological situation and seek its land protection under the sixth Schedule of the Constitution on the other hand, the local people of Ladakh unknowingly being destroy the precious evidence of early life or Geoheritage site by the need and greed of rapid urbanization.

Here we attempting to highlight the significance of Geoheritage sites, which hold strong potential for the establishment of a geopark and the promotion of tourism. Tourism and hospitality are among the primary sources of income for the people of Ladakh. However, tourism in the region has largely been focused on monasteries, stupas, lakes, and other popular attractions. In these tours, visitors enjoy the scenic and cultural sites but gain little understanding of the geological history of the region. Integrating geological knowledge into tourism can provide valuable insights into the history and age of rocks, enhancing the overall travel experience. This approach will contribute to the promotion of Geotourism.

Lastly, the paper emphasizes an urgent need to protect and conserve paleolake in situ sections at Spituk and Shey for the long-term development of Ladakh. Conservation of this Geoheritage sites can leave a good legacy for our future generations, These sites can be preserved with a little care and they can provide a lot of information about our rich geological past to our future generations and this Geoheritage site will be of great help to researchers, students and scientists visiting from different parts of the world.

# **EXPLORING LAMANOK COMPLEX OF ANDA, BOHOL: A CONVERGENCE OF GEO-HERITAGE AND CULTURE WITHIN THE BOHOL ISLAND UNESCO GLOBAL GEOPARK**

Presenting Author: *Procopio Resabal Jr., Bohol Art and Cultural Heritage Council*

Email: *procoresa8@gmail.com*

Presentation Style: *Flash Talk*

Day: *Monday*

Time: *14:25 GMT*

Co-Authors:

*Athena G. Vitor, Holy Name University*

*Rachelle Lacea, National Museum of the Philippines Bohol*

## **ABSTRACT**

This research explores the Lamanok Archaeological Complex in Anda, Bohol, as a convergence of geo-heritage and cultural current within the context of the Bohol Island UNESCO Global Geopark. Through an interdisciplinary approach, combining archaeological, geological, and cultural studies, this study aims to: 1. investigate the geological setting and formation of the Lamanok caves and rock shelters; 2. examine the archaeological evidence of human habitation and cultural practices within the complex; 3. analyze the cultural significance of Lamanok within the context of Bohol's indigenous heritage and its relevance to the island's UNESCO Global Geopark designation. This research contributes to a deeper understanding of the intricate relationships between geological processes, human culture, and the environment, highlighting the importance of conserving and managing geo-cultural heritage sites within the framework of sustainable development. The findings of this study will provide valuable insights for policymakers, conservationists, and stakeholders in preserving the Lamanok Archaeological Complex and promoting Bohol Island's unique geo-cultural heritage.

# NEW ZEALAND GREYWACKE. THE ANCIENT GONDWANAN GEOLOGICAL FOUNDATION OF A COUNTRY AND ITS GEOHERITAGE.

Presenting Author: *Ilmars V. Gravis, Geoconservation Trust Aotearoa Pacific, New Zealand.*

Email: [igravis@geoconservation.org](mailto:igravis@geoconservation.org)

Presentation Style: *Talk*

Day: *Monday*

Time: *14:40 GMT*

Co-Authors:

*Karoly Nemeth, Geoconservation Trust Aotearoa Pacific, New Zealand; Saudi Geological Survey, KSA; ; Institute of Earth Physics and Space Scienc, Hungary.*

*Chris Twemlow, Geoconservation Trust Aotearoa Pacific, New Zealand.*

## ABSTRACT

In response to the IUGS global heritage stones project, members of the Geoconservation Trust Aotearoa Pacific are proposing three stones for consideration. These will be the first stones recognized in this project from New Zealand and Australia. The stones include Hinuera Natural Stone, formed by the Ongatiti Ignimbrite of the Taupo Volcanic Zone, Coromandel Granite, and New Zealand Greywacke. Geologically, greywacke comprises nearly one quarter of our nation's most recognizable and iconic landscapes and geographical features. The term "greywacke" originates from the German word *grauwacke*, which translates to "grey rock." However, this designation scarcely encapsulates the complexity of greywacke, which displays extensive variations in mineralogy, colour, weathering response, sediment sources, hardness, grain size, and crystalline structures on both macro and micro scales. Recent scientific research has yielded significant advancements in understanding the petrology, mineralogy, and geological origins of greywacke, and we can confirm its role in terrane accretion on the eastern continental margins of the Gondwana supercontinent, hundreds of millions of years ago. Sediment deposition and accretion of newly formed rocks at an active subduction zone is a process we see occurring in real time at the offshore Hikurangi Trench, potentially forming the greywacke of the future. Despite its widespread national presence, the geoheritage value of greywacke has often been overlooked. It has played a crucial role in communities from pre-European Māori society to today's industrialized New Zealand. Greywacke landscapes are key features of New Zealand's geology and hazard profile. This rock is integral to our abiotic environment, built environment, and cultural identity, making it perhaps our unofficial national rock. This presentation reviews New Zealand greywacke's role in geological heritage, cultural and social heritage, and industrial history. Geoheritage research in New Zealand is still developing, with most efforts focused on specific sites rather than the significance of stone types in cultural development, architecture, and community awareness of geological materials. Participation in the IUGS programme is one significant step in a programme of work highlighting the importance of geoconservation in New Zealand and facilitating engagement with New Zealand's geoheritage through science, education, art, tourism, and community development.

# **GEOHERITAGE RESEARCH IN THE MENA REGION: A CRITICAL REVIEW**

Presenting Author: *Kenta Sayama, School of Geography and the Environment, University of Oxford*

Email: *kenta.sayama@ouce.ox.ac.uk*

Presentation Style: *Talk*

Day: *Monday*

Time: *14:55 GMT*

Co-Authors:

*Iain Stewart, Royal Scientific Society, Amman, Jordan; Sustainable Earth Institute, University of Plymouth*

## **ABSTRACT**

Geoheritage conservation is an emerging initiative in the Middle East and North Africa (MENA) region. However, despite its growing significance, the region remains largely absent from UNESCO's international designations, such as the World Heritage List and the Global Geoparks Network. While various review papers have explored geoheritage from topical and geographical perspectives, MENA as a region has never been comprehensively examined. This lack of representation raises an important question: is there a lack of academic efforts on geoheritage in MENA countries?

To address this query, we conducted a systematic review of geoheritage literature in the MENA region, analysing 145 published studies to assess the extent and focus of academic contributions. Our findings demonstrate that the number of publications has increased significantly since 2017, dominated primarily by works from four countries. Despite the interdisciplinary nature of geoheritage, the majority of the studies were conducted by geoscientists, with limited representation from other relevant fields.

Additionally, we examined the publication sources and the stages of geoheritage conservation addressed in these studies. Similar to global trends, our analysis found that topics such as interpretation, promotion, and community engagement were underrepresented. Instead, much of the research focused on site inventories or evaluations. The findings highlight the tendency for many studies to directly implement schemes and methods developed outside of the region, with limited contextualisation based on local socio-cultural and environmental considerations.

Our findings underscore both the challenges and opportunities for geoheritage research in the MENA region. While there has been notable growth in interest and effort towards geoheritage in this region, there is a pressing need for locally-grounded strategies that integrate cultural and societal dimensions into geoheritage conservation efforts across Middle East and North Africa.



# HERITAGE BUILDINGS AS GEOLOGICAL ARCHIVES IN SPACE AND TIME: A CASE STUDY OF MEDIEVAL CHURCHES IN EASTERN ENGLAND

Presenting Author: *Nigel H Woodcock, University of Cambridge*

Email: *nhw1@cam.ac.uk*

Presentation Style: *Talk*

Day: *Monday*

Time: *15:10 GMT*

Co-Authors:

## ABSTRACT

Heritage buildings provide a valuable ex-situ archive of constructional and ornamental stone, often from quarry sources that are no longer productive or even exposed. Studies of such buildings usually focus on identifying the geographical and geological source of the stones involved, but less often try to quantify the history of stone use.

English medieval churches provide an opportunity to date church construction projects, because changing architectural styles constrain their age, even in the absence of documentary evidence. For a case study, external building stone has been recorded in 124 medieval churches in a 1200 km<sup>2</sup> area in south Cambridgeshire, eastern England. Each component (e.g. walling, windows, doors) in each architectural part (e.g. tower, nave, aisles, chancel) of each church has been separately recorded, generating over 2000 records of construction or repair projects. Every project has been dated from documentary records or architectural style, allowing quantitative analysis and graphical display of stone use in both space and time.

The pre-Reformation churches of the area mostly have rubble walls of local Fieldstone and Clunch (Cretaceous Chalk), and imported Jurassic limestone from Barnack, about 60 kilometres to the northwest. Less common are ashlar walls of Clunch or Barnack Stone. The medieval dressings (e.g. windows, doors, buttresses, quoins, string courses) are local but easily weathered Clunch in less exposed positions but imported weather-resistant Barnack Stone in exposed locations. This use of Barnack was despite the high transport costs for the circuitous inland waterway journey of about 100 kilometres. The proportion of imported Barnack Stone to local Clunch in windows and doors is proposed as a good indicator of a church's medieval wealth.

The methodology of data collection, analysis and presentation in the Cambridgeshire study should prove useful for other heritage buildings nationally and internationally. One important by-product of the study is the best decade-scale estimate of the volume of medieval church building in Britain. Fluctuations can be linked to the Black Death, the Protestant Reformation, and the Church's re-emphasis that time in purgatory could be reduced by funding parish good works. Heritage stone yields unexpected secrets!

# THE CALCARENITE DI GRAVINA FM AT MATERA (SOUTHERN ITALY): A POTENTIAL CANDIDATE FOR THE IUGN HERITAGE STONES LIST

Presenting Author: *Vitantonio Venezia, University of Bari "Aldo Moro"*

Email: *vitantonio.venezia@uniba.it*

Presentation Style: *Flash Talk*

Day: *Monday*

Time: *15:35 GMT*

Co-Authors:

*Luisa Sabato, University of Bari "Aldo Moro"*

*Marcello Tropeano, University of Bari "Aldo Moro"*

## ABSTRACT

The rupestrian old town of Matera (southern Italy) is an urban area known as “Sassi” included in the UNESCO World Heritage List since 1993. Its spectacular landscape is an extraordinary example of perfect integration of human development and geology. The old town, that hosted up to 20.000 people, was excavated into the Calcarenite di Gravina Fm, Early Quaternary in age. Rheological and mechanical characters of these soft-rocks determined the architectural development, and, therefore, the cultural identification of a unique and worldwide known urban context. For this reason, we argue that the Calcarenite di Gravina Fm, locally known as “Tufo”, could be a candidate for the designation in the “International Union of Geological Science Heritage Stones”, since it fulfils at least two out the four criteria asked from the Heritage Stone Subcommittee Secretary General for the submission:

- Use in emblematic buildings/sites: Historical use of the stone in singular and iconic buildings internationally recognized as a relevant contribution to human culture. The use of the stone must have played a key role in the valuable features of the building.
- Traditional architecture: Historical use of the stone as a key factor in the development of a significant culture or society and its traditional architecture, which is internationally recognized for its distinctive features.

The inclusion of the Calcarenite di Gravina Fm at Matera into the IUGS Heritage Stone List will give Matera a further International Recognition, along with the UNESCO World Heritage Site and the 2019 European Capital of Culture, enhancing the opportunity of the town to become an international site of geotouristic interest, for its clear and strong bond between geology and culture.

# THE ROLE OF MINING IN GEOHERITAGE EXPOSURE WITHIN UNESCO GLOBAL GEOPARKS

Presenting Author: *Silas S S Costa, Institute for Sustainable Development and Environment of Rio Grande do Norte, Natal, Brazil*

Email: *silas.costa.105@gmail.com*

Presentation Style: *Flash Talk*

Day: *Monday*

Time: *15:40 GMT*

Co-Authors:

*Manu M Ganuzas, International Association for the Conservation of Geological Heritage*

*Diamantino M I Pereira, 8 Institute of Earth Sciences, University of Minho, Braga, Portugal*

*Marcos A L Nascimento, Department of Geology, Federal University of Rio Grande do Norte, Natal, Brazil*

## ABSTRACT

The relationship between resource extraction and nature conservation is often viewed as contradictory. Traditionally, conservationists consider them compatible only when rehabilitation efforts restore biodiversity in areas degraded by extractive activities. However, in UNESCO Global Geoparks (UGGps), mining and quarrying can serve as natural windows into the Earth's surface, unveiling significant geoheritage. This study explores how extractive activities contribute to the identification and protection of geoheritage within the 213 UGGps designated by UNESCO. The methodology involved: (i) mapping geographic, geoheritage, and mining-related variables through documentary and bibliographic analysis; (ii) conducting fieldwork; and (iii) applying descriptive statistics and linear regression techniques. Results indicate that 53% of UGGps have geoheritage features that are either fully or partially exposed due to mining or quarrying. Over two decades of the Global Geoparks Network (GGN), the number of UGGps showcasing geoheritage revealed by extractive activities has grown. Among the most frequently exposed geoheritage types are paleontological, stratigraphic, igneous, tectonic, mineralogical, and cosmogenic features. The interaction between extractive activities and geoheritage exposure plays a crucial role in developing projects within UGGps, fostering global sustainability initiatives, shaping policies for rehabilitating degraded landscapes, and strengthening partnerships with the mining industry.

# **GEOINFORMATICS FOR GEOHERITAGE: INSIGHTS FROM THE MOROCCAN MIDDLE ATLAS**

Presenting Author: *Mustapha Amzil, Laboratory of Geosciences, Geo-informatics and Environment, Faculty of Sciences Ben M'sick, Hassan II University of Casablanca, Morocco*

Email: *mustapha.amzil1-etu@etu.univh2c.ma*

Presentation Style: *Flash Talk*

Day: *Monday*

Time: *15:45 GMT*

Co-Authors:

*Omar Zafaty, National Institute of Archaeological Sciences and Heritage, Rabat, Morocco*

*Mostafa Oukassou, Laboratory of Geosciences, Geo-informatics and Environment, Faculty of Sciences Ben M'sick, Hassan II University of Casablanca, Morocco*

## **ABSTRACT**

The tools, methods and techniques developed in the field of geoinformatics are intended to acquire spatial information. Usually, the geographic information targeted by the field concerns the scale of the territory. However, there are many disciplinary fields where spatial information is also needed to carry out several tasks. The fields of archaeology, museology and the conservation of the palaeontological and ichnological heritage are all consumers of spatial information acquired on objects that are generally smaller in size than those targeted by geomatics. This presentation provides feedback on the application of the geoinformatics process in several geological heritage documentation projects (palaeontological and ichnological geosites) in the Boulemane-Skoura M'daz region in the Moroccan Middle Atlas. Based on projects involving documentation using terrestrial and aerial photogrammetry and lasergrammetry, and the mediation of objects in a variety of formats, we show that quality control, the structuring of geometric and semantic information, graphic semiology and mediation using virtual reality tools (3D models and virtual visits) provide fundamental scientific knowledge about the objects studied, and enable these data to be used for geoheritage conservation and enhancement.

Keywords: Geoheritage, Virtual Reality, Photogrammetry, Lasergrammetry, Middle Atlas.

# TRACING THE ANCIENT SEAS: MEGALODON TEETH FOSSILS AND THE PALEO GEOGRAPHY OF CISANGKAL, PANGANDARAN"

Presenting Author: *Lutfia Thahir, universitas padjadjaran*

Email: *sapari@unpad.ac.id*

Presentation Style: *Flash Talk*

Day: *Monday*

Time: *15:50 GMT*

Co-Authors:

*Mohamad Sapari Dwi Hadian, Universitas Padjadjaran*

*Luthfia Thahir, Universitas Padjadjaran*

*Cecep Yandri Sunarie, Universitas Padjadjaran*

*Lia Jurnalaha, Mochamad Nursiyam Barkah, Winantris Winantris, Universitas Padjadjaran*

## ABSTRACT

The Pamutuan Formation, dating back to the Middle to Late Miocene, comprises limestone, sandstone, volcanic rocks, and sandy claystone deposited in a shallow marine environment. These sedimentary deposits provide significant insights into past ecosystems and the organisms that once inhabited them. This study aims to analyze the depositional characteristics of the shallow marine environment, with a particular focus on the occurrence of Megalodon tooth fossils. The research seeks to establish a geological model that delineates the distribution and characteristics of fossil-bearing rock formations within a specific stratigraphic and paleogeographic context. Additionally, the findings will contribute to the identification of potential geological conservation areas and support the development of aspiring geoparks.

The methodology employed in this study includes direct field observations, stratigraphic profiling, lithological identification, and fossil sampling for laboratory analysis. Petrographic examinations using a polarizing microscope were conducted to determine mineral composition and rock textures. The obtained data were then correlated with the geological time scale to ascertain the relative age of the deposits and compared with existing fossil records.

The results indicate that the Pamutuan Formation is extensively exposed in Pangandaran, West Java, and contains significant fossil assemblages crucial for reconstructing past depositional environments and paleoclimatic conditions. The presence of Megalodon tooth fossils within this formation provides valuable evidence for understanding Miocene marine ecosystems and their paleoenvironmental implications. These fossils serve as key biostratigraphic markers, aiding in the determination of relative depositional ages and contributing to the broader field of paleontology.

Ultimately, this study enhances the scientific understanding of the Pamutuan Formation and underscores its importance in geological heritage conservation. The findings offer essential references for future paleogeographic reconstructions and reinforce the significance of the region in global paleontological studies.

to contribute valuable data on the initial discovery locations of Megalodon teeth, aiding in the precise determination of the relative age and depositional environment.

Keywords: Conservation, geopark, geological heritage, geological model, Megalodon tooth

# **GEOLOGICAL DIVERSITY, GEOSITES AND GEOTOURISM IN GREECE: CURRENT STATUS AND FUTURE POTENTIAL DEFINED IN THE FRAMEWORK OF THE GEOINFRA PROJECT.**

Presenting Author: **Irene Zananiri**, *Hellenic Survey of Geology and Mineral Exploration*

Email: [izananiri@eagme.gr](mailto:izananiri@eagme.gr)

Presentation Style: *Flash Talk*

Day: *Monday*

Time: *15:55 GMT*

Co-Authors:

*Vasiliki Mparsaki, Hellenic Survey of Geology and Mineral Exploration*

*Evgenia Moraiti, Hellenic Survey of Geology and Mineral Exploration*

## **ABSTRACT**

Greece, located in the convergence space of two tectonic plates, is characterized by an active tectonic regime and a complex geological structure, exhibiting a variety of geological formations, landforms, geological processes (past or emerging), that are of particular scientific or educational interest, while many of those have high cultural and touristic value. The Hellenic Survey of Geology and Mineral Exploration has been working towards the recording, designation and promotion of the Hellenic geodiversity the past three decades. In the frame of the “GEOINFRA” project (“Geological Mapping of Greece for the support of innovation and entrepreneurship”), Work package 5 “Documentation of Geosites and Geotrails, Geopark studies” (NSRF 2014-2020/2023), a systematic database has been compiled, available through the HSGME portal with the up to now listed geosites and geotrails in Greece. Through systematic fieldwork, complemented by modern technology (e.g. UAVs), more than 1800 sites of geological diversity have been recorded and about 90 geotrails have been defined, connecting attractions of geological, archaeological, historical, cultural, environmental, and religious significance, as well as sites important for biodiversity, aiming to narrate the story of a destination in a holistic way. For the promotion of the hellenic geoheritage to the public several tools were used, like leaflets, interpretation panels, ESRI story maps, online tourist guides and a mobile application. Finally, during the GEOINFRA project several areas were explored to assess their potential for the designation of geotrails in future works and the possibility of establishing thematic geoparks.

# SANDSTONE CRAGS OF THE CHŘIBY RIDGE (MORAVIAN CARPATHIANS, SE OF THE CZECH REPUBLIC) – GEOHERITAGE VALUES AND THREATS

Presenting Author: **Lucie Kubalíková**, *Institute of Geonics of the Czech Academy of Sciences, Brno, Czech Republic*

Email: [luc.kubalikova@gmail.com](mailto:luc.kubalikova@gmail.com)

Presentation Style: *Flash Talk*

Day: *Monday*

Time: *16:00 GMT*

Co-Authors:

*Karel Kirchner, Institute of Geonics of the Czech Academy of Sciences, Brno, Czech Republic*

*Piotr Migoń, Institute of Geography and Regional Development, University of Wrocław, Poland*

## ABSTRACT

Rock landforms provide non-invasive, easy insights into the distant geological past, and they reflect landform evolution and processes shaping the earth surface in the past and present. Moreover, rock landforms, especially crags and tors, have a high geoheritage relevance. The territory of the Czech Republic shows many diverse examples of crags and tors, especially in sandstone areas. However, while the Bohemian Cretaceous areas have been examined in detail, the sandstone crags in Moravian Flysch Carpathians have been given only limited attention.

The paper is focused on the sandstone crags in the Chřiby Mountains being explored from two main perspectives: identification of the crags as geoheritage elements and their assessment in terms of threats and degradation risk. The application of semi-quantitative assessment methods (degradation risk evaluation and Risk Assessment Matrix) enabled the ranking of the sites according to the degree of possible deterioration and helped to identify particular threats, which can be considered important when planning and managing the area's natural resources. The recognition of geoheritage values of sandstone crags, along with identifying and evaluating risks and threats, may serve as a basis for effective management and further research.

# THE GEO-AESTHETICS OF THE MEXICAN VOLCANO XITLÉ – POTENTIAL OF A NEW INTERDISCIPLINARY RESEARCH CONCEPT

Presenting Author: *Peter Krieger*, Instituto de Investigaciones Estéticas, Universidad Nacional Autónoma de México (UNAM)

Email: *krieger@unam.mx*

Presentation Style: *Talk*

Day: *Monday*

Time: *16:15 GMT*

Co-Authors:

## ABSTRACT

This talk addresses conceptual and methodological aspects of geo-preservation, focused on a specific case, the stony desert (Pedregal) in the southern part of Mexico City.

1) The object: The Pedregal of San Ángel is a lava field which since the eruption of monogenetic volcano Xitlé in the 3rd century CE expanded on 80 km<sup>2</sup>. The lava flows destroyed the settlements of the Cuicuilco culture, and via secondary succession, the zone became a site of high biodiversity, however not apt for urbanization nor agriculture and thus devaluated as badlands (malpaís). In mid-20th century, artists and landscape architects discovered the bizarre beauty of the lava formations, and then, two sublime urban interventions, the estate of “Jardines del Pedregal” and the new campus of the National University (UNAM), attracted, subsequently, hyper urban developments – which left only a protected ecological reservation of 2.37 km<sup>2</sup>, the REPSA, and few other natural enclaves.

2) The methods: The REPSA, located on the autonomous territory of the UNAM, was designated in 1983, based on ecological research. Yet, as I will argue in my paper, the preservation of nature, such as the geological heritage, is a contradictory venture, because nature is a dynamic entity in continual process of evolution and cannot be protected as a photographic image. Therefore, geo-preservation requires conceptual support from aesthetic research. Aesthetics, defined as “sensorial cognition”, is a neural operation which allows complex and complimentary insights into the presence of nature in civilization, and its most important product, the city. Geo-aesthetics is a new research concept based on Alexander von Humboldt’s intellectual heritage of relating scientific and aesthetic research on mountain-scapes, focused on many volcanoes in Mexico. As will be shown in the paper, geo-aesthetic research sustains the recodification of the “badlands” as a high environmental and aesthetic value in the sprawling, non-sustainable mega city of 22 Millions of inhabitants in the Mexican Basin.

3) The collaborations: Some concrete research projects on the volcanic heritage in Mexico City, such as the REPSA, the “GeoCity”, and the university programs on soils (PUEIS) and the city (PUEC), may prove how this interdisciplinary exchange works, and how it produces innovative knowledge for geo-preservation in the megacities of the Global South.



# **HIGH DEGRADATION OF RECENT MONOGENETIC VOLCANOES IN COASTAL AREAS: MONTAÑA DE LOS FRAILES AND MONTAÑA DE LA HORCA VOLCANOES, TENERIFE ISLAND.**

Presenting Author: *Nicolás Chicharro, IGME - CSIC*

Email: *nico25chi@gmail.com*

Presentation Style: *Talk*

Day: *Monday*

Time: *16:30 GMT*

Co-Authors:

*Juana Vegas, IGME - CSIC*

## **ABSTRACT**

Volcanic Islands are major geological features that help understanding the history of our planet. Volcanism is one of the main geological processes that can produce significant impacts on humans, both by providing rich soils and landscapes, but also posing a variety of geohazards. Thus, understanding recent volcanism can help human development in high volcanic risk areas, such as the Canary Islands. Otherwise, the IPCC ranks the archipelagos as one of the most vulnerable places on Earth, with the rising sea levels as the main threat. Moreover, lava deltas are the most susceptible because of their location on the coast. The Canary Islands face also other threats: An increasing human occupation and land use pressure, and a constant increment in tourism. This is especially substantial in Tenerife, the most populated of the archipelago, and the island that receives more tourists annually (approximately 40%).

The Montaña de los Frailes and Montaña de la Horca volcanoes are two monogenetic scoria cones, with associated lava flows and lava deltas, formed in La Orotava Valley, which is included in the Spanish Geoheritage Inventory (IELIG, acronym). They have endured the growth of Puerto de la Cruz city since, at least, early XVI Century, with occupation by natives dating back centuries earlier.

These volcanoes are completely anthropized: crops, urban areas, roads and other infrastructure. These facts made both geosites' features not recognisable, despite them being of recent age. They present much higher risk of degradation (RD) than other similar geosites of Tenerife, but also lower intrinsic value (VS), as their degraded state has prevented them from attracting as much attention from scientists.

This mismatch in values between recent volcanoes geosites is produced by the low altitude at which they are formed, which overlaps with the most populated areas of the island. While the volcanoes formed at higher altitude are best preserved, volcanoes erupted near the coast are always heavily anthropized. This can also be seen in the Teno lava platforms. The scarcity of scientific research made in these geosites undervalues them, despite having similar characteristics as other recent eruptions that do have higher scientific values. This endangers the outreach to society, retroactively increasing risk of degradation and, indirectly, exposure and susceptibility of people to future volcanic eruptions.

# **A PARTICIPATORY DECISION-MAKING STRATEGY FOR GEOCONSERVATION, IMPLEMENTED IN PORTLAND, JAMAICA**

Presenting Author: *Estefania Salgado Jauregui, Colombian Geological Survey*

Email: *e5tefaniia.5j@gmail.com*

Presentation Style: *Talk*

Day: *Monday*

Time: *16:45 GMT*

Co-Authors:

*Katherine Ellins, The University of Texas at Austin*

*Denise Henry, Alligator Head Foundation*

*Debbie-Ann Gordon-Smith, The University of the West Indies, Mona, Jamaica*

*Rowan Martindale, The University of Texas at Austin*

## **ABSTRACT**

Geoconservation aims to protect the legacy of the Earth, and an integral component is decision-making. Decisions in geoconservation impact residents and other stakeholders; therefore, strategies to facilitate participatory decision-making are needed. Here, we present a strategy to facilitate the implementation of the Analytic Hierarchy Process (AHP) with a diverse group of stakeholders in Portland, Jamaica, without previous experience in the mathematical model. The AHP uses pairwise comparison matrices to assign numerical values to different components of a decision model, representing preferences in given scenarios. We designed a participatory session that guided workshop participants through the implementation of the AHP to decide between two hypothetical proposals for geoconservation in Portland, community-based tourism versus a resort, incorporating two criteria in the model: funding and reef health. We facilitated a session in which each community member (n=20) had a voice in the decision process. Our results show that local stakeholders defended community tourism as viable and desirable to protect the land-ocean system in connection to people in East Portland (i.e., community-tourism was 73.6% preferred over resort). When only considering funding available to execute the project, the resort appeared to be the preferred option (i.e., 75.0% preferred over community-based tourism); however, when only considering reef health, most participants stated that community tourism would be better for the environment (i.e., 83.3% preferred over resort). The collaborative product is a decision-making model that reflects the conversations between workshop participants. Structuring a participatory workshop to build a mathematical model for decision makers, as described herein, has potential application in a broad spectrum of decision-making scenarios in geoconservation and geosciences.

# **VOLCANO MULTI-DIVERSITY AND MULTI-HERITAGE**

Presenting Author: *Benjamin van Wyk de Vries, Univeristé Clermont Auvergne*

Email: *ben.vanwyk@uca.fr*

Presentation Style: *Flash Talk*

Day: *Tuesday*

Time: *14:00 GMT*

Co-Authors:

## **ABSTRACT**

Volcanoes are multi-dimensional objects, diverse in all geological, biological and human fields of existence and study. They evolve through time and space in all these aspects, creating a dynamic diversity and can be seen as a dynamic heritage. My aim in this flash talk is to draw a picture that starts from the birth of a volcano and travels through it's geobiodiverse evolution and socio-cultural development. I'll show that the whole volume of a volcano can be included in a holistic picture (including it's past and future). This holistic view can be used to support geoheritage and resilience to risks of all kinds in this multidiverse volcanic environment. These ideas have been developed with the communities of Geoheritage for Resilience (UNESCO International Geosciences project 692), an ECOS project 'Building Sense in Natural Diversity' and GEOCITY a Mexican CONAHCYT project.

# DEEP-EARTH GEOHERITAGE: GEOCONSERVATION OF GEOSITES OF XENOLITHS IN VOLCANIC AREAS

Presenting Author: **Mátyás Hencz**, *MTA-EPSS FluidsByDepth Momentum Research Group, HUN-REN Institute of Earth Physics and Space Science, Sopron, Hungary*

Email: [hencz.matyas@epss.hun-ren.hu](mailto:hencz.matyas@epss.hun-ren.hu)

Presentation Style: *Flash Talk*

Day: *Tuesday*

Time: *14:05 GMT*

Co-Authors:

*Károly Németh, Saudi Geological Survey, Jeddah, Saudi Arabia; MTA-EPSS FluidsByDepth Momentum Research Group, HUN-REN Institute of Earth Physics and Space Science, Sopron, Hungary*

*Csaba Szabó, MTA-EPSS FluidsByDepth Momentum Research Group, HUN-REN Institute of Earth Physics and Space Science, Sopron, Hungary*

*Tamás Spráncz, MTA-EPSS FluidsByDepth Momentum Research Group, HUN-REN Institute of Earth Physics and Space Science, Sopron, Hungary*

*Thomas Lange (MTA-EPSS FluidsByDepth Momentum Research Group, HUN-REN Institute of Earth Physics and Space Science, Sopron, Hungary)*

*Márta Berkesi (MTA-EPSS FluidsByDepth Momentum Research Group, HUN-REN Institute of Earth Physics and Space Science, Sopron, Hungary)*

## ABSTRACT

Geoheritage studies have traditionally concentrated on surface and near-surface geological features, such as stratigraphic sequences, fossil sites, or geomorphological formations. However, the Earth's deep interior also encompasses invaluable geological records that are seldom considered within geoheritage frameworks. This discussion introduces the concept of deep-Earth geoheritage, which emphasizes the unique scientific and conservation significance of volcanic rocks containing mantle or crustal xenoliths. These xenoliths serve as direct samples from the deep lithosphere, transported to the surface predominantly by monogenetic volcanic eruptions, offering an exceptional opportunity to investigate deep-Earth processes that would otherwise remain beyond reach. Mantle and crustal xenoliths (as well as fluid and melt inclusions within) act as time capsules, preserving information about the physical and chemical features (temperature, pressure, chemical interactions) of the deep lithosphere at the time of eruption. The depth of origin, furthermore, represents such a deep part of the lithosphere that cannot be sampled by artificial drilling, hence only conserved by the volcanic eruption from a deep lithospheric source. Their study enhances our knowledge of lithosphere dynamics, lithosphere-asthenosphere interactions, as well as large-scale geochemical and geodynamic processes. Additionally, these rocks provide data on mantle metasomatism, element cycling, and the evolution of deep Earth reservoirs over geological time. Despite their scientific importance, xenolith-bearing volcanic sites are often not prioritized in conservation efforts, leaving these records exposed to natural erosion and human activities. The Carpathian-Pannonian region serves as a prominent natural laboratory for studying the deep lithosphere, with numerous xenolith studies conducted over the past 50 years. These xenoliths have been revealed by monogenetic basaltic volcanism, active from around Late Miocene to Late Pleistocene. However, due to quarrying, construction, urban development and natural erosion, many previously investigated outcrops are no longer accessible, making earlier studies irreproducible. Only remaining samples can be analyzed using newer methods. Consequently, geoconservation efforts in this region to preserve deep-Earth geoheritage are crucial.

# **BASALTS FROM THE HARRATS OF SAUDI ARABIA AS A HERITAGE STONE OF WESTERN ARABIA**

Presenting Author: *Károly Németh, Saudi Geological Survey*

Email: *knemeth@geoconservation.org*

Presentation Style: *Flash Talk*

Day: *Tuesday*

Time: *14:10 GMT*

Co-Authors:

*Mohammed Rashad Moufti, Afaq Consulting, Jeddah*

*Turki Sehli, Saudi Geological Survey*

*Iyaed Zalmout, Saudi Geological Survey*

## **ABSTRACT**

The basalts of western Arabia's harrats constitute the largest Neogene–Quaternary monogenetic volcanic province on Earth, significantly influencing the landscape and human evolution since the Paleolithic era. These basalts form a distinctive and concentrated feature that shapes the appearance of western Arabia. The Red Sea escarpment demarcates the coastal plain from the upland interior, underscored by the prominent black basalt topography. Conversely, Pliocene-era coral reef rocks provide white building stones for the coast, beige sandstones are predominant in the north, and clay bricks are commonly used in the interior areas of Arabia. Basalts are notably heavy, strong, and dark construction materials, distinguishing them from other regional building materials. The harrats represent extensive dark rock deserts that define the harsh landscape of western Arabia. Spanning nearly 3000 kilometers and rising approximately 1000 meters above sea level atop the Arabian Plate, they delineate a vast zone in western Arabia. Neogene-Quaternary basaltic lava flows have also extended toward the Red Sea, with some reaching paleo shorelines over 50 kilometers from their source vents. The flat surfaces of the harrats have likely facilitated human migration since the Paleolithic era. Basalt is the predominant rock type in this expansive area, constituting a significant element of the region's landscape and cultural heritage as heritage stones. Although not traded directly, these basalts supported early commerce in Arabia, shaping north-south trade routes for millennia. Basaltic harrats served as zones with favorable habitation conditions due to their elevated locations, lava tubes that channeled surface runoff, and broad inter-cone regions with scoria infill that promoted rapid vegetation growth and created ecological niches to sustain early humans. Historically, basalt was utilized as foundation stones or facades in building constructions. During the Early Islamic period, particularly under the Ottoman Empire, basalt became an integral construction material for mosques and other significant structures such as railway stations, fortresses, and government buildings. In their coherent (lava) form, these basalts are essential for studying and understanding the emplacement of lava flows. Consequently, basalt serves as a significant geo-educational resource aimed at enhancing Saudi society's resilience to volcanic hazards.

# **ESTABLISHING VARIOUS SITES IN THE FIELD MUSEUM OF GEOLOGY SALT RANGE, PAKISTAN, AS A GEOPARK: CONSERVATION, AI INTEGRATION, AND SUSTAINABLE TOURISM**

Presenting Author: *Syed Haroon Ali, 1Department of Earth Sciences, University of Sargodha, Punjab 40100, Pakistan*

Email: *haroon.ali@uos.edu.pk*

Presentation Style: *Flash Talk*

Day: *Tuesday*

Time: *14:15 GMT*

Co-Authors:

*Tahfoor Ali Khan, 1Department of Earth Sciences, University of Sargodha, Punjab 40100, Pakistan  
Shahid Ghazi, Insitute of Geology, University of the Azad Jammu and Kashmir, Muzaffarabad  
Shahid Ghazi, Insitute of Geology, University of the Punjab, Lahore*

## **ABSTRACT**

Pakistan's Salt Range is an area of tremendous geological and paleontological importance, having 600 million years of the Earth's history intact. Despite being endowed with rich fossil beds, extraordinary sedimentary rocks, and immense mineral wealth, it has no formal status as a geoheritage site, thus exposing its geologic marvels to destruction. The research seeks to determine the Salt Range as a defined geoheritage site highlighting its stratigraphic variability, fossil endowment, and economic value, together with solutions to major conservation issues. Field surveys, lithological mapping, and fossil description were conducted to study major localities such as the Khewra Salt Mine, Cambrian fossil beds, and gypsum deposits, of international significance for geoscience education and research. For better site location and conservation, this study integrates Artificial Intelligence (AI) and Geographic Information Systems (GIS). The study recommends the implementation of geoheritage conservation policies, education initiatives, and sustainable geotourism measures for preserving the geological heritage of the Salt Range while promoting responsible tourism. The designation of the region as a UNESCO Global Geopark would ensure its long-term conservation, scientific accessibility, and economic sustainability. This study emphasizes the immediate need for geoheritage recognition in balancing scientific conservation, sustainable tourism, and local economic gains to ensure that the Salt Range is provided with the protection and international recognition it warrants.

# **VOLCANIC GEOHERITAGE IN SMALL OCEANIC ISLANDS: EL HIERRO UNESCO GLOBAL GEOPARK (CANARY ISLANDS, SPAIN) A TOOL FOR GEOTOURISM PROMOTION**

Presenting Author: *Arianna Testa, Departamento de Historia, Patrimonio Cultural, Formación y Sociedad, Università degli Studi di Roma "Tor Vergata", Rome, Italy*

Email: *arianna.tes22@gmail.com*

Presentation Style: *Flash Talk*

Day: *Tuesday*

Time: *14:20 GMT*

Co-Authors:

*Javier Dóniz-Páez, Geoturvol-Departamento de Geografía e Historia, Universidad de La Laguna, Spain.*

*Instituto Volcanológico de Canarias (Involcan), Puerto de La Cruz, Canary, Spain*

*Carlos Cornejo-Nieto, Departamento de Geografía, Universidad de Concepción, Chile*

*Rafael Becerra-Ramírez, Geovol-Departamento de Geografía y Ordenación del Territorio, Universidad de Castilla-La Mancha, Spain. Instituto Volcanológico de Canarias (Involcan), Puerto de La Cruz, Canary, Spain*

## **ABSTRACT**

Volcanic areas are spectacular landscapes that contain great geodiversity and geoheritage, offering many resources to local communities. El Hierro island is located in the east Atlantic Ocean, and it is the most western and the second smallest island of the Canaries. Currently, El Hierro is a Biosphere Reserve (2000), UNESCO Global Geopark (2014, and more than the 58% of its space are natural protected areas. The Hierro UNESCO Global Geopark (HGG) draws thousands of visitors every year, mainly by diving and trekking. However, the foremost geomorphological landscapes are not very significant geographical spots for the tourists yet. This work aims to study the geoheritage in HGG as potential tools for geotourism. Methods are based on a non-systematic inventory of geoheritage from HGG through literature review, topographical and geological maps, aerial photos, and fieldwork. HGG is a recent subtropical volcanic island, with a rich and diverse geoheritage. Regarding the former, the main mafic geoforms are polycyclic volcanoes, monogenetic cones, tuff ring, spatter cones, hornitos, lava fields, lava deltas, lava tubes, lava lakes, dykes, and other minor volcanic forms. Regarding the latter, leading geoforms are exemplified by cliffs, paleo-cliffs, ravines, deposits, beaches, dunes, fossil geoforms, etc. Moreover, structures associated with faults (San Andrés) and large landslides (El Golfo or Las Playas) can also be noticed. In addition to the abovementioned geoheritage, there is also a cultural heritage linked to livestock farming (sheep's cows and goats), traditional crops (cereal, potatoes, fruit trees, etc.) and export agriculture (banana, pineapple or avocado). The natural and cultural geographical heritage of the island shapes a stunning landscape which are the base of HGG economy: primary sector and tourism. However, despite the potential, geoheritage for geotourism is still overlooked owing to the predominance of diving as the most consumed active tourist activities in the island. Thereby, this work shows the great geodiversity of the GHH geoheritage and its potential for other geotourism activities such as hiking, scientific tourism, urban geotourism. proposals of different strategies that highlight the importance of geoheritage are always welcomed by the Geopark the aims of sustainable development. Therefore, this must be considered as a great opportunity to turn El Hierro's landscapes into a remarkable resource for geotourism and local development.

# DEVELOPING A FUNCTIONAL GEOTOURISTIC STRATEGY IN THE OPHIOLITES OF THE BEIGUA UNESCO GLOBAL GEOPARK (ITALY)

Presenting Author: **Fedra Gianoglio**, *Department of Earth, Environment, and Life Sciences (DISTAV) - University of Genova (UniGe)*

Email: [fedra.gianoglio@edu.unige.it](mailto:fedra.gianoglio@edu.unige.it)

Presentation Style: *Flash Talk*

Day: *Tuesday*

Time: *14:25 GMT*

Co-Authors:

*Pietro Marescotti, Department of Earth, Environment, and Life Sciences (DISTAV) - University of Genova (UniGe)*

## ABSTRACT

Geotourism is an important asset of geoconservation and, if well structured, it could have a pivotal role to mainstream geoheritage and to foster sustainable development of a territory, particularly in a Geopark.

The Beigua UNESCO Global Geopark (UGGp) is an area rich of geodiversity, which tells a complex geological story of over 200 million years. The territory is mostly composed by metamorphosed ophiolites and their oceanic sedimentary cover, representing the main ophiolitic complex of Italian Alps-Apennine system. In terms of tourism, Beigua UGGp can be divided into coastal and inland domains. The challenge to be faced is to redirect part of the coastal tourist flow, mainly related to seaside tourism, to rural zones.

This study shows the methodology used to develop a functional and sustainable geotouristic strategy in the Beigua UGGp. It included i) a review of the inventoried geosites, ii) the identification of geological frameworks, iii) the selection of geosites with high touristic value and iv) the assessment of degradation risk and geotouristic impact, v) the development of an interpretation strategy for geoheritage promotion. These phases included the involvement of the local community, who attended a focus group conducted across three meetings. The objective of the focus group was to evaluate the perception of geoheritage, select geological themes for georoutes, and identify the most effective language and iconography to promote them.

This work contributed to the development of a local geotourism strategy focused on i) promoting the value of the geoheritage, ii) increasing knowledge and awareness of its importance, iii) promoting sustainable development of the Geopark area, and iv) protecting sites of geological significance.

The preliminary results have been used to create a thematic georoute and to realize a first draft of geosites profiles, which will allow the public to obtain information about the geosite and to gain a deeper insight into geodiversity.



# SOIL HERITAGE: THINKING ABOUT SOME PARTICULARITIES AND CHALLENGES

Presenting Author: *Rosangela G M Botelho, Brazilian Institute of of Geography and Statistics*

Email: *rgmb2008@hotmail.com*

Presentation Style: *Talk*

Day: *Tuesday*

Time: *14:40 GMT*

Co-Authors:

## ABSTRACT

Geoheritage inventories, in its various categories and territorial boundaries, have been increasingly developed. However, those related to soil heritage are still few. The aim of this study was to identify the reasons for this scenario and the particularities and challenges of inventorying and protecting soil heritage. Inventories and literature on the particularities of different categories of geoheritage were consulted and the experience of developing the principles and criteria for the Inventory of Soil Heritage applied to Brazil and Rio de Janeiro state was fundamental. The main reasons for this scenario of few inventories of soil heritage are: shortage of professionals with knowledge of soils and geoconservation; lack of systematic soil surveys, which are taken as starting points for inventories; few efforts to develop methodologies based on criteria harmonized with the identification of geoheritage (scientific value), but which consider the specificities of soil heritage; and low number of discussion forums on soil heritage at scientific events on Geoconservation. The particularities of the soil heritage are: 1. represents only the most recent part of the Earth's history; 2. is commonly hidden in the landscape; 3. is generally difficult to demarcate; 4. has no scenic beauty; 5. hardly generates interest and attracts the attention of people. 6. is unconsolidated and dynamic (constantly evolving and quickly mobilized by erosion, transport and deposition); 7. can be easily altered (physically and chemically) by human activity; 8. has a strong relationship with biodiversity (it can contain life and sustain it); 9. can be removed (sampled) from its place of occurrence and preserved in collections and museums; and 10. in Brazil, it does not have specific protection laws, like speleological and paleontological heritage. The challenges in identifying and protecting soil heritage are related to its particularities, which are becoming increasingly known as inventories are carried out. The biggest challenge seems to be its protection in situ, an action that has not yet been carried out and which will certainly require innovative technical and legal strategies. Some particularities can be considered vectors of strength for its protection, as its interaction with biodiversity. The union of soil scientists and geoscientists and the increase in forums for discussions on soil heritage at geoconservation events would enhance its inventorying and protection.

# **ORDOVICIAN PHYLLITES EXPLOITED IN THE OTTRÉ-VIELSALM AREA: A GEOHERITAGE FINE-GRAINED NATURAL STONE USED IN THE CEMETERIES OF THE ARDENNES (WALLONIA, BELGIUM)**

Presenting Author: **Xavier Devleeschouwer**, *Institute of Natural sciences, Geological Survey of Belgium, 29 Rue Vautier, 1000 Brussels & Université Libre de Bruxelles, DGES, 50 Avenue F.D. Roosevelt, 1050 Brussels*

Email: [xdevleeschouwer@naturalsciences.be](mailto:xdevleeschouwer@naturalsciences.be)

Presentation Style: *Talk*

Day: *Tuesday*

Time: *14:55 GMT*

Co-Authors:

*Tiago Basyn, Université Libre de Bruxelles, DGES, 50 Avenue F.D. Roosevelt, 1050 Brussels*

*Geneviève Hublet, Université Libre de Bruxelles, DGES, 50 Avenue F.D. Roosevelt, 1050 Brussels*

*Géraldine Maulet, Institute of Natural sciences, Geological Survey of Belgium, 29 Rue Vautier, 1000 Brussels*

*Bastien Tribolet, PNDO, Maison du Parc Naturel des Deux Ourthes, 8 Rue de Laroche, 6660 Houffalize*

*Nadine Mattielli - Université Libre de Bruxelles, DGES, 50 Avenue F.D. Roosevelt, 1050 Brussels*

## **ABSTRACT**

The "Parc Naturel des Deux Ourthes - PNDO" is a natural park situated in the northeastern region of the Province of Luxembourg within Wallonia, Belgium. The PNDO encompasses the alluvial valleys of the Ourthe rivers, which cut through the highest plateaus of the Ardennes. Throughout the villages, historic churches are accompanied by ancient churchyards, which typically contain slaty gravestones and ledger stones. Dating back to the 19th century, these churchyards contrast with the modern cemeteries established on the outskirts of the villages during the 20th century. During the 19th century, the slaty stones were predominantly crafted from locally sourced rocks, often extracted from nearby quarries located outside of the north-eastern PNDO area. Two types of Ordovician phyllites have been intensively exploited. The thicker slabs, exhibiting a purplish hue, originate mostly from the "Les Plattes" Member (Otrré Formation, Lower Ordovician). In contrast, thinner slabs, characterized by dark grey to black tones, hail from the Ordovician Jalhay Formation, predating their purplish counterparts. Since the late 19th century, the primary material for graveyards shifted to a Belgian rock known as blue Petit Granit, sourced from numerous quarries across Wallonia. In the 20th century, ornamental stones from various global locations became prevalent in modern cemeteries, marking a transition from local to diverse stones uses in the graveyards creating a geodiversity site. The slaty stones correspond thus to the oldest part of the graveyards, sometimes still in use for the most recent ones, sometimes removed and aligned along the church walls and sometimes re-used as decorative elements. Depending on their location and lithology, the slaty graves are well preserved to highly affected by weathering processes due to their nature, the presence of fractures or veins, and the development of a diversified flora of saxicolous lichens. The slaty stones are beautifully hand-made crafted and graved with abundant and diversified religious symbols. Their presence requires an effort of conservation and an urgent digital inventory to preserve the only last remaining traces of a disappeared flourishing period of quarry exploitation associated with the urban development of this area of the Ardennes. The ongoing project has started a geodiversity inventory of 4 cemeteries with ancient and modern sides and a larger slaty stone inventory covering already tens of cemeteries inside PNDO.

# **GEOHERITAGE AS A REPOSITORY OF NARRATIVES: VALUES AND MEANINGS OF THE GEOLOGICAL HERITAGE IN SÁCHICA AND VILLA DE LEYVA, COLOMBIA**

Presenting Author: *Jose Gomez-Romero, Posgrado en Ciencias de la Tierra UNAM*

Email: *jogomezro@unal.edu.co*

Presentation Style: *Talk*

Day: *Tuesday*

Time: *15:10 GMT*

Co-Authors:

*Carles Canet-Miquel, Escuela Nacional de Ciencias de la Tierra de la UNAM*

## **ABSTRACT**

This study, developed as part of a Master's thesis in Earth Sciences at the National Autonomous University of Mexico (UNAM), explores the values and meanings associated with the geological heritage of the municipalities of SÁCHICA and Villa de Leyva in the department of Boyacá, Colombia. Through a mixed-method approach—including the consolidation of a documentary corpus of geological research and semi-structured interviews—this research examines the scientific, cultural, and educational significance of key geological elements and how they are perceived.

The findings reveal the academic framework that has shaped major paleontological discoveries in the region, particularly those related to Lower Cretaceous marine reptiles, which hold international scientific relevance. Moreover, this study highlights the local community's perceptions of geological heritage, emphasizing its cultural and historical significance for regional identity and its deep connection to the landscape.

From a broader perspective, geoheritage can be understood metaphorically as a repository of narratives, the result of a process in which nature, specifically geodiversity, is recognized and transformed into heritage through social valuation and cultural significance. This process emerges from the interaction of social actors within a given territory and the differential attribution of values to abiotic elements in the physical space. Thus, when referring to geological heritage, we are addressing the crystallized outcome of the heritagization of geodiversity.

By integrating scientific, educational, and cultural dimensions, this research underscores the need for conservation and sustainable management strategies that acknowledge both the intrinsic scientific value of these geological elements and their significance to local communities and society at large.

# THE IMPACT OF PALAEOILLUSTRATION AS A STRATEGY TO ACKNOWLEDGE GEOHERITAGE IN UNDERGRADUATE STUDENTS

Presenting Author: *María J. Cañón-González, Escuela de Geología, Facultad de Ingenierías Físicoquímicas, Universidad Industrial de Santander, Carrera 27 Calle 9 Ciudad Universitaria, Bucaramanga, Santander, Colombia.*

Email: *marajoscan1@gmail.com*

Presentation Style: *Flash Talk*

Day: *Tuesday*

Time: *15:35 GMT*

Co-Authors:

*Gatsby-E. López-Otálvaro, Escuela de Geología, Facultad de Ingenierías Físicoquímicas, Universidad Industrial de Santander, Carrera 27 Calle 9 Ciudad Universitaria, Bucaramanga, Santander, Colombia*

## ABSTRACT

Scientific illustration is a useful tool for describing fossils or their sedimentary environments. It aims to ensure a realistic identification and characterization that facilitates visual scientific communication. On the other hand, naturalistic illustration expands the boundaries of creativity, without attempting to replicate exactly the object of study. From an educational perspective, both disciplines are powerful techniques to communicate science-related topics to non-experts in the fields of palaeontology and palaeoenvironments.

In light of this, the present study aims i) to promote the importance of paleoillustration in geoeducation of undergraduate students and ii) to communicate the experiences gained through the Paleooceanography and Paleoclimatology (SPP) research group at Universidad Industrial de Santander in Bucaramanga, Colombia. Given the relevance of scientific illustration with an emphasis on geoeducation, the research group has organized activities for the community using colored pencils, pens, regular pencils, charcoal, watercolors, and acrylic paints to depict fossil taxa and marine sedimentary environments.

These palaeoart sessions enhanced the participants' ability to identify and characterize the morphologies used in the taxonomic classification of echinoderms, brachiopods, bivalves, gastropods, foraminifera, and coccoliths, as well as to conduct their respective palaeoenvironmental analyses. Another notable outcome was a significant artistic improvement among the participants that progressively resulted in a realistic representation of the specimens. Furthermore, this scientific and artistic knowledge contributed to motivate students to recognize the importance of conservation of sites and materials.

The applied methodology leads to a didactic approach that teaches values of respect for nature, marine ecosystems, and the ocean. Additionally, this knowledge is a crucial step in fostering a sense of identity and belonging to education of geoheritage.

# **GEOROTEIROS - RS, 16 YEARS OF GEODISEMINATION OF GEODIVERSITY IN THE STATE OF RIO GRANDE DO SUL, IN THE SOUTHERN REGION OF BRAZIL.**

Presenting Author: **Luiz Filipe SS. Leite**, *GeoRoteiros - RS*, *University of Vale do Rio dos Sinos*

Email: [geoartigos@gmail.com](mailto:geoartigos@gmail.com)

Presentation Style: *Flash Talk*

Day: *Tuesday*

Time: *15:40 GMT*

Co-Authors:

*Luiz Filipe SS. Leite, GeoRoteiros - RS, University of Vale do Rio dos Sinos*

*Mauro Daniel Rodrigues Bruno, , GeoRoteiros - RS, University of Vale do Rio dos Sinos - (UNISINOS)*

*Marcos Antonio, , GeoRoteiros - RS, University of Vale do Rio dos Sinos - (UNISINOS)*

*Mariane Candido<sup>2</sup> Priscila dos Santos Ebling<sup>2</sup>, Marcos Antonio<sup>12</sup>, Gustavo Nunes Aumond<sup>12</sup>, Emanuel Mendonça<sup>2</sup> Francisco Laís Vieira de Souza<sup>2</sup>, Jaqueline Lopes Diniz<sup>2</sup>, Victória Herder Sander<sup>12</sup>, Fernanda Luft de Souza<sup>12</sup>, Daiana Rodrigues<sup>2</sup>, Mauro Daniel Rodr*

## **ABSTRACT**

The state of Rio Grande do Sul is located in the southern region of Brazil, where a great geodiversity records the prolonged history of collisions between continents, ocean floors, island arcs, volcanoes and sedimentary basins, as well as its corresponding paleontological collection. Faced with the rich Geodiversity existing in the State and its little knowledge by the population, in 2009 a group of students from the Geology course at the University of Vale do Rio dos Sinos - UNISINOS decided to create an initiative to spread knowledge about this Geodiversity. From this initiative, the Georoteiros RS Project was born, which aims to disseminate knowledge about the geological evolution of Planet Earth and Rio Grande do Sul in a simple and didactic way. In order to reach a wider audience, a website was created (<https://www.georoteiros.com.br>) for the dissemination of geological itineraries and geotouristic points, which stimulates, in addition to understanding the phenomena that change our planet, the preservation of geological heritage and the environment. Through the collaboration between the members of the Georoteiros RS project and the professors of the undergraduate and graduate courses in Geology at Unisinos, 9 Georoutes were created in order to demonstrate the great geodiversity of the state through the presentation of the Geosites. In addition to the creation of this free Geotourism Guide, in 16 years of project, Georoteiros RS has been promoting Geosciences at school science fairs, at conferences, through reference in undergraduate and master's works, as a source of content for tourism companies, or in discussions about incentive policies.

# TRANSLATING THE UNWRITTEN: UNCONFORMITIES AS A KEY TO GEOSCIENCE COMMUNICATION

Presenting Author: *Annachiara Rosati, University of Bari Aldo Moro*

Email: *annachiara.rosati@uniba.it*

Presentation Style: *Flash Talk*

Day: *Tuesday*

Time: *15:45 GMT*

Co-Authors:

*Luisa Sabato, University of Bari Aldo Moro*

*Marcello Tropeano, University of Bari Aldo Moro*

## ABSTRACT

James Hutton famously likened rocks to the pages of Earth's history – although with many missing, damaged, inverted, or jumbled out of order. In this vast chronicle of deep time, the voices that have vanished far outnumber those that remain. Yet, the traces of these absences are etched into the landscape in what geology terms “unconformities”: contacts between rocks formations that mark the boundary between two distinct worlds, a stretch of time that has undoubtedly passed but left no direct record. These gaps, imprinted within what might be called “the bones of Mother Earth”, embody the profound immensity of geological time, rendering it not merely a concept to be perceived temporally, but a tangible presence within space.

The challenge is to bridge the abyss of time that both geologists and non-geologists alike grapple with. Unconformities serve as a gateway to deep time, offering a way to grasp its immensity through direct observation and insightful interpretation. By bringing these geological features into focus, a fragment of time is drawn out from the vast, indistinct chaos of Earth's ancient past, making it clearer and more comprehensible to non-specialist audiences.

By learning to read and “translate” unconformities for the public – recognising shifts in rock types and linking them to the events that shaped a particular place across deep time – the story of Earth can gradually be reconstructed as something that exists not only in time but also as a physical entity in space. This approach offers a narrative framework that makes geological time more comprehensible, more accessible, and ultimately, more human in scale. In doing so, we gain a tool to help anyone grasp the true scope of the Earth's 4.6-billion-year history.

# **THE DINOSAUR ON YOUR DOORSTEP: RAISING AWARENESS OF HASTINGS' DINOSAUR HERITAGE**

Presenting Author: *Phil Hadland, Hastings Museum & Art Gallery*

Email: *philip.hadland@hastings.gov.uk*

Presentation Style: *Flash Talk*

Day: *Tuesday*

Time: *15:50 GMT*

Co-Authors:

## **ABSTRACT**

Historic sites of palaeontological heritage are all too often off the radar of the local communities which reside alongside them. Local museums that hold related collections, along with curators with the remit to champion this heritage, can address deficits in local knowledge and improve relationships between museums and communities through outreach and working with community partners. The benefits of heritage outreach in communities include the generation of greater community spirit; a greater sense of place, and an ambition for communal spaces. The Royal Society's Places of Science scheme funded a community outreach project to celebrate and raise awareness of the story of Hastings' dinosaurs. Through outreach events over the summer of 2022, The Dinosaur on your Doorstep project engaged residents in Hollington with their local palaeontological heritage. The focus of the project was the creation of a permanent outdoor artwork telling the story of a locally found Cretaceous dinosaur named *Iguanodon hollingtoniensis*. The project also provided an opportunity to work with an under-engaged local community and the involvement of local charities and a social housing provider were key components. The project aimed to engage the community with their paleontological heritage, promote museum participation, and foster interest in geological sciences, while cultivating pride and ambition for communal spaces and local heritage.

# **GEOLOGICAL HERITAGE AND SPATIAL MEMORY: A CASE STUDY OF CERRO LEONES, BUENOS AIRES, ARGENTINA.**

Presenting Author: *Schneider Gonzalo, CONICET - CIG - INSUGEO*

Email: *gonzaloschneider@conicet.gov.ar*

Presentation Style: *Flash Talk*

Day: *Tuesday*

Time: *15:55 GMT*

Co-Authors:

## **ABSTRACT**

This study examines the communal space of Cerro Leones from an interdisciplinary perspective, integrating geography, memory anthropology, and geological heritage analysis. Based on fieldwork and historical records in various formats, it examines issues related to mining, anarcho-syndicalism, and environmental liabilities. Cerro Leones is a peri-urban neighborhood of Tandil, a city in Buenos Aires province, situated in the center of the Tandilia System, 300 km from Buenos Aires City and 170 km from Mar del Plata (Argentina). This hill system, located in east-central Buenos Aires province, in the southeastern Pampas region, features a discontinuous relief comprising the Crystalline or Precambrian Tandilia, formed by granitoids, gneisses, migmatites, and amphibolites from the Transamazonian orogeny (2,100-2,300 Ma), and the Tabular or Sedimentary Tandilia, consisted of Neoproterozoic-Silurian sequences of shallow marine origin. These craton rocks evolved in these two aforementioned geotectonic cycles. They are the southernmost rocks of the middle Precambrian of South America. Two predominant landforms are present: domed hills in the central sector, linked to the crystalline basement, and tabular landforms with plateau-like surfaces in younger areas (700-900 Ma), indicative of sedimentary stratification. This system is the oldest geological formation in Argentina and the second oldest in Latin America, as the southern extension of the Río de La Plata craton. Its geological record provides evidence of continental collision, the evolution of Gondwana, and tectonic stabilization at a regional scale. Mining activity in the region has had a central role since 1870, beginning with the artisanal extraction of granite by European picapedreros for paving the streets of a growing Buenos Aires. This was followed by industrial exploitation, which ended in 2000, leaving environmental liabilities. This study aims to analyze the community's spatial memory regarding its historical and socio-environmental identity connected with the quarry and geological heritage. Both tangible and intangible elements will be analyzed, and the implication of various stakeholders will be assessed based on interviews, non-participant observation, documentary analysis, and audiovisual records. Finally, the site's memory, threatened by degradation and neglect, will be represented using thematic mapping to identify, integrate, assess and foster a resilient collective memory of its geological legacy.



# ANTARCTIC GEOLOGICAL REPOSITORIES: THE CREATION OF THE JAMES ROSS ISLAND ROCK COLLECTION

Presenting Author: *Tamara Manograsso Czalbowski, Instituto Antartico Argentino-CICTERRA*

Email: *tamamc2903@gmail.com*

Presentation Style: *Flash Talk*

Day: *Tuesday*

Time: *16:00 GMT*

Co-Authors:

*Jorge A.Strelin, Instituto Antartico Argentino-CICTERRA*

## ABSTRACT

The geoconservation and enhancement of the Antarctic Geological Heritage is a relatively new subject on the agenda of the Antarctic Treaty System. For that purpose, the Scientific Committee on Antarctic Research (SCAR) created an expert group on this subject in 2016. One proposed strategy is to promote the creation of an international network of repositories, in order to facilitate international scientific cooperation through consultation, and to minimize the impact on the sampling sites. In 2019, CEP published the first list of national repositories (museums, universities, institutes, etc.) housing Antarctic geological and paleontological specimens.

In Argentina, the Antarctic Repository of Paleontological and Geological Collections of the Instituto Antártico Argentino (IAA) was created in 2015. Initially, efforts were focused on fossils, although rocks were incorporated too. The process has been very challenging: after decades of national Antarctic geological research, large number of samples has been dispersed in numerous research centers, without following any protocol for their storage and documentation. Furthermore, metadata of samples face the same problem.

Concerning to rock inventory, IAA decided to create the first collection of Neogene rocks from the James Ross Island Archipelago, formed by samples collected between 1985 and 2020 by the research group led by Lic. Jorge Strelin. In addition to 130 specimens incorporated in 2016, 1.100 samples were added in 2021. Metadata of the samples, if not available, were also obtained through the analysis of fieldbooks and photographic records. In the case of pre-GPS timing specimens, sampling sites were also identified and georeferenced from topographic maps and aerial photographs. In order to comply SCAR repositories policies, our ultimate goal is to create a digital repository collection and to facilitate the access to collections.

# PUZZLE GAMES AS EDUCATIONAL TOOLS: ASSESSING THE EFFECTIVENESS OF GAMIFIED LEARNING IN PROMOTING GEOCONSERVATION AWARENESS

Presenting Author: *Fauzan N Muslim, Padjadjaran Univerisity*

Email: *fauzan13004.unpad@gmail.com*

Presentation Style: *Flash Talk*

Day: *Wednesday*

Time: *14:40 GMT*

Co-Authors:

*Ghazi O Muslim, Central South University*

*Muhammad R F Habibie, Institute Technology Bandung*

*Hanif Hidayaturrahman, Bogor IBN KHALDUN Univerisity*

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## ABSTRACT

Geoconservation, the practice of preserving geological heritage, faces significant challenges in public engagement due to the abstract nature of geological concepts and limited accessibility of traditional educational methods. This study explores the potential of puzzle games as an innovative medium to enhance understanding, retention, and proactive attitudes toward geoconservation among young learners (ages 12–18). A quasi-experimental design was employed, with 150 participants divided into an experimental group exposed to a custom-designed puzzle game (GeoGuardian) integrating geological formations, biodiversity, and conservation strategies, and a control group using conventional textbook-based learning. Over six weeks, quantitative pre- and post-intervention assessments revealed a 27% higher score in knowledge retention and 40% improvement in problem-solving skills among the experimental group compared to the control. Qualitative data from focus group discussions highlighted increased motivation, with 82% of participants describing the game as "intellectually stimulating" and "visually immersive." The game's mechanics—such as matching geological features to conservation actions, time-bound challenges, and interactive storytelling—were critical in fostering deeper connections to environmental stewardship. Furthermore, 68% of participants reported a heightened intention to engage in real-world conservation activities post-intervention. These results suggest that puzzle games not only demystify complex geological concepts but also transform passive learners into active advocates for geoconservation. The study advocates for integrating gamified learning into formal and informal environmental education curricula, offering scalable solutions to address the global gap in geodiversity literacy.

Keywords: puzzle games, geoconservation education, gamified learning, geological literacy, environmental stewardship

# **HARNESSING THE POWER OF VIDEO GAMES: EVALUATING THE EFFECTIVENESS OF GAMIFIED DISASTER MITIGATION TRAINING FOR YOUTH PREPAREDNESS**

Presenting Author: *Muhammad F Rizaldi, Central South University*

Email: *feilurizaldi@csu.edu.cn*

Presentation Style: *Flash Talk*

Day: *Wednesday*

Time: *14:45 GMT*

Co-Authors:

*Ghazi O Muslim, meng\_lin@csu.edu.cn*

*Willy B Sadewo, willybsadewo@csu.edu.cn*

*Willy B Sadewo,*

*Ghazi O Muslim ; Willy B Sadewo ; Central South University*

## **ABSTRACT**

Natural disasters pose significant threats to communities worldwide, yet disaster preparedness among youth remains critically underprioritized. Traditional educational methods, such as lectures or pamphlets, often fail to engage young populations effectively. This study investigates the potential of video games as an innovative tool for disaster mitigation training, focusing on their ability to enhance knowledge retention, situational awareness, and proactive decision-making among adolescents and young adults (ages 15–24). Utilizing a mixed-methods approach, 120 participants were exposed to a gamified disaster simulation (e.g., earthquake or flood scenarios) over four weeks, while a control group received conventional training. Quantitative data from pre- and post-intervention assessments revealed a 32% increase in knowledge retention and 45% faster crisis-response times among the gaming cohort compared to the control group. Qualitative interviews further highlighted heightened engagement, with 78% of participants describing the gamified experience as "immersive" and "practically applicable." The game's mechanics, including real-time feedback, role-playing elements, and reward systems, were identified as key drivers of behavioral change. These findings suggest that video games not only bridge the engagement gap in disaster education but also empower youth to internalize mitigation strategies through experiential learning. This research advocates for integrating gamification into national disaster preparedness programs, offering scalable solutions to build resilience in tech-savvy generations.

Keywords: serious games, disaster preparedness, youth engagement, gamified learning, crisis management

# **GEOHERITAGE AND RESILIENCE: LEVERAGING HISTORICAL ERUPTIONS OF MAYON VOLCANO FOR MODERN DISASTER RISK REDUCTION THROUGH GIS AND COMMUNITY PREPAREDNESS**

Presenting Author: *Ana Marie R. Abante, Bicol University - Legazpi City, Philippines*

Email: *anamarie.abante@bicol-u.edu.ph*

Presentation Style: *Flash Talk*

Day: *Wednesday*

Time: *14:50 GMT*

Co-Authors:

*, Bicol University, Legazpi City, Philippines  
Ana M Lorilla,*

## **ABSTRACT**

This research delves into the relationship between geoh heritage and resilience in the economically disadvantaged and densely populated foot slopes of Mayon Volcano, highlighting training, intuition, and instinct as key preparation factors. By examining historical eruptions such as the 1724 resettlement plan to Daraga and the 1814 eruption, the study demonstrates how geoh heritage informs modern disaster risk reduction (DRR) strategies. In 1616, visitas (small villages or barrios) had already experienced Mayon Volcano's wrath. The GIS Training and Preparation Model supports movement, resettlement, and return by providing a framework to identify suitable resettlement areas, plan the resettlement process, and monitor movements before and after the 1814 eruption. Daraga (Cagsaua Nuevo) survived after the 1814 eruption, and Budiao as a village became part of the Municipality of Daraga in 1992. In 2006, Typhoon Reming (Durian), Budiao was relocated to the Anislag Resettlement site, 8 km south, but residents of Barangay Budiao, Mi-isi, and Bañadero continued to use their lots and evacuate when necessary. This GIS model helps decision-makers use geospatial data to select safe, sustainable resettlement locations, track resettlement progress, assess support measures' effectiveness, and integrate preparation and training, decision-making during disasters, and instinctual planning to boost resilience. In conclusion, this research emphasizes the impact of lahar exposure in Mayon's densely populated and economically disadvantaged region, highlighting the need to address policy gaps in disaster preparedness and risk reduction for communities like Miisi and Bañadero through training, intuition, and instinct. The study underscores the need for comprehensive preparation, adaptation, and proactive measures to enhance community resilience against volcanic hazards, contributing to the development of more resilient and adaptable communities by examining historical and ongoing efforts.

Keywords: GIS, Lahar, flood, preparedness, DRR, settlements, zero-casualty strategy, volcanic landscape, sensitivity

# **A DIALOGUE BETWEEN SPIRITUAL AND GEO-SOCIAL SCIENCES KNOWLEDGE FOR OTHER UNDERSTANDINGS OF CLIMATE CHANGE AT THE RANCHERIA RIVER BASIN, COLOMBIA**

Presenting Author: *Catalina Gonzalez Tejada, EAFIT University*

Email: *cgonza16@eafit.edu.co*

Presentation Style: *Flash Talk*

Day: *Wednesday*

Time: *14:55 GMT*

Co-Authors:

*Jazmin Romero Epiayu,  
Karen Cecilia Villazon Lobo,  
Maria Isabel Marin Ceron,*

## **ABSTRACT**

The Rancheria River is their source of life and spiritual power of Wayuu indigenous peoples. It represents the veins of mother earth, a fabric of fabrics allowing a dialogue between nature and culture. The persistent water scarcity, increased by the climate variability and the detrimental impacts of intensive coal mining exploitation, have severely undermined the region's ecological balance and traditional ways of life. This vulnerability is compounded by socio-political factors that marginalize local populations, rendering the Rancheria River Basin a paradigmatic example of territorial vulnerability.

In response, this research initiative co-defined with a Wayuu leader, adopts a multidisciplinary and participatory approach, merging modern scientific methodologies with the ancestral wisdom of the Wayuu peoples. The project aims to generate robust and actionable data on the geo-bio-cultural characteristics of the Rancheria River Basin, using remote sensing, statistical modeling, and participatory methods such as participatory mapping or the co-construction of a Wayuu Calendar. This integrated dataset will serve as the foundation for co-define sustainable strategies tailored to the needs and challenges of this vulnerable territory.

The proposed methodology divided in five processes, is an adaptation of the one used to analyze Geoparks processes (Gonzalez Tejada, 2019).

1. Identification and inclusion of actors, for the engagement of nontraditional actors.
2. Heritage stage, for the selection and justification of the geo-bio-cultural heritage.
3. Creation stage, for the collective intelligence to define a common reference.
4. Visionary stage, for the identification and definition of different scenarios, strategies, actions and tools.
5. Dissemination and communication, for awareness raising, evaluation and feedback.

In conclusion, this project seeks to redefine territorial management by demonstrating that the fusion of modern science with indigenous wisdom can produce sustainable solutions that are culturally resonant and contextually relevant. Additionally, by establishing a framework of science diplomacy, the initiative seeks to expand the lessons learned, contributing not only to the academic discourse on environmental governance and climate actions but also to the empowerment of local communities, ensuring that their voices and traditional practices play a central role in shaping the future of their territory.

# INTEGRATING SCIENCE AND LOCAL KNOWLEDGE FOR GEODIVERSITY CONSERVATION: A CASE STUDY FROM PATI VALLEY, CHAPADA DIAMANTINA – BAHIA, BRAZIL

Presenting Author: *Nuno M M Vieira, Instituto de Geociências - Universidade Federal da Bahia (UFBA)*

Email: *nuno\_ksudachix@hotmail.com*

Presentation Style: *Flash Talk*

Day: *Wednesday*

Time: *15:00 GMT*

Co-Authors:

*Nuno M M Vieira, Instituto de Geociências - Universidade Federal da Bahia (UFBA)*

*Raphael Parra, Instituto de Geociências - Universidade Federal da Bahia (UFBA)*

*Laila M Magalhães, Instituto de Geociências, UNESP – Campus Rio Claro*

*Ramon B N Oliveira, Instituto de Geociências - Universidade Federal da Bahia (UFBA)*

*Rodrigo V Cezar, Associação Projeto Geoparque Serra do Sincorá*

*Ricardo G F A Pereira, Instituto de Geociências - Universidade Federal da Bahia (UFBA)*

*Angela B Menezes Leal*

## ABSTRACT

This work presents a second-phase results of a major project of science popularization, linked to the Federal University of Bahia and developed at the Pati Valley, northeast Brazil. It highlights the importance of integrating academic and local knowledge to promote geological heritage conservation and geodiversity appreciation. In a previous phase, geoheritage inventory and assessment were carried out, identifying potential geosites and supporting the elaboration of interpretative material. At this stage, the project included house-to-house visits and the distribution of illustrated A3 laminated panels with geoscientific content of three geosites adapted to the community's language. Over four days, a total of 39 panels covering tectonics, sedimentology, and weathering processes were distributed to 13 households that use to provide accommodation for visitors. Two-way conversations allowed rich discussions about the local geoheritage, both through the scientific perspective as well as the traditional knowledge. Therefore, residents' sense of belonging was strengthened, encouraging them to act as disseminators of geological knowledge. Challenges such as the need for effective communication strategies and opportunities to expand dialogue between science and the community were discussed. Participatory geoconservation proved essential to the project's aims, once Pati Valley's geoheritage is both a natural asset and also an important resource for cultural and economic benefits. In addition, community participation was fundamental in identifying local elements linked to geodiversity, while integrating academic and local knowledge contextualized geological information in cultural practices, such as agriculture and architecture. Simplifying scientific language transformed geosites into symbols of local identity, fostering territorial pride and engagement. Strengthening relationships between the university, local guides, and the community created economic opportunities, especially through community-based tourism, and increased awareness of sustainable practices, benefiting geosite preservation and local well-being. Anchored in bottom-up policies and collaborations such as the Serra do Sincorá Geopark Project, participatory geoconservation proved to be an effective strategy, demonstrating that dialogue between science, communities, and institutions is crucial for sustainable and replicable actions in other regions.

# **EXPLORING THE RELATIONSHIP BETWEEN LEGENDS AND GEOLOGICAL SCIENCE FROM THE RUNA SHIMI WORLDVIEW**

Presenting Author: *Patricia J Rengel, Independent Researcher*

Email: *patricia.rengel.c@gmail.com*

Presentation Style: *Flash Talk*

Day: *Wednesday*

Time: *15:05 GMT*

Co-Authors:

*Patricia J Rengel, Independent Researcher*

*Lisbeth A Oña, Independent Researcher*

## **ABSTRACT**

The Indigenous people of the Ecuadorian Andes, including those in Imbabura UNESCO Geopark, have a unique spiritual connection with nature. Their language, Runa Shimi, is more than a means of communication; it is the vessel that embraces their beliefs about nature's essential role in human life. This Indigenous Andean worldview recognizes the interconnection between God (Wiraqucha), nature (Pachamama), and humans (Runas). This relationship is centered on respect for each other. The Runas believe that rivers, mountains, stones, and stars are not just inanimate objects but also expressions of Pachamama's life. Legends among others (ceremonies, practices, music, beliefs, and rituals) demonstrate Runas connection with their surroundings.

Legends reflect the connection of Runas with Pachamama and the exchangeable characteristics from one group to another group, while accurately describing the surrounding geopatrimony. The legend of Mama Cotacachi exemplifies the essence of Runasimi as well: "An old mountain in the shape of a woman decided to die to be reborn as the new Cotacachi. However, the renewed mountain fell in love with Imbabura Volcano, betraying her husband, Rucu Pichincha Volcano. Her son Yanahurco was born from an illegitimate romance, and they were eventually separated. Mama Cotacachi continues to weep to this day for the loss of her son, and the flow of her tears can be seen in the form of a river called Chumaví that runs down her face towards the lagoon".

In this small talk we introduce the profound connection of indigenous people of Imbabura Geopark and the explanation to the geomorphology that constitutes their territory.

# **BROADENING THE DEFINITION OF GEODIVERSITY BY INCLUDING ATMOSPHERE AND OCEANS**

Presenting Author: *Murray Gray, Queen Mary University of London*

Email: *j.m.gray@qmul.ac.uk*

Presentation Style: *Flash Talk*

Day: *Wednesday*

Time: *15:35 GMT*

Co-Authors:

## **ABSTRACT**

The current, most favoured definition of geodiversity comes from my 2013 book (Gray, 2013). It states that geodiversity is “the natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (landforms, topography, physical processes), soil and hydrological features. It includes their assemblages, structures, systems and contributions to landscapes”. According to Boothroyd and Henry (2019), this definition, or variations of it, was supported by 88% of relevant publications between 1993 and 2019, while Maliniemi et al. (2014) argued that there has been “too much diversity” in the use of the term and that my 2013 definition “should be used consistently when bringing geodiversity into biodiversity research” (p.4). I have also argued (Gray, 2011) that “geodiversity is the abiotic equivalent of biodiversity” and that it is the “oft-forgotten half of nature” (Gray, 2023). However, others (e.g. Zarnetske et al., 2019; Claudino-Salles, 2021; Tukiainen et al., 2022) have pointed out that other parts of abiotic nature are not covered by my 2013 definition, particularly climate, but also the oceans. Both of these support the biodiversity of the air and seas and both of them are very large and important parts of the global system. I am therefore now proposing that the definition of geodiversity is broadened to include atmosphere and oceans so that it becomes truly half of nature.



# A LOCAL-SCALE FIELD METHOD FOR QUANTIFYING GEODIVERSITY

Presenting Author: **Helena Tukiainen**, *Geography Research Unit, University of Oulu*

Email: [helena.tukiainen@oulu.fi](mailto:helena.tukiainen@oulu.fi)

Presentation Style: *Flash Talk*

Day: *Wednesday*

Time: *15:40 GMT*

Co-Authors:

## ABSTRACT

There is a variety of quantitative methodologies for measuring geodiversity at different scales, but methods for field-based observations on a local scale are rare to date. Recently, we introduced a methodology based on observing geological, geomorphological, and hydrological features at study sites ranging from a few to tens of meters in size (Hjort et al., 2022). The method is especially developed to be used together with biodiversity observations. In this presentation, I will scrutinize the fundamentals of this local-scale geodiversity method and present examples of its usage from northern environments in Finland. I will also go through different possibilities for its applications, from observing geodiversity-biodiversity relationships to utilizing the field-based data obtained with the methodology in further geodiversity assessments and analysis (based on Salminen et al., 2023 and Tukiainen et al., 2024).

References:

Hjort, J., Tukiainen, H., Salminen, H., et al. 2022. A methodological guide to observe local-scale geodiversity for biodiversity research and management. *Journal of Applied Ecology* 59(7), 1756–1768.

Salminen, H., Tukiainen, H., Alahuhta, J., et al. 2023. Assessing the relation between geodiversity and species richness in mountain heaths and tundra landscapes. *Landscape Ecology* 38, 2227–2240.

Tukiainen, H., Maliniemi, T., Brilha, J., Alahuhta, J., & Hjort, J. 2024. A framework for quantifying geodiversity at the local scale: a case study from the Rokua UNESCO Global Geopark. *Philosophical Transactions of the Royal Society A*, 382: 20230059.

# HOW GEODIVERSITY IMPACT SPECIES TRAIT DISTRIBUTION IN NATIVE AND NON-NATIVE PLANTS.

Presenting Author: *Lira L Lewis, Anglia Ruskin University*

Email: *ll510@pgr.aru.ac.uk*

Presentation Style: *Flash Talk*

Day: *Wednesday*

Time: *15:45 GMT*

Co-Authors:

*Hannah J White, Anglia Ruskin University*

*Jospeh J Bailey, Anglia Ruskin University*

*Peter M J Brown, Anglia Ruskin University*

## ABSTRACT

Plants are closely related to geodiversity and geofeatures. These relationships have recently been shown to depend on species characteristics (traits), which are shaped by plant life history and whether the species is native or non-native (native status). Understanding species-geofeature relationships is essential for emphasising the holistic value, to living and non-living nature, of geoheritage sites. We investigated the strength of species-geofeature relationships for Great Britain's native and non-native plants (1,649 species) and how species traits (e.g. leaf dry matter content, (LDMC) and height) can help reveal and explain these links. Trait data was collected from online databases such as TRY. The strongest trait-geofeature associations occurred in LDMC, which increased with higher mean elevation ( $r = 0.058$ ,  $P = 0.05$ ) and decreased with areas dominated by weathered superficial deposits ( $r = -0.051$ ,  $P < 0.01$ ). This indicates that geofeatures affect plant survival strategies as LDMC changes occur in response to resource availability. There were significant differences across native status' trait-landscape associations strength ( $\chi^2(2) = 475.27$ ,  $df = 260$ ,  $P < 0.01$ ). Historic non-native plant height increased with metamorphic rock, and the association ( $r = 0.055$ ,  $P = 0.027$ ) was stronger than the native negative association ( $r = -0.029$ ,  $P = 0.042$ ). Further research could use trait-geofeature associations to explore whether conservation areas such as geoheritage sites support higher plant trait diversity in native and non-native species to safeguard biodiversity in landscapes.

# **GEOBIODIVERSITY, AN INTEGRATIVE APPROACH TO NATURAL SCIENCES**

Presenting Author: ***Maria F. Martinez-Báez Téllez***, *Universidad Nacional Autónoma de México*

Email: *fermbt@gmail.com*

Presentation Style: *Flash Talk*

Day: *Wednesday*

Time: *15:50 GMT*

Co-Authors:

*Maria P. Ortega Larrocea, Universidad Nacional Autónoma de México*

*Benjamin van Wyk de Vries, Université Clermont-Auvergne*

*Marie Noelle Guilbaud, Universidad Nacional Autónoma de México*

## **ABSTRACT**

There is no biodiversity without geodiversity. There is almost no environment without some life form on it, whether on the surface or even inside Earth. Geodiversity sets the scene and is a source of resources for life to settle and develop.

Natural sciences have evolved into separate disciplines necessary for providing deep advances in our understanding of Earth. However, the natural world is not divided into disciplines, it is one system. While specialization allows for precise advances, it may not help us understand it as a whole. With this view we propose to fuse geo and biodiversity studies under geobiodiversity. Using this term is a way to emphasize the need and value for both visions to come together. Taken together, geobiodiversity provides an enhanced vision of ecosystem services and landscape ecology.

I will discuss the findings on Xitle volcano lava flow, which shows how specific biological communities establish on specific geodiversities while biological establishment and activities can create different geodiversities, as vegetation and organisms can change landforms. I will share the integrative approach we propose while doing geological or biological assessments, which will allow a wider comprehension of the natural systems we are working on.

Geological studies can be improved by adding life into their descriptions, while biological studies that include the association of species with geological features provide much needed information on environmental preferences and resource distribution. This gives an enriched view of the sites we are studying, with more arguments for the protection and sustainable management of them. Geodiversity conservation ensures the protection of the biodiversity associated with it and likewise, spaces meant to preserve biodiversity, are actively conserving the geodiversity in which the life is rooted.

Adopting geobiodiversity as an enveloping term is the way to go. Geobiodiversity is not just the sum of the potential benefits; it is a multiplier of the two.

# QUANTITATIVE GEODIVERSITY ASSESSMENT IN BIODIVERSITY INVESTIGATIONS

Presenting Author: *Maija Toivanen, Geography Research Unit, University of Oulu*

Email: *maija.toivanen@oulu.fi*

Presentation Style: *Flash Talk*

Day: *Wednesday*

Time: *15:55 GMT*

Co-Authors:

## ABSTRACT

In this presentation, I introduce my doctoral dissertation and its key findings, offering insights into geodiversity assessment and its role in biodiversity research.

Despite growing recognition of geodiversity in recent years, it remains overshadowed by its biotic counterpart, biodiversity. This doctoral thesis aims to narrow this gap by advancing the quantitative assessment of geodiversity within the context of biodiversity. Specifically, it provides a theoretical and methodological framework for studying landscape-scale geodiversity in biodiversity investigations, with insights for nature conservation.

To achieve this goal, I (I) reviewed the theory of the geodiversity–biodiversity relationship, (II) empirically tested this relationship in Finnish freshwater ecosystems, and (III) provided data and methods for Europe-wide geodiversity and biodiversity studies. Using quantitative geographical research methods inspired by ecological traditions, I investigated the relationship between geodiversity and biodiversity across aquatic and terrestrial ecosystems. Empirical studies revealed positive correlations between geodiversity and vascular plant species richness in Finland and Switzerland, across both aquatic and terrestrial ecosystems. This supports the theoretical assumption that geodiversity fosters greater biodiversity. Moreover, the Europe-wide geodiversity dataset produced in this thesis offers ready-to-use variables for future biodiversity investigations and contributes to large-scale geodiversity assessment.

In conclusion, I recommend further development of geodiversity assessment methods and the establishment of systematic frameworks across research contexts. These steps would enable standardized and reproducible research practices, helping to unlock geodiversity's potential in biodiversity and conservation research. Integrating geodiversity into conservation and policymaking is essential to fully acknowledge its role in shaping a sustainable future. By expanding the perspective on natural diversity beyond biodiversity alone, this thesis seeks to enhance understanding and appreciation of geodiversity.

# **THE IMPORTANCE OF WATER IN THE MURGE AREA (SOUTHERN ITALY): AN ESSENTIAL RESOURCE FOR ANCIENT RUPESTRIAN TOWNS AS RECORDED BY THE MASCHERONI FOUNTAIN AT LATERZA**

Presenting Author: **Filippo Bellini**, *Department of Earth and Geoenvironmental Sciences, University of Bari Aldo Moro, Bari, Italy*

Email: [f.bellini4@phd.uniba.it](mailto:f.bellini4@phd.uniba.it)

Presentation Style: *Flash Talk*

Day: *Wednesday*

Time: *16:00 GMT*

Co-Authors:

*Luisa Sabato, Department of Earth and Geoenvironmental Sciences, University of Bari Aldo Moro, Bari, Italy*  
*Marcello Tropeano, Department of Earth and Geoenvironmental Sciences, University of Bari Aldo Moro, Bari, Italy*

*Francesca Clemente, Freelance Architect, Laterza, Italy*

## **ABSTRACT**

The availability of water resources has played a crucial role in the development and culture of civilizations throughout history, especially in pre-modern times. The presence of water is strictly interconnected to the urbanization and the water resource must be well taken into account in order to trace the beginning of the history of many of our towns. A water source, like a spring, was often viewed as a sacred gift and a real asset to be protected and defended; as a consequence, the control of water resources was and still is one of the main causes of conflict in ancient and present times. This was particularly true in semi-arid Mediterranean regions, such as the Murge area in Southern Italy where the randomly presence of surface water tables was a key factor in the establishment of ancient human settlements. Here, the implementation of catchment systems enhanced the value of the presence of water through the construction of monumental fountains that improved the use and sustainability of the resource.

Laterza, with its Mascheroni Fountain, exemplifies how geological conditions, including the presence of water resources and easily digging rocks, led the development of urban settlements. The fountain, also known as the Cinquecentesca Fountain or the Medieval Fountain, has served as a vital source of water for the population of the old rupestrian town of Laterza for over six centuries, supporting various activities such as drinking, crafting, and agriculture. Accordingly, the Mascheroni fountain represents a geosite where the interconnection of geological, historical, and cultural aspects presents valuable opportunities for the development of geotourism practices.

## KEY GEOHERITAGE AREAS: ONE MORE STEP FORWARD

Presenting Author: *José Brilha, University of Minho, Portugal*

Email: *jbrilha@dct.uminho.pt*

Presentation Style: *Talk*

Day: *Wednesday*

Time: *16:15 GMT*

Co-Authors:

*Manu Monge-Ganuzas, ProGEO Europe, Spain*

*Kyung-Sik Woo, Kangwon National University, Korea*

*Thomas Casadevall, U.S. Geoheritage Committee, USA*

*Piotr Migoń, University of Wrocław, Poland*

*John Gunn, University of Birmingham, UK*

*Lars Erikstad, Norwegian Institute for Nature Research, Norway*

*Kevin Page, University of Exeter, UK*

*Maria da Glória Garcia, University of São Paulo, Brazil*

*Francisco Mondej*

### ABSTRACT

There are numerous international designations to promote nature conservation, with a predominant focus on biodiversity. However, geoheritage has received relatively little recognition. Beyond UNESCO's World Heritage and Global Geoparks programmes, as well as the recent IUGS Geological Heritage Sites initiative, few international efforts have been specifically dedicated to recognising geoheritage sites of global significance. Recognising the need for a more structured and inclusive approach to geoheritage conservation, the IUCN adopted Resolution 074 in 2020. This resolution called for a scoping study on a new initiative known as Key Geoheritage Areas (KGAs), envisioned as a complement to the existing Key Biodiversity Areas (KBAs) programme. A working group was formed to conduct the requested study and following public consultation and reviews by two external experts, the final version is now published in the IUCN WCPA Issues Paper Series (<https://iucn.org/our-union/commissions/world-commission-protected-areas/our-work/wcpa-publications/iucn-wcpa-issues>).

A KGA is defined as an "area with well-defined boundaries where significant geological features (including rocks, minerals, fossils, sediments, soils, landforms and landscapes) represent past or on-going Earth processes contributing substantially to the global understanding of the planet's history and its life-support systems and provide opportunities for increasing public awareness, knowledge and understanding of geoheritage conservation. In addition to their scientific value as geoheritage, KGA may also have supporting cultural, ecological, aesthetic, and/or educational values".

The primary aim of this initiative is to recognise and encourage countries to conserve geoheritage of international significance. It also seeks to communicate and promote this information to raise public awareness about the value of these sites, foster their conservation and advance geoconservation practices worldwide.

A formal motion proposing the establishment of the KGA initiative has been submitted for the upcoming IUCN World Conservation Congress, scheduled for October 2025 in Abu Dhabi, United Arab Emirates. Co-sponsored by twenty-two IUCN members from nearly all continents, the motion demonstrates broad international support. If approved, it will be converted into an official IUCN Resolution, enabling the full launch of the KGA initiative and reinforcing global geoconservation efforts.

# INTERNATIONAL GEODIVERSITY DAY: BROADENING VALUES AND JUSTIFICATIONS FOR GEOSCIENCES IN SOCIETY

Presenting Author: *Elaine Hooton, The Open University*

Email: *Elaine.Hooton@open.ac.uk*

Presentation Style: *Talk*

Day: *Wednesday*

Time: *16:30 GMT*

Co-Authors:

*Richard Holliman, The Open University*

*Clare J. Warren, The Open University*

*Jonathan G. Larwood, Natural England*

*Stewart J. Clarke, National Trust*

## ABSTRACT

Despite the fundamental interdependency of biodiversity (living) and geodiversity (non-living) components of nature, geodiversity lacks the status and standing of biodiversity as a concept that generates research and action beyond its base academic discipline. A recent International Union for Conservation of Nature issues paper outlined how nature's abiotic components are marginalised in public discussions around sustainability and the natural environment, which often equate "nature" with "biodiversity". Initiatives have been developed since the 2000s which contribute to counteracting this marginalization, such as the United Nations Educational, Social and Cultural Organization (UNESCO) Geoparks Programme and the International Union of Geological Sciences Commission on Geoheritage. The establishment of the annual UNESCO International Geodiversity Day (IGD) in October 2022 can be included in this list of initiatives and is the focus of this research presentation. In this talk I will document justifications and arguments that were deployed in proposing and supporting the inaugural IGD. Advocates for IGD sought to raise the public profile of geodiversity and to prompt wider discussion of its practical applications. The involvement of UNESCO represented high-profile institutional support, associating geodiversity with the United Nations Sustainable Development Goals (SDGs). Discourse analysis showed that instrumental values were predominant for this event in particular, and geodiversity in general, whilst scientific and environmental justifications for IGD were prevalent. Social, cultural, economic and political arguments were deployed to a lesser extent but furthered the idea that research and action related to geodiversity could drive positive change. I'll set out how the research analysis showed that more specific attention to relational values could broaden the appeal of geodiversity beyond the academic community. Finally I'll argue that geodiversity is increasingly seen by geoscientists and a range of other actors as a concept that should be valued as equivalent to biodiversity in terms of its contribution to nature conservation and sustainable development. Communication and engagement strategies, involving relevant constituencies, will be influential in further shaping this concept.

# OVERTOURISM AS A THREAT TO GEOHERITAGE IN UNESCO WORLD HERITAGE SITES AND UNESCO GLOBAL GEO-PARKS

Presenting Author: *Heidi E Megerle, University of Applied Forest Sciences Rottenburg*

Email: *megerle@hs-rottenburg.de*

Presentation Style: *Talk*

Day: *Wednesday*

Time: *16:45 GMT*

Co-Authors:

## ABSTRACT

Overtourism is understood (mostly as urban) tourism that exceeds the social, ecological and economic carrying capacity limits of a destination and thus triggers extensive negative effects (UNWTO 2018) up to a “tourism phobia” (Milano et al 2019). In principle, overtourism is not a new phenomenon; aspects of carrying capacity have been discussed since the 1970s (Kainthola et al 2021, p. 21).

Until now, overtourism and all its negative effects have mostly been discussed in connection with urban destinations (Dodds and Butler 2019), but it is now increasingly affecting rural areas and geo-landscapes in particular (Sæþórsdóttir et al. 2020). Peeters et al (2018, p. 16) even assume that, contrary to previous assessments, it is not cities but rather rural areas, coasts and islands that are most vulnerable to overtourism.

UNESCO World Heritage Sites and Geoparks have been recognized as such, because of their out-standing, but often also very sensitive geo- and bioheritage. At the same time, destinations with UNESCO or other recognition usually attract significantly higher visitor numbers than other areas. Visitor numbers are often concentrated at the main, but usually also the most vulnerable attractions, particularly in the high season and at certain times of day (Kainthola et al 2021, p. 26). The UNESCO World Heritage Sites of Plitvice Lakes (Croatia) and Halong Bay (Vietnam), among others, made negative headlines due to overtourism. Iceland is also increasingly affected by this phenomenon.

In Germany, overtourism increased dramatically during the Covid-19 pandemic. As vacation trips were prohibited but day trips were possible, we observed extremely high concentrations of visitors in protected areas close to home. This led to considerable damage to the geotopes affected (Megerle 2024).

While the protection of biodiversity has been largely undisputed since the corresponding convention came into force in 1992, the protection of geodiversity was long considered less relevant. Arguments are still often put forward that, unlike biodiversity, geoheritage does not require special protection because it is perceived as “unchangeable” and without any specific threat (Crofts and Gordon 2015, p. 536). This attitude began to change with the start of the geopark movement, since geotope protection is an implicit goal here.

The presentation uses selected case studies mainly from Germany and Europe.