OXFORD GEOHERITAGE VIRTUAL CONFERENCE ABSTRACT VOLUME

VERSION 2

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Keynote Abstracts, followed by Abstract Volume

All times given in British Summer Time (UTC+1)

KEYNOTE

USING GEOHERITAGE FOR COMMUNITY RESILIENCE

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Presentation Day: **Monday** Presentation Time: **2:00:00 PM**

A community that is resilient is one that can deal with internal and external changes, and which can maximise on the benefits of change, by absorbing or adapting. Communities face challenges, such as natural hazards or societal pressures, and if resilient can have the potential to meet these and flourish. The idea that geoheritage could benefit communities, and strengthen their resilience has been around for some time – it's in the essence of a Geopark that the rocks should serve the community, so the UNESCO International Geoscience Programme project 'Geoheritage for Resilience' really is just going with the flow, although that flow is not universally recognised. For example, academic or institutional geological sciences are possibly still too self-centred, and are yet to grasp that socially relevant geoscience is that which has most value. Over the last three years Geoheritage for Resilience projects have started and flourished in various locations around the world. I will give an overview of these, moving from the basics of starting a project with partners, adapting to a community's needs and wants, as expressed by them; developing a team around a geoheritage object; and the sorts of internal and external resilience that can develop, be it against 'natural' hazards, or societal ones. We have melded tangible (rocks, landscape, sculpture) and intangible geoheritage (books, dance, film), that crystallises, creates or communicates a stronger sense of place. Within that sense of place we have involved many sectors of society, having geoscientists working as members of that society, and in doing so have brought us closer to communities and the communities closer to their environment.

KEYNOTE

GEOHERITAGE AND GEOCONSERVATION IN ANTARCTICA

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Presentation Day: **Thursday** Presentation Time: **4:10:00 PM**

Only 0.3% of Antarctica is ice-free, comprising isolated areas of glacial sediments and bedrock exposure where human activity is often concentrated. These ice-free areas contain geological, glaciological, geomorphological and paleontological features of significant geological heritage value and are worthy of protection. While the concepts and goals for Antarctic geoconservation are similar to those elsewhere in the world, the institutional framework and process for assessment, decision-making and protection of geological sites are unique to Antarctica. The Protocol on Environmental Protection to the Antarctic Treaty entered into force in 1998 and designated Antarctica as a "natural reserve, devoted to peace and science." The Protocol stated that "any activity relating to mineral resources, other than scientific research, shall be prohibited." However, impacts resulting from tourism and research activities, including overcollection, have increasingly degraded important geoheritage and geodiversity sites.

Annex V to the Protocol, Area Protection and Management, entered into force in 2002 and provides for the designation of Antarctic Specially Protected Areas (ASPAs). Examples of sites designated on the basis of outstanding geological features include ASPA 148 Mount Flora, Antarctic Peninsula, which was established to protect a remarkable assemblage of Jurassic plant fossils; and ASPA 174 Stornes Peninsula, Larsemann Hills, Prydz Bay, where outstanding examples of extremely rare borosilicate and phosphate minerals are found.

The Scientific Committee on Antarctic Research (SCAR) Expert Group on Geological Heritage and Geoconservation has recently developed a Code of Conduct for Geosciences Field Research and a new method to identify Geosites in Antarctica, analogous to the Global Geosites Project of the International Union of Geological Sciences in cooperation with UNESCO. The first Antarctic Geosite resulting from application of this method is Seymour (Marambio) Island, which is recognized for its exceptional exposure of the Cretaceous-Paleogene (K-Pg) transition. Potential future areas for consideration as Antarctic Geosites may include the blue ice meteorite field at Frontier Mountain, northern Victoria Land, and the Archean high temperature beryllium metapegmatites at Casey Bay, Enderby Land. Implementation of the Code of Conduct for Geosciences Field Research and the addition of new protected areas are urgent geoheritage priorities for Antarctica.

FLASH TALKS

GEODIVERSITY INDEX MAPS: USES AND DISCUSSIONS

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Monday** Presentation Time: **3:50:00 PM**

Presentation Number/Poster Group: **1**

ABSTRACT:

Geodiversity is the abiotic part of nature, and includes both the materiais and the processes that generated them. Either qualitative or quantitative methods can be used to characterize the geodiversity of an area. Qualitative methods deal with the description of geodiversity, whilst quantitative methods represent the variety and the frequency of geodiversity elements. The index map is a quantitative method of spatial analysis that has been used in several types of research on geodiversity. The product of the method is a map whose indexes represent the number of geodiversity elements in a given area. This study intends to verify how the geodiversity index map has been used in research and what are the potential uses of this methodology.

The following methods were used: (i) initial search in the Scopus database with scientific articles written in English that used the keyword “geodiversity index map”; (ii) reading of selected articles; (iii) analysis of these articles to identify how the index map was used in research.

As a result, 18 articles that developed the geodiversity index map were obtained. Nine of them (50%) discussed the spatial distribution of geodiversity elements; five (28%) overlapped the generated map with other types of maps; two (11%) presented a methodological discussion about the possible ways of elaborating the map; two (11%) showed comparison with maps and data referring to biodiversity.

The results indicated the predominance of using the geodiversity index map to discuss the spatial distribution of elements in the physical environment. Nevertheless, the index map, as a spatial analysis tool, has the potential not only to present the study area but also to deepen the knowledge of an area when added to other information. Using the index map overlaid on watershed maps, urban expansion data, and biodiversity data, among others, can help to increase understanding of the study area. This improvement will allow the use of the geodiversity index map as a basis for selecting areas for fieldwork, priority areas for public policies, and priority areas in the identification of ecosystem services provided by geodiversity.

IMPACTS ON ECOSYSTEM SERVICES PROVIDED BY GEODIVERSITY: A STUDY ON THE SOUTHEASTERN COAST OF BRAZIL

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Monday** Presentation Time: **3:55:00 PM**

Presentation Number/Poster Group: **2**

ABSTRACT:

Although the first protected area created in the world was based on geological elements and processes, nature conservation strategies have been traditionally focused on a biodiversity perspective. Since natural diversity is composed of both living and nonliving elements, this represents an unbalanced strategy of nature conservation, which has an impact on the role of geodiversity in the functioning of ecosystems. The ecosystem services (ES) provided by geodiversity are goods that directly and indirectly benefit society and can be classified into regulation, support, provision, cultural and knowledge functions. The Protected Areas (PAs) have an important role in conservation and maintenance of ecosystem services, especially in Brazil which has a National System of Protected Areas that predicts this maintenance. Brazil comprises about 3,202 PAs, which represents 32% of the total of the Caribbean and Latin America. However PAs have been impacted by urban growth and industrialization, so to study these areas it is important to understand which are the threats and impacts that affect this provided services. This work aims at the identification and assessment of impacts on ES provided by geodiversity on the southeast coast of Brazil, in the Caraguatatuba county and a protected area Serra do Mar State Park. The methods used consisted of two steps: (i) identification of the ES based on the recognition of the Essential Variables of Geodiversity (EGVs) and bibliographic research and (ii) quantitative assessment of the impacts on the ES provided by geodiversity. The results presented seventy six ES provided by geodiversity in Caraguatatuba, which the ecosystem functions most affected mainly by urban area, absence of native vegetation and farming, forestry and pasture were, respectively: supporting (50.9%), regulating (47.7%), cultural (41.9%), knowledge (34.9%) and provisioning (31.2%). The main losses on ES provided by geodiversity are represented by the vulnerability of aquifers, support of biodiversity and carbon sequestration and storage. The results show the clear relationship between geodiversity and biodiversity in a promotion of ES provided by geodiversity. This can be shown as a new integrated conservation strategy, but it is a challenging task in PAs, as they are under anthropic threat. It

indicates an efficient and useful methodological tool used in land management strategies towards geodiversity and environmental law enforcement.

A FIELD-BASED METHOD FOR OBSERVING LOCAL-SCALE GEODIVERSITY FOR BIODIVERSITY APPLICATIONS

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Monday** Presentation Time: **4:00:00 PM**

Presentation Number/Poster Group: **3**

ABSTRACT:

A multiplicity of approaches for measuring geodiversity across scales, areas and objectives have been introduced in scientific research. In studies where the relationships between geodiversity and biodiversity are explored, the focus has been on landscape-scale investigations. This is partly due the lack of methods for collecting geodiversity data on local scale (at the scale of few to tens of meters). In this study, we developed an accessible field method for observing local-scale geodiversity and applied it in an Arctic-alpine tundra environment in northern Finland and Norway. The method is based on observation of geofeatures, i.e., elements of geology, geomorphology, and hydrology, from a given area surrounding a location of species observations. We also explored, whether local-scale geodiversity correlates positively with vascular plant species richness of the same sites. Our results indicated high potential of the method, as the field team successfully observed geofeatures with relatively little experience in geomorphology and field mapping. According to the results, vascular plant richness was positively correlated with geodiversity. This highlights the potential of incorporating field-based geodiversity information into biodiversity investigations in high-latitude tundra and mountain ecosystems, which is promising for the conservation and sustainable management of these sensitive terrestrial systems.

A BIOLOGICAL VIEW ON GEODIVERSITY

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Monday** Presentation Time: **4:05:00 PM**

Presentation Number/Poster Group: **4**

ABSTRACT:

Nature conservation seeks to preserve, maintain and care for the diversity of biotic and abiotic environments (such as rocks, fossils, relief, rivers, seas, lakes, soils), as both are related. The Earth is considered a superorganism, in which the interaction of its components, biological, physical and chemical, maintain its characteristics, which allows the existence of various forms of life. The rational and sustainable use of natural resources involves much more than the conservation of species, it also requires care with geodiversity and the minimization of impacts on the physical environment. In this context, an integrated approach to nature conservation is necessary, mixing geodiversity and biodiversity, for adequate management of natural resources, identifying threats and challenges in the use of natural resources. Thus, in this work, some remarkable cases around the world are presented, which have been raised about the relationships and interactions between species of fauna and flora and the elements of the abiotic environment where they inhabit. Among these cases are: the Galapagos Land Iguanas (Conolophus subcristatus), which use volcanic conditions for nesting in the Galapagos (Ecuador); the Lesser Flamingos (Phoeniconaias minor), which nest in Lake Natron (Tanzania), whose conditions are very adverse for the vast majority of species; the Amazonian Turtles (Podocnemis expansa), which have a single annual reproductive period and use the bars of Amazonian rivers (Brazil) for this purpose; the Rain Frogs (Breviceps macrops), which forage at night in coastal deserts in southern Africa; and Wild Camels (Camelus ferus), in the Gobi Desert (Mongolia), adapted to the low availability of water, especially in winter. For each case, the species and elements of geodiversity involved, the region of occurrence, the insertion in special areas and the existence of formal protection and threats, notably anthropic ones, have been raised.

It is worth noting that rocks, soils, rivers, volcanoes, climate, oceans, etc. are like gears that condition, protect and challenge the survival of species, promoting all biodiversity on Earth. By investigating and out reaching these interactions, we defend a biological perspective on geodiversity and on the need for its valuation and protection for the future of species on the planet, including ours.

COMMON PATTERN OF DISTRIBUTION FOR MESOAMERICAN TRIATOMA DIMIDIATASUGGEST GEOLOGICAL AND ECOLOGICAL ASSOCIATION

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Monday** Presentation Time: **4:10:00 PM**

Presentation Number/Poster Group: **5**

ABSTRACT:

The phylogeny of the Triatoma dimidiata complex has been widely assessed with different genetic and morphological data, which has allowed to reach the consensus that the complex consists of at least three taxonomic units. However, these taxonomic units seem to have a distribution related to geography throughout Mesoamerica, with different groupings depending on the source of information used. In the present study, we aimed to determine if there is a common biogeographical, genetic and phenetic distribution pattern among the T. dimidiata species in Mesoamerica and if this pattern is related to ecological and geological variability of the region. We found that panbiogeographical analysis showed three generalized tracks that coincide with genetic/ phenetic data which showed a general pattern of distribution in two big clusters to the north and south of Mesoamerica. We also found that these clusters were significantly related to geological tectonic plates and ecotypes. We conclude that the geological history may be a plausible explanation for the greater differentiation observed in the T. dimidiata complex, but that the current ecological characteristics of the morphotectonic units or ecotypes may be responsible for the additional variation observed and therefore differential control strategies for each cluster considering geological history and ecotype should be used. Further, more detailed biogeographical and landscape genetic analyses are necessary with the goal to elucidate T. dimidiata differentiation related with ecological and geological variables in the region and the possible epidemiological and evolutionary consequences.

GEOROTEIROS - RS, 13 YEARS OF GEODISEMINATION OF GEODIVERSITY IN THE STATE OF RIO GRANDE DO SUL, IN THE SOUTHERN REGION OF BRAZIL.

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Monday** Presentation Time: **4:25:00 PM**

Presentation Number/Poster Group: **6**

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 13 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.

GEODIVERSITY; ENRICHING AN URBAN TOUR OF THE CLASSICAL CITIES OF THE SPANISH MESETA

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Co-authors:

Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Monday** Presentation Time: **4:30:00 PM**

Presentation Number/Poster Group: **7**

ABSTRACT:

As a relative newcomer to the explicit study of geodiversity and geoheritage I have learnt much over the last months to inspire and enjoy. Postgraduate study ahead for me, starting next autumn, will include researching and communicating social, economic and cultural connections within these geo-based themes. After limited travel through the COVID years, this spring saw an opportunity to apply this new understanding to enrich urban exploration of the cities of classical Spain.

Topography gave rise to these cities' prominence as settings for major royal events as the modern Spanish state took shape. The skilful use of various geological materials enabled its institutions to invest in formidable facades, enclosing special spaces, where intellectual debate and discovery was correspondingly valued. Geological processes are inherent in these urbanised settings. The interplay with fluvial processes and water supplies is central to city foundation and expansion. Slower processes of weathering and tectonics are also displayed within these built environments, if sought out. Challenging issues of sustainability also arise.

In my Flash Talk I will focus each slide on one of these aspects of geodiversity (topography, materials, processes) and illustrate where and how they can be encountered in the cities of Segovia, Salamanca and/or Toledo.

Looking closer means greater attention. With this comes an enriched experience of our natural-cultural world. All of us at this conference, I think, wish to communicate this further afield to a more diverse audience, especially in this year of the inaugural International Geodiversity Day. I hope to make my small contribution to show how popular destinations can be given different perspective.

CURRICULUM DESIGN AS A METAPHORICAL AND PRACTICAL GUIDE FOR MEANINGFUL DESCRIPTIONS OF GEOHERITAGE ATTRIBUTES

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Monday** Presentation Time: **4:35:00 PM**

Presentation Number/Poster Group: **8**

ABSTRACT:

Geoheritage describes interactions between people and the geosphere that embody elements of various human values—especially scientific values, but also aesthetic, economic, cultural, historical and other values.

Describing the geoheritage attributes of a site involves identifying specific concepts, principles, and interactions by which the site gains significance and are, as a result, considered worth documenting. Therefore, identifying the geoheritage potential of a site can be seen as an inherently educative act in that it is intended to build knowledge of the site in a larger framework of human knowledge and experience. This educative aspect of geoheritage raises the possibility of associating the process of identifying a location as a geoheritage site with processes of curriculum design—metaphorically, and also practically.

Curriculum design is a broad term that describes processes in which sets of principles, derived from theories of teaching and learning, are utilized to plan instructional experiences that will guide learners to develop a body of knowledge (where "knowledge" is understood to have multiple dimensions—e.g., cognitive, behavioral, socio-emotional). The argument that emerges, therefore, is that principles of curriculum design could inform the ways a site's geoheritage attributes are presented.

For example, among the principles applied in contemporary curriculum design is a focus on equity—in terms of both access to knowledge and the forms and sources of knowledge that will be included in instruction. Important in discussions of equity is the recognition that curricula formalize knowledge, thereby validating certain perspectives in more or less explicit ways. Curricula also guide the processes by which knowledge is shared with learners. Both of these (and other) dimensions of equity can raise questions in discussions of geoheritage, such as which forms and sources of heritage knowledge are represented in the attributes of the site to be recognized.

Other curriculum design principles—such as relevance, a problem-solving focus, attention to place-based elements, alignment to dimensions of standards, and others—raise similar questions that can inform discourses regarding how geoheritage features are presented. This paper will describe principles of curriculum design and explore how those might be applied to the information about geoheritage sites in ways that make that information accessible and meaningful to diverse audiences.

URBAN-TOURISTIC IMPACTS ON THE NATURAL GEOHERITAGE OF THE AEOLIAN SEDIMENTARY SYSTEMS FROM CANARY ISLANDS (SPAIN)

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Monday** Presentation Time: **4:40:00 PM**

Presentation Number/Poster Group: **9**

ABSTRACT:

Coastal aeolian sedimentary systems have been anthropogenically altered in recent decades due to the littoralization process, causing the loss of their natural and cultural geoheritage. In this sense, in Canary Islands (Spain), aeolian sedimentary systems are developed under arid climate conditions, differing from the rest of European counterpart systems located in more wet regions, and are exposed to high human pressure due to tourism development since 1960, especially due to the good weather all year round, that attracts mass sun and beach tourism. The associated urbanization has used these systems as a tourist resource, building resorts around them and producing block and isolation of the main sedimentary inputs areas, which has altered their natural aeolian sedimentary dynamics. This work aims to demonstrate how the urban-tourist impact developed around four aeolian sedimentary systems in the Canary Islands subject to environmental protection (Maspalomas, in Gran Canaria; Corralejo, in Fuerteventura; and Lambra and Jable Sur, in La Graciosa), has produced a reduction in the aeolian landforms with active aeolian sedimentary processes and, therefore, of the natural geoheritage. Changes in the number of aeolian landforms detected in each system are analysed on a temporal and spatial scale through photointerpretation, using historical aerial photographs and current orthophotos. In addition, these landforms are also classified as indicators of anthropization, erosion, stabilization or sedimentary accumulation. The results indicate that the systems affected by urban-

tourist development (Maspalomas, Corralejo and Jable Sur) show significant changes, where in some cases 50% of the active landforms, and therefore of the natural geoheritage as indicator of processes of accumulation, mobility and a natural dynamic of the system, have disappeared, due to these. In other cases, the landforms result of anthropization (up to 400%) and erosion (up to 200%) have increased. However, the number of landforms related to stabilization remains stable, although their increase of the area has been verified. On the other hand, the systems not impacted by buildings nor construction of infrastructures (Lambra), show minor changes, and keep the number of landforms and their natural geoheritage. The reduction of the natural geoheritage related to an increase in urbanization around these aeolian sedimentary systems indicate deficiencies in the management of these protected areas.

KEWEENAW GEOHERITAGE: EXPLORING RELATIONSHIPS WITH LANDSCAPE AT THE HEART OF THE MIDCONTINENT RIFT ON LAKE SUPERIOR

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Monday** Presentation Time: **4:45:00 PM**

Presentation Number/Poster Group: **10**

ABSTRACT:

The Keweenaw Peninsula in Michigan, USA sits at the heart of the Midcontinent Rift and is renowned for the world's largest accessible native copper deposit and Lake Superior, the largest freshwater lake on Earth. The billion-year geologic history of the Keweenaw, a combination of rift and glacial processes, has sculpted shorelines, peninsulas, islands, harbors, and other unique landscape features. The cultural fabric of our place has been woven by the varied ethos and purposes of people whose migrations, settlements, traditions, industries, heritage, and legacies were cultivated by their relationships with the rock and the Lake. Geoheritage emphasizes the importance of the varied personal values people have for geologic features and explores the wide-ranging connections people have with landscape. As such, geoheritage is an effective geoscience communication tool affording place-based learning experiences that nurture our sense of place. The rich geodiversity of the Keweenaw provides an accessible platform for people to learn about deep time, Earth's dynamic processes, and importantly, the diverse relationships and reciprocity people have with our geologic underpinnings. Most interpretations and public educational programming depicting the relationship between people and geology have largely focused on stories and heritage associated with the European diaspora that fueled the Copper Boom of 1845-1968. Less interpreted, yet central to our history, is how this place is the site of the oldest metal workings in the Western Hemisphere and how the geology has shaped, and continues to shape, the ancestral, traditional, and contemporary lands, waters, and livelihoods of the Anishinaabeg Nation and their more-than-human relatives. To elevate these varied histories and heritages the overarching theme of geoheritage guides professional learning opportunities for educators, field experiences for informal audiences, digital educational resources, and art inspired by our rich geologic underpinnings. This interdisciplinary learning, facilitated by many valued community partnerships, provides a means of acknowledging and honoring our varied relationships, knowledge sets, and ways of appreciating place thereby fostering formal and informal learning opportunities that help deepen Earth science literacy and our sense of belonging.

SOILS IN GEOLOGICAL ROUTES: AN EXPERIENCE IN PORTUGAL

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

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Wednesday** Presentation Time: **3:50:00 PM**

Presentation Number/Poster Group: **11**

ABSTRACT:

The present work came from the opportunity to carry out a geological route with didactic character, related to the Master Degree on Geosciences, specialisation on Geological Heritage and Geoconservation, of the University of Minho, Portugal. The objective of this route was to visit distinct geosites and geodiversity sites throughout the Portuguese territory. Portugal is one of the leading countries in the studies and defense of geological heritage and geoconservation in the world. It has an inventory with more than 300 geosites and five geoparks accredited by UNESCO in a relatively small territory (about 92.090 km2). However, as most countries, its inventory does not include geosites in the soil category or pedosites. The objective of this study was to observe/evaluate the soil at the visitation points in order to verify the possibility of it adding value to the already existing geosite (multicategorization) or even constitute a potential pedosite. The route left the city of Braga, in the North of the country, crossing 2,130 km in six days, to the Algarve region in the far South, passing through the districts of Guarda, Castelo Branco, Beja, Faro, Lisbon, Leiria and Santarém, five Natural Parks and the Estrela and Naturtejo UNESCO Glogal Geoparks and the aspiring West Geopark Lands of Jurassic. Slightly more than 50% of the country is covered by Leptsols, poorly evolved soils, usually acidic, that are formed from non-calcareous parent rock, with severe limitations on use. However, there are important differentiations of soils in the Portuguese territory, mainly related to lithology and the prevailing climate. Considering the 53 visitation points, 6 were selected as having soils of relevant scientific interest, either because they represent soils typically found in the country or because they present characteristics that show natural formation processes strongly related to the current environmental conditions. They are Umbrisol (organic soil in mountainous climate), in Serra da Estrela Geopark; Luvisol (deep yellow redish soil), in Beja; Luvisol (ferralitic red soil), in Mina de São Domingos, Beja; Leptosol (thin soil), in Ponta de Sagres; Podzol (sandy soil formed on dunes), in Palmela; and Luvisol (Calcisol), in Algar de Pena Mine, Santarém. In this context, this study emphasizes the importance of soil as a geoheritage that needs to be recognized, valued and popularized in inventories and in the circuits of geoparks and geological routes.

RECONCILING SUSTAINABILITY AND GEOHERITAGE IN MINING LANDSCAPES OF THE MINAS GERAIS STATE, BRAZIL.

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Wednesday** Presentation Time: **3:55:00 PM**

Presentation Number/Poster Group: **12**

ABSTRACT:

The State of Minas Gerais in Brazil is composed of transformed landscapes configured as symbolic landmarks that impacts and characterizes many municipalities. The essential social, cultural, environmental, economic, and political components historically molded the state and the heritage of its people, carrying the mining heritage even in the state's name. However, mining as one of the central pillars of the Brazilian development model has put different natural and cultural heritage at risk. Several cases of mining activity are inserted in regions of great heritage interest and modify valuable pre-existing cultural, social, and physical-environmental relations. The concepts of geodiversity and, specifically, geoheritage, which includes abiotic features and geologic sites that inform humanity of its relationship with the Earth, emerge as an alternative for nature conservation, territorial planning, and sustainable development, as an attempt to reconcile these spheres. This study analyzes an extensive use of archives to catalog and report geoheritage in mining landscapes of the Minas Gerais State. In addition, it links to well-established strategies (i.e., UNESCO Global Geoparks and GEOfood) to understand how they provide essential information to raise awareness of the importance of geoheritage and management of these areas. We concluded that in mining landscapes of Minas Gerais, they must be sought as a viable possibility for economic and environmental dynamic actions in the maintenance of municipalities, from the very beginning to after the end of operational activities. Knowledge sharing and enabling cross-generational engagement with geoheritage, improve the comprehension of short and long-term impacts of mining, plus, how geodiversity can work as a source of important information in the "greening" of mining policies. Finally, serving as monitoring tools for many issues related to cultural landscape (e.g., climate change, geohazards, deforestation, etc.), while proving strong innovation potential for this research field within the broader context of industrialization, urbanization, and environmental change in Minas Gerais.

MINERALP INTERREG PROJECT: COOPERATION FOR MINING HERITAGE

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Wednesday** Presentation Time: **4:00:00 PM**

Presentation Number/Poster Group: **13**

ABSTRACT:

The mountain for years has been considered a place for enthusiasts. In recent years, however, there has been an approach to mountain places linked in particular to the naturalistic and environmental aspects; however, the visitor, and often also the resident, has little information on the birth and value of mountain economies. Since ancient times the mountain territory was a place of interest, not only for the agricultural or breeding aspect, but also for the exploitation of the quantities of natural resources present; among these, metals have always represented a value that deserves particular attention.

The closure of most mining activities has greatly reduced awareness and knowledge of this heritage and how this has affected the economies and transformation of the territory, according to human needs. The project aims to recover and disseminate this knowledge, in order to provide greater attractiveness to the territories, with the creation of itineraries and the training of operators capable of making people read and understand how the mountain has contributed to the development of civilization.

The MINERALP project is an Italy-Switzerland Interreg Project, working on a wide area across the two nations in western Alps.

From Mont Blanc to Lake Maggiore, a huge mining activity developed in the previous centuries, with a great impact on local communities and landscapes.

A big heritage made of places (mostly abandoned), knowledge and Man's memories about the hard work in mines and quarries. What is needed is keeping this heritage still alive and give the opportunities to discover it as a new way of tourism, enriched with culture and adventure!

The MINERALP project, launched in April 2019, will end at the beginning of 2023 with the recovery of 3 ex-mining sites, the implementation of already recovered sites, the setting up of new visitor and document centers and information points.

In addition, there are the mapping and signage of about twenty geo-mining itineraries distributed in the project area, the creation of video clips, documentary databases on a dedicated web platform, together with competitions for schools and training of local Guides and tour operators for the promotion of the recovered heritage.

The MINERALP project wants to be a kind of launch network for a wider one, across all the Alps, from France to Slovenia, in strong connection with other network in Europe and in the world for the study and conservation of historical mining heritage.

GEO-ROUTE IN EL GOLFO VALLEY (EL HIERRO, SPAIN) TO PROMOTE THE GEOTOURISM AND LOCAL DEVELOPMENT IN A SMALL VOLCANIC UNESCO GLOBAL GEOPARK

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Wednesday** Presentation Time: **4:05:00 PM**

Presentation Number/Poster Group: **14**

ABSTRACT:

El Hierro island is located east Atlantic Ocean, is the most western and the smallest one of the Canaries. It is a subtropical recent volcanic island, and it possesses a rich and diverse volcanic and non-volcanic geoheritage. The last eruption was in 2011-2012 in the Mar de Las Calmas reserve marine, which is located in the south of the island. Currently, El Hierro is a Biosphere Reserve since 2000, a UNESCO Global Geopark since 2014 and more than 54% of its surface are natural protected areas. El Hierro receives thousands of visitors a year mainly motivated by diving and trekking, but the main geomorphological landscapes (giant landslides and volcanic rifts) are not very important for the tourists yet. We selected the El Golfo Valley (EGV) because it constitutes the most important topographical, geological and geographical unit of the El Hierro and it has the largest number of geosites of the geopark. The study area (EGV) is located in the north part of El Hierro which was originated by a giant landslide more than 100.000 years ago and then the depression was filled with several monogenetic eruptions and detrital deposits. Into the EGV is the most important human activity and economy of the El Hierro associated to the traditional crops and livestock and the exportation crops (banana, pineapple or avocado) generated a diverse rural landscapes and rich cultural heritage. In this sense, the main aim of this work is to identify, inventory and selected an important geotourism sites preserved, accessible and representative of the EGV heritage in order to promote its the local development through a geographical approach of geotourism with a coastal path that could diversification the economic activities in EGV. The selected and studied sites in this study include the geoheritage of the EGV (paleo-cliffs, ravines, taluses, sedimentary deposits, cliffs, beaches, cinder cones, hornitos, lava fields or coastal lava delta) and the rural elements (stone walls, “goronas”, salines, crops or livestock). The geo-route has fifteen stops, a total path of 17.5 km and it can be done by car, but several stops can be done on foot. Along the itinerary it can be observed the diversity linked to the natural and cultural heritage of this recent volcanic landscape of El Hierro. For

all, the selection of these important geotourism sites could contribute to local development and the geotourism through the geo-routes for the coast of the EGV (Volturmac-MAC2/4.6c/298).

ANALYSIS OF THE TERRITORIAL HERITAGISATION PROCESSES IN THE UNESCO GLOBAL GEOPARKS IN SPAIN BETWEEN 2015-2017

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Wednesday** Presentation Time: **4:10:00 PM**

Presentation Number/Poster Group: **15**

ABSTRACT:

Through a multidisciplinary analysis of the heritagisation processes in the 11 Spanish UNESCO Global Geoparks and the two aspiring territories, between 2015 and 2017, this study gathered contributions from museological and geographical research studies. The main results expose a series of ambivalences in the Spanish framework, regarding the differences between the UNESCO and the Global Geoparks Network guidelines and the interest, representations, and statement of intent in the management structures of each Geopark, influenced by the national, regional, and local context. Highlighting the presence of epistemological conflicts and antinomies logics from the very beginning of the heritage awareness of geology. This constrains the possibilities to co-construct a territorial narrative and to keep the holistic approach of education, conservation and development, prioritizing one of those three goals.

INVENTORY OF THE IN SITU PALEONTOLOGICAL HERITAGE OF COLOMBIA BASED ON A QUALITATIVE ASSESSMENT METHODOLOGY

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Wednesday** Presentation Time: **4:25:00 PM**

Presentation Number/Poster Group: **16**

ABSTRACT:

Paleozoic, Mesozoic and Cenozoic eras and is represented in at least 13 paleontological sites of national or international relevance. These sites constitute the pillars on which the paleontological research of the national territory has been built and, therefore, their study has given rise to numerous publications such as books, papers and dissertations. It is thanks to the broad scientific tradition of these sites that it has been possible to value them through a qualitative methodology that supports their geological importance, in connection with educational and cultural values, that not only reinforce their importance but also show how much appropriation there is by the communities regarding these sites.

Despite the great scientific, educational and cultural interest that these paleontological sites arouse as vestiges of life in the past, they are often affected by anthropogenic actions such as irresponsible collection of material, plundering and illicit traffic. Therefore, the Colombian Geological Survey, being the leading entity in the integral management of national geological heritage, has prioritized the protection and conservation of paleontological heritage both in situ and ex situ, through good conservation practices that ensure adequate and sustainable management of the primary sources and the fossil pieces extracted.

The evaluation of paleontological sites within the framework of a national inventory of geological heritage called INGEP, has allowed adapting the assessment methodology to the Colombia context under a qualitative approach in which the relevance of the sites is supported through organic and argumentative texts. In the case of scientific value, the justification is based on information already published and for educational and cultural value, it is based on publications but also on information extracted from visits directly to the sites and their surrounding sectors.

The scope of these assessments is to: highlight and promote scientific research in the national territory; generate conservation guidelines to be implemented by local authorities and site managers, which will be monitored by the Colombian Geological Survey; provide the technical information necessary to generate educational and communicative products; be the input on which to support the nomination of areas for international recognition (e.g. UNESCO figures).

GEOLOGICAL HERITAGE AND THE UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS 2030 AGENDA: AN APPROACH ON THE NORTH COAST OF SÃO PAULO, BRAZIL

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Wednesday** Presentation Time: **4:30:00 PM**

Presentation Number/Poster Group: **17**

ABSTRACT:

Geodiversity is essential for supporting life and natural resources. Among all the geodiversity there are important places that record Earth's history. These are the geosites. On the northern coast of the state of São Paulo, Brazil, geological heritage inventories defined 43 geosites that record the geological history of the region since the Neoproterozoic and represent the abiotic components of the ecosystems in which they are inserted. This work aims to relate these geosites with the 17 Sustainable Development Goals (SDGs) and 169 targets of the UN 2030 Agenda. The method consisted of 4 steps: 1) Identify the values of geodiversity in the geosites; 2) Group geosites according to Essential Geodiversity Variables (EGVs); 3) Link EGVs with Ecosystem Services and 4) Integrate the results in the context of the SDGs. The geodiversity values recognized show that the region has places with high scientific values; aesthetic values mainly related to beaches and landscapes; cultural values linked to traditional communities and the region's occupation history; and functional values associated with geodiversity elements. The elements present in the geosites were categorized according to 3 EGVs: Hardrock, fossil & mineral distribution; Un-consolidated deposits; Landform distribution. Regulating functions were recognized by means of promoting quality of life, as services through weathering; Supporting may be provided by the rocky substrates that shelter vegetation; Provisioning, through construction materials; Cultural, as a sense of belonging and Knowledge, with research on geosciences. Data integration allowed the identification of 13 SDGs associated with the region's geodiversity. Geosites have the potential to contribute to the achievement of goals mainly associated with human well-being, providing nutrients, reducing social inequalities, helping to maintain life, and identifying new areas for geotourism. The data obtained show that the proper management of geodiversity can stimulate its capacity of contributing to reach the SDGs and has the potential to influence public policies, among other topics, associated with nature conservation, promotion of education, and tourism.

PHOTOGRAMMETRIC 3D MODELS OF THE CLIFFS OF LUMIGNANO GEOSITE (N. ITALY) FOR GEOHERITAGE DOCUMENTATION AND GEOCONSERVATION.

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Wednesday** Presentation Time: **4:35:00 PM**

Presentation Number/Poster Group: **18**

ABSTRACT:

In the last few years, the theme of the geoheritage has gained more and more importance. The cliffs of Lumignano, a little village located in Veneto region (Italy), are an example of complex and unique geology, important for both science and tourism. The geology of Lumignano tells the history of an early Oligocene (ca. 33 Ma) coral reef which was set up at a global sea-level drop, due to the Antarctic ice cap emplacement, and which was then cut by volcanic conduits and faults. Those episodes generated spectacular limestone walls, dotted by hundreds of caves, and renown as a climbing area. This work, which is part of the GeoKart project (Interreg Italy-Slovenia), aims to visualize the geodiversity and geoheritage of Lumignano. In order to do that, we produced 3D models of 3 rock walls and 2 quarries, considered the best geoheritage sites of the area, through photogrammetry. These rock walls are on average 300 m wide and 50 m high. We acquired an average of 150÷350 pictures per site using a Dji Phantom 4 RTK. Pictures were georeferenced with an error in the order of centimeters directly during the survey. Then, we used Agisoft Metashape to generate point clouds, which were cleaned of inaccurate data. Meshes were then generated and texturized with the pictures. We finally obtained 5 models of the areas of study with an average spatial resolution of 5 cm and an average vertical accuracy of 4.5 cm. Those models represent important documentation of the geoheritage of Lumignano which, especially in the quarries, is potentially subjected to degradation. Moreover, those models have been decimated and uploaded on sketchfab (https://sketchfab.com). Using a QR code, models can be accessed by the broader public of tourists, educators, and local administrators. We also used Virtual Reality Geoscience and Lime software to draw geological features, e.g., facies boundaries and fault planes. In Sketchfab, interactive buttons were positioned directly on the points of interest of the model. Those buttons link to explanations of specific geological features on the rock wall.

GEOCONSERVATION IN THE BÜKK-REGION GEOPARK

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Wednesday** Presentation Time: **4:40:00 PM**

Presentation Number/Poster Group: **19**

ABSTRACT:

The Bükk-Region Geopark covers one of the most complex geological environments in Hungary. The central zone of the Geopark's 2817 km2 territory consists of the Bükk Mts and its northern neighbour, the Upponyi Mts., both of which are characterised by fold-and-thrust structures mainly formed during the Cretaceous tectogenesis. The Palaeozoic-Mesozoic rocks forming the mountains can also be found in various depths below younger deposits in the surrounding basins.

The Bükk-Region is rich in geological, archaeological and cultural-historical values. Numerous key sections reveal an almost continuous sediment sequence spanning around 300 million years within its territorial scope. In the Bükk Mts., numerous crystal caves and one travertine cave are present, the latter of which is of international significance due to the number and size of its formations. There are forty-six prehistoric caves within the region. During their archaeological survey, the remains of Neanderthals were discovered, proving their presence to the east of the Alps. The hillforts dispersed around the region provide valuable information about the local land use from the early Bronze Age to the early Middle Ages. Last, the beehive stones found in the Bükk piedmonts are part of the Bükk Stone Culture and one of the earliest examples of carvings in the Carpathian Basin.

The protection, rehabilitation and promotion of Geoheritage in the Bükk-Region is a noble and important mission, which is performed by the Bükk National Park Directorate, the working organisation of the Bükk-Region Geopark. In recent decades the Directorate carried out rehabilitation related tasks and placed interpretation boards, stairs and railings at a significant proportion of key sections, hillforts and beehive stones from various project funds. In the case of beehive stones and hillforts, LIDAR surveys were also performed. At the local caves, the Directorate carried out debris removal, the closure of dangerous chimneys, and the modernisation of lighting systems.

Geoheritage protection in the region expanded with new opportunities and challenges with the establishment of the Bükk-Region Geopark. On the one hand, the Bükk Mts. and its surroundings are rich in geological values that can prove to be a valuable asset in Geotourism, education and regional development. On the other hand, the increased visibility of geological heritage and the management of the increased number of visitors pose new challenges.

EVALUATION OF THE BÜKK MOUNTAIN GEOPARK GEOSITES USING THE GAM METHOD

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Wednesday** Presentation Time: **4:45:00 PM**

Presentation Number/Poster Group: **20**

ABSTRACT:

Of the three geoparks in Hungary, the Bükk Region Geopark was last established in 2017. The organization is coordinated by the Bükk National Park and it has 109 municipalities. Its central part is the Bükk Mountain in the southern part of the Western Carpathians.

Behind the spectacular earth science heritage of the mountain, there is a more than 450 million years long geologic and geomorphic evolution, which has given variable resources of geodiversity. Its character is the result of the lithological diversity, the structural processes of the Alpine Orogeny, the predominant karst surface, periglacial and fluvial geomorphology of the mountains, karst hydrology, and anthropogenic values adapted to the conditions.

With the results of our research and geotourism experience in the mountains, we are helping the Bükk Region Geopark to apply for membership in the UNESCO Geopark Network. The first step in this is to analyze the 356 geosites in the area. For this, we used the GAM model developed by Vujicic et al. (2011) and modified by us. The Scientific-Educational values of the versatile method were supplemented with a pedagogical indicator related to the actual field, namely the Educational role of geosites, while the Viewpoints indicator was deleted from the Scenic values. In addition, the Maintenance time of geosites was evaluated as a new element in the Protection values.

As a results five geosite types have been highlighted, with additional geosites of importance in the environment. Based on the GAM Additional values, the geotourism role of the landscape was examined. The optimal number of visitors, the condition of the geosites suitable for presentation, their varied accessibility and the development of several core areas allow the geopark to be attractive to a wide range of geotourists in the landscapes of the Bükk region. These main core sites are: the edges of the central Bükk, which carries prehistoric caves, with spectacular karst morphological and hydrological presence; the Jurassic mid-ocean ridge in Szarvaskő, with its castle and ore mining forms; the Bükk Plateau called the „Giants' Table" with the bastion-like limestone cliffs, called „The Rocks" along its marked edges; the ancient rocks and spectacular gorge of the Uppony Mountains, as well as the rhyodacite rocks and treasures of the Bükkalja, and the anthropogenic elements of the associated stone culture.

THE GEOCONSERVATION TRUST AOTEAROA PACIFIC: A TRANSDISCIPLINARY RECOGNITION OF GEOLOGY AS A FUNDAMENTAL BUILDING BLOCK OF OUR ENVIRONMENT

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Thursday** Presentation Time: **2:05:00 PM**

Presentation Number/Poster Group: **21**

ABSTRACT:

The Geoconservation Trust Aotearoa Pacific provides a transdisciplinary vehicle to facilitate projects, promote research, and recognise geological features alongside flora and fauna for their intrinsic, and human-centred values. Recently a plethora of terms have come into use utilising the prefix “geo” including geoscience, geoheritage, geodiversity, geoparks, geotourism, and geoconservation. We provide a platform for cross disciplinary collaboration between diverse fields such as archaeology, ecology, natural history, cultural history, arts, and storytelling, within the context of geoconservation. In New Zealand to date conservation awareness and management has predominantly focussed on the biotic elements supported by the abiotic nature and their ecosystems. The non-living foundations of the ecosystems, and their connection to human society, has not been treated in a holistic geosystem approach yet in New Zealand.

Acknowledging our abiotic environment as the foundation on which all other aspects of our environment rest, and as sustaining and shaping human society, we bring a holistic and integrated philosophy and methodology that will benefit conservation, strengthening relationships between geodiversity and biodiversity, promote the value of geodiversity to society, and highlight threats to its existence. The newly established Trust aims to act as a conduit of knowledge and action along the following key objectives: 1) Recognising principles of geoethics, geodiversity, and geoconservation as necessary in building a sustainable and low-impact framework for protecting New Zealand’s unique, fragile, and world-class geological features within a culturally and environmentally rich landscape; 2) Establish a hub of resources, technology, and expertise in, geology; palaeontology; archaeology; indigenous knowledge systems; sociology, history, land use, law, and communications; 3) Engage in research, education, art, storytelling, recreation, and other activities to develop and share principles and practice of geoconservation for sustainability and to support community-based whanaungatanga (establishing relationships and kinship); 4) Promote scientific and systematic assessment of geoheritage inventory; shaping policy in conservation, education, tourism, land management and kaitiakitanga (stewardship) and recognise Aotearoa New Zealand’s role as a Pacific nation in promoting geoheritage locally, regionally, and globally.

LESSONS FROM THE 15TH JANUARY 2022 HUNGA TONGA-HUNGA HA'APAI CATASTROPHIC EXPLOSIVE ERUPTION FROM GEOHERITAGE, GEOEDUCATION AND GEOCULTURAL PERSPECTIVES

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Thursday** Presentation Time: **2:10:00 PM**

Presentation Number/Poster Group: **22**

ABSTRACT:

The 15th of January 2022, Hunga Tonga-Hunga Ha'apai hydrovolcanic explosive eruption in Tonga quickly became a headline story across the globe. The eruption generated atmospheric pressure waves recorded multiple times everywhere on Earth, triggered a tsunami and injected highly fragmented particles up to 55 km height. The eruption lasted about several hours, with a dozen of individual large blasts causing lighting “show” recorded by satellites. The consequences were devastating to the local community. The tsunami also felt across the Pacific. The impact of the eruption was truly global and comparable to the Krakatau 1883 eruption. The question naturally posed, what geoheritage elements created and preserved after the eruption. First reports confirmed that while the fine ash covered lands about 100 km from the source, most of them were thin (mm-cm thick). This indicates that it is unlikely that any major section will be preserved even after few years of the event. Most of the ash fell to the Pacific leaving no visible mark of this catastrophe. Unluckily, the proximal region has also been destroyed leaving no geoheritage elements to be accessible. This is a major problem, as human societal memory commonly keeps major catastrophic events in the mindset of communities only over few decades even if there are significant product preserved. Without “visible” geoheritage elements, this time will likely be much shorter. However, geocultural elements (oral traditions or cultural activities) are likely keep similar information within the local communities. Hence now it is important to trace and explore them through a mix of traditional and western approaches of community engaged activities. The Pacific, however, experienced several similar large-scale eruptions in historic times, and few of them preserved geoheritage elements such as those superb sections of the AD 1452-53 Kuwae eruption in Vanuatu. While these sites are locally known, their appearance and their geological context are not evidently and immediately considered as part of a major volcanic system as human perception about volcanoes commonly associate them with large conical mountains. Such visual scene doesn’t fit to the common near-sea level/shallow subaqueous caldera-dominated systems such as the recent Tonga event. To achieve a better understanding of the local communities of this type of geohazards, the geoheritage and geoeducation values of those rare geosites increases significantly.

FIRST DETAILED REGIONAL SCALE GEODIVERSITY AND GEOHERITAGE ASSESSMENTS OF CENTRAL KARAKORAM NATIONAL PARK (CKNP) AND ADJACENT AREAS, NORTH PAKISTAN; MULTIPLE CONSTRAINS FORM FIELD EVIDENCES AND PETROLOGY

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Thursday** Presentation Time: **2:15:00 PM**

Presentation Number/Poster Group: **23**

ABSTRACT:

This study was conducted on the petrology and geoheritage assessment of Central Karakorum National Park and surrounding areas. The CKNP is the world's highest geoheritage site pocessing around 60 peaks which have height of over 7 thousand meters, and contains the ten most famous and world highest mountain peaks including K-2 (world second highest peak), and 4 have heights more than 8000.0 meters. The geosites which were encountered in the study area are; 1) Geomorphological Site, 2) Tectonic zones, 3) Mineralogical sites, 4) Geo-visiting sites, 5) Archaeological site. These sites are analyzed based on the different procedures adopted by different researchers and data collected during the field observation. The result achieved from the analysis is that all the geoheritage sites have values greater than sixty percent out of their total calculations in different sites. And the 2 sites running between 60% and 70%, like geomorphological sites and archeological sites, and the other remaining geoheritage sites have a value greater than 75%. The geoheritage sites which have high potentials are Tectonic sites, mineralogical sites, and geo-tourism sites. Tectonic sites of CKNP have scored more than 80%, which is assigned as the highest site for geoheritage points of view. From the critical observation it is assumed that, except archeological sites, all the other geoheritage sites have the highest values (based on scientific values). The highest score is 100% in ‘scientific values’ which is attain tectonic site. In ‘educational value’ tectonic and mineralogical sites gain high marks while the archeological sites gain fewer values. In ‘economic values’ the geo-tourism and archeological sites attain the highest value.

GEO'NLINE EDUCATION DURING THE COVID-19 PANDEMIC IN HATEG COUNTRY UNESCO GLOBAL GEOPARK

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Thursday** Presentation Time: **2:20:00 PM**

Presentation Number/Poster Group: **24**

ABSTRACT:

In the Hateg Country UNESCO Global Geopark, the restrictions imposed by the COVID 19 pandemic brought geoeducation from the field to online. This significant change in our approach to passing on information about Geopark has produced outstanding results. We have managed to reach and work with many students simultaneously. We also managed to bring personalities from the scientific world in Romania in front of the students. Both situations would have been almost impossible to achieve under the pre-pandemic conditions. In the Hateg Country, there are 12 municipalities, each of them with primary and secondary schools. We have created several online programs dedicated to students from these schools. We aimed to maintain students' high interest and creativity on issues relating to geodiversity, biodiversity, cultural heritage, and education for the community. ABCDino was the online program dedicated to primary schools. Students could learn about the dwarf dinosaurs of Transylvania, creating themselves stories whose main heroes were those unique dinosaurs. Read heritage was another project dedicated to the primary schools from the Geopark and another Romanian UNESCO designation. Students had to discover local legends related to local geology and natural or cultural heritage and present them to their colleagues. The project created an interactive experience exchange and an online celebration of UNESCO heritage. EduGeopark Science School was an online project dedicated to secondary schools' students and teachers. In each edition, a Romanian scientist was invited to discuss subjects like the history of Planet Earth, astronomical observations, dwarf dinosaurs, the presence of celts in the area, or butterflies of the Geopark. For more challenges, each scientist's presentation was preceded by a presentation on the same subject sustained by the students from one of the Geopark's schools. We have also paid attention to education for the community. We brought in front of secondary schools students important experts in combating fake news. They help students understand the phenomena of fake news including in science and how to be aware of it using fact-checking. All the programs were interactive, and they offered access to more than 400 students and teachers to the best quality information and the possibility to speak directly with specialists. In addition, the programs help us to continue activities in the field at a higher level of information than ever before.

SUSTAINABLE DEVELOPMENT GOALS IN ROMANIAN GEOPARKS

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Thursday** Presentation Time: **2:25:00 PM**

Presentation Number/Poster Group: **25**

ABSTRACT:

Geoparks are territories where geological, natural and cultural heritage is managed in a sustainable way promoting, protecting, conserving and educating the public about its values. Geoparks are bottom-up approaches emphasizing the participation of the local community in development initiatives. The geoparks encourage community's ownership, and commitment to the development of projects aiming the sustainable use of natural and cultural resources for wellbeing.

In 2015 the United Nations adopted Agenda 2030, which includes 17 Sustainable Development Goals and 169 targets. Their purpose is to guide the actions of the signing states to a coherent sustainable development which relates to the wellbeing of the people, planet, to prosperity, peace and partnerships (sdgs.un.org).

Geoparks as part of the UNESCO Geoscience and Geoparks Program are promoting and sustaining the 2030 SD Goals as common objectives for all members. The number of territories in the Global UNESCO Geoparks Network is brought to 169 in 44 countries and very soon 177 from 46 countries. All these territories are implementing the Sustainable Development Goals according to their specific, in order to better accomplish their sustainable development purpose.

In Romania, the two UNESCO Global Geoparks and other aspiring geoparks are working as a national network to promote the 17 SDGs through their actions, from hands-on activities to reaching the community and creating durable partnerships on a national and international level. During the Covid-19 pandemic Romanian geoparks showed resilience and focused on developing projects related to education and environment protection sustainable development goals, strengthening existing partnerships and building new bridges within community and between different communities.

GEOTOURISM DEVELOPMENT AROUND GEOHAZARD PRONE AREA OF SUOH, WEST LAMPUNG REGENCY, SUMATRA, INDONESIA

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Thursday** Presentation Time: **2:40:00 PM**

Presentation Number/Poster Group: **26**

ABSTRACT:

West Lampung Regency is known for the frequent earthquake along the Great Sumatran Fault in the south-eastern part of Sumatra Island, where Suoh area is currently being proposed to be aspiring geopark in the future. Sumatra Island is located in the active margin of Eurasian plate and prone to the subduction zone of Eurasian and Indo-Australian plates, where the Great Sumatran Fault lies NW-SE along the island. This region has undergone frequent geohazard, such as earthquakes, tsunamis, volcanic eruptions, floods, and landslides, due to its tectonic and geological setting. This study has aimed to assess the potential geotourism development around Suoh area despite its geohazard condition. Methodology in this study consist of geomorphologic analysis of surface features through remote sensing and GIS techniques. Field work was carried out to examine the variables related to parameters of geotourism development. Parameters gained from desktop study and field data are used as technical concerned for this aspiring geopark, which is predicted to have more visitors despite its vulnerable condition to geological hazards. Results from this study showed that Suoh area is tectonically characterized by the feature of pull-apart basin. Its geomorphological features consist of fault lineaments, triangular facets, and steep fault scarps. Several fault related lakes and hotspring craters are found, namely Keramikan, Nirwana, etc. These unique geological phenomena such as scenic views of mountains, valleys, and lakes as well as hotspring craters are being exploited to attract more visitors in the frame of aspiring geopark. Several aspects of geotourism development such as accessibility, amenity and safety are currently underway to develop by local government of West Lampung Regency. This study area has also potential biodiversity under the management of National Park of Bukit Barisan Selatan (TNBBS), where Suoh area has an attraction of frequent elephant migration. The combination of geodiversity and biodiversity in the study area is potential for geotourism development leading to the establishment of national geopark in the future.

PROMOTION OF GEO-TOURISM IN IRON SMELTING SITES OF SAMANALAWEWA, BALANGODA, SRI LANKA

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Thursday** Presentation Time: **2:45:00 PM**

Presentation Number/Poster Group: **27**

ABSTRACT:

In the tourism sector of Sri Lanka, terms such as geo conservation, geo-diversity, and geo-tourism are novel. Implementation of the required strategies to promote the geo endowment of Sri Lanka has the potential to enhance international recognition. This study was carried out along with a proposal for the implementation of the geo-tourism site focusing on the wind-powered iron smelting sites in Samanalawewa, Balangoda, Sri Lanka. The uniqueness, distinct culture, natural splendor, and the well-known hospitality of this area makes it an ideal tourist destination. Many tourists are attracted to the area mainly due to the ecotourism or the natural splendor of the entire Belihuloya region. The awareness among both local and foreign communities on the specific geological site is poor thus gaining less attention from the visitors to the area. Similarly, the information gathered during the field excursions shows that there is a high potential to initiate the industry and bring back the global recognition that existed earlier.

The remnants of the iron smelted sites are found even today. The sites have been even scientifically investigated with the intervention of foreign scientists for the uniqueness of the techniques used. The industry is believed to have prevailed with the interconnection of geomorphology, community and the technological aspects. It has proven the use of unique geomorphology of the area to acquire the perfect wind direction to power the furnaces. The significance of the industry was found to be remarkable since well-known Damascus steel has been exported from Sri Lanka. This steel is recognized as a special type due to the properties given to the tools or weapons made. Till today the story behind the wind-powered iron smelting in the Samanalawewa area and the evidence that persisted are bound to the community of the area and not revealed outside. Most of the areas are defunct today and the villagers have dropped their interest in the field.

Thus, the conveyance of the awareness to the people out and emphasizing the importance is identified as a key requirement with the prevailing invaluable geological assets. With a view to achieving this objective, an investigation was done and a management plan is proposed consisting of the collection of information from documented records, preparation of the maps, field visits to a selected site of interest, preparation of the management plan and the designing of sightseeing guide.

“GUIDE OF THE PORTUGUESE GEOLOGICAL AND MINES SITES” – A PORTUGUESE EDUCATIONAL AND TOURIST PLATFORM

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Bernardo Lemos Guide of the Portuguese Geological and Mines Sites

Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Thursday** Presentation Time: **2:50:00 PM**

Presentation Number/Poster Group: **28**

ABSTRACT:

The “Guide of the Portuguese Geological and Mines Sites” is a platform for the dissemination and promotion of the mining and geological heritage of Portugal, promoted by Portuguese Directorate-General of Energy and Geology (DGEG), the Mining Development Company (EDM) and 41 other public and private institutions, such as municipalities, associations, universities, polytechnic institutes, foundations and public and private companies. This initiative aims to contribute to local development, through the protection and enhancement of the heritage and the promotion of scientific knowledge.

The online platform brings together +/- 150 sites with mining or geological relevance, including museums, interpretation centres, science centres, geoparks, mines and places of geological interest. These sites have recreational, cultural, pedagogical and scientific relevance and have, as an essential requirement, to provide a minimum of basic conditions for educational or tourist visits. The platform provides for each site, a general description, scientific information, logistical data and tourist information that support the preparation of the visit. Visitor can choose the areas or the sites to visit and there arealso pre-defined thematic routes, at regional and national level, such as the Wolfram Route, the Geoparks Route or the Roman Gold Route, among others.

Every year the “Guide of the Portuguese Geological and Mines Sites” produces the Guide "Educational services and school visits", a specific tool for teachers, compiling all educational activities about topics, related to Geology, Geodiversity and Mining Resources. This eBook includes online and face-to-face resources with didactical and technical information, supporting teachers to prepare visits, within the framework of the school curricula.

Over the last 13 years, great efforts have been developed by all the institutions and partners together, to engage society with these topics, and thus contribute to local development, especially in low-population areas, where current environmental challenges are posed with great acuity. Also constraints on classes and school visits, as well as tourist activity, over almost 2 years, due to the COVID-19 pandemic, forced this networking platform and all the partners to seek new solutions to promote mining and geological heritage in Portugal.

GEOTRAILS IN THE MAIELLA UNESCO GLOBAL GEOPARK : THE GUSTAV LINE TRAIL, THE MINERS' TRAIL AND THE RUDISTS URBAN TRAIL, THE STRONG LINKAGE BETWEEN GEOHERITAGE AND INHABITANTS IN THE PARK TERRITORY DURING TIMES

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Thursday** Presentation Time: **2:55:00 PM**

Presentation Number/Poster Group: **29**

ABSTRACT:

The Maiella UNESCO Global Geopark is characterized by high geodiversity and geoabundance indices, comprising ninety-five geosites, twenty-two of which are of international interest (Ruban, 2010; Liberatoscioli, 2018). It includes thirty-nine municipalities, mainly mountain villages, that led to a strong linkage between human and landscape during time. Signs of human settlement trace back to the Palaeolithic Period in the Giumentina Valley geosite (Demangeot J. & Radmilli M.A., 1953; Nicoud et al., 2016; Villa et al., 2016). The Maiella UGGp is playing an active role in the economic development of the territory, by designing new trails related to the linkage between the geological heritage and humans during time in the park territory. The new routes will be about the Second World War, the Maiella Mining District and the Geosite with rudists in Fara S. Martino (Ch). The first one will include the territory of five municipalities along the Gustav Line, a German defensive system built at the end of 1943 (Garzarella et al., 2019), in the Park area. The project aims to track an integrated tourist trail, not showing exclusively historical facts, but combining them with other disciplines, such as military geology, nature and culture. The second one will tell the story of the oil extraction in the northern sector of the Maiella UGGp (Lipparini et al., 2016). It was first opened in June 2021, during the XIII National Day of Mines, to retrace the paths used by miners until 1956, and will be updated with new panels in future. The third one will be about the "Fara San Martino rudist paleontological site". The rudist site is related to the Urgonian facies (Lower Cretaceous). During time, the inhabitants of the valley sourced from it for building material, ignoring its scientific importance: the old town walls are made with blocks studded with rudists. The urban trail will allow to explore the area from a geological point of view, integrated with art, culture and food. Moreover, it will be possible to observe the Urgonian facies "inside" the town, avoiding reaching the outcrop in the mountain, to better protect and conserve it. Inside the information centers and museums in the involved municipalities, digital and interactive stations will be set up, by using 3D technologies, Augmented Reality and Oculus quest headset, thus making knowledge of the Maiella UGGp geoheritage and culture also accessible to poor health and disabled people.

GEOFOOD: GEOSCIENCE, GEOEDUCATION, GEOTOURISM AND SUSTAINABILITY

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Presentation Format: *Flash Talk (5 minutes, maximum of 3 slides)*

Presentation Day: **Thursday** Presentation Time: **3:00:00 PM**

Presentation Number/Poster Group: **30**

ABSTRACT:

IGCP Project 726 “GEOfood for Sustainable Development in UNESCO Global Geoparks” was approved in March 2021 by the UNESCO International Geoscience Programme (IGCP) and it officially started in May. Of the 18 applications approved this year, the UNESCO International Geoscience Programme Council awarded GEOfood the "Special Prize", for its special relevance. Under the topic «geoheritage for sustainable development», the project focuses on the connection between geoheritage, geodiversity, ecosystem services, food production and sustainable development, through the implementation of an innovative brand - GEOfood. Nowadays, this project involves 53 partners: the research is essential to understand the local identity of a UGGps in all its cultural, social and economic aspects (use of natural-geological resources) and will guarantee to reach inhabitants, local producers, consumers, delivering the message about the necessity of respecting the environmental and geological resources in connection with the provisioning ecosystem services. UNESCO Global Geoparks (UGGps) are single, unified geographical areas where sites and landscapes are managed with a holistic concept of protection, education, and sustainable development. In the last 20 years, the concept and work of UGGps has changed the way geology and geoheritage is seen by the public.The geodiversity within each UNESCO Global Geopark influences the authentic variety of food products which characterize UGGp territories around the globe: local products are a structural factor in the development of rural territories. GEOfood is now a registered copyrighted brand owned by Magma Geopark (Norway) for local food, producers and restaurants working inside an UGGp, including 31 territories in 20 Countries. Therefore, GEOfood was created as an international movement that promotes the connections between local food and geological heritage and its link to people's livelihoods, which makes consumers aware of the strong relationship between food production and local geodiversity. It enhances and fosters the use of local products and contributes to the development of the local communities and rural areas, the reduction of inequalities, food waste and CO2 emissions and therefore contributes to the valorization of food along the production-transformation-distribution-consumption channel. www.geofood.no

POSTERS

GEODIVERSITY, GEOCONSERVATION, AND GEOTOURISM IN CENTRAL AMERICA

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Presentation Format: *Poster*

Presentation Day: **Monday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **A**

ABSTRACT:

Central America is located in a dynamic region where tectonics and volcanism together with the tropical climate and its diverse vegetation have shaped the landscapes. Our main objective is to review the status of the geodiversity, geoconservation, and geotourism in Central America. We will identify the region's geomorphic environments and geodiversity using classic regional geomorphology mapping techniques. Likewise, using touristic maps and webpages we identify the most prominent geosites of different origin in Central America. Moreover, we will explore the national environmental policies, natural conservation systems, and tourism initiatives to promote their national geoheritage through geotourism. We found that volcanic, coastal, karstic, glacial, and fluvial geomorphic environments are the most common in the region. In addition, we identified 393 geosites of volcanic, coastal, karstic, glacial, fluvial, and archeological origin in Central America. The promotion of geoheritage, its geodiversity, geoconservation and thus the development of geoparks are excellent opportunities to promote sustainable development, sustainable lifestyles, appreciation of natural and cultural diversity, and the promotion of peace. These results may prove important to spread information about geoscience widely to decision makers on geotourism and conservation in each country and the stakeholders of the region. Geoheritage studies in tropical and developing countries such as those in Central America should be improved and a priority for due to the geomorphological dynamics and strong anthropic pressures on their geo- and biodiversity, to increase their income through geotourism, especially among the less favored communities and avoid affecting their already threatened natural resources.

THE GEOLOGICAL AND CULTURAL DIVERSITY OF BZOU (M'GOUN REGIONAL GEOPARK): A GEOTOURISM POTENTIAL TO PROMOTE FOR LOCAL DEVELOPMENT (CENTRAL HIGH ATLAS OF MOROCCO)

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Presentation Format: *Poster*

Presentation Day: **Monday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **A**

ABSTRACT:

In the last twenty years, the term of geotourism has started to get more interest, essentially as a patrimonialization process of any exceptional geological and geomorphological object and a tool to present the regional geodiversity. Indeed, Bzou is a small town located in the North-Western part of the Central High Atlas on relatively low peaks and near the road from Beni Mellal to Marrakech. It has great potential for the development of geotourism as it is home to a geological, biological and cultural heritage with many areas of exceptional value. Thus, it includes the Tamda lake with its marvellous travertine concretions, exposed stratigraphic sections, chevron folds, synsedimentary faults, doleritic basalts, attractive caves as well as angular unconformities; this geoheritage attests the post-Hercynian sedimentary evolution of the Central High Atlas .In addition to the geological heritage, the study area is also home to a precious cultural heritage which characterises the Heskoura tribe, it includes the Zaouia (religious building) of Sidi Sghir Ben Lmeniar, the traditional stone houses as well as Lmellah and the Jewish cemetery. The intangible heritage includes ancient crafts, related to pottery and textiles. The study area is crossed by the Oued El Abid, thus providing a fertile ground for the development of different plant species within a diversified ecosystem.

Despite all these opportunities, this heritage remains unknown to the general public and decision-makers, even though it offers a good means of meeting the economic, social and environmental objectives of the local population. To address this issue, the sites of interest in the study area were identified and evaluated with a view to promoting them as geotourism routes. The evaluation of the inventoried sites revealed important scientific values combined with a high cultural and historical value. The conditions for visiting are very good with improved accessibility and tourist offer.

ENVIRONMENTAL QUALITY AND GEOTRAIL TOURISM POTENTIAL IN THE PROPOSED GEOPARK COSTÕES AND LAGUNAS OF RIO DE JANEIRO (BRAZIL)

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Presentation Format: *Poster*

Presentation Day: **Monday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **A**

ABSTRACT:

The debate on environmental issues is increasingly important. There is an urgent need to reflect on our relationship with the environment, specifically, on how to carry out sustainable management, including conservation. Despite this, the approach adopted in nature conservation is still more related to the protection of biodiversity than geodiversity. One way to promote geodiversity and geoconservation is to carry out geotourism activities based on trails. This research aims to evaluate the environmental conditions and the geotourism potential of the a geotrail (trail in a geosite) called Farol da Lajinha, in Cabo Frio Municipality, in the proposed consolidation area of the Geopark Costões and Lagunas of Rio de Janeiro, Brazil. For that, the Rapid Trail Assessment Protocol (PAR-T) was applied, whose parameters are established to assess the degree of integrity of the trail, considering aspects such as: width of the trail bed, mass movements and or loss of critical edge, slope, floor situation, handling structures, human impact, among others. According to PAR-T, the geotrail was divided into thirteen sections due to the differences in environmental conditions. Good conditions were observed in the first sections. The following sloping sections present points that need management structures and adaptations. The geotrail demands attention on the width of the trail bed, sinuosity and management structures, especially where there are erosive features. In addition to this assessment, the Potential of Tourist Use of the (Geo)Trail (PUTT), created to be evaluate geosites, was applied to a geotrail. The results indicate high potential in the sections of rising to the Boca da Barra Natural Viewpoint and arrival at the Lajinha Lighthouse. From this, it was possible to carry out an integrated diagnosis of the environmental quality of the geotrail and its geotourism potential. It is noteworthy the existence of sections with high geotourism potential, but not good environmental conditions. Therefore, recommendations were proposed to improve the conservation status of the geotrail, promoting a better user experience and safety, as well as its environmental integrity. e The combination of the two methods allows an integrated vision of the potential for local geotouristic use by means of trails, in a complementary way, and constitutes one more supporting tool for managers in areas of special geological interest.

CONSERVING NATURE'S STAGE PROVIDES A FOUNDATION FOR SAFEGUARDING BOTH GEODIVERSITY AND BIODIVERSITY IN PROTECTED AND CONSERVED AREAS

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Presentation Format: *Poster*

Presentation Day: **Monday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **B**

ABSTRACT:

We outline the fundamental connections between geodiversity and biodiversity by providing a geoconservation perspective on the concept of "conserving nature's stage" as a basis for safeguarding both geodiversity and biodiversity in the face of environmental and climate change. Conserving nature's stage — the physical environment in which species exist — provides a means of developing more integrated approaches to nature conservation, delivering benefits for both geodiversity and biodiversity conservation, and incorporating key principles of geoconservation in the management of protected and conserved areas.

The publication that is the basis of this presentation was published in a Parks Stewardship Forum special issue, Jan 2022, volume 38 (1), pp. 46 - 56.

OBLIGED AND RESPONSIBLE – GEOSCIENTISTS' ROLE IN PLACEMAKING, CONSERVATION AND SUSTAINABLE DEVELOPMENT

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Presentation Format: *Poster*

Presentation Day: **Monday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **B**

ABSTRACT:

A remote desert town overlooking the largest erosional crater is embracing the values and concepts of UNESCO Global Geoparks. By promoting geo-conservation, geo-education and geo-tourism and by celebrating the intricate human-nature heritage, this community hopes to reconnect people to nature and protect its unique environmental values. The only local scientific institute actively working with local authorities and the community is the Dead Sea and Arava Science Center (DSASC) – an independent rural research institute. The DSASC fosters and leads regional research and environmental monitoring, it promotes science in education and community programs and it provides insights and guidance to local and national authorities. Since 2015, DSASC geoscientists, together with local leaders, have spearheaded an initiative to establish the Negev Craterland Geopark. However, in some cases, our obligations to local and national authorities clashed with responsibilities towards their local and global communities.

The talk will present research and outreach activities that strengthen community awareness to geodiversity and geoheritage and foster involvement in geoconservation and sustainable development. The talk will also present community achievements in protecting and promoting the unique geoheritage and landscape of the Negev Craterland. As scientists, our commitment to provide society with knowledge and insights mustn't be constrained by specific agenda and funding of authorities and stakeholders. Earth scientists are obliged to represent the Earth and its processes, based on their research, in a way that reflects an intrinsic responsibility towards society (and future generations), the local communities that look up to them and the global scientific community which they represent. This commitment requires that stakeholders and funders of research understand the broader responsibilities of the scientific community. This is true for geoscientists and environmental scientists, as much as for scientists of computer, social and medical studies.

GEOPATH OF RESTORED LAVA OUTCROPS FOR THE CONSERVATION OF GEODIVERSITY, ECOSYSTEM SERVICES AND BIODIVERSITY IN CIUDAD UNIVERSITARIA, MEXICO CITY

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Presentation Format: *Poster*

Presentation Day: **Monday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **B**

ABSTRACT:

The ecological restoration of geosites in urban areas can raise awareness on environmental issues and conserve remnants of the natural landscape to inform about geohazards. The central campus of the Universidad Nacional Autónoma de México (UNAM) in Mexico City preserves some elements of the local geoheritage associated with the pristine basaltic pahoehoe lavas of Xitle volcano. Only 30% of the 80 km 2 lava field is still cropping out, a large part of it (270 Ha) in UNAM's ecological reserve. Within the campus but outside the reserve there are localized outcrops of this lava field called "pedregales" which preserve features of the original ecosystem but are vulnerable due to the lack of knowledge of the community about their value.

We identified four "pedregales" with potential for conservation and restoration that are adjacent to the Geology, Geophysics, and Geography research institutes. They cover a total area of 6863 m 2 and may be linked by a geopath. Field mapping allowed determining their diversity in lava morphological structures (tumuli, lava rises, lava rise pits, skylights), indicators of their use as corridors by fauna (excreta, species pollinated by bats, etc.) and their relative abundance in native flora species (e.g., Pittocaulon praecox, Echeverria gibbiflora) with respect to exotic and invasive ones (e.g., Pennisetum clandestinum, Ricinus communis, Leonotis nepetifolia). In addition, the main threats were identified (domestic and garden waste, use as a public bathroom, shelter for indigents) and the ecosystem services that these spaces provide were evaluated (infiltration potential, carbon capture, pollination services, aesthetics, etc.).

The results allow defining the geosite potential of each one of the “pedregales”. A management plan is proposed that considers measures to mitigate the threats they present. All this information is used to develop a restoration strategy and a proposal to integrate them into a network of university geopaths. In the future, it is expected that these spaces will be rehabilitated for a better scenic and functional use, conserving all the ecosystem services they present. Thus, the people who visit the campus will have access to beautiful, recreational and safe natural spaces providing them with environmental and geoscience education. This type of initiative, which involved researchers and students, allows to improve the well-being of the university community.

MINERAL COLLECTING AS A DEGRADATION RISK, A CASE STUDY FROM MEDIEVAL GOLD-SILVER MINING AREA, TELKIBÁNYA HUNGARY

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Presentation Format: *Poster*

Presentation Day: **Monday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **C**

ABSTRACT:

The geological resources as important assets of geotourism might be seriously damaged by collection of rocks, minerals, and fossils by geo-amateurs which has become a very popular activity in the last decades. The surface and underground excavation possibilities are limited in most cases by state laws and other nature conservation regulations. In Hungary, the organized amateur collecting started in the 1970's. The continuous increase in the number of mineral collectors resulted in establishment of a national, site-based compilation in 2007 (geomania.hu).

The study area is located in theMiocene volcanism (15-9.6 Ma, andesite, dacite, rhyolite) associated with hydrothermal alteration (silicification, potassic, argillic, etc). The Au-Ag deposits are connected to a low sulphidation type epithermal N-S striking ore veins (0.5-2 m wide). The most common mineral species are quartz varieties (amethyst, chalcedony), sulphides, sulphates and other small Au-Ag minerals (native gold, acanthite).

Currently, the area is frequently visited by the collectors. The geoconservation survey of mining sites started in 2015 under the coordination of the Aggtelek National Park. Additionally, an extensive field campaign was carried out at a scale of 1:1000 in 2018 covering more than 20 km2. The individual site mapping identified 6 larger medieval pit field (Kánya, Sinta, Fehér, Joó, Veresvíz, Gyepű) in the study area with an extent of 0.04-0.9km2. The survey recorded primary medieval mineral excavation sites (over 1000 pits) and the recent mineral collecting disturbances (<10% of pits).

The most intense disturbance was identified at the top of Kánya and Sinta Hill following the N-S striking ore veins. The largest excavations are 50-70 metres long, 25-40 meter wide and 0.5-2m deep. The excavations haunted the quarzitic waste rock material from the medieval mining. At certain regions, the medieval anthropogenic geomorphology was completely destroyed, and a secondary disturbance region was created. The recent vegetation is represented by a woody cover (oaks, limes, maples). The root zone of the trees has suffered significant damage. Several have dried out as a result of root cutting. Losing their support, they have fallen to the ground which are a problem for forest

owners. Some mineral species have been almost completely removed from natural occurrences. This underlines the importance of site-based protection and continuous control on geotourism based disturbances.

THE ROCK COLLECTION FROM THE AMAZON STATE IN THE MUSEUM OF EARTH SCIENCES (MUSEU DE CIÊNCIAS DA TERRA – MCTER), BRAZIL – THE INITIAL RECORDS OF THE AMAZON GEODIVERSITY.

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Presentation Format: *Poster*

Presentation Day: **Monday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **C**

ABSTRACT:

The collection that is currently housed in the Museum of Earth Sciences/Museu de Ciências da Terra (MCTER), located in the Urca neighborhood, city of Rio de Janeiro, Brazil, began to be organized by the North American geologist Orville Adelbert Derby. The museum's rock collection has 12,500 samples, collected since the beginning of the 20th century by great precursors of Geology in Brazil, belonging to the Geological and Mineralogical Survey of Brazil (SGMB), created in 1907, and to the later National Department of Mineral Production (DNPM), created in 1934, which replaced the old geological survey. Currently, the rock collection is under the tutelage of CPRM – Geological Survey of Brazil, and little has changed in terms of arrangement, in a large exhibition hall, boasting cabinet furniture, consisting of shelves, windows and drawers. The rock collection became a record of the work of pioneer geoscientists, graduates of the Ouro Preto School of Mines/Escola de Minas de Ouro Preto (EMOP), created by Claude Henry Gorceix in 1876. Ouro Preto instructed the new mining engineers of the time, and until the 1930s, they were very close to the Geological and Mineralogical Survey of Brazil, and contributed greatly to the development of Brazilian geology. Some of these geocientists from the Ouro Preto school stood out as pioneers of the Amazonian territory in the early 20th century, contributing with the first geological records and also with the formation of this historic rock collection, representing the until then inhospitable Brazilian state, Amazonas. These geologists were: Avelino Inácio de Oliveira, Pedro de Moura, Glycon de Paiva, Luís Felipe Gonzaga de Campos, Euzébio Paulo de Oliveira, Odorico Rodrigues de Albuquerque and Paulino Franco de Carvalho. The rock collection from the state of Amazonas has 163 rock samples, distributed in 7 drawers in the exhibition hall. The organization and digital systematization of this collection data was made possible through the development of a digital cataloging system, created by MCTER in partnership with the geoprocessing division of CPRM, which gathers photographs and data about this collection of rocks, as well as their collectors and its location in the Brazilian Amazon, allowing us to glimpse the ancient paths of these geologists and the lithological types sampled over the years, being a rich geodiversity record of the Amazon territory and a good example of ex situ geoconservation over more than a century.

PROMOTING THE GEOHERITAGE OF "EL FÓSIL", A LOCAL COMMUNITY MUSEUM, IN BOYACÁ, COLOMBIA, SOUTH AMERICA

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Presentation Format: *Poster*

Presentation Day: **Monday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **C**

ABSTRACT:

Museo El Fósil preserves an important collection of fossils, including two holotype or reference specimens, from the Lower Cretaceous of Colombia: the marine reptile Monquirasaurus boyacensis and the dinosaur Padillasaurus leivaensis, the most complete yet discovered in Colombia. The museum also holds numerous specimens of ammonites, fish, bivalves, other marine reptiles, plants, as well as some rock and mineral specimens. Monquirasaurus boyacensis was discovered in 1977 and has become known as 'El Fósil' ("The Fossil") of the region, from which the name of the museum is derived. Museo El Fósil preserves locally, regionally, nationally, and internationally important specimens of scientific, cultural, and educational value. Most of the fossils are derived from the Paja Formation Lagerstätte exposed in the Ricuarte Alto region around Monquirá, which includes the towns of Sachicá, Sutamarchan and Villa de Leyva, in the Departamento de Boyacá, Colombia. Museo El Fósil has a major impact on the region, which is an important tourist destination for both Colombians and international visitors.

Starting in 2011, Universidad de los Andes and the Servicio Geológico Colombiana began developing a relationship with partners in the Ricuarte Alto, with the intention of developing research and teaching resources in one of the most geologically rich regions of Colombia. With the implementation of Presidential Decree 1353, on 31st of July 2018, relating to the protection of Colombian National Geological and Palaeontological Heritage it became increasingly imperative to work closely with local community, starting with existing partners such as members of the Junta Acción Comunal (JAC) of Monquirá, which runs Museo El Fósil. We used these links to develop greater community understanding of the importance of, and pride in, the local and regional geological and palaeontological heritage, and to promote museological best practice. Amongst other benefits, this work has resulted in increased investment in museum infrastructure, increased visitor numbers and revenue for Museo El Fósil (income which is used to directly benefit the local Monquirá community), improved conservation, display, long-term preservation, and re-description of "El Fósil" itself. In addition, Museo El Fósil now acts as an ambassador for geological and palaeontological heritage in the regions and expounds museum best practice to other local and regional museums.

NEOGENE-QUATERNARY MEGAFAUNA REGISTRY IN THE CAMINHOS DOS CÂNIONS DO SUL UGGP (SOUTH BRAZIL): IDENTIFYING SITES WITH EXCEPCIONAL PALEOGEOGRAPHIC VALUE.

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Presentation Format: *Poster*

Presentation Day: **Monday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **D**

ABSTRACT:

The Caminhos dos Cânions do Sul (CCGS) UGGp, located in the south of Brazil, has an area with 2824 km². Inside its territory can be found geodiversity sites from geological, geomorphological, hydrological and others to be valued, like the various occurrences of paleoburrows and possible crotovines. The paleoburrows/crotovines are bierosive features excavated by Big and Megafauna animals, from Neogene to Quaternary, when these animals were extinct. The animals listed like the producer of such excavations are the species commonly knows as Giant-Groundsloths and Giant-Armadillos from the Xenartros Superorder. The importance of paleoburrows and crotovines of the CCGS territory remain the fact of them indicating expressive environmental changes, disclosing part of environmental history of territory. For treating a theme less explored yet, the characterization of these forms of research are incipient. This research has the objective of identifying and listing the new paleoburrows from the CCGS territory, trying to provide elements for the understanding of its features and distribution characteristics. Field works were realized for collect measurements of length, height and azimuth. Relevant observations to the geomorphological compartiments and the lithologic units where they are inside were also realized. From the realized prospects, 30 paleoburrows inside the CCGS territory were found, mainly on the Morro Grande city. The paleoburrows are found mainly on the arenites from Botucatu Formation (Jurassic) and subordinately on the weathered substrates of volcanic igneous rocks of Serra Geral Group (Cretaceous), occurring since the Escarpment to the Plateau. Furthermore, there are reports of sedimentary environments of Pleistocene occurrences, at the colluvium-alluvium plain. The concentration of diverse paleoburrows shows the wide occupation of the Megafauna in the CCGS territory, and indicates in the last thousand years the predominance of these habitants in the south of the south American continent. The inventory and classification of paleoburrows and crotovines serves to understand the paleoenvironment of the CCGS, which is valued as geodiversity sites, in addition to having contributed to the dissemination of knowledge.

SOIL HERITAGE INVENTORY IN BRAZIL

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Presentation Format: *Poster*

Presentation Day: **Monday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **D**

ABSTRACT:

The recognition of soil as a non-renewable natural resource on the human time scale has been growing more and more, which has stimulated programmes, projects and practices of soil conservation in Brazil and the world. However, such actions are focused on soil conservation to guarantee a support to plants, especially agricultural crops, and their protection against erosion and degradation. Examples are the establishment of the Global Soil Partnership, the proclamation of World Soil Day (December 5), the International Year of Soils (2015), the Soil Decade (2015-2024), the World Soil Charter, the FAO Voluntary Guidelines for Sustainable Soil Management, the European Commission's Soil Observatory and Brazil's National Soil Programme - PronaSolos. However, soil should also be considered as geoheritage because it helps to uncover and understand the Earth's history through its organizational structure, attributes and location in the landscape. This is the conceptual base of this research that also considers important all other conceptions and proposals related to the other facets of this natural element capable of accumulating multiple functions and values and performing various ecosystem services. This work presents the first soil heritage inventory of Brazil, concluded at the end of 2021, and its bases that can be applied in other countries or areas. Brazil has a robust taxonomic system and a national soil database, which is a fundamental source of information. In this inventory three major aspects of soil heritage were recognized: soil diversity (representativeness and rarity), history of pedology and ex-situ soil heritage. For each aspect, specific criteria were defined to support the identification of soil heritage. The general principles that govern these criteria are largely inspired by those used to establish the scientific value of geoheritage. The inventory includes 298 pedosites representative of the different soil classes in Brazil and 110 pedosites with rare soil attributes. As 24 of these pedosites are also representative pedosites, the soil diversity aspect sums up 384 pedosites. Besides that, 220 pedosites were added considering the 13 Brazilian Soil Classification and Correlation Meetings editions carried out in different regions from 1978 to 2019 representing 40 years of history of soil in Brazil, raising the total to 604 pedosites. Finally, 24 Brazilian organisations with ex-situ soil heritage samples were identified.

DEVELOPING A GEOCULTURAL DATABASE OF QUATERNARY PALAEOENVIRONMENTAL SITES AND ARCHAEOLOGICAL SITES IN SOUTHEAST ARABIA:INVENTORY, ENDANGERMENT ASSESSMENT, AND ROADMAP FOR HERITAGE RECOGNITION

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Presentation Format: *Poster*

Presentation Day: **Monday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **D**

ABSTRACT:

Quaternary Paleoenvironmental (QP) sites in Southeast Arabia are found in landforms such as sand dunes, ancient lakes/riverbeds, and alluvial fans, all of which demonstrate how the region has periodically alternated between wetter and drier conditions. Recent studies have helped reveal the complexity of climatic change across the region at both macro- and micro-scales, and have highlighted the importance of variations in water availability for early human settlement (e.g., Bretzke et al., 2013; Parton et al., 2015). The archaeological relevance of the QP records makes such sites not only important as climatic archives, but also as "geocultural" heritage sites, in which we can study how ancient humans adapted to a changing natural environment. Currently, however, many of these QP sites are under threat or already destroyed, without much consideration for their heritage values.

Acknowledging the importance of interpretation and contextualisation in geoheritage conservation, our project has created a geocultural database with three key features. First, we have made openly available the first comprehensive list of QP sites and their chronological data. Second, we have conducted an endangerment assessment via the analysis of satellite imagery to understand the extent of threat that QP sites face. Third, by including both QP sites and archaeological sites, this database enables chronological and spatial analysis of the relationship between these two types of sites. It can be used as a tool to visualise, analyse, and communicate the geocultural nature of QP sites.

This unique database includes a comprehensive list of 221 QP sites, of which 30 were identified as already destroyed and 34 were identified as under imminent threat. The database also includes 743 archaeological sites, including 44 with radiocarbon dated artefacts/occupational layers. Urban development and infrastructure development are the main causes of QP site destruction; the destroyed sites are concentrated in coastal areas where most cities are located. Spatial analysis demonstrates that about 40% of QP sites are within 200m of major roads and identified a lack of data from the

north-eastern coast (i.e. Fujairah, UAE, Musandam and Shamal al-Batina, Oman) as well as in the south of Oman. Analysis of chronological and spatial relationships between the two types of records provides a powerful tool for the identification of target areas for future research.

STUDIES ON THE GEODIVERSITY OF THE NORTHERN SECTOR OF THESAN MATIAS GULF, RIO NEGRO, ARGENTINA

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Presentation Format: *Poster*

Presentation Day: **Monday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **E**

ABSTRACT:

This work deals with the study of the geodiversity of the northern San Matías Gulf, following the coastline of the province of Río Negro, Argentina. The area of analysis is relatively small, where important geological coexist features that allow us to describe the events that occurred in the Cenozoic that led to the formation of the gulf. The objective is to analyze and assess the geodiversity of the northern coast of San Matias Gulf. The methodology used was based on the sum of partial numerical indices, calculated on different maps that represent the greatest number of geodiversity elements. The Geodiversity Index is obtained from the sum of these partial indices, the latter being the the result of the sum of units and occurrences in units in areas defined by a grid. They were georeferenced under the same reference system (POSGAR 2007, Faja 3) served as input for the different indexes that make up the geodiversity index. As result, 45 squares of 5x5 km each were created. From this grid, the number of structures present in each square was number of structures present in each square, and thus the partial indices were partial indexes. Finally, the partial was summed to generate a single geodiversity index in the study area. As a result, a geodiversity map with a minimum value of 1 and a maximum of 10, ordered in three intervals: Low (1-5), Medium (5-8) and High (8-10).As results, it can be seen that, following the coastal zone, it is the highest index, on the other hand, the zones with the lowest indexes cover the areas with the lowest indices cover less areal extension even smaller than those with average index values. Indexes results in an area of significant geological diversity, in an area that, in the last decades, has consolidated as a tourist corridor in the Patagonian coast. The Geodiversity Index Map of the northern San Matias Gulf shows high values in areas coinciding with the littoral and the Pleistocene littoral ridges associated with the fossil mollusks of the Tegula atra and Anomalocardia brasiliana and a smaller stretch to the east and a smaller section located to the east where eolian deposits (dunes) of fine sands with beachrocks associated by Chama iudica. The sectors of medium values coincide with the tidal plains and and edaphically correspond to aridisols. Finally, the areas with the lowest values of the Geodiversity Index are located in the sectors where the tidal plains of the estuarial system.

GEODIVERSITY OF THE LESSER ANTILLES

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Presentation Format: *Poster*

Presentation Day: **Monday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **E**

ABSTRACT:

The main objective of the presentation is to create a map showing the terrain geodiversity of selected islands of the Lesser Antilles. The study based on the digital elevation model (SRTM), and for the purposes of the analysis, geologically and geomorphologically diverse islands were selected. The acquired spatial data were processed using geoinformation software. The work includes the following steps: from data collection, calculation of nine geomorphometric parameters enabling creation of factorial maps, to creation of a geomorphological diversity map and calculation of a geodiversity indicator for each island. The map created allows the spatial variation of the geodiversity of the islands of the Lesser Antilles to be visualised on a five-degree scale. From the calculated geodiversity indicator, it is possible to determine what degree of geodiversity characterises each island on a three-degree scale by means of a quantitative parameter. The geodiversity indicator satisfactorily differentiates the islands from flat areas (e.g. Barbuda) to islands which are entirely made up of volcanic cones and whose slopes go straight down to the sea (e.g. Saba).

THE COMPARISON SURVIVE CULTURE OBJECT BY DISASTER BETWEEN INDONESIA AND JAPAN

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Presentation Format: *Poster*

Presentation Day: **Tuesday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **F**

ABSTRACT:

The Buildings or objects that are considered sacred by people make them sacred and special because of the influence of these beliefs. These beliefs culminate about religion and matters of holiness. Today things that smell supernatural or something that is not physically visible, are vulnerable to being considered mystical or unreal. In this case, a supernatural thing is considered to show its physical strength in dealing with natural disasters. Indonesia and Japan apart from having a long relationship between countries

turns out to have the same phenomenon as evidenced by the occurrence of Tsunami and Earthquakes in 2004 and 2011 ago. With the Comparative Method, this article will contain (1) Disaster Survivor Object Comparative Table; (2) Object Location Map; (3) Folklore around the object. I believe this article is important to study in strengthening relations between the two countries, especially in terms of the similarity of phenomena and culture. I call this approach “Comparison Survive Culture by Disaster”

THE DIVERSITY OF WATERFALLS IN THE PAGARDEWA AREA, WEST LAMPUNG, INDONESIA AS AN OBJECT OF GEOTOURISM

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Presentation Format: *Poster*

Presentation Day: **Tuesday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **F**

ABSTRACT:

The identification of the diversity of waterfalls in the Pagardewa area, West Lampung Regency, Indonesia was carried out in order to support the West Lampung Regional Government program to realize the Suoh Geopark and its surroundings. The methods used are image analysis, google maps, google earth, and geological field survey activities. The results showed that there were approximately 4 (four) waterfalls (Curug). The location of the waterfall is in the north of the Liwa-Sumberjaya West Cross Road, West Lampung, Indonesia with a distance of 1-1.5 hours away. Access to the location of the waterfall can be reached by car, motorbike, and on foot. The location of the waterfall is in the morphology of the faulted mountains. The constituent rocks are extrusive volcanic rocks. Because the position of the waterfall is in an area with a high level of earthquake vulnerability, the location is good to be used as a geotourism area with the topic of disaster education and the beauty of tropical nature.

CHARACTERISTICS OF ROCK SALTS AND PRODUCTS DEVELOPMENTS IN KHON KAEN NATIONAL GEOPARK: A CASE STUDY FOR GEOTOURISM PERSPECTIVE IN THAILAND

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Presentation Format: *Poster*

Presentation Day: **Tuesday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **F**

ABSTRACT:

Khon Kaen Geopark (KKGp) is the national geopark of Thailand and will be signed up as an aspiring UNESCO global geopark next year. The KKGp is located in the Khorat Plateau, the northeastern part of Thailand, presenting diverse first dinosaur fossils. In addition, this area demonstrates halite resources interbedded with Mesozoic clastic sedimentary rocks of Mahasarakham Formation, Khorat Group. The rock salts contain high Na+, Mg2+, Ca2+, and Al3+ with a small amount of Si4+, P5+, and Fe2+. In the Ban Bo Village, middle of the valley of KKGp, local people discovered the primary method for producing salts from rock salt and saline soil: fermentation, filtering, boiling, evaporation by using local resources (clays, bamboo, firewood, and metal sheet). They develop the local packages and make salted eggs for generating extra income via geoproducts with the slogan "salt in dinosaur land 130 million years". There is a salt festival from March to May presenting the interaction of georesources and the culture of local people that can increase geotourism trends on this KKGp.

GEODIVERSITY ELEMENTS OF WAULPANE CAVE, SRI LANKA

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Presentation Format: *Poster*

Presentation Day: **Tuesday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **G**

ABSTRACT:

The 90% of Sri Lanka is underlined by metamorphic rocks. Different types of rock in Sri Lanka make her rich in Geodiversity. Two of such rocks are marble with coarse grains, dolomite along with calcite, and calc-silicate gneisses. The literature shows the time of formation of these rocks is older than 550 Ma (Proterozoic).

Even though the rocks are as earlier as Proterozoic in genesis, the weathering is believed to be after the Pleistocene ice age. The secondary formation of caves after weathering effect of marble and calc-silicate gneisses have left the remarkable karst geodiversity at Waulpane cave. The Waulpane cave is one of the most attractive places for local and foreign tourists. It is an isolated cavern situated at the Waulpane Village in Ratnapura District, Sri Lanka.

The elements of geodiversity of this cave are formation processes, rock types, karst elements, and intrinsic beauty. The cave basement is Precambrian metamorphic gneisses. Therefore, the process of formation of the cavern can be identified as a mixture of fluvial weathering and Karst solution. The original rock has been completely redeposited by the karst formation. This secondary formation has created several remarkable karst landforms such as caverns, swallow holes/ shafts, springs, an underground waterfall, karst windows, cave travertines, and several erosion remnants. The inside of the cave is obviously very dark and filled with bats and cockroaches. The outside of the cave is also darker even in broad daylight may be due to the surrounding thick vegetation and its unique formation.

Geodiversity and intrinsic beauty have given the Waulpane cave a unique place in geotourism in Sri Lanka even though the term is novel. Villagers are the current guardians of this cave and they would guide tourists to the cave with their experience. Waulpane cave is not only a tourist place but also a natural laboratory for students and researchers who study Earth Science.

SANJAY GANDHI NATIONAL PARK, MUMBAI, INDIA: A GEOHERITAGE LABORATORY AMIDST THRIVING BIODIVERSITY

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Presentation Format: *Poster*

Presentation Day: **Tuesday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **G**

ABSTRACT:

The Sanjay Gandhi National Park (SGNP) is a 103.09 km2 area of thriving biodiversity existing in complete harmony with a unique geodiversity. It is situated well within the suburban municipality precincts of the northern part of the city of Mumbai in Maharashtra, India and hosts an abundance of of basaltic exposures that belong to the extensive DVP (Deccan Volcanic Province), within its premises. These basalts are eponymous to the geological understanding of Large Igneous Complexes, mass extinction rubrics and their close connect to the present-day ecosystem of the park. Predominantly sub-aerial to sub-aqueous flows of tholeiitic basalts with subordinate layers of picrites are seen. All variants such as massive, amygdaloidal and vesicular types have been observed. The lava pile is intruded by incipient columnar jointed, medium grained doleritic dykes which grade into layers of red boles and inter-trappean beds consisting of different types of shales. Vesicles and amygdales increase toward the top of a single flow unit as expected. Sizeable volumes of sub-aqueously formed pillow basalts are exposed at the Dahisar River bed. Formation of pillow lavas within a continental flood basalt province, such as the DVP, is uncommon. The Pillow lavas are currently exposed at elevations of more than 75 m to 150 m above mean sea level. This could mean a much higher paleo-sea level or a tectonic uplift of the Mumbai geographical area possibly due to the thrust motion along the Panvel flexure. The basalt exposures are also prospective reservoirs for carbon sequestration. CO2 injection into the resident basalt stocks could well be a future pilot project as a simulation of a natural analogue. SGNP boasts of Tulsi and Vihar Lake impoundments, which along with the rest of the network of forest streams, form an important determinant in the natural watershed management of the park, thereby promoting good forest and animal species health.

GEODIVERSITY IN THE SOUTH-CENTRAL COAST OF VIETNAM

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Presentation Format: *Poster*

Presentation Day: **Tuesday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **G**

ABSTRACT:

The South-Central Coast of Vietnam extends about 1,200 km across 8 provinces and city. Initially, the study quantified the geodiversity according to two parameters: geological units and geomorphology classified by the origin of the South Central Coast. For this, the evaluation methodology is based on the grid overlay, with a 4.0 x 4.0 km mesh, on the available cartographic base at scales ranging from 1:100,000 to 1:200,000, including formation, complex, Quaternary sediments, and landforms. The basis for the geodiversity of the South-Central Coast is the interaction between the internal and the external geological activities through time. Geodiversity reflects the complexity of geo-activities: The coast was divided into three tectonic-structural units with a complex geological development history: a) the Kon Tum high metamorphic massif is located in the middle; b) the Se Kong Early Paleozoic orogenic belt is distributed in the north; and c) the Da Lat Mesozoic active continental margin is located in the south; (2) the presence of about 50 stratigraphic units and magmatic units from the Archean to the Quaternary were recognized; (3) geomorphological diversity is manifested by the distribution of many topographical types, from the mainland to the sea, into the following groups: mountains, plateaus, hills, and plains; estuaries, bays, and lagoons; rocky coasts and headlands; sand dikes connecting islands and beaches; and coastal islands. The resulting map was classified into five classes: very low, low, medium, high, and very high geodiversity. It was observed that the Kon Tum high metamorphic massif is endowed with a high potential for geodiversity. The geodiversity map that has been created will be used to zone high-value geodiversity areas and propose geosites.

EDUCATIONAL VALUE OF RAWA DANAU VOLCANIC COMPLEX, BANTEN AND ITS SURROUNDING AREA: CONSERVATION CHALLENGES IN MASSIVELY QUARRIED GEOLOGICAL SITES

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Presentation Format: *Poster*

Presentation Day: **Tuesday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **H**

ABSTRACT:

Rawa Danau Volcanic Complex in Banten holds importance scientific and educational value for following reasons. Pyroclastic rocks produced by this volcanic complex are massively blanketed central and northern part of Banten. Studies show that these products have very diverse volcanic features which is importance for science and education. These diverse products comprise of hand scale features (various type of pumice), outcrop scale features (PDC, fallout deposit, volcanic unconformity), and map-scale features (caldera, sector collapse, volcanic cone, etc.). The area is situated in western part of Java which is considered as transition zone between oblique Sumatera subduction system and orthogonal Java system. Previous studies suggest that geochemical characteristic of western part of Banten shows Sumatera features despite being geographically located in Java. It therefore makes RDVC an important clue for our understanding about transitional subduction system. Much of these deposit locations are being quarried for its sand deposit. These activities have exposed potential important geosites that previously hidden by soils and vegetations. However, over exploitation by quarrying activities has posed high threat for important geosites. Here we show potential geosites of RDVC that has potential for geo-educational purposes. We also address many challenges that have been threatening these geosites' integrity.

ROLE OF VOLCANIC GEOHERITAGE TO DEVELOP EFFECTIVE GEOEDUCATION PROGRAMS TO FACILITATE RESILIENCE TO VOLCANIC HAZARDS IN A COUNTRY EXPERIENCED MINOR ACTIVE VOLCANISM

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Presentation Format: *Poster*

Presentation Day: **Tuesday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **H**

ABSTRACT:

The most abundant region of volcanic fields in China is located in the rapidly developing NE section of the country. This region hosts the Wudalianchi Volcanic Field (WVF) that has a recorded historical eruption in 1719–1721 CE and 1776 CE. While WVF has a well-developed geoeducation program, the field itself is simple from a volcanological perspective, and its geosites provide graphic examples mostly of "dry" monogenetic volcanism. East of Wudalianchi, there is a larger and more complex volcanic field [Arxan-Chaihe Volcanic Field (ACVF)] that were active last ~2000 years ago and produced a great variety of volcanic geoforms such as dry and wet monogenetic volcanoes. The ACVF is located across two geoparks. In the west, the Arxan UNESCO Global Geopark is located, while in the east the Zalatun Geopark, part of the Chinese Geopark Network. The main geosites are associated with monogenetic volcanism within the Arxan UNESCO Global Geopark. The 2000-year-old eruption initiated from the Yanshan region at the top of a normal fault bonded ridge produced extensive aa-type lava flows in steep slopes and typical pahoehoe surface features along ponded regions. The lava flow blocked and diverted the Halaha river creating lava tumuli fields and localised lava tubes. Toward the east, a new administrative region starts that manage the Zalatun Geopark including the Tongxin Lake near Chaihe township. It is a maar crater formed by violent phreatomagmatic explosive eruptions during Pleistocene time and created a ~3-km wide maar within a pre-existing intramountain basin. Both geopark favours the volcanic attractions to be in their geoeducation program; however, very little information and/or linkages of the geosites could offer to the visitors to utilise the experience to be used in volcanic hazard resilience. The ACVF has great potential to demonstrate the full spectrum of monogenetic volcanism and link them to similar volcanic regions in the Chinese-Mongolian- regional context with an aim to utilise the region volcanic geoheritage values for natural hazard resilience. Our geodiversity estimate (Zakharovskyi, Nemeth 2021) showed that the volcanic geoheritage elements indeed correlate with the high geodiversity

values, but the calculation also showed alternative potential geosites that could be utilised for future geoeducation and geotoursitic development.

Zakharovskyi, V, Németh, K (2021) - Land 10(9), 946: https://www.mdpi.com/2073-445X/10/9/946

NISYROS GEOPARK: A VOLCANIC LANDSCAPE WITH UNIQUE GEODIVERSITY.

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Presentation Format: *Poster*

Presentation Day: **Tuesday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **H**

ABSTRACT:

Nisyros Geopark, an island geopark in the Southeastern Aegean Sea, Greece, is here presented as an official candidate for the UNESCO Global Geoparks designation, featuring outstanding geological, natural and cultural characteristics. The area of the Geopark includes Nisyros, an active volcano and the geopark's main island, as well as a number of surrounding islets along with the marine and submarine region among them. As part of the South Aegean Volcanic Arc, it bears a dramatic landscape shaped after the five eruptive cycles of its geological history for the past 160.000 years, that left their scars both on the onshore and the offshore areas of the geopark. It features a number of exceptional geosites and geomorphological features, including the central caldera, lava domes, flows, vents, fractures and even hydrothermal eruptive craters like Stefanos, one of the largest of its kind in the world. The offshore area is nothing but the continuation of the landscape below the sea, featuring a number of basins, underwater volcanic structures like craters, lava domes and fractures as well as a pre-historic caldera, Avyssos. Apart from geology the Geopark features rich biodiversity protected by two internationally designated Natura 2000 areas including its entire surface, as well as three wildlife refuge areas recognized at a national level. A great number of species of flora, avifauna and reptiles thrive within the geopark's territory. Its cultural heritage has remained immutable through time, while it exposes the splendor of art and civilization, expressed through prehistoric and historic locations and monuments. It hosts exceptional archaeological and cultural sites including fortresses, remnants of ancient habituations, numerous churches and monasteries, several thermal springs directly connected to the long tradition of its thermal baths which all together have ultimately encapsulated the region's history and given rise to the traditions, tangible and intangible heritage of locals today. Through a network of well-established walking trails, visitors can admire the unique geodiversity and biodiversity of the area, discover its cultural and archaeological features that are bound to its eruptive past and even listen to the rumble of the Earth itself, by walking on the bottom of Stefanos crater. Nisyros Geopark is the only area in the broader region that hosts all these features at such a restricted area, making it an ideal candidate for a UNESCO Global Geopark.

USING PLACE NAMES IN GEOTOURISM FOR THE PROMOTION OF THE IRISH LANGUAGE

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Presentation Format: *Poster*

Presentation Day: **Tuesday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **I**

ABSTRACT:

The context of the Joyce Country and Western Lakes aspiring geopark in the west of Ireland is characterised by the presence of two living languages, with the English and the Irish language still in use in parts of the region called Gaeltacht. This Irish language, sometimes referred to internationally as Gaelic, is the modern version of the ancient Celtic language spoken in Ireland for over 2,000 years. Its use by the Irish people has been decreasing continuously since the end of the 18th century, a tendency unfortunately still experienced today despite the status of the language as the primary language of the Irish Republic. The knowledge of the Irish language helps to decode the landscape through its place names or logainmeacha in Irish; the names of rivers, lakes, islands and mountains, of the towns and villages and of the 60,000 townlands (the smallest historical land division).

Place names can be associated to people, plants or animals but also to their geographical context whether current or historical. And significantly, they can also be associated to the local geology; places with many glacial erratics from the last Ice Age, significant karst features such as springs, swallow holes and turloughs, ore of economic interest or the colour of the local bedrock as found in the names of mountains. These relationships are explored in this paper with particular reference to examples found in the geopark region. It shows how the comprehension of the natural heritage in Ireland is enriched by the understanding of the Irish language but also how the geopark can use such links to promote the Irish language itself.

NEW INPUTS ON GEO-HERITAGE AND GEODIVERSITY OF THE DINDEFELO COMMUNITY NATURE RESERVE (SENEGAL). GEOLOGICAL KNOWLEDGE TO SERVE THE SOCIAL DEVELOPMENT.

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Presentation Format: *Poster*

Presentation Day: **Tuesday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **I**

ABSTRACT:

Geodiversity is understood as the variation of the Earth surface because of natural processes (endogenous and exogeneous) and human activities. This concept joins natural abiotic elements with other territory aspects such as the climatology, economy, or culture. When the elements involving geodiversity integrate scientific and educational high value and they are connected to biological and cultural aspects, we speak of geo-heritage. Geodiversity and geo-heritage take more weight in the enhancement of protected natural areas, such as the Dindefelo Nature Reserve, in Southeast Senegal. This work aims to value the geological heritage of the Dindefelo Reserve to promote economic growth in the area through the development of geotourism.

For that, touristic sites have been appraised from a geological perspective. As a result, this work proposes 4 geosites and 1 geomorphosite. In first place, the Pelel area where the Birrimian basement outcrops followed by the first infilling deposits of the Madina Kouta basin leading to a carbonate tidal flat and the record of Cryogenian global glaciation. Secondly, there is a group of cascades built in Neoproterozoic Dindefelo sandstones showing a complete sequence of coastal deposits. In addition, a human-made cave in saprolites exhibits a typical tropical paleosol profile. Next, Gambia river zone is found as a main hydrogeological place controlled by conjugated faults and where the Birrimian basement outcrops. Finally, the geomorphosite called “Dande’s Teeth” consists of squared-base columns resulting from regional extensional tectonic activity. They are cut by two conjugated joint families.

In conclusion, this reserve has a geological history that spans more than 2,300 My, linked to the evolution of the West African Craton and the opening of the Proterozoic Madina Kouta basin. In conclusions, the reserve has a very high geodiversity, and its components present a huge heritage value. The geological events carried out in the reserve open a window to the Proterozoic era, permitting to improve the knowledge of the West African Craton and even some main world-wide spread events.

EFFICACY OF GEOSCIENTIFIC EDUCATION OF TOKACHI-SHIKAOI GEOPARK, JAPAN

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Presentation Format: *Poster*

Presentation Day: **Tuesday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **I**

ABSTRACT:

Geopark's three objectives are to protect geological relics, to disseminate geo-knowledge, and to promote local economic development. Geoscientific knowledge education serves as the foundation of these three objectives.

The aim of this study is to examine the efficacy of geoscientific education methods on the sustainable development of geoparks in Japan. This research focuses on Tokachi-Shikaoi Geopark and Hokkaido Shikaoi High School. This study is mainly conducted through field interviews with five key informants of geoscientific education in Shikaoi Town and an online questionnaire survey of Shikaoi High School students, followed by a SWOT analysis of two different geoscience-related education programs: (1) the former systematic geoscientific education program called ‘Shin-Chikyu Gaku’; and (2) the current selective minimum course in the ‘Shikaoi Revitalization Program’.

According to the results of a questionnaire survey, the students who have received the systematic geoscientific education generally have a more profound understanding of geo-knowledge than the students who have not received the systematic geoscientific education. Moreover, there are significant differences in the understanding of geo-knowledge (P-value ranges from 0.000-0.048). About 46.4% of the students who received systematic geoscientific education expressed a strong interest in geopark, and 61.7% stated that their understanding of the geopark is extremely thorough. However, only 19.7% of students who had not received the systematic geoscientific education exhibited interests in the geopark, and only 9.1% of the students believed that they had a reasonable knowledge of the geopark.

A comparison of two different types of geoscientific education through the SWOT analysis determined that Hokkaido Shikaoi High School can maximize the efficacy of geoscientific education in Tokachi-Shikaoi Geopark by using the following strategies: (1) Ensuring the inclusion of geoscience-related education in the curricula of all students in elementary, junior-high, and high schools in Shikaoi; (2) Providing effective geoscience education through the development of curriculum adapted to the local context; (3) providing better geoscientific training for teachers; (4) strengthening cooperation with the geopark; and (5) acquiring the government's long-term support. These strategies will serve as guidelines for the long-term development of geoscientific education in other geoparks of Japan.

ENSENADA DE RIONEGRO, ANALISIS OF EFFECTS OF ARMED CONFLICT THROUGH MULTITEMPORAL ANALISIS OF EROSION

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Presentation Format: *Poster*

Presentation Day: **Wednesday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **J**

ABSTRACT:

The territory can suffer changes derived from social phenomena, (e.g., The Colombia armed conflict), where the natural covers have been transformed. In adition, the geodiversity, usually has been ignored, thus the link between biotic, abiotic and social factors. In order to quantify these relations, we calculated the erosion in two different scenarios along the Ensenada de Rionegro protected area, located in the municipality of Necocli (the Ursba Gulf - Caribbean Sea). So far, we have found an ecosystem affection related to an increment of sediment load and production (+33%) related to a human intervention. Furthermore, ussing the Geographic Information Systems (GIS), a quantitative and qualitative analysis were done between 1992 and 2019, resulting in a proximity matrix for changes in coverage, highligthing the erosion risk areas up to 109 t / ha-year

DIGITAL VERSUS ANALOGIC. DIGITAL CONSERVATION OF THE GEOARCHAEOLOGICAL RECORD OF THE UPPER PLEISTOCENE GEOSITE OF JARAMA VI (VALDESOTOS, GUADALAJARA, SPAIN)

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Presentation Format: *Poster*

Presentation Day: **Wednesday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **J**

ABSTRACT:

Jarama VI is located on the NW edge of the Guadalajara province (Castilla–La Mancha, Spain). It is a rock shelter partially filled up by sediments which were excavated between 1989 and 1994. The archaeological excavation shows a lithostratigraphic sequence formed by three Pleistocene sedimentary units (Jordá Pardo 2007) with thousands of archaeological remains of the Middle Palaeolithic (Navazo et al. 2017) with an age older than 50 ka BP (Wood et al. 2012; Kehl et al. 2013) and even a bone remain of Homo neanderthalensis (Lorenzo et al. 2012; Higham et al. 2014). These human occupations correspond to later Neanderthal populations who lived in central Iberia many years before the arrival of the first modern humans to this area (Cacho et al. 2012). During the last years we have reviewed the traditional archaeological record of the excavation (excavation diaries, inventories of materials, drawings of stratigraphic sections, planes of distribution, photographs, publications, etc.) obtained in analogical format in order to convert it to digital format. To do this, we have created a geodatabase where we have included all the excavation data collected in paper until now. In addition, we have made the digital topography of the site and the territory in which it is located as well as the digital model of the terrain in 3D. All the data obtained has been integrated into a Spatial Data Infrastructure. All this has allowed us to make a digital reconstruction of the archaeological record of the site. We present here the preliminary results of these works that we have made with the authorization and the financial support of the autonomous government of the Junta de Comunidades de Castilla – La Mancha.

References

Cacho, C. Et al., 2012. Quaternary International 272-273: 42-54.

Higham et al., 2014. Nature 512: 306-309.

Jordá Pardo, J.F., 2007. Geodinamica Acta 20/4: 209-217.

Kehl, M. et al., 2013. Quaternary Research 80(2): 218-234.

Lorenzo, C. et al., 2012. Journal of Human Evolution 62: 720-725.

Navazo, M. et al., 2017. Quaternary International, in press.

Wood, R.E. et al., 2013. PNAS 110(8): 2781-2786.

GEODIVERSITY LOSS THROUGH ANTHROPIC IMPACT: A STUDY CASE FROM A HILLY AREAS WITH LOW GEODIVERSITY

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Presentation Number/Poster Group: **J**

ABSTRACT:

While geoheritage and geodiversity studies are applied to the present situation ,there are cases of lost geoheritage, mainly in the case of anthropic interventions that induce drastic modificatiosn to the landscape. I reffer here to the reservoir construction and floodplain draining. The study area is the Moldavian Plateau, a hilly area in NE Romania with Miocene to Pleistocene rocks, that has an overall low geodiversity. The construction of the Stanca-Costesti reservoir, with the dam built between 1974 and 1978, destroyed the Stanca Stefanesti gorge. This sector of the Prut river valley was 400 m wide, both banks being developed in miocene limestone, as vertical cliffs. The vegetation was specific to the limestone areas.

The drainign of the floodplains after 1960 generating the dissapearance of the floodplain mud volcanoes, that were present in many places. These volcanoes represented a type of local circulation of water in the floodplain ,with the aparition at the surface of a network of craters.

The main scope of the paper is to bring to attention the existing geoheritage and geoheritage loss of the study area.

ANTI-ATLAS FOSSIL SITES (MOROCCO): PRELIMINARY STUDY

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Presentation Format: *Poster*

Presentation Day: **Wednesday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **K**

ABSTRACT:

The Anti-Atlas chain, subdivided into three parts (the Anti Western Atlas, the Anti Central Atlas and the Anti Eastern Atlas), is in the form of a vast anticlinal bulge with at its heart outcrops of base called buttonholes, themselves bordered by a pleated paleozoic sedimentary cover. The Anti Atlas Oriental that represents jbel Saghro is formed by a precambrian base consisting of conglomerates, breaches, sandstone, volcanic tuffs and rhyolite ignimbrites and a paleozoic cover rich in sandstone, carbonate, schists, quartz, etc.

The objective of our work is to make an inventory of exploited fossil sites of exceptional scientific interest in the Anti-Atlas; these sites are identified through the work of N. Lazreq (2015). Arcgis and Wikimapia software have been of great use in the work of reporting the fossil sites exploited on the Anti-Atlas geological map.

The inventory identified a total of 49 Devonian sites looted and/or in operation. We mention for example: the Praguian trilobites of jbel Issimour, the limestone blocks of the Erfoud slab of the lower Famennian of jbel Amerboh and the Mud-mounds of the lower Devonian of Hamar lakhdad.

Our study aims to safeguard the Anti Atlas fossil sites that must be valued and conserved for future generations, as part of a sustainable development. This inventory could serve as a database to raise awareness among decision-makers about safeguarding at least the highly exploited and disappearing fossil sites.

Keywords: Anti-Atlas(Morocco), inventory, fossil sites.

PLEISTOCENE MAMMALIAN REMAINS FROM THE SIWALIK HILLS OF SARDHOK, PUNJAB, PAKISTAN

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Presentation Format: *Poster*

Presentation Day: **Wednesday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **K**

ABSTRACT:

PLEISTOCENE MAMMALIAN REMAINS FROM THE SIWALIK HILLS OF SARDHOK, PUNJAB, PAKISTAN

Muhammad Akbar Khan

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Abstract. Remains of Early Pleistocene mammals have been reported from the Quaternary basin nearby the Sardhok village in the Gujrat district of the Punjab province, Pakistan. The Early Pleistocene mammals are presented based on the description of the recovered material from the Sardhok outcrops of the Pabbi Hills (Upper Siwaliks), and the remains increasingly indicate taxonomic diversity. The described taxa include bovids, cervids, giraffids, hippopotamids, rhinoceroses, equids, and elephants. The bovids are represented by a reasonable number of specimens suggesting that the niche probably was filled by the large bovines. But cervids, rhinocerotids, equids and proboscideans are approximately as common as each other at Sardhok. Giraffids and hippopotamids present rare findings whereas tragulids and suids are absent. Most of these taxa indicate a predominance of savannah habitat during the deposition of the Pinjor Formation of the Siwaliks.

Keywords: Artiodactyla, Perissodactyla, Proboscidea, Pleistocene, Siwaliks.

SUSTAINABLE PALEONTOLOGIC ELEMENTS IN FLORESTA, COLOMBIA: FROM THE FIELD TO THE MUSEUM OF LIFE (MUSEO DE LA VIDA) AND THE PUBLIC EDUCATION.

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Presentation Day: **Wednesday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **K**

ABSTRACT:

The Floresta Massif is in the northeastern part of the Eastern Cordillera of the Colombian Andes, in the Department of Boyacá, 200 km northeastof Bogotá. The Massif constitutes one of the four Colombian metamorphic massifs of Precambrian-Paleozoic age. It is cut off by pre-Devonian granitic intrusions, and unconformably covered by a Devonian siliciclastic transgressive-regressive sedimentation cycle, as well as by Mesozoic and Cenozoic sediments.

The Paleozoic sedimentary sequence in the Floresta Massif consists of Devonian El Tibet, Floresta and Cuche Formations, being Floresta and Cuche the most fossiliferous formations. Marine invertebrates and fishes have been recovered in Floresta sediments, while terrestrial plants, marine invertebrates, and fishes have been reported for Cuche. The presence of such palaeontological content points to the proximity of Gondwana and Laurasia continents.

The conservation and good use of the paleontological elements of Floresta have been carried out by the community led by Mr. Luis Becerra, Director of the Museum of Life, and recognized woodworker of paleontological replicas of Floresta, as well as by Mrs. Marie Giraud López, promoter, coordinator, teacher, and scientific illustrator of geo-educational activities in the schools of Floresta. These community members have been working together with scientists, scholars, amateurs and the Colombian Geological Service according to the national and regional legislation which governs it. Their work is a great example of how community encourages social understanding of geoeducation, ethical principles and values and sustainable management allowing to preserve and share the significant paleontologic elements of Floresta.

THE USE OF INTERACTIVE THEMATIC MAPS AS A MEANS OF GEOEDUCATION AND GEOSITE EXPOSURE: THE STATE OF RIO GRANDE DO NORTE, BRAZIL

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Presentation Format: *Poster*

Presentation Day: **Wednesday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **L**

ABSTRACT:

The Brazilian state of Rio Grande do Norte has an incredible geological heritage - in the sense of geodiversity elements of relevant importance for scientific knowledge - widely researched and exploited by mineral resources for decades; from Archean to Paleoproterozoic gneisses, the Neoproterozoic Seridó fold belt and voluminous granitic intrusions to more recent Meso-Cenozoic volcanic-sedimentary basins, all covered by Cenozoic sedimentary rocks and sediments. Such geodiversity was recently evaluated in the form of an inventory of the main scientific geosites in the state, with 175 geosites classified in 15 frameworks.

Inventorying the in situ geological heritage of a region makes it possible to, amongst other things, support geoconservation initiatives and raise awareness among the population; but in spite of the growing success of geo education programs, the general public is still woefully unaware of the importance of geodiversity and how to explore it in a sustainable and inspiriting way. Because of it, new forms of approaching and educating people are always being looked for, and online tools such as websites, forums and social media are the best way to reach out to a large number of people in a flexible, fast and cheap way.

In this context, the My Maps tool provided by Google serves as an excellent way to display maps and locations online in a recognizable GIS interface familiar to most users, due to its use in everyday life GPS applications. Not only are the maps highly customizable and able to store multiple layers of information, but they can easily be shared through weblinks and incorporated into sites and blogs.

As such, the inventory of geosites of the Rio Grande do Norte state, alongside a simplified version of its 2021 geological map, has been made into an online map using this tool (available at encurtador.com.br/mrLN6). This map allows the user to see the spatial distribution of the geosites (color-coded by their geological framework), the geological unit they're related to, and nearby roads and landmarks that can identify them. It also displays information about the main geological features, rock types, age and bibliographic references for each point

We can only protect that which we know; so it's through initiatives like this that the preservation of geodiversity and the collective conscience of its importance can become possible, either through intervention of public or private agencies or, even better, by the population as a whole.

PUBLIC SQUARES AS PLACES FOR LEARNING EARTH SCIENCES: STUDY IN A TOURIST CLUSTER IN THE STATE OF SÃO PAULO, BRAZIL

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Presentation Format: *Poster*

Presentation Day: **Wednesday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **L**

ABSTRACT:

Squares are public spaces commonly aimed at promoting leisure and tourism, due to the presence of cultural and/or cultural elements, such as churches, fountains, monuments, gardens, and woods, in addition to artistic and cultural events. In this context, public squares have the potential for teaching and disseminating Earth Sciences. Educational and geocommunication activities in these public spaces can allow citizens to have contact with elements that integrate geoscientific knowledge. In this study, visits were made to eight public squares located in the tourist region of Circuito das Águas Paulista, the eastern region of the State of São Paulo, Brazil, seeking to identify potential for learning Earth Sciences. In the study of the potential of the squares for Education in Earth Sciences, the publications "Earth Science Literacy", "Alfabetización en Ciencias da Tierra", and "Internacional Geoscience Syllabus" were used as references. The Official Curriculum of the State of São Paulo for basic education, elaborated in the light of the National Common Curriculum Base of Brazil, was also considered in the analysis of potential pedagogical uses of these places of learning. In the squares, elements of geological and cultural diversity are identified, such as ornamental rocks and ex-situ rock blocks, constituting buildings, monuments, and gardens, as well as in the paving. Such elements make it possible to observe and study the main types of rocks, features geological processes, use of geological resources by living beings, aspects related to geological time, and anthropic impacts. Within the scope of formal education, several skills were identified from the curricula of Science and Geography subjects that can be taught in public squares. Despite the identified potential, it is important to highlight the need for geocommunication initiatives that awaken awareness among the general public and, also, facilitate the use of squares in their pedagogical practices for teachers. The occurrence of graffiti and depredation in some of the studied squares reiterates the importance of these initiatives, since the understanding of the elements of geological and cultural diversity present is fundamental for changes in society's perception and the appreciation of these elements. In this context, geocommunication can constitute a strategy for the popularization of Earth Sciences, as well as for the geoconservation of the elements that constitute these places.

POSITIONING GEOHERITAGE IN U.S. PRE-COLLEGE SCIENCE CURRICULA

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Presentation Format: *Poster*

Presentation Day: **Wednesday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **L**

ABSTRACT:

The fascinating phenomena of Earth and space science takes on heightened relevance in learners' lives when presented through the frameworks of geoheritage. Investigations through geoheritage frameworks highlight both iconic and locally meaningful examples of how Earth phenomena can be described and connected to larger themes in science teaching and learning. As geoheritage advances as an increasingly important feature of geoscience, it also informs approaches to Earth and Space Science instruction. For example, the widely used Framework for K-12 Science Education (NRC, 2012) in the United States calls on science educators to approach instruction from three dimensions—integrating disciplinary core ideas, crosscutting concepts, and science and engineering practices. In the US context, this has fostered an emphasis on phenomena-based instruction where teachers introduce real-world experiences that encourage students to ask questions and undertake investigations from multiple perspectives. The concept of geoheritage calls attention to such phenomena, highlighting their scientific relevance while concomitantly situating that relevance in human experience. This opens opportunities for students to conduct investigations using the crosscutting concepts described in the Framework. For example, phenomena related to the interpretation of surface changes on Earth encourages students to use the lens of the crosscutting concept “stability and change” to argue from evidence about the processes that formed these landscapes. This presentation illustrates the crosswalk between curricula and geoheritage through examples of both iconic and local geoheritage locations within the United States, such as Mt. Saint Helens (iconic), the Keweenaw Peninsula region of Michigan (local).

SIBE OF JBEL MOUSSA (NORTHERN RIF, MOROCCO): INVENTORY AND QUANTITATIVE ASSESSMENT OF GEOSITES

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Presentation Format: *Poster*

Presentation Day: **Wednesday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **M**

ABSTRACT:

SIBE OF JBEL MOUSSA (NORTHERN RIF, MOROCCO): INVENTORY AND QUANTITATIVE ASSESSMENT OF GEOSITES

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The SIBE of Jbel Moussa is located on the Strait of Gibraltar, in the northern part of the Tingitane Peninsula (extreme northwest of Morocco), between Ksar Sghir and Sebta. The study area has a very special continental and maritime position. In addition, it is part of the Mediterranean Intercontinental Biosphere Reserve (RBIM).

Geologically, the SIBE of Jbel Moussa is located at the northern extreme of the limestone ridge of the Rif's Mountain range. It is formed by rocks that belong to several structural units: karstified limestone massif culminating at Jbel Moussa which belonging to the Predorsalien domain, metamorphic

outcrops of the Sebtides domain in the eastern part, the Paleozoic or Ghomarides sheets in the south and the Tisirène flysch in the west.

The objective of our work is making inventory and quantitative assessment of the geosites using the methodology of Brilha (2016), which is the most convenient for the study area.

The selected geosites show a huge diversity in term of geology: structural, stratigraphic, paleontological, sedimentary, geomorphological, hydrogeological, etc. In addition, they have cultural, aesthetic, historical, archaeological values. 6 geosites have been selected as preliminary results, for example: the unique landscape of “the sleeping lady” (structurel), the marine terrace of Ras Leona (sedimentary); the Radiolarite of Jbel Moussa (paleontological and stratigraphic), and Punta Ciress flysch.

Some of these geosites have a high scientific value; therefore, they should be integrated into a geoconservation strategy and geotourism action plan. In addition, involvement of local people could be cooperative and lead to the sustainable development of the study area.

Keywords: Geological heritage, geosite, inventory, quantitative assessment SIBE Jbel Moussa, northern Rif.

INVENTORY AND QUANTITATIVE ASSESSMENT OF THE AZROU-KHENIFRA BASIN (EASTREN PART OF CENTRAL MASSIF-MOROCCO)

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Presentation Format: *Poster*

Presentation Day: **Wednesday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **M**

ABSTRACT:

The Azrou-Khenifra basin is located between two provinces Azrou and Khenifra. It is characterized by Paleozoic deformed and granitized outcrops with rare Precambrian points; those outcrops represent an important geological and geomorphological heritage.

The Azrou-Khenifra basin geosites present more geological interest with scientific value than others (geomorphological, educational, touristic...). They show richness from the point of view of geosites interest on one hand: petrographical, paleontological, sedimentary, volcanic, mineralogical, structural interests...etc, on the other hand, geosites are various in term of geological age. For instance, Variscan granite of Ment, veins with Tourmaline of Ment and the Zain's table

The aim of our work is to make inventory and quantitative assessment of geosites using the methodology of Brilha (2016). The geological framework of the study area and the typology of geosites are the main reason that lead to the choice of this method, since it takes into account the scientific relevant of them.

The geoheritage of the Azrou-Khenifra area deserve to be preserved through a geoconservation strategy. Moreover, it could be used in geoeducation and geotourism in order to enhance the sustainable development and the economical level of this area.

Keywords: Geosite, Quantitative assessment, Azrou-Khenifra basin

INVENTORY AND QUANTITATIVE EVALUATION OF GEOLOGICAL HERITAGE IN PARANÁ STATE, SOUTHERN BRAZIL

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Presentation Format: *Poster*

Presentation Day: **Wednesday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **M**

ABSTRACT:

The inventory of geological heritage, as well as the quantification of its value, are fundamental tasks for the implementation of geoconservation strategies. The Paraná inventory is the second state-level geological heritage inventory made in Brazil. The assessment method was adapted from previous methods established in international literature, considering the Brazilian socioeconomic and cultural conditions. The main changes that were implemented in the assessment method were focused on the evaluation of the tourist and educational values. The criteria cultural diversity, related to archaeological, indigenous and traditional communities aspects, and ecological diversity, associated to flora and fauna in geosites, were added. It was also added the criteria natural safety, related to natural hazards and personal safety, concerning visitors' wellbeing. In relation to vulnerability, the method considers two types of geosite degradation: anthropic vulnerability and natural fragility. The carrying capacity criterion was also added with the objective of evaluating if a maximum number of visitors needs to be defined due to the geosite's fragility. The geosites were selected by experts according to the following criteria: representativeness, rarity, integrity and scientific knowledge. The scientific, touristic, and educational values, as well the vulnerability of geosites were evaluated. The inventory has 76 geosites distributed in eight geological categories, which represent the state's geological history. Palaeontological geosites obtained the maximum score in what concerns the scientific value. Geosites with higher tourist and educational values were those that are already used for these purposes. As for vulnerability, the least vulnerable sites are those with some type of state statutory protection, designated as geological sites by the Paraná State Department of Culture, or included in protected and conserved areas according to the federal legislation. These results are expected to help geoconservation actions in the state of Paraná and to support the implementation of effective management actions, especially in geosites with high degradation risk.

INVENTORY OF THE GEOLOGICAL HERITAGE OF THE STATE OF RIO GRANDE DO NORTE, NORTHEAST OF BRAZIL

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Presentation Format: *Poster*

Presentation Day: **Wednesday** Presentation Time: **5:15:00 PM**

Presentation Number/Poster Group: **M**

ABSTRACT:

The Earth landscapes were not always as they present themselves today, thanks to the interaction with the internal and external dynamics of the Earth. Thus, it is clear that the rocks are true "files" where what can informally be called "key files" capable of telling the history of a territory are stored.

Threats to outcrop protection demand urgent management actions. In this way, the (re)knowledge, conservation and promotion of this geology (or in this case – Geodiversity) are one of the greatest challenges of the geoscientific community, especially in the present century.

The protection of this geodiversity, for example, can only be achieved by raising the awareness of people, who, knowing the local geodiversity, will appreciate its value and, consequently, protect it. In view of this, making an inventory of the geological heritage of a place makes it possible to delimit these places of interest and, through a quantitative assessment - to reduce subjectivities - to support measures for the geoconservation of this natural heritage.

Considering the importance and scientific potential of the State of Rio Grande do Norte and the lack of systematic actions for the geoconservation, interpretation and valorization of its geological heritage, the need to develop this work was perceived, with a view to establishing a proposal sustainable use of this geological heritage. Thus, the present work consists of the first steps of the elaboration of an inventory of the geological heritage in the state of Rio Grande do Norte, and one of the first state inventories in progress in the country. In this text, it is exposed how the potential geosites were selected based on different bibliographic sources, filtered according to their uniqueness or regional representation, through 15 thematic categories (based on their tectono-stratigraphic context), to then be organized in a uniform database, with general information on each point for consultation by the scientific community. Cartographic and graphic products were also generated that best represent the information obtained in each location of geological interest.

This study can be constantly updated and aims to direct future work on the inventory of geological heritage or with emphasis on specific topics such as geomorphological, paleontological, mineralogical, among others in Rio Grande do Norte.

THE POTENTIAL OF GEOLOGICAL SITES IN THE LIWA AREA AND ITS SURROUNDINGS IS BASED ON THE REGULATION OF THE MINISTER OF ENERGY AND MINERAL RESOURCES 2020.

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Presentation Format: *Poster*

Presentation Day: **Thursday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **N**

ABSTRACT:

Liwa Botanical Gardens is part of the West Lampung Regency area, has a historical background of the great earthquake disaster at the tip of the island of Sumatra. Geologically, this area undergoes changes caused by natural fluctuations during the formation of the universe. Covering the boundary between Lampung province and South Sumatra, this area has the potential for geological diversity that can be developed. Having a lithological background dominated by volcanic and tectonic settings of the Kumering segment of the Sumatran fault, trending north-south shows the added value of education in visiting this tourist area. The purpose of this study is to optimize the potential for geological diversity around the ancient Mount Ranau. The method used in this research is field observation and value calculation based on the Regulation of the Minister of Energy and Mineral Resources. Number 1 of 2020 concerning Guidelines for Determining Geological Heritage accompanied by a study of literature regarding the tourism area of the Liwa Botanical Gardens which has existed for a long time. This area has a unique geological history that can become a focus area for government development in improving the quality of human and natural resources such as landslides, earthquakes and volcanic eruptions. This research resulted in an assessment and recommendation for a determination of a candidate for geological diversity heritage.

GEOSITES OF SCIENTIFIC AND GEOTOURISTIC IMPORTANCE IN THE REGION OF ORAN (NORTHEWESTERN ALGERIA) : A FIRST STEP TO GEOCONSERVATION

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Presentation Format: *Poster*

Presentation Day: **Thursday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **N**

ABSTRACT:

Two geological sites in Orania (northwestern Algeria) among many others have an important scientific (are of significant scientific), geotouristic, heritage and educational interest : the Chaabet Bou Seter called "Canyon de Tafraoui" by hikers and Sassel beach Messinian stromatolites.

The Chabet Bou Seter is located on the northern termination of the Tessala Mounts in the vicinity of Tafraoui village in the Oran Wilaya. The stratigraphic series is dated as Messinian, subdivided into six sedimentary units (Saint Martin, 1990; Chikhi, 1992, Conesa, 1992 ; Boukli, 200 ; Mansour, 2004) : sandy marls ; diatomaceous formation; clayey limestone; corallinaceous limestone ; reef formation at Porites overlain by oolithic limestone (post-reef deposition). The canyon of Chabet Bou Seter, created by the erosive rivers activity in the sandy marls and the diatomaceous formation shows an example of preservation and valorisation.

Sassel Beach Messinian stromatolites is located in the Ain Temouchent Wilaya (West of Oran). The Sassel-Beach outcrop presents a Late Messinian stromatolites that corresoponds to the post-reef deposition (Saint Martin, 1990), unconformably (ravinement unconformity) overlain by a 20 m thick sandy clay rich in bivalves, and attributed to the Zanclean age (Atif et al., 2008). The stromatolites are generally whitish and intensively recrystallized. The limestones rocks are banded, lamellar and are cropping as dome form resulted from microbial structures (Saint-Martin et al., 1997).

These geosites require a first step to geoconservation and protection because are important geoheritage sites with great geoeducational and geotouristic potential.

Keywords : Geosites, Orania, Chabet Bou Seter, Sassel-Beach, Geoconservation, Nortwestren Algeria.

GEOSITES – GEOPARKS IN GREECE: THE USE OF TRADITIONAL AND MODERN TOOLS FOR DISSEMINATION AND PROMOTION OF GEOTOURISM

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Presentation Format: *Poster*

Presentation Day: **Thursday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **N**

ABSTRACT:

Greece, located in the convergence zone 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. Thus, the need for detailed recording of those sites is imminent in order to preserve their scientific, educational and environmental value; moreover, towards promotion of the Hellenic geological heritage, areas which fulfill the necessary conditions and potential must be highlighted and specific tasks may be designed: geotrail mapping, thematic networks of geosites, geo-tourism promotion, and establishment of geoparks. During more than 40 years of activity and participation in numerous research projects, the Hellenic Survey of Geology and Mineral Exploration has carried out extensive work in the systematic recording of the geological heritage of Greece. As a result, a wealth of data has been collected about geosites, geotrails and geoparks, along with a large background information. In this context, more than 1400 sites have been recorded in the Greek territory, many of which have been classified as of "National Importance". Moreover, geotrails have been thoroughly mapped in nine (9) areas and several more are planned. Finally, seven areas are nominated UNESCO Global Geoparks (Chelmos-Vouraikos, Lesvos Island, Psiloritis, Sitia, Vikos-Aoos, Grevena-Kozani, Kefalonia-Ithaca), while Lavreotiki region in Attica is under evaluation. With the aim of promoting geotourism as an alternative form of vacation in Greece, for both native and foreign audience, various products have been produced in Greek and English. Today, through the ongoing “GEOINFRA” project (funding NSRF, 2019-2023) the aforementioned work is being complemented and new products following current technological trends (e.g. Android applications, drone videos, e-books, digital twins etc) are designed in order to call attention of visitors and provide them with handy tools for exploration of the geological world. Furthermore, special material for kids is created, as a means of introduction of the younger audience to Geoheritage.

GEOPARKS AND GEOTOURISM FOR PROMOTING EARTH HERITAGE AND CULTURE

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Presentation Format: *Poster*

Presentation Day: **Thursday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **O**

ABSTRACT:

Geoparks are the unified areas with geological heritage-es of international significances which use those heritages to promote awareness of key issues facing societies in the context of the dynamic planet we all live on. They operate as a partnership of people and land managers working to promote Earth heritage through education and sustainable tourism. The concept of a Geopark originated in Europe in the late 1960's, when a group of European scientists recognized the need for new ways to protect Earth resources. Their work led to the formation of an international organization dedicated to this purpose, the European Working Group on Earth Science Conservation. Many geoparks exists in different parts of the world, but for any geopark to be known globally, it should be registered on the Global Geopark Network (GGN), the network which works under support of the United Nations Educational, Scientific and Cultural Organization (UNESCO). For a geopark to be registered by the Global Geopark.

Network (GGN), it should fulfill the UNESCO criteria which are, to have a management plan designed to foster socio-eco¬nomic development that is sustainable based on geotourism, demonstrate methods for conserving and enhancing geolog¬ical heritage and provide means for teaching geoscientific disciplines and broader environmental issues, have joint proposals submitted by public authorities, local communi¬ties and private interests acting together which demonstrate the best practices. Tanzania is endowed with a multitude of geological features that are suitable for educational, cultur¬al, ecological and tourist purposes. Ol Doinyo Lengai, the only active carbonatite volcano in Tanzania which erupt-ed at the lowest temperature lava in the world, at 500-600 °C. The lava is natrocarbonatite dominated by nyerereite and gregoryite. Geopark is among of currently streaming issues in the world and hence there is the need for Tanzania to promote its endowned geoparks to be globally known.

ACKNOWLEDGING THE GEOLOGICAL TIME IN THE CAMINHOS DOS C NIONS DO SUL/BRAZIL UGGP: EXPLORING IT THROUGH THE GEOROUTE

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Presentation Format: *Poster*

Presentation Day: **Thursday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **O**

ABSTRACT:

A major obstacle to teaching geoscientific topics is related to the abstraction and complexity of geological time. In this way, the georoutes are an approach to explore the geoparks territories and their associated geosites that have scientific, cultural or educational attributes and retells the geological and geomorphological history of this territory. Moreover, the georoutes offer the possibility to integrate these thematics through the geoheritage of international, national and local relevance, working with the stratigraphical principles for understanding the geological time. The Geopark Caminhos dos Cânions do Sul (CCGS), located in southern Brazil, has a geomorphological and paleontological geoheritage with international relevance. The GCCS landscape encompasses canyons and escarpments developed on rocks from volcanic spills, residual hills that evidence landscape evolution, Paleozoic sedimentary sequences, waterfalls, natural belvederes, Quaternary deposits, paleoburrows and other elements of geodiversity. Thus, in order to approach the concepts and principles from the geological features of the GCCS, this paper aimed to create a georoute from the existing geosites. Therefore, six geosites were selected and separated on a georoute to run in two days: 1st day (1) Angelgres Mining (Rio do Rasto Fm.; Paleozoic); (2) Areia Branca Wall (Rio do Rasto Fm. and Botucatu Fm.; Permian and Jurassic); (3) Cortina Waterfall (Serra Geral Gr.; Cretaceous); 2nd day (4) Timbé do Sul Belvedere (Serra Geral Gr. and Continental system deposits; Cretaceous and Pleistocene-Holocene); (5) Toca do Tatu (Megafauna Paleoburrow; Pliocene-Holocene); (6) Colluvium-Alluvium Deposit (Quaternary). The geosites present in the GCCS allow the approach of different geological concepts and principles along the proposed route, providing visitors with an understanding of the geological time necessary for the formation of the features that constitute the local landscape, in addition to verifying the importance of the conservation of geosites. In this way, the proposed itinerary presents an educational potential, configuring itself as an extension of the classroom in the case of school visits, since the landscape components help in the assimilation of the geological processes that contribute to the formation of the geomorphological units that make up the territory of GCCS.

ARFAK HIGHLAND: COMPLEXITY GEOLOGY AND CANDIDATE GEOPARKS WITHIN THE UPLIFT TECTONICS, BIRD'S HEAD PENINSULA, WESTERN NEW GUINEA

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Presentation Format: *Poster*

Presentation Day: **Thursday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **O**

ABSTRACT:

Arfak Highland is a mountain range located on the Bird's Head Peninsula in the Province of West Papua, Indonesia. The Bird's Head Peninsula is a part of region of New Guinea Island, the second largest island in the world, with the shape of island looks like a bird flying to the west. Located at about 3000 m above sea level, the Arfak Highland has rich geodiversity, many of which have scientific value and significant vintage point for geotourism. However, the geotourism potential of the geosite still remains fully unrevealed. Overview of the geology the Arfak Highland has various terrain and country rocky data record. The Arfak Highland is characterized by a central rugged mountain massif named the Kemum High. The Kemum High is dominated by the Kemum Formation consisting metamorphosed mid Palaeozoic turbidites succession. This formation is moderately to steeply dipping and deformed into isoclinal folds with cleavage/foliation development. Granitic rocks mainly from intrusive rocks exposed in the Arfak Highland and vary in age from Devonian to Triassic and intruded the Kemum Formation. These rocks are an extension of the Australia continental crust, and the abundance of Palaeozoic orogenic rocks indicates a connection with the Tasman Orogenic Belt of eastern Australia as is also found farther east in the Bird's Body within Papua New Guinea territory. The highland recorded collision between Australia continental crust and Pacific oceanic crust with the occurrence of Arfak Block which comprises mafic to intermediate volcanic and volcaniclastic rocks of the upper Eocene to lower Miocene. The Miocene Lembai Diorite forms a pluton in the north-eastern of the Arfak Highland. Cenozoic uplift of the Kemum High is indicated by minor occurrences of Pliocene-Pleistocene shallow marine sediment (Menyambo Formation) that unconformably overlie the Kemum Formation at an elevation over 1500 m above sea level. One of spot the unique geology is an amazing hidden twin lakes in the Arfak Highland, they are called Anggi Giji (male lake) and Anggi Gida (female lake). The lake consists of Palaeozoic turbidite intruded by Permian-Triassic granitoid, and surrounding area comprises of Quaternary deposits. The location of the lake at 2955 m above sea level. Not just a site of purely scientific value, the Anggi Lake holds tremendous potential

tourism in culture of the Arfak society. The Arfak Highland is proper geopark candidate in the southern hemisphere in geoheritage tectonic type.

GEODIVERSITY OF THE MACIN MOUNTAINS - A HOTSPOT OF TOURISM DEVELOPMENT IN ROMANIA

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Presentation Format: *Poster*

Presentation Day: **Thursday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **P**

ABSTRACT:

The Macin Mountains are a distinct range of the Carpathian Mountains, located near the Danube River, in the historical region of Dobrogea, in southeastern Romania. From an altimetric perspective, it is included in the category of old, eroded mountains, with altitude values that do not exceed 400-450 m, the only exception being Tutuiatu Peak, 467 m. From a geological point of view, they are well-individualized mountains, tectonic and lithological, and from a morphological perspective, this mountain unit has a unitary character. They have a crenelated profile, with a northwest-southeast orientation, and represent one of the most prominent residual proofs (inselberg) of the Hercynian orogeny (Late Paleozoic).

The Macin Mountains are of great geological and biodiversity importance at the national level, being the oldest mountains in Romania. The historical remains focused the research on the archaeological value of the area but at the same time, the natural factor was not excluded, being a geological, botanical, and zoological mosaic, of significant value, both for the scientific community and for the tourists.

Being easily accessible, the Macin Mountains have become more and more known to tourists in the last decade. Tourism is stimulated by a wide range of attributes provided by this area as landscapes, local fauna, flora, hiking, scientific tourism, climbing, birdwatching, photo hunting, etc. The specificity of the site is given by the fact that is an area where the anthropic factor is in close interdependence with natural aspects and vegetation. There are unique steppe landscapes, oak, hornbeam, beech, linden, or ash forests, leading to bushes on the peaks and cliffs, and steppe-looking alpine meadows. We can apply the term "Geoheritage" in the case of the Macin Mountains due to the diversity, marked by unique geologic characteristics, rare plant species and habitats, scientific and cultural value, and tourism potential.

THE GEOHERITAGE IN CAMPO DE CALATRAVA VOLCANIC REGION (CENTRAL SPAIN) AS A BASIS FOR THE DEVELOPMENT OF VOLCANO TOURISM

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Presentation Format: *Poster*

Presentation Day: **Thursday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **P**

ABSTRACT:

Spanish sun-and-beach tourism is one of the most popular in the world, however, in recent years it has been experiencing economic and social difficulties derived from a growing demand to discover new tourist destinations. Volcanic tourism is presented as an alternative and complementary option that generates a huge interest for the population, not only as part of the tourist offer of the Canary Islands, but also of the Iberian peninsula, advocating knowledge of the natural and cultural heritage based on the volcanic phenomenon. Territories such as the Campo de Calatrava Volcanic Region (Ciudad Real province, Central Spain), which is currently developing a project to present its candidacy as a UNESCO World Geopark "Calatrava Volcanoes. Ciudad Real". This has great tourist attractions to develop geotourism activities thanks to its cultural values (historical, ethnographic, etc.) and the use and current degree of conservation that the volcanoes present. The volcanic resources can be used as tourist products, both in rural and urban areas, ranging from the design of geotourism itineraries to the creation of new products with a "volcano brand". The study of the volcanic complexes allows to understand their high geodiversity (landforms and landscape). They also have a strong link with cultural values and their good degree of conservation, which is why they are presented as relevant sites in the territory (geosites or geomorphosites). These relevant sites offer attractions that can be used as tourist resources and products, and can be visited through hiking trails. For this reason, he aim of this study is to identify, inventory and evaluate territorial resources present in this volcanic region. Based on an adequate methodology, potential tourism resources would be determined, revaluing the natural heritage (magmatic, hydromagmatic, volcanic edifice, etc.); and on the other hand, also revaluing the cultural heritage linked to volcanic geosites, which can be seen in both rural and urban areas (volcanic rocks constructions, hotsprings, etc.). All this, to create an immersive tourist experience that allows the visitor to enjoy leisure and rest in a rural landscape, as an emerging tourist destination within the UNESCO World Geopark Project "Calatrava Volcanoes. Ciudad Real".

GEO-HERITAGE AND GEO-TOURISTIC VALORISATION OF AGOUDAL IMPACT CRATER (CENTRAL HIGH ATLAS MOROCCO)

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Presentation Format: *Poster*

Presentation Day: **Thursday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **P**

ABSTRACT:

The crater of Agoudal is the first proven impact crater in Morocco. With spectacular shatter cones and an iron meteorite. It is rare to have a similar structure with cones smashed on the surface of the earth in Africa. This new exceptional geological structure enriches the diversity of Moroccan geology. This article aims to strengthen this structure by showing its importance in geotourism and geoeducation. Also, its role on geo-heritage as an irreversible and unique phenomenon, in Morocco. We proposed to apply the same approach, as the Berringer Crater in Arizona in the United States, which attracts hundreds of thousands of people every year. This could be done by integrating this impact crater into a tourist circuit and teaching official programs.

This could be achieved by integrating this impact crater into a tourist circuit and official educational programs. The sustainable development of this region as a geotourism destination is very important. To the extent that the local community will immediately benefit from its impact on the socio-economic development of the region (infrastructure such as roads, hotels, markets, etc.). Finally, it is up to the Ministry of Culture to designate this crater as a national heritage.

GEOHERITAGE, CULTURE AND SUSTAINABLE COMMUNITIES IN RURAL AREAS IN FINLAND, ICELAND AND NORWAY – A THREE-YEARS EDUCATIONAL PROJECT ENHANCING GEOHERITAGE KNOWLEDGE

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Presentation Format: *Poster*

Presentation Day: **Thursday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **Q**

ABSTRACT:

In autumn 2020, just in the middle of the covid crisis, a common Nordplus-funded school project was initiated between Rokua UNESCO Global Geopark (RUGGp) in Finland, Trollfjell UNESCO Global Geopark (TUGGp) in Norway together with Katla UNESCO Global Geopark (KUGGp) and Vatnajökull National Park (VNP) in Iceland as well asthree upper secondary schools from each country.

The project consists of one-week exchanges between the schools and the territories. The first two exchanges took place remotely, the third exchange in September 2021 took place partially remotely as the Icelandic group travelled to RUGGp and Norwegians participated remotely. The third exchange took place in Iceland in March 2022, and finally all the partners could meet physically. In each exchange, a group of ten students and two teachers from each schools participates. In addition, the geoscientists of the parks take part in the exchanges. The coordinator of the project is Vaala Upper Secondary School located in RUGGp.

The main goal of the project is to strengthen students´ knowledge and awareness about geoheritage, culture and sustainable communities in rural areas in the three countries. The project studies natural processes and development of the landscapes and human cultures in the framework of six of the United Nations' Sustainable Development Goals (SDG´s): Goal 6 (Clean Water and Sanitation), Goal 7 (Affordable and Clean Energy), Goal 8 (Decent Work and Economic Growth), Goal 12 (Responsible Consumption and Production), Goal 13 (Climate Action) and Goal 14 (Life Below Water). Each exchange has a specific topic with one of the SDG´s in focus.

The four territories with their unique geoheritage offer comprehensive and concrete learning environments to study the SDG´s. Understanding the functioning of Earth's natural processes is a prerequisite for students to be able to understand the role of human activities in phenomena like climate change and the responsible use of natural resources. Simultaneously, the students improve their knowledge about the uniqueness of their home regions which enhances positive attitudes towards their home and Nordic environments. So far, the students´ experiences have been very positive and they have learned the Nordic environment from multiple points of view.

GEODIVERSITY ON THE ISLE OF ARRAN, SCOTLAND: A LOCATION-BASED GAME FOR GEOEDUCATION.

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Presentation Format: *Poster*

Presentation Day: **Thursday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **Q**

ABSTRACT:

The fields of geoeducation and location-based games have both increased in popularity in recent years. Previous research suggests that developments in mobile technology and web-GIS coupled with an increased interest in geodiversity has led visitors at geoparks to seek increasingly engaging educational methods. However, current research in this field is restricted to large geographical areas such as Geopark Ruhrgebiet, Germany. This research aimed to apply these methods to a smaller area of the Isle of Arran, Scotland which was designated geopark status in 2019. Arran is often referred to as "Scotland in miniature" due to its varied geodiversity, making it interesting for visitors attracted to geology and ideal for this research.

We therefore present a location-based game to assist visitors in learning about the island's geological history. The game, entitled "Arran Geotrail", aims to provide an interactive and educational insight into Arran's geodiversity in the form of a trail that compliments existing educational resources on the island. An absence of visitors between 18-25 years old was identified in the Geopark and so this age bracket became the target audience. Arran Geotrail consists of a series of geofences (virtual geographical boundaries around a point of interest) surrounding six geosites on the island which represent a wide range of geological, geomorphological and hydrological features. Gameplay is controlled by the user's current location and educational information is provided in the form of 'popups', which appear when the user enters a geofence.

Feedback from users was overwhelmingly positive; many praised how content was delivered through the combination of both 2D and 3D maps, images, diagrams and text. They stated this was engaging and suitable for their level of understanding. Users also agreed that the chosen geosites covered a wide range of features. However, it was noted they could be further expanded to include less well-known geological and palaeontological features such as the Fulgurite at Corrie or the Chirothermium footprints at Drumadoon Point.

The flexible design of Arran Geotrail means that the inclusion of additional sites is easily implemented. Nevertheless, through its current implementation, Arran Geotrail already constitutes an important educational resource on the island; it is hoped that it's interactive and engaging nature will encourage more visitors to the island to engage with its varied geodiversity.

INVENTORY AND QUANTITATIVE ASSESSMENT OF GEOSITES FOR GEOCONSERVATION, GEOEDUCATION AND GEOTOURISM: OULMES-SOUK SEBT-TILIOUINE GEOROAD

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Presentation Format: *Poster*

Presentation Day: **Thursday** Presentation Time: **1:15:00 PM**

Presentation Number/Poster Group: **Q**

ABSTRACT:

The Central Massif is well known set of outcrops related to the Hercynian orogeny in Morocco, it presents aspects of the geodiversity represented by different type of rocks and showing numerous geological phenomena which lead to the understanding of geological history of the area. In order to preserve this richness, inventory and quantitative assessment of geosites have been performed using the method of Brilha 2016, since it lead to select only significant geosites through giving importance to scientific value. This step is necessary not only for promotion geotourism and enhancing the sustainable development but also for geoconservation especially those that have a scientific relevant. Organize geosites into georoads is not less important than the previous step, it contribute to show the easy access that could also be a way for supporting the geotourism development mostly in the rural zones.

The Souk Sebt-Tiliouine-Oulmes georoad contain 8 geosites which are:

(1) Autunian fluviatil channels volcano-detritic Red serie of Souk Sebt

(2) Upper Ordovician slump balls

(3) Middle Devonian reefal limestone olistoliths within the Tournisian turbidites West of Tiliouine

(4) Famenno tournaisian calcareous (Mid Devonian reef limestones) rocks falls of Tiliouine

(5) Givetian reefal limestones Stromatoporas

(6) Givetian reefal limestones Algal laminitis

(7) Givetian reefal limestones Slump balls

(8) Permian Ryolite of Souk Sebt

Keywords: Souk Sebt-Tiliouine-Oulmes georoad, geological heritage, geosites.

TALKS

EXPLORATION AND MONITORING: TWO DISTINCT PURPOSES OF GEOSITE ASSESSMENT

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Monday** Presentation Time: **2:45:00 PM**

Presentation Number/Poster Group: **1**

ABSTRACT:

Geosite assessment is the process of inventorying and valuing inanimate natural sites that are important from an earth science point of view and may also be of interest to tourists. These inventories are necessary for the establishment of a geopark and are created through comprehensive geosite mapping. The assessment considers the scientific and tourist infrastructure values of the sites and strives for objectivity by quantifying various indicators.

The quantitative 'Geosite Assessment Model (GAM)' is composed of two main sets of indicators. The 'Main Values (MVs)' are scientific, educational, scenic, and protectional, while the 'Additional Values (AVs)' are functional and infrastructural characteristics of a geosite.

Our research highlights the two possible uses of the GAM. We designated two sample areas in Hungary. The Csopak area of the Balaton Uplands (within the Bakony–Balaton UNESCO Global Geopark) has already been evaluated using this method and is actively exploited as an important geotourism region. In contrast, the northern part of the High Gerecse Hills has not been assessed either qualitatively or quantitatively – although its geoscientific heritage is also highly valuable, and it belongs to the Gerecse Landscape Protection Area.

We have evaluated all MVs and AVs for about 70 selected geosites per sample area. By comparing the results, some significant differences can be noticed: almost all geosites in the High Gerecse received lower overall GAM scores than those in the Balaton Uplands. In terms of MVs, both areas scored high, but the AV scores of Gerecse sites are much lower than those of the Balaton Uplands – due to the less developed tourism infrastructure and services.

These results highlight two different uses of the GAM. Before geoconservation works are started, the evaluation of the MVs can be used as a kind of reconnaissance work, while the survey of the AVs can indicate a baseline. After the establishment of a geopark or other organised institution of geotourism, the growth of the AVs will also start. In this phase, the GAM can be a tool for geosite monitoring: an instrument to continuously assess the state of tourism infrastructure and visitor satisfaction. This latter process has already started in the Balaton Uplands and can be completed in the High Gerecse once geosite identification and infrastructure development are finished. This methodology may also contribute to the establishment of the Hungarian National Geosite Inventory.

THE HUNGARIAN NATIONAL GEOSITE INVENTORY (HUNGI) PROJECT

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Monday** Presentation Time: **3:00:00 PM**

Presentation Number/Poster Group: **2**

ABSTRACT:

Management of geological heritage assumes the existence of comprehensive inventories. This has become quite common at a regional level with the emergence of geotourism and related developments (e.g. geoparks). Several countries have already established a national geosite cadaster to inventory geological and geomorphological objects. In Hungary, since the first declaration of protected areas (1939), hundreds of natural values have been protected, including a large number of geological and geomorphological areas. Beside the thematic (e.g. geological key sections) and regional compilations (Budapest GeoGuide) currently there is no comprehensive national geoheritage cadaster yet.

The recent project "Hungarian National Geosite Inventory", launched in 2019, aims to create a national inventory of geosites in order to develop a useful tool for regional geoheritage management, environmental protection and geotourism development. The national cadaster is based on regional inventories prepared in geoparks (two existing and one aspirant) and other regional landscape units, as well as available thematic datasets (e.g. key sections). The project involves research institutes,

geologists, geopark and geoconservation experts giving a valuable contribution to the national cadaster. They have already proposed objects into the preliminary inventory: the filled simplified data sheets contain geographical and descriptive information about each site (geology, conservation status, protection). The objects are classified based on their major thematic interest: sedimentology, palaeontology, geomorphology, volcanism, natural resources, metamorphism, landscape values and others. The percentage of main interest varies according to the geology of the region.

Currently, the inventory contains about 1000 geosites surveyed in the country. This number changes continuously, as the work proceeds in parallel with the insertion of newly processed areas. The thorough evaluation process is planned to be preceded by a qualitative assessment using representativeness, integrity, rarity, and scientific knowledge criteria. For the comprehensive documentary, the Hungarian ProGEO Section compiled a datasheet, which records the basic object data and contains indicators needed for a detailed quantitative geosite assessment (e.g. tourism infrastructure). The thematic mapping data of the selected database will be available next year, but a detailed site assessment will take several years to be completed.

A GEODATABASE MODEL FOR MOROCCAN CAVES INVENTORY

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Monday** Presentation Time: **3:15:00 PM**

Presentation Number/Poster Group: **3**

ABSTRACT:

Caves were visited by humans since the prehistoric times, human used cave as shelter, he consider them as places of worship and burial sites. Meanwhile, caving exploration for scientist purpose started late 15th century and the systematic or modern exploration called Speleology began in the 18th century.

In Morocco, speleology is experiencing a tremendous rebound from the last 20 years, caving community is growing and caves are more and more over-visited for leisure and scientific purposes.

Caves are an important source of information and has interest for different areas of scientific specialization, this multidisciplinary characteristics of speleology lead to a multitude data gathering method and data storage techniques, this repetition are potentially harmful for caves which are an extremely fragile environment.

Awkwardly, there is no common ground for the various scientific domains to conduct cross analysis with other domains.

With technology democratization and Geographic Information Systems (GIS) development, we have today a promise tool to satisfy scientific needs.

For Morocco, the only official reference that list caves of the country remain “Inventaire Spéléologique du Maroc” published in 1981 which repositories 593 caves, since then, number of discovered caves are growing and data are handled separately by caving community and researcher.

The integration of Geographic Information Systems associated to cave inventory resources for web-map application aspire to improve data management, centralization and controlled access database.

This presentation aim to :

- Propose a Spatial Geo-database Model for cave repository to visualize, record, analyze and add a spatial dimension to cave data.

- Create a modernized and user-friendly GIS-based cave inventory divided to a simplified database inventory for visitor and cave explorers and advanced database for scientist and researcher.

- Develop a community web based application, where scientist, researcher and caver enrich continuously.

An ArcGIS Geo-database model is established and data entry is in progress for the 1500 listed cave, this Geo-database use a common data format making data exchange and sharing between researchers a simple procedure.

GEOSITE DETERMINATION BASED ON GEODIVERSITY ASSESSMENT UTILIZING VOLCANIC HISTORY OF A NEAR-SEA-LEVEL EXPLOSIVE ERUPTION-DOMINATED VOLCANIC ISLAND: TUHUA/MAYOR ISLAND, NEW ZEALAND

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Tuesday** Presentation Time: **2:00:00 PM**

Presentation Number/Poster Group: **4**

ABSTRACT:

The recent eruption of a partially submerged intermediate polygenetic caldera volcano in Tonga demonstrates the unpredictability of eruptions' explosive power, which rise a question about humans' inability to be prepared for similar events in the future. Mayor/Tuhua Island is one of the warning locations of SW Pacific regions, located in the Bay of Plenty, New Zealand, presents as intermediate complex volcanic island with at least 130ka eruptive history formed by numerous of water-magma interactions-controlled by explosive eruptions. More detailed studying of eruption history will help scientist to understand the scale of potential danger in the future. Hence, geodiversity assessment is an efficient way to highlight the most important places (geosites) for studying volcanic activity. The geosites will help scientist to understand the scale of potential danger during eruptive event. Qualitative-quantitative assessment of geodiversity utilized data of high-quality map of the island with a systematic revision of the volcanic geology providing a unique opportunity to estimate protentional geosites adjusted towards volcanic history rather general geology. The result of research shows that most places around Mayor Island especially near cliff side should contain numbers of visible outcrops presented by cone building pyroclastic deposits with high value of geodiversity. Then, tuff cone (high value of geodiversity) specifically located in the inner part of eroded Island's caldera. Meanwhile, Tuhua pyroclastic deposits, specifically presented in the north part shows the highest value. Further observation of potential geosites is compulsory to provide more detailed information of Island's forming processes.

SCIENCE DRIVEN MOBILE APPLICATION HIGHLIGHTING THE NATIONAL GEOLOGICAL PARK OF NEA KAMENI VOLCANO, SANTORINI, GREECE.

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Tuesday** Presentation Time: **2:15:00 PM**

Presentation Number/Poster Group: **5**

ABSTRACT:

Santorini volcano comprises Palea and Nea Kameni islands in the middle of a large flooded caldera. The volcano is rich in awe-inspiring topography and geology and is a top tourist attraction. In order to integrate the services of the National Geological Park of Nea Kameni Volcano as well as to promote public understanding of the volcanic history and present-day volcanic landscape, a digital guide in the form of a modern mobile application for smart devices was developed. The user of the application can discover the wondrous volcanic laboratory and learn from the experts the history of its evolution through up-to-date material. The application showcases the geological volcanic path of Nea Kameni and the points of interest. The content involves original photographic and video material, historical records of volcanic eruptions, thematic Digital Elevation Models (DEM), volcanological map of Palea Kameni and Nea Kameni with the points of interest (POI), digital maps of the lava flows and the elevation phases of Kameni islands from 197 BC to 1950 AD based on scientific data enriched with an enlightening, descriptive text. Moreover, the application is promoted through a corresponding website and a modern tourist leaflet for the volcano.

THE VOLCANIC GEOHERITAGE OF MOGODÉ AND RHUMSIKI (KAPSIKI PLATEAU, FAR NORTH CAMEROON): ASSET FOR SUSTAINABLE GEOTOURISM

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Tuesday** Presentation Time: **2:30:00 PM**

Presentation Number/Poster Group: **6**

ABSTRACT:

The localities of Mogodé and Rhumisiki are located on the Kapsiki plateau, which overlooks the vast peneplain of the Far North Region of Cameroon. This territory had been marked by volcanic events and surface processes that have created numerous outcrops that constitute geological sites of interest. This study aims to inventory, select and study this volcanic heritage for a sustainable geotourism activity. To achieve this, the method used is based on alternating field and laboratory work using numerous tools including hammer, GPS, Compass, Camera and GIS software. The geological heritage in the study area includes rhyolitic and trachytic necks and dykes. About 43 necks were selected. They have varying altitudes ranging from 900 to 1145 m. They are mostly conical structures with numerous fissures and diaclases and columnar joints. The latter facilitate the detachment of multidimensional, polygonal and diffuse blocks found on their piedmont. Nearly 10 dykes of varying dimensions, i.e. 1.5 to 15 m wide, 200 to 1355 m long and 200 to 1355 m high, were encountered in the study area. They mostly present several cracks networks and eventually collapsed blocks on their piedmont. Through their exceptional shapes, geological features and active geomorphic processes, these geosites have a high aesthetic and geo-educational value. Geosites such as Mogodé Dyke and Mchirgue Neck in Rhumsiki are used for initiation rites and other traditional activities; giving them a significant cultural value. Through these values, the volcanic heritage of the study plot is a major asset for geotourism. Even if this locality attracts a strong national and international community and fostered several economic activities (pottery, threads and cloths by weavers, sculpture and jewellery, hotels and restaurants…) several years ago, the implementation of geotourism through a sustainable policy would increase the number of visitors and sustain economic activity in Mogodé and Rhumsiki.

GEOHERITAGE IN THE CLASSICAL MYTHOLOGY OF HESIOD (~700 BCE)

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Tuesday** Presentation Time: **2:45:00 PM**

Presentation Number/Poster Group: **7**

ABSTRACT:

Mount Olympus of Greece is a geologic treasure, a remnant of the Apulian Continent subducted beneath the old European continent and exhumed from a depth of ~25 km. As a geological monument, its exceptional lithologies delineate ~170my (Triassic-Eocene) of a carbonate platform and the mechanisms of negative buoyancy exhumation within the Miocene. Outcrops of global significance include blueschist formations among pioneering studies in models for exhumation.

The area of Mount Olympos has been occupied by modern peoples for about 40,000 years, its coastal environment an ecologic paradise. These early people witnessed active glaciation and peri-glacial conditions. The mythology recorded by Hesiod (~700BCE) pictures their Neolithic world. Reading The Theogeny as a geoscientist reveals environmental and geographic conditions we can witness today. The mythic origins of areas such as the Vale of Tempe corresponds to the geological explanation of a cataclysmic event, the instantaneous drainage of the waters of Thessaly creating a canyon attributed to the work of Poseidon and his trident – that is, by earthquakes and waters. The holy tales describe a battle between the gods and the titans, "scars" of which can be seen in the geology of Olympus and Ossa; conditions of their warfare describe a climate under battle by the eruption of Thira including a "seismic" storm, and tephric dust falls initiating severe lightning storms. We read of Zeus hurling the monster Typhoeus burning from the sky to the earth, melting the rocks themselves with his landing. This sounds to the geoscientist like a meteor impact, and a search of recent geologic research locates a proposed impact crater south of Mount Olympus dated to the Neolithic: this impact would have been witnessed by the makers of myth, recounted hundreds of years later in Hesiod.

Twenty mountains on Earth and Mars are named after Olympus. Geomorphologically impressive, Mount Olympus is esteemed as the home of the ancient gods of Greece. The history of these gods as recorded by Hesiod has become a foundation for much of the cultural evolution of the western world: consider the Olympic games, the archetypal drama of Sophocles, the narrative of Homer. Without this religious mythology, would the concept of democracy and the "Greek Miracle" have entered the early evolution of western civilization?

CELEBRATING HYDRO(GEO)LOGICAL HERITAGE – THE TABLE MOUNTAIN DAMS TRAIL AND HERMANUS WATER WALK (WESTERN CAPE, SOUTH AFRICA)

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Tuesday** Presentation Time: **3:00:00 PM**

Presentation Number/Poster Group: **8**

ABSTRACT:

Hydrogeology and hydrology are commonly overlooked aspects of geoheritage, despite strong geological links. Water in all its forms has played a critical role in the development of Earth and shaping of its landforms (in addition to sustaining all life on the planet), and access to water has been the core reason for the establishment of numerous human settlements. The evolution of a settlement's water supply tracks its history of development across the Holocene, providing an excellent tool for teaching the public about human's interactions with the Earth and our shared future going forward in a changing climate. Many of these historical water supply systems also reflect engineering feats of the time, and are hence important cultural heritage features. To this extent, The Umvoto Foundation (with funding assistance from the 35IGC Legacy Fund) is in the process of developing two walking trails (with associated guidebooks and mobile apps) in areas of the Western Cape province (South Africa) with rich water supply histories and hydro(geo)logical heritage – the Table Mountain Dams Trail in Cape Town, and the Hermanus Water Walk in the Overberg region. The surface and groundwater supply systems that both trails cover have an inherently unique link with the Ordovician to Devonian Table Mountain Group (TMG) metasedimentary rocks and associated fractured aquifer systems (including the complex tectonic and geomorphic evolutionary history that has led to the present landscapes), which most local Cape Town/Overberg residents and international tourists are generally unaware of (despite both Cape Town and Hermanus being major tourist regions in South Africa). The five dams on the Back Table of Table Mountain (the Woodhead, Hely-Hutchinson, Alexandra, Victoria, and De Villiers Dams) are now part of the Table Mountain National Park landscape and remain symbolic of the late 19th and early 20th century heritage of Cape Town. The three TMG wellfields in Hermanus form the best managed municipal groundwater abstraction system in South Africa, and their positioning allows for the full hydrological cycle to be viewed along scenic mountain contour paths. It is envisioned that through these guides/trails the reader/walker (whether local resident or international tourist) will gain a greater appreciation and feeling of ownership for the natural history of the city/region they live in, and strive to preserve associated hydro(geo)logical and cultural heritage for future generations.

HOW DO WE DO GEOEDUCATION?

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Tuesday** Presentation Time: **3:35:00 PM**

Presentation Number/Poster Group: **9**

ABSTRACT:

The promotion of geoheritage is crossed by a web of activities with the purpose of contextualize certain communities about their territories and the abiotic natural heritage present there. In the studies and activities related to geoheritage, the educational value is a particularly relevant aspect, thus, it has been possible to position geodiversity's elements of special relevance in the collective imagination and even in the local or international academic community. Various instruments have been used in our community to ensure an objective assessment of the geoeducational value of the elements that comprise (or could comprise) geoheritage. However, such use of 'geoeducation' concept has made it obviousness. 'Geoeducation' is a ghost that appears in the academic documents related to geoheritage, without saying much. In this talk, we want to remind that the earth sciences have an incredible potential for pedagogical innovation; a potential that should be exploited, systematized and even extended to other fields of knowledge. Earth sciences offer the possibility of executing different epistemological practices that are related directly and practically to the educational needs of our present. Practices that should take into consideration the developments of contemporary phenomenology and the demands of educational sciences. In that sense, we are convinced of the need for scientific community to take seriously what should involve the inclusion of geoeducation concept in academic texts. That is to say, a rigorous accompaniment of pedagogical sciences that allows us to systematize teaching methodologies that contemplates the need of using the body in educational praxis, specifically in the learning and teaching of earth sciences. Consequently, if we already know the importance and educational value of the heritage we study, it is time to pay attention to how we develop our educational practices, in short: how do we do geoeducation?

UNESCO GLOBAL GEOPARKS AS DRIVING-FORCE OF ENVIRONMENTAL GOVERNANCE TOWARDS GEOCONSERVATION AND SUSTAINABLE DEVELOPMENT IN PORTUGAL

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Tuesday** Presentation Time: **3:50:00 PM**

Presentation Number/Poster Group: **10**

ABSTRACT:

Portugal bears the sixth largest lithium reserves in the world, and is the fifth largest producer in the matter. This production supplies predominantly the ceramic industry, but with the recent trends towards a digital economy, along with the energy transition to a decarbonised economy, prioritising electric vehicles over fossil-fueled ones, Portuguese stakeholders have found an opportunity in reinforcing lithium mining to supply the electronic and automobile industries. For the recent few years, economically viable sources of lithium for energy uses have been sought and, in 2021, eight potential new areas for the exploitation of lithium were disclosed and licensing procedures for prospection were initiated.

The definition of those areas have taken into account the protected areas such as the natural parks, which were excluded from the licensing process at the very first moment. International designations such as UNESCO Global Geoparks (UGGp), however, were neglected in these studies and, as a result, Estrela UGGp had 23.6% of its area made available for lithium prospecting.

Lithium mining in Portugal is wide open-air mines of pegmatite, which also imply soil and vegetation removal, besides rock extraction and processing, resulting in a huge change in landscape. Furthermore, nearby populations frequently complain of noise pollution and dust as secondary impacts of the activity. Thus, this sort of mining could directly impact thirteen of the 145 geosites identified under the Estrela UGGp strategy, located in the areas delimited for lithium prospecting, risking the maintenance of the UNESCO label. Also, indirectly, it could impact the touristic attractiveness enhanced by this designation, starting 2020. Furthermore, lithium mining and its benefits have been a very controversial subject in locations where similar activities occur, since the economical impact for the local communities is not very clear.

Aware of the difficulties to confront the economic influence of major stakeholders, once the eventual economic viability has been found, Estrela UGGp staff presented an official position, stating this rationale, at a public consultation made available as part of the licensing procedures. As a result, following the evaluation of the participations in the public consultation, the government published the

adjusted prospecting areas that excluded not only the Estrela UGGp, but also the other UGGp and UNESCO Biosphere Reserves whose areas would overlay.

THE KARST LANDSCAPES OF BENI MELLAL ATLAS (CENTRAL MOROCCO): IDENTIFICATION FOR PROMOTING AND GEOCONSERVATION

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Tuesday** Presentation Time: **4:05:00 PM**

Presentation Number/Poster Group: **11**

ABSTRACT:

Karst is a distinct landform modeled generally by the dissolving action of water on carbonate rocks such as limestone, dolomite and marble. This process resulting in a variety of features above and below ground, including gorges, sinkholes, underground streams, karren, ruiniforme landscapes and caves in thousands or millions of years. The study karst area is located in the northern part of the Moroccan central High Atlas. Has characterized by a diversified geological and geomorphological heritage and exceptional high mountain landscapes. This territory has considered a regional reference of underground streams and spectacular karst landforms and support unique ecosystems, which is why they need protection.

Until now, little attention been paid to this particular heritage, so the aim of this research is to inventory and assessment this special landform. The study focused on 26 potential karst landscapes with a high scientific, educational and tourist interest.

This study should serve as a database to help regional authorities to manage this geoheritage in the framework of territorial valorization. The evaluation of the geosites have established using a quantitative methodology to obtain numerical scores. The addition of the quantitative evaluation of the protection status has allowed to determine that the karst geosites of the study area are selected as the most vulnerable ones requiring geo-conservation programs and promotion strategies through geo-tourism that take into account both the geo-diversity, biodiversity and cultural diversity of the territory.

Keywords: Geo-conservation, karst landscapes, Central High Atlas, Atlas of Beni Mellal.

EVALUATING THE CONDITION, USE AND FUTURE OF THE UK'S LARGEST DINOSAUR TRACK SITE AT SPYWAY QUARRY, DORSET

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Tuesday** Presentation Time: **4:20:00 PM**

Presentation Number/Poster Group: **12**

ABSTRACT:

Spyway Quarry in Dorset is the largest dinosaur track site in the UK. It contains >100 prints made by large sauropod dinosaurs walking across what was a shelly beach next to a freshwater lagoon in the Early Cretaceous. This site provides compelling evidence for sauropods in Dorset in the Early Cretaceous in the absence of body fossils, filling a key gap in the global record. Its impressive size, accessibility and novelty also make it a unique UK location for the public to directly engage with dinosaurs. The site is owned by the National Trust and managed by them in consultation with the Jurassic Coast Trust. Following extensive consultation on how best to open and manage the site considering its "value", longevity and resources available, it was left unmanned with the track surface directly accessible and an interpretation panel was installed at the site. It has had an understated rollout and online presence to both help to manage visitor numbers (and expectations) and to fit into the 'Journey of Discovery' ethos at the heart of the Jurassic Coast visitor experience. The site has now been open to the elements since 2014. Its 2016 opening to the public was on a provisional basis, with a plan that a photogrammetric model created of the site in 2014 could be used as a baseline to assess changes through time and the sustainability of direct public access to the surface. We created a new 3D model of the site in 2021 using photogrammetry, and are comparing this quantitatively with the 2014 model to identify areas of the trackway surface that have been eroded or damaged over time, as well as to map the orientations and distributions of major cracks within the bedding plane that threaten the integrity of the surface. In order to better understand public use of the site, a visitor counter was installed at the main entrance to the site in 2021, and data on social media posts related to the site are currently being compiled. Photographs of the quarry surface were also taken at regular intervals on busy visitor days during the summer of 2021 using a GoPro, and images were subsequently analysed to produce a heat map of which parts of the trackway surface were most intensively walked over by visitors. Analyses of these data are being used to generate increased understanding of the current use of the site and risks to its preservation and to inform future management decisions.

RE-IMAGINING PLACE: A STUDY ABROAD EXPERIENCE ON HERITAGE, STORY, AND RESTORATION.

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Tuesday** Presentation Time: **4:35:00 PM**

Presentation Number/Poster Group: **13**

ABSTRACT:

The southwest of England is an area both rich and diverse in its long-term environmental history and record of human impact. While dinosaurs roamed the land, the coast was a shallow sea hosting many species of animals now extinct, leaving only fossils behind. Forces deep from deep with the Earth left their mark with a rich legacy of metal ore deposits that were a great source of wealth from Roman times, but were also critical elements in ushering in the Bronze Age, and later supporting Celtic kingdoms. The region was also part of the Kingdom of Wessex, made prominent by Alfred the Great, and has also served as literary and artistic setting, such as the Poldark series. Accessing the richness of the region had environmental, cultural, and economic impacts that have lasted to this day. During this presentation, we will share the experience of a study abroad course designed examine the environmental legacy of southwest England in field-based settings, traveling to sites that illustrate the crossroads between humans and their relationship to the Earth from prehistory to the present day. The course also invited a psychological, emotional, storied, and regional heritage conversation. From this experience, students were inspired to develop plans for reclaiming areas from negative impact, while honoring the environmental history, culture, and the reimagining of place, in an area where the long-term elements are laid open. Students were guided to:

- Examine the interactions between the social and physical aspects of environmental issues in a historical context;
- Express the political, economic, and sociological consequences of earth resource management and mismanagement;
- Examine the complexity of environmental problems and potential solutions;
- Engage in collaborative cross disciplinary and cross cultural inquiry into the evolving understanding of the complex relationship between people, history, environment, and place; and
- Apply what they learned abroad to local environmental reclamation and restoration opportunities.

FROM GEODIVERSITY TO GEOFUNCTIONALITY: A CASE-STUDY ON FRENCH GUIANA AND IMPLICATIONS FOR SUSTAINABLE LAND PLANNING

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Wednesday** Presentation Time: **2:00:00 PM**

Presentation Number/Poster Group: **14**

ABSTRACT:

As operational concept, geodiversity implies a measurement and its application narrowed to a given spatial area. However, such concept is often integrated to support planning perspectives that focus mostly on geoconservation. Furthermore, diversity alone might not account for the contribution of abiotic and interfacial resources to socio-ecological functioning.

First, we review the geodiversity concept within a methodological framework towards its operationalization for territorial management. Geodiversity is defined both in its typological and functional diversity, the latter one being related to the geo-ecosystem services (GES) supply. The characterization of geodiversity is completed with the identification of the anthropogenic drivers linked to land-planning strategies (e.g. urban projects, mining activities, agricultural practices) and that might affect GES supply. The second part, aims at confirming the necessity of an operational framework through the first assessment of French Guiana geodiversity. This area is an Oversea French territory located in South America and is considered as an international conservation and land-planning challenge.

A geodiversity index was calculated as the sum of four sub-indices (lithodiversity and unlithified diversity, mineral diversity, hydrodiversity, geomorphodiversity). Spatial correlation was used to identify geodiversity clusters and finally the index was aggregated at different spatial units relevant for land-planning (e.g. municipalities, hydrographic sectors, natural park, mining planning). The results show that the geodiversity index is mainly controlled by lithodiversity and that high geodiversity clusters are located along the gold-bearing greenstone belts crossing the territory. Data about French Guiana geodiversity are still scarce and this represents a challenge for land planning. Furthermore, when comparing the index to the location of ecological areas or points of geological interests, geodiversity seems to do not follow systematically the same patterns of geofunctionality. The paper allows encourages towards a more comprehensive definition of geodiversity. The assessment of diversity alone is not always enough for geoconservation nor broader land-planning

perspectives. It is pivotal to account for the contribution of geodiversity to the functioning of a given area (i.e. geofunctionality) and its interaction with the anthroposphere.

INVENTORY AND QUANTITATIVE EVALUATION OF TINGHIR GEOSITES (MOROCCO)

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Wednesday** Presentation Time: **2:15:00 PM**

Presentation Number/Poster Group: **15**

ABSTRACT:

Our study area is located in the Tinghir region, which is a southern-eastern geographic segment of Morocco. It is a geomorphological hinge wedged between two mountainous massifs: the High Atlas central to the north and jebel Saghro to the south which is a natural continuity of the Anti-Atlas located at the Saharan borders of Morocco. The Anti-Atlas chain, subdivided into three parts (the Anti Western Atlas, the Anti Central Atlas and the Anti Eastern Atlas), is in the form of a vast anticlinal bulge with at its heart outcrops of base called buttonholes, themselves bordered by a pleated paleozoic sedimentary cover.

The Anti Atlas Oriental that represents jbel Saghro is formed by a precambrian base consisting of conglomerates, breaches, sandstone, volcanic tuffs and rhyolite ignimbrites and a paleozoic cover rich in sandstone, carbonate, schists, quartz, etc. The central High Atlas area is characterized by a thick triasic series (red sandstone and argillites with tholeitic basalt intercalations) followed by a thick jurassic series (marls and alternating dolomites and limestone), followed by gypsum limestone, then conglomerates and lacustrine limestone in Mio-pliocene.

The objectif of our work is to inventory, identify and evaluate the Tinghir Geopatricmoine based on the Brilha method (2016) which responds to the diversity of the region's geosites characterized by important scientific qualities. Preliminary results show the following geosites: dinosaur footprints at Issil Ait Arbi (paleontological), Alnif trilobites (paleontological), caves in carbonate levels (geomorphological), Imitate silver deposit (mineralogical) and sites of plant footprints (paleontological). In addition to their scientific qualities, some geosites have exceptional tourist qualities with high to moderate tourism potential value. This expresses the importance of the region in

terms of tourism, especially the Dades gorges and the Todgha gorges, which are known by national and international tourist destinations especially during the period from spring to summer. In educational terms, sites have important values.

Our study is a vector of geotourism promotion aimed at a sustainable regional development inserted in the preservation of the geodiversity of the region that must be valued and conserved for future generations.

Keywords: Tinghir, Morocco, geosites, quantitative evaluation.

MINING AND SUSTAINABLE DEVELOPMENT IN SERIDÓ UNESCO GLOBAL GEOPARK, BRAZIL

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Wednesday** Presentation Time: **2:30:00 PM**

Presentation Number/Poster Group: **16**

ABSTRACT:

Mining industry has been one of major economic activities of Seridó UNESCO Global Geopark territory since 20th Century begin. Between world conflicts, international trade, urban development and local traditions, the mining grows up closer to the local natural heritage. In Seridó Geopark, two of 21 geosites are directly associated with mining, the Mina Brejuí and Açude Boqueirão geosites have one of the largest productions of scheelite and Paraíba tourmaline in South America context, respectively. From this, we analyzed how mining activities contribute or impact the geoconservation role, and by what means mining companies that work in geosites collaborate to sustainable development. For this study we used three methodological stages. The first one consists of geoprocessing tools for identifying opportunities and threats from mining to geopark and their 21 geosites, using data from national geological and mining agencies. Through the second method applied was possible to investigate the education and tourism potential in these two mining sites studied. The last part was the MONET framework application together production control managers of two mining companies studied and their comparative with Sustainable Development Goals (SDGs). As result was possible to identify geosites linked with rivers and dams, as Açude Gargalheiras and Cânions dos Apertados, that had benefited with sand and clay removal by extraction, as well in Mina Brejuí and Açude Boqueirão geosites the visitation for geotourism and education practices are positive relationships between mining and sustainability. We observed that Mina Brejuí and Açude Boqueirão are important mining sites, both regard relevant historical and cultural heritages associated with World War II and highlight the importance of Neoproterozoic to Cambrian mineralizations as a most important geological heritage of this geopark territory, on the other hand possibly without mining were be an unknown heritage. Both companies historically have developed good jobs in three dimensions of sustainable development, promoting social actions together their neighborhood communities, generating jobs and develop ways to minimize environmental impacts. The mining industry can improve the SDGs advancement in Seridó Geopark territory, the partnership in educational and touristic actions are the main strengths able to approximate communities from your own heritage and turn social image of mining better.

UNESCO IGCP-714 - 3GEO – GEOCLIMBING AND GEOTREKKING IN GEOPARKS: PRELIMINARY RESULTS

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Wednesday** Presentation Time: **2:45:00 PM**

Presentation Number/Poster Group: **17**

ABSTRACT:

The IGCP-714 UNESCO project entitled "3GEO – Geoclimbing and Geotrekking in Geoparks: sustainable practices for enhancing the tourist and education experience" aims at clustering iconic sites in different countries around the Earth to investigate the potential of geoclimbing and geotrekking activities, highlighting both advantages and limitations. The selected sites are located in 11 countries (Brazil, Chile, Greece, Italy, India, Oman, Poland, Portugal, South Africa, Spain, United Kingdom), and they belong to either UNESCO or aspiring Global Geoparks, otherwise to other geoheritage valuable natural parks. During the first year of the project, 24 geoclimbing sites and 28 geotrekkings were selected in different countries to represent specific regional geological and geomorphological contexts (i.e. geodiversity). For example, we can name: Dolomites as well as sites in the Italian Alps where metamorphic and magmatic rocks crop out; the Central Iberian Zone (Spain and Portugal) characterized by widespread granitoids and gneissic rocks; Tatra Mountains and Central Carpathians mountain chains in southern Poland and northern Slovakia with dominant limestone, travertine but also magmatic rocks; limestone platforms of Greece and Oman; the basaltic lava flows of the Deccan Trap Volcanic Province in India; the sandstone of the Karoo Basin in South Africa in comparison with those outcropping in the Italian Apennines; the metasediments of the Chapada Diamantina in Brazil. More geotrekking and geoclimbing sites are under evaluation to be included in this pool of geodiversity sites. In the 3GEO project we will employ multimedia tools and 3D models from drones and cameras, to boost geoparks and natural areas awareness. Site inventories will also be integrated within a data repository for users to discover the worldwide geodiversity. Although the outdoor experiences in these marvellous geosites are already ongoing, they will be empowered by Earth Sciences contents (videos, virtual tours, photos, scientific information, and interpretations)

developed within this project; both onsite and remote data will thereby enhance relationships between outdoor activities and geodiversity for the community.

OVERVIEW OF GEODIVERSITY AND GEOHERITAGE IN ARGENTINA

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Wednesday** Presentation Time: **3:00:00 PM**

Presentation Number/Poster Group: **18**

ABSTRACT:

Argentina, in the southern extreme of South America, comprises a continental territory of 2,791,810 km2. It extends from latitude 21°46'S to 55°03'S and from longitude 73°34'W to 53°38'W. Besides, the Atlantic Ocean covers almost 5,000 km of coast to the E and the Andes Range is a natural borderline along 3,500 km to the W. These characteristics give unique features with a great variety of climates and landscapes that, together with the rich geological evolution, create multiple sceneries that underpin a valuable geodiversity and offer massive opportunities to learn about natural history under the scope of the Earth Sciences.

Though the country possesses this wide range of georesources which are worthy of conservation after their intrinsic value and scenic beauty, it lacks a specific law that safeguards its geoheritage. Despite the fact that there is a federal system of natural protected areas -which include more than 500 covering 37 million hectares- Argentina does not have a national conservation instrument that focuses exclusively on geodiversity. However, some laws protect specific elements of geodiversity or the geological landscapes as a background scenery. Moreover, some institutions have adhered to the Geodiversity International Day proclaimed by UNESCO. Although there are no Global Geoparks, some enterprises have been developed in order to promote geotourism. Additionally, Argentine geoscientists and tourismologists have been working in geodiversity as a new domain of research. As a result, the National Geological Congress has included a symposium on geoheritage in its programme since 2014. In 2008, the National Geological and Mining Survey selected 72 sites of geological interest across the country that at first sight seem not to be enough. In this sense, this contribution aims to present 5 of them that offer varied geodidactic functions: the Puna Pleistocene monogenetic volcanic cones in the NW; the Iguazú active waterfall complex in the NE; the Talampaya red rocky vertical outcrops containing paleontological records in the W; the Precambrian basement rocks forming the Tandilia orogenic system at the centre; and the Perito Moreno discharge glacier from the Andean icefield in the SW.

These georesources do not pretend to be a representative sample of the Argentine geodiversity, instead we seek to raise awareness of the geopotential of the country and the need to boost a geoconservation policy.

WHERE GEODIVERSITY MEETS BIODIVERSITY AND CULTURE: A CASE STUDY FROM ABANDONED LIMESTONE QUARRY OF HÁDY (BRNO, CZECH REPUBLIC)

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Wednesday** Presentation Time: **3:15:00 PM**

Presentation Number/Poster Group: **19**

ABSTRACT:

Geodiversity represents a basis of landscape and it has tight connections to biodiversity and culture. This complexity is well visible in different types of areas and should be taken into account when planning and managing natural resources, reconsidering legal protection, and developing of sustainable forms of tourism or environmental educative activities. A holistic view on landscape and heritage significantly contributes to the acceptance of the (geo)conservation needs and sustainable management of heritage sites and objects. Abandoned quarries represent a good example of specific areas where the relationships between geodiversity, biodiversity and culture are very tight and well visible. The case study from abandoned limestone quarry of Hády (Brno, Czech Republic) shows such case which (besides its Earth-science importance) has a big potential regarding the development of geotourist and geoeducational activities. To recognize and evaluate the mutual links between abiotic, biotic and cultural issues, the ecosystem services concept was applied. In future, this may serve as a starting point for further management proposals. Evaluation of ecosystem services together with a mind mapping offered a conceptual framework for preparing a geotourist map which is going to serve both as a tool for environmental education and integrated promotion of geodiversity, biodiversity and cultural issues of the area.

GEODIVERSITY AND CULTURAL ECOSYSTEM SERVICES: PERSPECTIVES GAINED THROUGH SOCIAL MEDIA ANALYSIS.

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Thursday** Presentation Time: **3:30:00 PM**

Presentation Number/Poster Group: **20**

ABSTRACT:

Geodiversity actively provides cultural ecosystem services - the range of non-material benefits we receive from our interactions with nature. However, suitable datasets for assessing human-nature relationships are difficult to obtain, even at smaller spatial and temporal scales. Therefore, the evaluation of geodiversity's' role in the generation of these services has been scarce. Social media websites present a novel approach to assessing cultural ecosystem services. Social media datasets are rapid and inexpensive to gather compared to traditional ecological and social assessments, whilst being available over a range of spatial and temporal scales. Here, we focus on applying social media datasets to investigating the importance of geodiversity on recreational and aesthetic services. Posts to social media sites, such as Flickr, are often georeferenced, meaning we can identify the location of where people are taking photographs or are writing a text post about their experience. Using location data from posts that represent specific recreational activities or aesthetic views, we can assess the spatial distribution of these services and start to understand what drives these patterns. Furthermore, innovative methods such as the use of machine learning algorithms can help identify what people photograph, while textual sentiment analysis can help us understand which aspects of geodiversity people positively interact with. Using case studies from Europe and North America, we find that geodiversity, such as geomorphological and hydrological features, plays an important role in providing positive human-nature interactions. Furthermore, we find that cultural ecosystem services are not only provided by geodiversity, but by our complex interactions with geodiversity, biodiversity and anthropogenic features. Future work can continue to build upon these methods to explore a wider range of cultural ecosystem services across broader spatial and temporal scales.

GEOHERITAGE AND GEODIVERSITY AS A TOOL FOR CONSERVATION IN JAMAICA

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Presentation Format: *Talk (14 minutes)*

Presentation Day: **Thursday** Presentation Time: **3:45:00 PM**

Presentation Number/Poster Group: **21**

ABSTRACT:

There is a need to recognise more facets of our heritage in the Caribbean, particularly, our geoheritage, a growing concept surrounding the heritage of the landscape, soil, geological processes, and resultant geological features. The Caribbean hosts a diverse selection of geological, geomorphological and geobiological features, most of which have not formally been recognised as 'geosites' or aspects of 'geodiversity', but rather as that of 'nature', 'natural heritage' or simple backdrops to already declared biodiversity.

Opportunities are recognised within Jamaica, a small Caribbean Island with a rich geodiversity. Being part of the Greater Antillean Caribbean has privileged the small island with a complex geological history, which geoscientists locally, regionally, and internationally have come to appreciate. However, among the public, there is minimal awareness, appreciation and protection of this geologic landscape and recognition of its contribution to our natural heritage. Legal conservation proceedings have prioritised biodiversity and culture as the motivation for site protection, and even more grandeur declarations like World Heritage. National parks, forest reserves, protected watersheds, and other conservation spaces present opportunities for major geological recognition, on local, national, and international scales.

Using the eastern parishes of Portland and St. Thomas, potential geosites and geoheritage can be identified within legally established protected areas, as well as areas with no protective declaration. This study aims to create awareness of geodiversity elements through the development of a local site inventory; with these sites serving as precursors for a national geosite inventory. Significant markers in the geological evolution of Jamaica will be identified along with their role in influencing our biological and cultural landscape. This would create opportunities for a more comprehensive system of conservation, which would foster public awareness, education and geotourism to encourage community involvement.