Geosciences and Society – Bridging the gap with GeoParks and Co

March 27 to 29 at Rupprecht-Karls-Universität Heidelberg (RKUH) and March 29 to 31 excursion to GeoParks in Baden Württemberg and Bavaria

A GOAL activity, thankfully and generously supported by DAAD

1. GOAL-internal meeting (27.03.2014)

2. Expert seminar on GeoParks (28.-29.03.2014)

4. GOAL-Field Workshop GeoParks and the Anthropocene (29.-31.03.2014)

a) **GeoPark Schwäbische Alb**. Site Aalen Urweltmuseum: an example for educational science for the general public (16:00–17:30 hrs)

b) **GeoPark Nördlinger Ries.** Site Nördlingen with overview and city walk (suevite observations) (as of 18:30 hrs)

c) **GeoPark Nördlinger Ries.** Site Nördlingen and environs with active limestone quarry, Meteorite museum and various relics of the impact event (09–16:00 hrs)

d) **GeoPark Bergstraße Odenwald.** Site Main-Tauber region with Michelstadt and Tertiary rock formations (as of 17:30 hrs)

e) **GeoPark Bergstraße Odenwald.** Site Grube Messel guided tour (full day)

End of the field Workshop and transfer to Frankfurt/Main airport

26 contributions from 14 countries (Argentina, Bolivia, Brazil, Chile, Columbia, Costa Rica, Ecuador, Germany, Mexico, Nicaragua, Paraguay, Peru, Sweden and United States of America) allow for a fine discussion on GeoParks and some additional topics.

***Left**: El Misti volcano near Arequipa, Peru; **Right**: the Future generation*

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Geosciences and Society – Bridging the gap with GeoParks and Co

at Rupprecht-Karls-Universität Heidelberg (RKUH)

1. GOAL-internal meeting (27.03.2014)

13.00 Registration and Welcome
Reinaldo Garcia, GOAL coordinator, Jörg Matschullat and Klaus Stanek, TU Bergakademie Freiberg, and Wolfgang Stinnesbeck, RKUH representative

1. Election of the *Ad Hoc* secretary for this meeting
2. Honorary German Coordination endorsement
3. German Coordinators' report
4. National Coordinators report

14:00 Visit of the silver and iron sulphate mine Anna Elisabeth in Schriesheim
Transport by tram and foot walk

16:30 Internal GOAL meeting continued
Reinaldo Garcia, GOAL Regional Coordinator

5. GOAL's media (Newsletter, webpage)
6. Short range GOAL perspectives (Argentina-2015?)
7. Longer range GOAL perspectives (Munster-2016; 15th GOAL's anniversary-2017)
8. Election of the Regional Coordinator
9. Others matters

18:00 end of first session

2. Expert seminar 01 (28.03.2014)

GeoParks (1/2)

09:00 Motivation, purpose, history and reality of the UNESCO GeoPark idea
Wolfgang Eder (former UNESCO GeoPark head, Munich)

10:00 The role of a national Geoscientific Society for the implementation and acceptance of the GeoPark idea
Gerd Röhling (DGG and GeoPark representative)

11:00 Coffee break

11:30 The Odenwald GeoPark
Reinhard Diehl (GeoPark Odenwald)

12:00 Why does a global player in the cement industry actively support the GeoPark concept and partakes in the GeoPark Schwäbische Alb?
Hans Georg Kraut (Heidelberger Cement, Schelklingen)

12.30 Lunch

14.00 Analysis of the legal situation in Bolivia in respect to GeoParks
Wilfredo Ramos Collorana and Rene A. Dávila Porcel (GOAL Bolivia)

14.30 Identification of zones to be successfully converted to GeoParks in Bolivia
René Alberto Dávila Porcel and Wilfredo Ramos Collorana (GOAL Bolivia)

15:00 GeoParks as a buffer elements between environmental and industrial sectors (Electrical energy)
Allan Lopez (GOAL Costa Rica)

15.30 Coffee break

16.00 GeoPark and industry. How may the concept be of mutual benefit?
NN (Holcim)

16:30 Cumbres de Monterrey National Park, Mexico (1): Geological development of the Sierra Madre oriental
Juan Alonso Ramírez-Fernández, Héctor de León Gómez (GOAL Mexico), and Dirk Masuch-Oesterreich

17.00 Cumbres de Monterrey National Park, Mexico (2): Relevance on drinking water and flood control of the ecological park “La Huasteca”
Héctor de León Gómez, Juan Alonso Ramírez-Fernández and René Alberto Dávila Porcel (GOAL Mexico)

17:30 Geological heritage and geoParks: current situation in Peru
César Muñoz (GOAL Peru)

18:00 The Villa de Leiva GeoPark – Perspectives
Pedro Patarroyo (GOAL Columbia)

18.30 Closing remarks for day 1 and preparation for day 2
Klaus Stanek and Reinaldo Garcia

3. Expert seminar 02 (29.03.2014)

GeoParks (2/2)

09:00 The Coconá caves and their speleothemes
Maria Vargas, Uriel Cruz, Simone di Santo, Eugenia Sardello and Ismael Mohayo (Schlumberger, Mexico)

09:30 Quarry exploitation in nature-protected areas
Celso Velázquez (GOAL Paraguay)

10.00 The Seridó GeoPark project in Rio Grande do Norte, Brazil. Why did it fail in the first round?
Jörg Matschullat (GOAL, TU Bergakademie Freiberg)

10.30 Coffee break

11.00 Environmental problems and impacts in the middle Rio São Francisco river basin, Minas Gerais, Brazil
Adolf Heinrich Horn and HJ Baggio (GOAL Brazil)

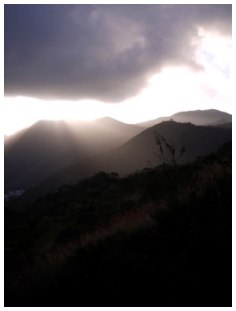
11.30 Permian wildfires on Gondwana in space and time and the paleobotanical history of fire
André Jasper (GOAL Brazil), Margot Guerra-Sommer, Neli Teresinha Galarce Machado, Joseline Manfroi, Isa Carla Osterkamp, Alcemar Martello, Átila Augusto Stock da Rosa, Abdalla Abu Hamid, Dieter Uhl

Poster presentations and discussion

12.00 The Painted Rocks Archaeological Park – more than 2.200 years of Nicaragua history
Alvaro Amador (GOAL Nicaragua)

12:00 Social, environmental and mining management: a challenge for Paraguay and its novel mining
Juan Carlos Benitez Maldonado (GOAL Paraguay)

12:00 New interpretation of the lower Jurassic in Central Peru
Silvia Rosas (GOAL Peru), Kathleen Ritterbush and David Botjjer



13.00 Lunch

4. GOAL-Field Workshop GeoParks and the Anthropocene

29.03.2014

Start: Heidelberg, 14:30 hrs

1. **GeoPark Schwäbische Alb**. Site Aalen Urweltmuseum: an example for educational science for the general public (16:00-17:30 hrs)
2. **GeoPark Nördlinger Ries.** Site Nördlingen with overview and city walk (suevite observations) (as of 18:30 hrs)

Accomodation in Nördlingen; joint dinner at about 20:00 hrs

30.03.2014

Start: Nördlingen, 09.00

3. **GeoPark Nördlinger Ries.** Site Nördlingen and environs with active limestone quarry, Meteorite museum and various relics of the impact event (09-16:00 hrs)
4. **GeoPark Bergstraße Odenwald.** Site Main-Tauber region with Michelstadt and Tertiary rock formations (as of 17:30 hrs)

Accomodation in or near Darmstadt; joint dinner at around 19:00 hrs

31.03.2014

Start: in or near Darmstadt, 09:00

5. **GeoPark Bergstraße Odenwald.** Site Grube Messel guided tour (full day)

19.00 **End of the field Workshop** Transfer to Frankfurt/Main airport

Abstracts of oral and poster presentation in alphabetical order of first author

Alvaro Antonio **Amador**: The Piedras Pintadas Archaeological Park – more than 2200 years of history of Nicaragua

Lolita **Campos**-Bejarano: "Geotouristic guide of the Valle Central": a result of a teaching outreach project from the Social Actions Vicerectorate of the Universidad de Costa Rica to diffuse geodiversity and promote Geoconservation through Geotourism

Raymundo **Casas** García, Juan Alonso Ramírez Fernández, Augusto Antonio Rodríguez Díaz and Bodo Weber: First petrological study of nelsonites from Grenvillian Novillo gneiss, basement of the Sierra Madre Oriental (NE Mexico): Preliminary results

María Eugenia **Cisternas**: Coal petrology applied to environmental studies in Chile

René Alberto **Dávila** Porcel, Wilfredo Ramos Collorana: Identification of high feasibility areas to become GeoParks in Bolivia

Jorge **Ellis**: General discussion about global geoparques

Horn, H.A. & Baggio, H.J.: Environmental problems and impacts in the Middle São Francisco River Basin, Minas Gerais, Brazil

André **Jasper**, Jorge Elis, Marjorie Kauffmann, Etiene Fabbrin Pires, Neli Teresinha Galarce Machado, José Rafael Wanderley Benicio, Joseline Manfroi, Mariela Inês Secchi, Cátia Viviane Gonçalves, Dieter Uhl: Paleontological heritage management in northern Brazil: the Tocantins fossilized forest case

André **Jasper**, Margot Guerra-Sommer, Neli Teresinha Galarce Machado, Joseline Manfroi, Isa Carla Osterkamp, Alcemar Martello, Átila Augusto Stock da Rosa, Abdalla Abu Hamad, Dieter Uhl: Permian wildfires on Gondwana in space and time and the paleobotanical history of fire

Hector de **León**-Gómez, Juan Alsonso Ramírez Fernández, René Alberto Dávila Pórcel: Cumbres de Monterrey National park, Mexico (Part II): Relevance on drinking ater and flood control of the ecological park La Huasteca

Allan **López**: Geoparques como element buffer entre sectores ambientals y empresas eléctricas

Katthy **Lopez**, Jenny Ramirez, Xavier Vera, Ignacio Ochoa, Danilo Davila, Ricardo Etcheverry: Determinación geológica-geotécnica mediante sísmica y prospecciones en terrenos destinados a la construcción de una infraestructura universitaria en la ciudad de Azogues, Ecuador

Juan Carlos Benitez **Maldonado**: Social, environmental and mining management, a challenge for Paraguay and its novel mining

Jörg **Matschullat**: The Seridó GeoPark project in Rio Grande do Norte, Brazil. Why did it fail in the first round?

Héctor **Mora**-Páez: Some advances in GNSS scientific applications in Columbia

César **Muñoz**: Geological heritage and GeoParks: current situation in Peru

Pedro **Patarroyo**: Villa de Leyva Geopark (Colombia). Perspectives

Juan Alonso **Ramírez**-Fernández, Hector de León Gómez, Dirk Masuch Oesterreich: National Park Cumbres de Monterrrey, Mexico (Part I): Geological development of the Sierra Madre Oriental

Juan Alonso **Ramírez** Fernández, Lorena de Leon Barragán, Uwe Jenchen: Genetic relationships of Gondwanan carboniferous arc magmatism in NE-Mexico

Wilfredo **Ramos** Collorana, Rene A. Dávila Porcel: Analysis of the legal situation in Bolivia in respect to GeoParks

Silvia **Rosas**, Kathleen Ritterbush, David Botjjer: New interpretation of the lower Jurassic in Central Peru

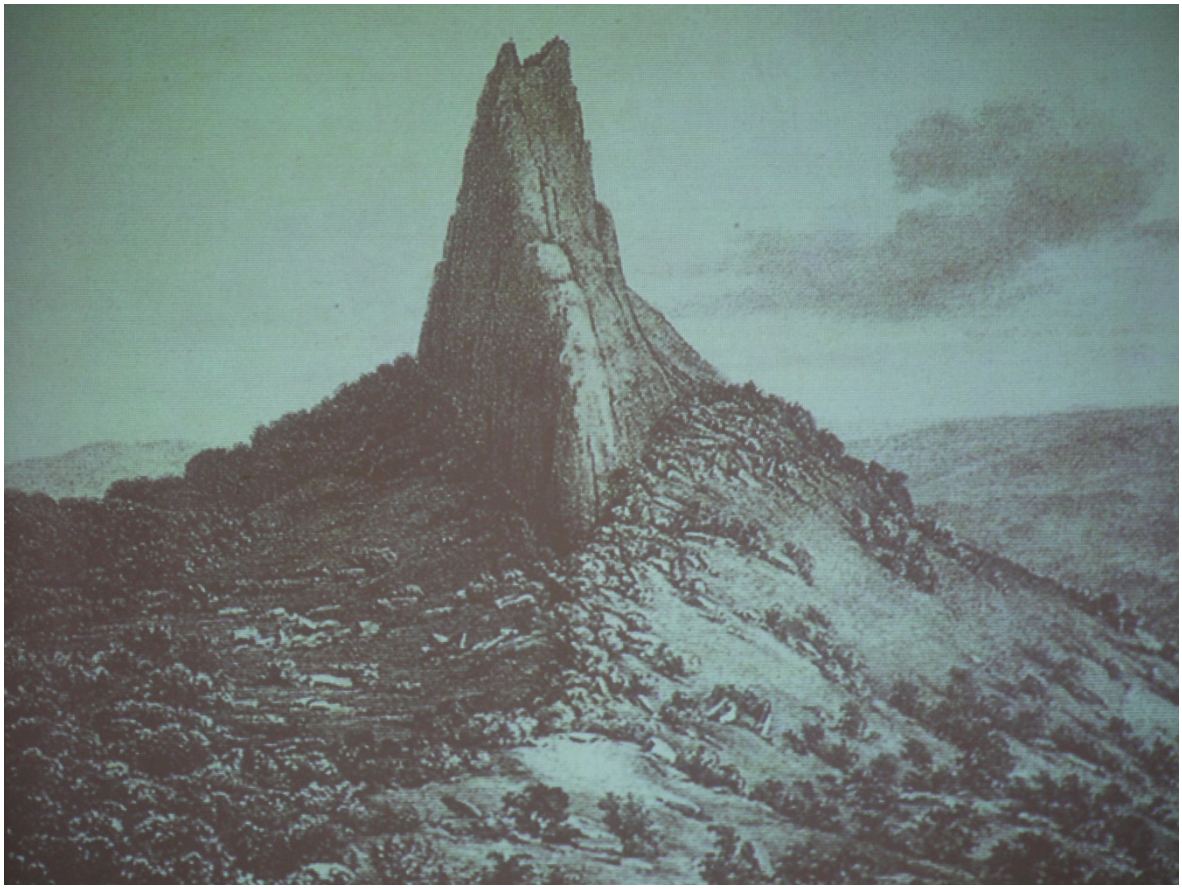
Daniel **Rubiolo**: Davis vs. Penck: Let's start the debate in South America?

Nury **Simfors**-Morales, Raymond Russo, Åke Sivertun: Information and Communication Technologies (ICT) for prevention and mitigation in case of natural catastrophes: A case study in the Caribbean region

Maria **Vargas**, Uriel Cruz, Simone di Santo, Eugenia Sardelli, Ismael Moyaho: The Coconá caves and their speleothemes

Fabian **Vasconez**: Hydrogeological aspects of landslides in tropical zones of Ecuador

Celso **Velazquez**: Quarry farm in protected areas



Historical picture of the Itabirito Peak natural monument in Minas Gerais, Brazil

The Piedras Pintadas Archaeological Park – more than 2200 years of history of Nicaragua

Alvaro Antonio Amador
Municipality from Santo Tomas, Santo Tomas, Chontales, Nicaragua. alvaroamador@yahoo.de

The Chontal was the oldest tribe that settled in Nicaragua. They came from the north (Mexico), from where they were expelled by other tribes inhabiting the Pacific region. When the Europeans arrived, the Chontal were settled in central Nicaragua. One of their sites was Villa Sandino, a small village in the Department of Chontales, where the Piedras Pintadas Archaeological Park (painted stones) is now established. The site was a ceremonial place for the Chontal people. Part of the history of the Chontal is registered in 158 stones and more than 2000 petroglyphs showing zoomorphic and anthropomorphic motives. The petroglyphs depict the Xulo, an extinct dog breed, which lived in Central America and Mexico before the colonization. The poster shows the location, characteristics and history of the Piedras Pintadas Archaeological Park.

Guerrero CJN, Guerrero LS de (1982) Las 9 tribus aborígenes de Nicaragua. 154 pp. Managua.
http://www.museoscentroamericanos.net/museosnicaragua/varios/piedraspintadas.html
https://www.facebook.com/pages/Parque-Arqueologico-Piedras-Pintadas-de-Villa-Sandino-Chontales/298799386849769

Rock paintings at Lajedo de Soledade, north-eastern Brazil

"Geotouristic guide of the Valle Central": A result of a teaching outreach project from the Social Actions Vicerectorate of the Universidad de Costa Rica for the diffusion of geodiversity and the promotion of Geoconservation through Geotourism

Lolita Campos-Bejarano
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The "Geotouristic Routes of Costa Rica" is a teaching outreach of the Social Actions Vice-rectorate from the University of Costa Rica. It was first proposed and executed in 2005 with the goal of bringing together various components: identification and conservation of the natural geological patrimony and the promotion of cultural and economical development of rural communities.

The introduction of geotourism as an additional ecological touristic activity has an established niche, due to the changes in soil policies in the last 20-30 years which have cost their jobs to a great sector of the population traditionally dedicated to agriculture, fishing or cattle-raising. In the face of this scenario some communities have organized themselves to offer services such as hosting, transportation and guiding. Many of these activities are centered in the vicinity of the conservation areas or national parks. The National System of Conservation Areas (SINAC, in spanish) manages these protected areas, nonetheless its vision of nature is solely focused on Biodiversity. Even if they protect some geodiverse elements, which may even amount to a patrimonial value, they are not considered attraction because the country lacks a *geological culture* for most of its population. Thus, knowledge of geodiversity is not offered to national or foreign tourists. In this sense, one of the goals of this project of teaching outreach is to promote "geo-alphabetization" through the explanation of geological concepts, phenomena and processes in "geosites" located along routes both outside and inside established protection areas. This objective is completed through workshops where community members, local guides and SINAC workers take part. As a complement to these activities, work is progressing on the development of geotouristic guides that cover geologically important routes of the country: North Pacific, Central Pacific, Southern Pacific, Valle Central, Talamanca Mountain Range and Southern Caribbean. With work currently in progress on the Talamanca Mountain Range Guide.

Regarding the "Valle Central Geotouristic Guide", it is composed by a total of thirty "geosites" that show the evolution of the sedimentary fill of this basin starting in the Paleocene, when it was still connected to the forearc Terraba basin and sedimentation had a deep-water character, until Middle Miocene when a shallowing trend is documented in the inner shelf sedimentation, and culminate with continental sediments and later cover by volcanics from the Upper Miocene-Pliocene, inner volcanic arc, Pliocene-Pleistocene transition volcanics and finally the inner volcanic arc Holocene volcanic of the Central Volcanic range.

Campos L (2001) Geology and basins history of middle Costa Rica: an intraoceanic Island arc in the convergence between the Caribbean and the Central Pacific Plates. Tuebinger Geowiss Arb A62: 138 pp.



***Left**: Baroque church of Brumal, MG; **Centre**: GOAListas on tour; **Right**: Inselberg in Piauí; BR*

First petrological study of nelsonites from Grenvillian Novillo gneiss, basement of the Sierra Madre Oriental (NE Mexico): Preliminary results

Raymundo *Casas García*[1], Juan Alonso *Ramírez Fernández*[1], Augusto Antonio *Rodríguez Díaz*[2] and Bodo *Weber*[3]

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This investigation represents the first integrated study of the precambrian nelsonites from the Grenvillean Novillo Gneiss. It is the oldest unit (~990 Ma; CAMERON *et al.*, 2004) of the Sierra Madre Oriental basement, with metamorphic conditions of granulite facies (730-775 °C and 8.9-9.7 kbar; OROZCO-ESQUIVEL, 1990). The latter unit is exposed in the Huizachal-Peregrina Anticlinorium located 10 km west of Cd. Victoria, Tamaulipas, and represents the northernmost part of the Precambrian Oaxaquia continent in Mexico.

Nelsonites are rocks composed of Fe-Ti oxides and apatite, and are associated with anorthosite complexes, in this case the Anorthosite-Mangerite-Charnockite-Granite (AMCG) suite of the Novillo Gneiss. There is a wide variety of hypothesis for the formation of these Fe-Ti oxide deposits, but there is still no consensus on this issue (DYMEK & OWENS, 2001). Previous works from this area are scarce and the only one known is that of ORTEGA-GUTIÉRREZ (1978), which focused on the precambrian and paleozoic metamorphic rocks of the basement, providing little petrological information on the nelsonites.

The preliminary results indicate that the nelsonites could be originated from a gabbro-anorthositic magma by a liquid immiscibility process, which derived a silica-rich melt (anorthosites; AMCG suite) and another with high contents of Fe, Ti and P (nelsonites). Petrographic evidence shows apatite globules within Fe-Ti oxides (ilmenites), a good indicator of immiscibility. On the other hand, geochemical graphics display clear gaps between the nelsonites and AMCG rocks. The REE and Spider diagrams show a strong enrichment of La, Ce, Pr, and Nd in the nelsonites, mainly concentrated in apatites. TiO_2 and Eu anomalies and trace element content are the most important differences between nelsonites and AMCG suite, in terms of composition. A U-Pb geochronological study in apatites is been carried out, but a grenvillian age is assumed on the basis of spatial and temporal association between Fe-Ti oxide-apatite deposits and anorthosites.

Cameron KL, Lopez R, Ortega Gutiérrez F, Solari LA, Keppie JD, Schulze C (2004) U-Pb geochronology and Pb isotopic compositions of leached feldspars: Constraints on the origin and evolution of Grenville rocks from Eastern and Southern Mexico. Geol Soc America Mem 197: 755–769

Dymek HF, Owens BE (2001) Petrogenesis of apatite-rich rocks (nelsonites and oxide-apatite gabbronorites) associated with massif anorthosites. Econ Geol 96: 797-815

Orozco Esquivel MT (1990) Zur Petrologie des Kristallins im Huizachal-Peregrina-Fenster, Sierra Madre Oriental, Mexiko, Diplom Thesis, Institut für Petrographie und Geochemie der Universität Karlsruhe (TH), 133 p.

Ortega Gutiérrez F (1978) El Gneis Novillo y rocas metamórficas asociadas en los cañones del Novillo y Peregrina, área de Ciudad Victoria, Tamaulipas. Revista del Instituto de Geología, Universidad Nacional Autónoma de México 2: 19–30

Sponsored by Consejo Nacional de Ciencia y Tecnología (CONACyT) and SRK Consulting Mexico

Coal petrology applied to environmental studies in Chile

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The present contribution is focused on organic petrology applied to environmental and anthropogenic impacts associates with the management and industrial utilization of coal. The organic petrology, particularly the coal petrology, play a significant role in environmental pollution studies through the identification of organic particulates derived from the industrial utilization of coal in thermoelectric plants.

This work presents the basic rules to differentiate, under the microscope, particles of unburned coal from those derived from industrial combustion process, through specific features that allow its identification and classification.

As a case study, will be presented the results of a two-years research carried out in the beach sediments in Quintero Bay (north of Santiago), one of the sectors of Chile with the highest degree of environmental contamination (two thermoelectric plants, a copper smelter and a petroleum-coke plant).

Ridge of the western Cordillera in Peru

Identification of high feasibility areas to become GeoParks in Bolivia

René Alberto Dávila Porcel[1], Wilfredo Ramos Collorana[2, 3]
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[2]Instituto de Recursos Minerales, Universidad Nacional de La Plata (UNLP) Calle 64 e/ 119 y 120, La Plata; [3]Wiracocha Antis Pacha (Bolivia). wramoscollorana@yahoo.com , willyramos@inremi.unlp.edu.ar

The "Sistema Nacional de Áreas Protegidas" (SNAP) was created in 1992 under the Environment Law, which defines protected areas as property of the State and of public and social interest. Protected Areas (PAs) in legal terms are natural areas with or without human intervention, declared under state protection, in order to protect and conserve wildlife, genetic resources, natural ecosystems, watersheds and scientific values, aesthetic interest, historical, economic and social, in order to conserve and preserve the natural and cultural heritage [1, 2].

The areas that make up the SNAP of Bolivia include a set of 49 protected areas of national and departmental character legally constituted. PA's of national importance occupy 15.5% (17,004,796.8 ha) of the country. PA's also include a significant part of the cultural heritage of the nation. The principles governing the SNAP are: a) Respect, assessment and recovery of cultural and natural diversity, b) Recognition of rights and customs of the local population, c) Completeness of the development and conservation, d) Effective participation in management of protected areas, e) Justice in the distribution of benefits as an ethical, social, political and environmental imperative f) Subsidiarity [2].

It is important to note that today in Bolivia, "there is no specific legislation" to declare Protected Areas (PA) or National Parks (NP) as "GeoParks". A significant number of areas within the PA and PN that meet the guidelines like: a) Size and environment, b) management and local participation, c) Economic Development d) Education and e) Protection and conservation, requested by UNESCO to integrate these areas to the Global GeoParks Network (GGN) [3].

The result of the analysis of the most important information available from PN 21 and / or AP in Bolivia make possible to identify those with the most potential for the establishment of a geopark inside: a) Apolobamba, b) Cotapata, c) Eduardo Abaroa, d) Madidi, e) Noel Kempf, f) Sajama, g) San Matias, h) Serrania del Iñao, and i) Tunari. The latest AP and PN have areas of great geological interest that meet the requirements set by the GGN [4].

Moreover, UNESCO experts recommended the establishment of a Geopark in the "Cerro Rico" which would allow the preservation and maintenance of mining activities in a sustainable manner. The CRP has great historical, cultural and tourist value to humanity, because it was an important source of wealth in colonial times and that it continues in operation to this day [5].

[1] Ley de Medio Ambiente 1333 Bolivia (1992)

[2] Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura (2010), Directrices y criterios para Parques Nacionales interesados en recibir asistencias de la UNESCO para integrar la Red Mundial de Geoparques (GGN) http://www.unesco.org/new/es/office-in-montevideo/ciencias-aturales/igcp/geoparques/

[3] http://www.sernap.gob.bo/index.php?option=com_content&view=category&layout=blog&id=36&Itemid=112

[4] http://www.vanguardia.com/actualidad/mundo/147283-geoparque-en-cerro-rico-de-potosi-permitira-preservarlo-ymantener-mineria

General discussion about global GeoParks

Jorge Ellis
UNESCO

The idea is to give a brief summary highlighting the main elements of a geopark, put some central tenets / ask provocative questions, that would hopefully lead to a discussion on global geoparks, including questions and answers, general comments and overall discussion.

The original idea was to first hear examples / case studies from the GOAL representatives of the countries in LAC, and at the end of the corresponding session / module, to place this discussion.

For more material, see the UNESCO annex at the end of this abstract and programme volume.

Art and culture, somewhere on the tropical Central Atlantic Ocean shores of NE-Brazil

Environmental problems and impacts in the Middle São Francisco River Basin, Minas Gerais, Brazil

Horn HA[1] & Baggio HJ[2]
[1]NGqA-IGC-UFMG; [2]LGA-UFVJM

Introduction

The investigated area is localized in the north-eastern part of Minas Gerais State, between the cities of Três Marias and Pirapora and covers the medium to upper São Francisco River. In the studied area, land use was always intensively by traditional populations and economic groups.

The construction of hydroelectric power plants led to an increase of implantation of heavy industry, agriculture and tourism. Important examples of impact activities are the heavy industry and smelters along the Paraobeba, das Velhas and São Francisco River and also charcoal ovens, textile industry and bricks production. With this intensive human influence and the lack of state and federal supervision, the situation escalated to an immense degradation of this region. The overall contamination levels of water, sediments, soil and air were very high, passing all law limitations, in the past, but also actually they are still beyond permitted limits.

The increasing of farming caused a second impact wave over the Cerrado (Savana), in a different way from the first, but with almost the same results. Big areas were transformed in corn, soybean, eucalyptus and coffee plantations allowing the exposure of large soil surfaces to the atmosphere together with intense fertilizer and agro toxic use. Today the agriculture activities are the principal sources of contamination in the region, passing the industrial sources and contribution influence and importance. In the sight of climate changes, reduction of water volume and the slow political reaction this situation may become more serious in the future.

Results

The element concentrations in sediment, clearly connected to human activities, are changing from punctual occurrences to a more diffuse distribution in the valley.

The high concentration of special elements in the water near the industrial plants disappears and gave place to a diffuse distribution along the whole river, principally was affected by agriculture activity.

Element concentration in sediments changes less rapid but came up along all analyzed river sediments.

The seasonal distribution of element concentrations registered from 1990 to now show a clear change in introducing sources, from industry to agriculture.

The chemical position changes from principally ionic to argillite and oxide absorbed one. The changes in the concentrations and spectra of the PDE´s indicate clearly a change in the primary sources. Together with climatic changes, such as stronger rains, winds and higher temperature changes, the later one increases continuously in intensity and reach.

Acknowledgements. We thank NGqA-IGC-UFMG, UNIMONTES, Votorantim, Brazilian Navy for logistic and CNPq for financial support.

Paleontological heritage management in northern Brazil: the Tocantins fossilized forest case

André Jasper[1]; Jorge Elis[2]; Marjorie Kauffmann[3]; Etiene Fabbrin Pires[4]; Neli Teresinha Galarce Machado[1]; José Rafael Wanderley Benicio[1]; Joseline Manfroi[1]; Mariela Inês Secchi[1]; Cátia Viviane Gonçalves[1]; Dieter Uhl[1, 5]

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Paleontological heritage and paleogeoconservation are innovative concepts that increasingly gain popularity alongside similar ideas of the “green” agenda. However, in most countries worldwide, and in Latin America in particular, the geological and paleontological components of the landscape are not given sufficient visibility as a fundamental asset of natural history (Prosser et al. 2011; Wimbledon 1996). The World Heritage List and the World Network of Biosphere Reserves include sites like the City of Potosí/Bolivia and the Cordillera Volcánica Central Biosphere Reserve/Costa Rica, respectively, which intensively deal with geologic features. In addition, Global Geoparks Network (GGN), supported by UNESCO, provides a platform for cooperation and exchange between experts and practitioners in geological heritage.

In Brazil, approximately 64% of the national territory is covered by sedimentary basins, which have a high fossiliferous record. The best-known fossiliferous areas, by both scientists and population in general, are located in the Paraná and Parnaíba Basins (Paleozoic-Mesozoic) and in the Araripe Basin (Mesozoic). Brazilian legislation protects all fossils on its territory as a National Heritage. The first legal reference on Brazilian fossil protection was made in 1935 in the Federal Ordinance number 25, which declared fossils as “Natural Notable Heritage”. In 1942, with the Federal Ordinance number 4.146, fossils were declared “Propriety of the Nation”. Following UNESCO orientations, the Federal Ordinance number 72.312 confirmed in 1973 that the sale of fossils, principally to foreign countries, violates the Brazilian legislation. Subsequently, complementary legislation e.g. on the punishment to be applied for the illegal sale of Brazilian fossils, has been enacted (Jasper 2010).

Despite these legal restrictions, Brazilian fossils are easily found in international markets and Internet sites. Permo-Triassic plant remains from the Parnaíba Basin (Tocantins State) are amongst the most commonly observed fossils found on this market. Reasons for this include insufficient control by governmental institutions and the poor conditions of the people living in the surroundings of the fossiliferous areas. Remarkably, in the national market, the fossils are relatively inexpensive, while in the global market they reach considerable prices. So far, Brazil and Uruguay are the only Latin-American countries that have sites in the GGN (Araripe Geopark and Grutas del Palacio Geopark, respectively). Geoparks combine conservation, sustainable development and community involvement. The geopark concept involves e.g. geo-tourism initiatives, which may lead to job creation in local communities. In this context, the application of geopark methodologies in the management of renowned fossiliferous sites from the Tocantins State and other Brazilian areas may constitute a valuable tool towards geological heritage conservation and local sustainable development.

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Sponsored by Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Brazil; Coordenação de Aperfeiçoamento de Pessoal do Ensino Superior (CAPES), Brazil; Fundação de Amparo à Pesquisa do Estado do Rio Grande do Sul (FAPERGS), Brazil.

Permian wildfires on Gondwana in space and time and the paleobotanical history of fire

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Fossil charcoal is widely accepted as a direct indicator for the occurrence of palaeo-wildfires (Scott 2000, 2010) and, in Upper Paleozoic sediments of Euramerica and Cathaysia, reports on such remains are relatively common and (regionally and stratigraphically) more or less homogeneously distributed (Jasper et al. 2013). On the other hand, just a few records have been published for the Late Paleozoic of Gondwana and only recently it has been demonstrated that macroscopic charcoals (and thus fires) were also common on this southern continent (Jasper et al. 2011, 2013). The most important Gondwanan records are predominantly charred gymnospermous wood predominantly connected to coal bearing strata. Charcoal occurrences are spread out in different sequences and also in distinct stratigraphic intervals in the Permian [e.g. Paraná Basin (Sakmarian/Artinskian of Brazil), Karoo Basin (Artinskian of South Africa), Damodar Basin (Lopingian of India) and Wadi Himara (Lopingian of Jordan)]. They range from peri-glacial/post-glacial to warm temperate climatic conditions throughout the Permian. The data obtained from fossil macro- and micro-charcoal are compared to known occurrences of inertinites to support the pyrogenic origin for these coal macerals and to provide an up to date overview on the occurrences of Permian wildfires on Gondwana in space and time.

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Sponsored by Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Brazil; Coordenação de Aperfeiçoamento de Pessoal do Ensino Superior (CAPES), Brazil; Fundação de Amparo à Pesquisa do Estado do Rio Grande do Sul (FAPERGS), Brazil.

Cumbres de Monterrey National park, Mexico (Part II): Relevance on drinking water and flood control of the ecological park La Huasteca

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La Huasteca Canyon (HC) is located 3 km south of the Federal Highway 40, which connects Monterrey (Nuevo León) with Saltillo (Coahuila). From Monterrey downtown the distance is ~19 km. It is situated within the metropolitan area in the municipality of Santa Catarina and represents one of the most emblematic areas of Cumbres de Monterrey National Park (CMNP).

The high mountains of the Sierra Madre Oriental (SMO) reach elevations of over 2,000 meters above sea level covering an area of 200 hectares. HC is located in the northern part of the fold and thrustbelt of the SMO, namely along the orogenic "Curvatura de Monterrey". There, outcrops of terrigenous and carbonated rocks of Mesozoic age from the Jurassic to the Cretaceous dominate. Quaternary alluvial sediments fill the valleys with blocks, gravel, sand and silt. HC offers world-class outcrops of geological structures as vertical strata, folds, faults, recumbent anticlines and synclinales, shear joints, stylolites, and many more.

From the hydrogeological point of view, HC represents the most important groundwater source of drinking water for Monterrey and its metropolitan area, with supplies of about 1600 l/s. On the other hand, the purpose of the regulatory flood dam called "Presa Rompepicos" is to control the fluvial discharges during hurricane events, dissipating the water velocity and the sediment load avoiding possible damages of the urban area of Monterrey and surrounding cities.

La Huasteca Canyon is one of the most beautiful places to visit in North-eastern Mexico for its various geological formations, fossils, marked morphology, Santa Catarina river watershed, caves, vertical limestone strata and so on. The canyon cuts thick vertical limestone strata representing an ideal and exciting challenge for climbing and trekking sports. At least 180 ascent routes have been established along its majestic walls.

Left: *A family enjoying the evening along the Tocantins River near Palmas, Brazil*

Geoparques como element buffer entre sectores ambientals y empresas eléctricas

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Las diferencias de criterio y oportunidad entre los diversos sectores ambientalistas y las compañías generadoras de electricidad, públicas y privadas, han crecido desmesuradamente en los últimos daños, produciendo conflictos de variada intensidad y muchas consecuencias socio-económicas. Los actores públicos no siempre toman en cuenta y representan a las comunidades que se encuentran en las zonas de influencia directa e indirecta de dichos proyectos, pues a veces son externos y obedecen a planteamientos ideológicos de moda e intereses comerciales y personales. Los actores públicos no siempre toman en cuenta y representan a las comunidades que se encuentran en las zonas de influencia directa e indirecta de dichos proyectos, pues a veces son externos y obedecen a planteamientos ideológicos de moda y/o intereses comerciales y personales.

En Costa Rica todavía no tenemos plenamente desarrollada la conceptualización de los Geoparques y se propone implementarla tomando muy en cuenta las experiencias positivas y negativas, Latinoamericanas y Europeas. Se sugiere un modelo que además sirva de buffer, puente de comunicación y denominador común, entre los legítimos intereses de las partes involucradas en esos conflictos ambientales que muy comúnmente afectan a los proyectos energéticos, en particular a los hidroeléctricos y geotérmicos en los cuales el autor ha laborado durante 30 años.

Las poblaciones estables y sedentarias dentro de las áreas de influencia directa e indirecta de esos proyectos, sin las cuales no hay Geoparque posible, a veces son invisibilizadas, divididas y manipuladas para responder a los intereses mencionados de los bandos en pugna. Se documentan dos situaciones recientes y se presentan los respectivos esquemas de Geoparques propuestos como coadyuvantes permanentes en la solución de los conflictos citados. Estos casos se ubican en áreas con significado geocientífico especial y atributos naturales particulares, además de una riqueza cultural indígena de gran interés. Esta se manifiesta muy interesada en la preservación de esa herencia y requiere ayuda estatal y privada para fomentar el desarrollo socio-económico de la región de una manera sustentable. En las cercanías de estas localidades se desarrollan actividades geoturísticas que deben incorporarse a los Geoparques y así contribuir a la protección, investigación y difusión del patrimonio geológico que contienen.

***Left**: Eucalpytus plantations replaced primary Amazon forest in south-eastern Pará;*
***Right**: Atlantic forest near Natal, RN; both Brazil*

Determinación geológica-geotécnica mediante sísmica y prospecciones en terrenos destinados a la construcción de una infraestructura universitaria en la ciudad de Azogues, Ecuador

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RESUMEN

Al sur de la provincia del Cañar se desarrolla un proyecto de construcción de una universidad en un área de 45 ha. Con el objeto de conocer los estratos del subsuelo de este predio, se realizan estudios geológicos y geotécnicos de los terrenos. El relevamiento geológico consiste en detalles de los estratos presentados en secciones estratigráficas, los datos del subsuelo son obtenidos a través de perforaciones de 10 a 30 m de profundidad. Con el propósito de conocer más información del subsuelo, como profundidad, espesor de contactos y presencia de fallas, se utilizó la geofísica, la misma que consistió en líneas de sísmica de refracción (LSR) y sísmica pasiva REMI´s. El estudio geotécnico incluye la caracterización física de los suelos y rocas presentes en el predio. De esta manera se reconoce dos estratos bien definidos que son de origen aluvial y asignados al Cuaternario. Le subyace una secuencia sedimentaria de niveles de arcilitas-lutitas de la Fm Biblián y areniscas de la Fm. Azogues, ambas del Mioceno. El área de trabajo se localiza en la denominada zona cuenca de Cuenca, de edad miocena, la cual constituye una depresión de origen tectónico. La cuenca está controlada por un sistema de fallas regionales de rumbo, llamadas Falla Girón-Santa Isabel. En cuanto a la actividad sísmica del área, se determinó que hace 18 años se registraron dos sismos.

ABSTRACT

To the south of the Province of Cañar, develops a construction project at a university in an area of 45 hectares. In order to know the subsurface strata of this property are conducted geological and geotechnical fields. The geological survey is presented details of the strata stratigraphic sections, subsurface data are obtained through perforations of 10-30 m. In order to learn more subsurface information, such as depth, thickness and presence of faults contacts, geophysics was used, which consisted of the same seismic refraction lines (LSR) and passive seismic REMI's. The geotechnical study included physical characterization of soils and rocks in the property. In this way it recognizes two well-defined strata are alluvial and assigned to the Quaternary. It lies a sedimentary sequence of argillite-shale levels of Biblián and sandstone Fm. Quicksilver, both Miocene. The work area is located in the area called Cuenca basin of Miocene age, which is a depression of tectonic origin. The basin is controlled by a regional fault system course called Santa Isabel Giron failure. On the seismic activity of the area, it was determined that 18 years ago there were two earthquakes.

Social, environmental and mining management, a challenge for Paraguay and its novel mining

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Latin American Minerals Inc. Paso Yobai, Paraguay

Paraguay is facing challenges in the mining sector. Its economy, since always based on the agricultural sector, with significant exports of meat and agricultural products; is experiencing the possibility of receiving contributions from the mining sector, as the discovery of mineral resources extend under the policies carried out by the Paraguayan Government in relations to attracting foreign investments, counting this segment that has huge potential to develop.

Paso Yobai, which is the country's first mining area since the IXX century, shows two very opposite facets. On the one hand, a gold mining company, operates with the support of a Law Of Concessions, and following modern techno-environmental parameters of quality, and all these in contrasts with the grim handling of informal mining in the surrounding areas, where more than half a thousand small informal miners, nucleated in several associations, exploit the metal or have a large number of mills along small water courses, where the gold is recovered through the amalgamation with mercury, contaminating the water streams of the area's basin. They usually operate illegally, they have neither environmental nor mining licenses, the exploitation of men, women and children by Paraguayan or foreign capitalists is a common practice, and the profits do not reach the government neither are reported, therefor the absent of the state is more than noticed in this area. This current reality, with the lack of effective control, sees a resurgence of the disorders previously described that in the long run are going to be affecting all local communities.

On the one hand, a proper government management must be conducive, so that international standards of exploitation, environment, health and occupational safety care are not unique tools of corporations, but that the use of such tools by the participants of the small-scale mining may work as a beneficiary solution of the dignity of the people (informal miners) besides constituting a way of living. On the other hand, the Government must be consistent with its policy of attracting investment, by ensuring such investment, so that companies could reach their goals, including side programs of social welfare that will allow its insertion into the community without any traumas.

These government efforts will favour all current activities being performed in the mining sector, and will result in it being environment friendly, peaceful and inclusive of the surrounding communities, although they are a part of the economic chain, they do so in detriment of its environmental quality of life and their own personal safety. The presence of the Government in Paso Yobai and in the country's emerging mining industry is imperative. Its policies should be clear and effective, redirecting the raw potential of the sector and organizing them harmoniously in a corporate form, raising awareness within all participants of the negative environmental, social and economic implications that may lead to messy resource exploitations. The state must …

- Provide security, legal framework and facilitate the sustainable development of the sector.
- Ensure harmonious coexistence among all the participants of the sector.
- Develop collective capacity of informal miners providing special training programs, access to technical criteria and funding.
- Raise awareness among companies to help the most vulnerable communities and mining sectors, providing real assistance.
- Make proper changes in order to recognize how much the mining sector can contribute to the whole country's economy chain.

The Seridó GeoPark project in Rio Grande do Norte, Brazil. Why did it fail in the first round?

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The Seridó is an old cultural landscape of about 5000 km^2 with some striking geological features in south central Rio Grande do Norte and some extension into Paraíba, both extreme northeast of Brazil. “Old” refers to the colonial history, starting about 500 years back in that region. It is dominated by the Caatinga biome, a xeric shrubland; yet shows a high biodiversity due to highly variable water availability and highly diverse exposure and relief.

The GeoPark concept comprises much more than just geological features and natural beauty. It embraces a wider vision of sustainable development with socio-economic wellbeing, celebration of cultural richness and diversity, and economic prosperity. Thus social, economic and environmental conditions and ideas for development need to be integrated for a concept to become successful.

A first and fairly recent proposal by the Brazilian Geological Survey CPRM to UNESCO to make the Seridó into a GeoPark to further enhance tourism and to promote the beauty and diversity of the landscape failed. In this presentation, we shall elucidate the reasons for that failure and pin-point some important boundary conditions that should be met to make such a proposal successful.

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The Cabugi volcano at the north-eastern edge of the Seridó – a well-known landmark

Some advances in GNSS scientific applications in Columbia

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The Colombian Geological Survey initiated in 2007 through the GEORED project the creation of a high-quality GNSS infrastructure that serves as an essential framework for the study of crustal and atmospheric dynamics of the entire Colombian territory, and at the same time-sharing data and research results with neighbouring countries. Data products will include raw GNSS observations, and data of atmospheric water vapour, that facilitate the construction of time series of high precision daily geographic positions, that in turn permit the compilation of surface velocity fields that register crustal dynamic behaviour that is of direct relevance to geohazards in earth and atmospheric sciences.

Since the analysis of the signals from the constellations that comprise the GNSS concept have given rise to other types of applications in various fields of knowledge, it is intended to achieve a greater density of the national GNSS network in an effort to address specific geoscience topics. 54 permanent installations and more than 260 campaign style constructions have been funded until now. Full implementation of 70 permanent installations and 280 campaign site constructions should be completed by 2014. Thus, the GEORED Project has begun to venture into such topics of study with the purpose of promoting this type of technology as a way of acquiring data of valuable scientific interest. Some results obtained so far are shown.

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***Left**: Evening cloud formations, somewhere in north-eastern Brazil*

Geological heritage and GeoParks: current situation in Peru

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The geological heritage of Peru is geo-diverse (in the sense of Carcavilla et al. 2008), abundant and interesting. However, studies and research related to its enhancement, conservation and protection are incipient. There are many references to geological sites in geological and related sciences literature, and/or related to other activities and interests, such as tourism, ecology and others. Knowledge of the geological heritage of Peru requires initiatives and decisions to identify, take stock (catalogue), classify, study and enhance it. The first step is to have adequate laws that as part of a State policy guarantee a legal framework, necessary resources, society's commitment –regions, communities, municipalities, civil society, etc.–and sustainability over time. The geological heritage of Peru is not included in existing laws. Only Natural Protected Areas (ANP), under the responsibility of the National Service for Natural Protected Areas (SERNANP an agency of the Ministry of Environmental Affairs) indirectly takes into account the protection of our natural heritage, including geological formations, volcanic areas, rock forests, and geological landscapes. Zavala (2011) proposes classifying Peru's geological heritage according to its geomorphological, volcanic, geodynamic, landscape, paleontological and touristic characteristics into natural monuments, natural parks, paleontological monuments and national sanctuaries.

Initial initiatives to enhance the geological heritage of Peru date back to the last decade (Rivas et al. 2000; Alleman and Benavente 2002; Rivera et al. 2002; Zavala and Fidel 2002), including a round table (Geoparks; enhancement of natural and cultural heritage) during the XV Peruvian Congress of Geology (2010), that proclaimed the Declaration of Cuzco proposing guidelines and policies to conserve Peru's geological heritage. In 2006, the Geology, Mining and Metallurgy Institute of Peru (INGEMMET) launched its Heritage and Geotourism program to study some areas regarded as protected geological and natural areas (APN), and published a series of geotourist guides (Marcahuasi, Paracas, Andahua, Huayllay). Since 2011, INGEMMET has included in its research programs the study of geological sites with a view at proposing the Global Geoparks Network the establishment of national geoparks. This will encourage geotourism and the sustainable development of local communities. So far, efforts to study, enhance, conserve and protect Peru's geological heritage are limited to the INGEMMET initiative and isolated efforts from some universities and/or private companies. These isolated efforts lack support of appropriate regulations to ensure their sustainability over time.

A comprehensive assessment of Peru's geological heritage and the possibility to create geoparks must be based on a conceptual analysis (both technical and scientific), stocktaking, and a methodological proposal for its enhancement (selection, information, identification, valuation, mapping and management). Our geological heritage and, consequently, geoparks should be included in land use planning, should be prepared as comprehensive projects, and receive cross-disciplinary support from a range of relevant government agencies. Many areas of geological importance will be degraded if they are not comprised in development policies. Existing programs, mainly from INGEMMET, intermittent private efforts (Huamán 2013) and by the Geological Society of Peru (XVII Congreso Peruano de Geología 2014), for the enhancement, dissemination and conservation of Peru's geological heritage must be actively supported through immediate laws to ensure their sanctity and sustainability over time. It is also necessary to recruit international organizations (UNESCO, RGG, EGN, ProGEO, etc.), scientific institutions and civil society (regions, municipalities and communities).

Villa de Leyva Geopark (Colombia). Perspectives

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The Villa de Leyva area locates in central Colombia over the Eastern Cordillera, to the NNW of Bogotá, is recognized related with the prehistory and history of our country, and with the lower Cretaceous marine stratigraphy of north South America. Since the Humboldt's expedition this region has been researching in different geological topics. Paleontological investigations and publications have been developed around these lower Cretaceous deposits with marine invertebrates and vertebrates, and plant remains.

The landscape is special because the morphological contrast between the litostratigraphic variations, structural development as the Arcabuco and Oiba anticlines, and the Villa de Leiva Syncline; and because the intensive agriculture since the Spanish colonization and the consequent soil degradation and erosion.

Karstic caves to the west of this area are common because the existence of thick calcareous successions of the Rosablanca Formation with good development of speleothems.

Actually the Villa de Leyva village is a touristic place to people that like to realize different activities, but principally to recognize the big cretaceous marine vertebrate fossils as the *Kronosaurus*, *Callawayosaurus*, *Platypterygius*, *Brachauchenius*, etc. Together with these fossils is possible to find ammonites, bivalves, fishes and plant remains that are very common into the Paja Formation deposits. Erratic boulders, glacial, fluvioglacial, travertine, lacustrine and colluvial deposits are too presents in this area that show landscape contrast. Some of these deposits include vertebrate and plant fossils. To Indian settlements was used stone material to build an astronomic observatory and other structures destroyed and covered by the Spanish colonization.

Legal and constitutionals laws in Colombia and UNESCO legislations are very clear to preserve patrimonial material related with archaeology and paleontology, but local costumes and political positions difficult scientific and cultural activities. In different opportunities local governments liked to impulse regional park activities, but private interests (museums, foundations, people associations, etc.) stopped these initiatives.

A geopark will be a good sustainable perspective to this region because its touristic economy, the paleontological richness, landscape and geological structures because the weathering and erosion expose color variations and geoforms. So with legislation respect to our natural patrimony is possible to propose cultural and touristic activities that benefit the regional economy and development.



***Left**: Private garden in Galo Novo, Brazil; **Centre**: Flower with ants; **Right**: Clothing store, Peru*

National Park Cumbres de Monterrrey, Mexico (Part I): Geological development of the Sierra Madre Oriental

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Parque Nacional Cumbres de Monterrey (PNCM) is situated in the central region of the State of Nuevo Leon. It was created in 1939 in order to protect the flora and fauna of the diverse ecological communities, as well as to regulate the immense water flows caused by tropical hurricanes that endanger Monterrey, a major industrial city of Mexico.

Its former extension was 245,000 ha, but it was reduced to 177,395 ha in 2000. Nevertheless, PNCM remains the biggest continental national park of Mexico, with 12.4% of all parks (Cantú Ayala et al., 2013). Since 2006, PNCM belongs to the UNESCO Man and Biosphere Program as Biosphere Reserve (http://cumbres_mty.conanp.gob.mx/).

PNCM is located in the Monterrey Curvature (MC), one of the most important mesostructures of the Sierra Madre Oriental (SMOr). SMOr is a cordilleran thrust and folded belt made up of a Mesozoic sedimentary sequence composed by continental red beds in its base, covered by a very thick pelitic-carbonate sequence. The sedimentary sequence was deposited during the initial stages of the Gulf of Mexico basin and overlays a complex Precambrian-Paleozoic basement. This huge depocenter resulted from the breakup of Pangea, when Yucatan Peninsula migrated from SE USA to its actual position, opening the door to the development of the Atlantic Ocean. During this period of ca. 200 Ma, several and very diverse sedimentary environments ruled the deposition of the stratigraphic column: fluvial, coastal, flood plains, platforms, and open sea areas.

At the Mesozoic-Cenozoic limit the tectonic conditions in Mexico changed dramatically. The sedimentary sequence was uplifted and pushed to NE against a very irregular basement resulting in complex structural patterns. The subsequent laramidic orogenic MC shows very narrow folds, very often with NE vergent axial planes, as well as box folds. The total uplift was of a magnitude of ca. 4 km, necessary to reach the maximal heights of the SMO (Cerro del Potosi with 3,700 masl). PNCM morphology, with typical sharp peaks and deep creeks, is controlled by contrasting rock competence, folds and faults, and the drainage pattern.

PNCM is a world-class protected area because of its flora and fauna, as well as of its geology, but also provides important environmental services to the society, especially for the nearly 4 Mio Monterrey inhabitants.



***Left**: Ant highway in the Caatinga; **Centre**: Cerradão forest; **Right**: Indígena in Peru*

Genetic relationships of Gondwanan carboniferous arc magmatism in NE-Mexico

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The geology of Northeastern Mexico is dominated by thick Mesozoic and Cenozoic deformed sedimentary sequences. However, magmatic events of very different ages are present in the lithogical record: the protoliths of the Grenvillian Novillo Gneiss, late Precambrian basic dykes, lavas and pyroclastica from Carboniferous Granjeno Schist, Carboniferous acid magmas, Permian pyroclastica in Guacamaya Fm., Jurassic Arc volcanics from La Boca Fm., altered distal pyroclastica in Upper Cretaceous San Felipe Fm., and finally the Tertiary Alkaline Province.

Unmetamorphosed Mississippian to Pennsylvanian plutonics and volcanics crop out in the basement of the Sierra Madre Oriental, near Ciudad Victoria. The former are described as "Tonalita Peregrina" (De León Barragán 2012), and were dated by Dowe (2005) with 351±54 Ma (U-Pb in zircons) and 313±7 Ma (Ar^{40}/Ar^{39} in muscovites). The latter are defined as "Riolita Aserradero" by Gursky & Ramírez (1986) and dated by Stewart et al. (1999) with 334±39 Ma (U-Pb in zircons). Both units have an arc affinity and are interpreted as direct product of the subduction of the Paleopacific Plate along the Northwestern Gondwana border, as known from other Late Paleozoic and Lower Mesozoic complexes in Southern Mexico, Middle, and South America.

The first hypothesis pointed out to a common origin of both units: plutonic roots and their volcanic equivalents of nearly the same age. However, the geochemical comparison of both arc related units shows that they are not genetically related, and are interpreted as originated from partial fusion of different crustal units. The tectonic processes along the Pacific border of Mexico during different times played and still play a major role in the regional geological development.

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***Left**: weathered basalt in Maranhão; **Centre**: Quarry unconsolidated river sediments in Pará; **Right**: Detail of Sete Cidades National Park, Piauí; all Brazil*

Analysis of the legal situation in Bolivia in respect to GeoParks

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In the new political constitution state (1, NPCS) of the Plurinational State of Bolivia (government decree 29894 in 2009 year) there is not a specific law about geoparks. Similar to these there are protected areas in Bolivia. Geoparks are becoming very popular due to their combination of conservation, sustainable development and involvement community. The protection laws about Bolivia heritage that could be related to geoparks, are protected areas, natural and cultural heritage in the NCPS and the Bolivian heritage culture law (still in course).

The law of protected areas (article 385, NCPS) forms a common good becoming part of the natural and cultural heritage of the country; it develops environmental, cultural, social and economic tasks for the sustainable development. In the environment law N° 1333 (article 60) the natural areas with the purpose of protecting and preserving the flora and fauna wild, genetic resources, natural ecosystems, hydrographic basins and values of scientific, esthetical, historical, economic and social interest, take as an objective maintain and preserve the natural and cultural heritage of the country. In 1997 was created the National Survey of Protected Areas (Government decree 25158) aimed at coordinating and assuring the starting up of the integral management of national interest related to them. In Bolivia their classification (Government decree 24781, of 1997 year) are: 1. National Park; 2. Wild Life Reserve; 3. Natural Monument; 4. National Shrine; 5. Natural Areas of Integral management; 6. Natural Standstill Reserve.

The natural heritage (article 346, NCPS) is of public interest and strategic appointment for sustainable development of the country. Its conservation and use of profit from population will be an exclusive attribution and responsibility of the State, and will not involve the natural resources sovereignty. The Bolivian cultural heritage (article 99, NCPS) is inalienable, it cannot be seized and it cannot be prescribed unavoidably, the economic resources that could be generated will be ruled by law, to pay special attention to its conservation, promotion and the State could guarantee the register, protection, restoration, recovery, revitalization, enrichment, promotion and publishing of its cultural heritage. Besides, the archaeological, paleontological, historical, natural resources also the documentary and anything that comes from the religious cult and folklore, is considered cultural heritage of Bolivian people. The Bolivian national law of cultural heritage (3) was passed by the senator's chamber in December 17, 2003, and it was treated by the chamber of deputies.

The legal situation analysis mentioned above is an advance and a basis law for applying geoparks in Bolivia. It is advised to use the guidelines and criteria of the Global Geoparks Network (2), in order to propose a geopark in Bolivia.

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New interpretation of the lower Jurassic in Central Peru

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The carbonate rocks of the Pucara Group (Upper Triassic – Lower Jurassic) at “Domo de Yauli“ in Central Peru, harbour polymetallic replacement ores described by various authors (Kobe 1995; Loughman and Hallam 1982; Mégard 1979; Szekely and Grose 1972), being studied and interpreted in detail during the last decades (Beuchat et al. 2004, 2005). New field and microfacies examinations show that the Lower Jurassic age Aramachay Formation was constructed with a significant abundance of siliceous sponges on a shallow carbonate ramp, which explains the formation’s pervasive diagenetic chert nodules and layers. The results are paleoecologically and lithologically consistent with contemporaneous siliceous sponge-dominated rocks from Nevada, USA (Ritterbush and Bottjer 2011). Development of these sponge colonies is consistent with enrichment of marine silica concentrations, here interpreted as a product of weathering of basalts produced during eruption of CAMP during the Triassic/Jurassic transition, which in turn is related to the mass extinction of biocalcifying organisms that characterizes this interval. The siliceous sponges represent the first major development of benthic ecosystems after the T/J mass extinction, and biocalcifying organisms did not develop pre-extinction diversities until the Upper Jurassic.

The Central Peruvian record would be worldwide, after Nevada, the second locality where this important event of siliceous sedimentation on epicontinental platforms of Panthalassa is recognized in high stratigraphic resolution for the early Jurassic. The biostratigraphic record in Nevada includes the Hettangian stage; in Peru the collected ammonites (Arnioceras) represent the Sinemurian stage (Rosas et al. 2007 and this work). To establish accurately the age of the Aramachay Formation siliceous sponge occurrences and its coincidence with those of Nevada, radiometric ages of intercalated volcanic tuffs are ongoing. At the “Domo de Yauli“ the Aramachay sequence is frequently described as a “silicified limestone“that would have acted as a trap or partial seal for ascending hydrothermal fluids through the underlying Upper Triassic more reactive carbonate rocks (Chambará Formation), which permitted the development of replacement ore bodies. It is then a case where the facial sedimentary features of the host rock have a connection with the development of ore bodies.

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Davis vs. Penck. Let's start the debate in South America?

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Davis and Penck's debate can also be perceived by those different regions, where both scientists did their first work in Argentina. How much could the South American landscape influence both young geoscientists to shape their minds on what would crystallize in their different geomorphologic models in subsequent years?

William Morris Davis (1850–1934) spent two and a half years in Argentina between 1870 and 1873. He was working as an assistant of Benjamin A. Gould at the Argentine National Observatory in Cordoba. Davis paid particular attention to entomology, rather than astronomy, geography or meteorology. Back in the United States, he held the chair for physical geography at Harvard University, and he emphasized education in high school and college throughout his career. Davis was a prolific writer and public speaker. His ideas took a leadership position extending over the entire first half of the 20th century. His most influential concept was the *"Geographical Cycle"* (1889) in which he presents a deductive, theoretical, and genetic model of landscape evolution. Davis, technically a geographer, formulated a general theory of landscape evolution in order to create an improved system for describing landforms. His model was simplified to an initial uplift of landmass, which was then modified by denudation processes during a still-stand. Uplift and denudation were successive and climatic erosion an important process. The Appalachian system, located on a passive continental margin of Eastern North America, played Davis's prototype for his model. Could the Cordoba's hills in Argentina have given Davis his earliest inspirations to his theory? Geology and structure of Appalachian and Pampean Ranges systems are totally different. Nevertheless, from a global tectonic point of view, both systems belong to intraplate setting.

Walther Penck (1888–1923) spent two years in Argentina, working at the National Geological Survey between 1912 and 1914. He was mapping a remote area of the Andes in Catamarca province. After returning to Europe, he was briefly teaching at the universities of Berlin, Leipzig and Istanbul. Penck never had the strong authority of a chair at a university behind him, and had no students during his short but productive life. He wrote and revised his most important paper, "*Die morphologische Analyse*", shortly before his death at 35 years of age. Penck, technically a geologist, proposed a different theory on land denudation in order to interpret the history of dynamic crustal movements. He challenged Davis's model, and he saw landforms as an expression of the continuous interaction of the tectonic and erosional processes. His landscape models depended on the comparative rates of uplift as against the rate of denudation: slopes reflect the ratio of endogenetic/ exogenetic processes. Evaluation of Penck's model was hindered by its hurried writing, posthumous publication (1924) and confused translation into English. Penck's theory was inspired mostly in the Andes, Alps and Anatolia, which are located at the border of geotectonic plates, and involve subduction-related volcanism and/or dramatic Cenozoic tectonic activity.

Davis vs. Penck debate could also be observed as the interrelationship between global tectonics and macro scale landscape development, i.e. "intraplate" vs. "interplate" settings.

Information and Communication Technologies (ICT) for prevention and mitigation in case of natural catastrophes: A case study in the Caribbean region

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The Caribbean region has long been recognized as an area susceptible to natural hazards, including seismic and volcanic hazards, and hazards posed by tropical storms. Endemic risk in the Caribbean region is exacerbated by an increasing population and high population density, poverty, and infrastructure that varies in quality from good to inadequate. In order to mitigate the consequences of future natural hazards, and in particular to assess the potential for cascading disasters in which one event triggers others (e.g., landslides, flooding, fires, and tsunamis) that may cause more damage than the triggering event, an integrated study of Caribbean natural hazards and emergency disaster and crisis management using Geographical Information Systems (GIS) and Remote Sensing are outlined in this project. We will design and demonstrate a functional GIS of the full suite of hazards that afflict the Caribbean region.

The Caribbean region is developing steadily, and current and potential partner institutions there are well positioned to take full advantage of the results of our study. The methods and models proposed herein can be adapted to other regions vulnerable to natural hazards and associated catastrophic events. In a short term, this study can reduce cost and increase coordination efficiency in the immediate aftermath of natural events. In long-term, it can allow to identify the construction in risk areas to be avoided and can indicate areas in need of mitigation measures. The possibility to use GIS and RS to gather information about a developing catastrophic situation and to exchange information critical for informed decision making is crucial in prioritizing time-critical mitigation actions.

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***Left**: Sisal being dried in Rio Grande do Norte; **Right**: Beans sold at a market stand; both Brazil*

The Coconá caves and their speleothemes

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The Coconá Caves are located in the southern portion of the Sierra region in the town of Coconá, only 5 km from the city of Teapa in the State of Tabasco. This place was declared a Natural Monument in 1988 to protect it from several environmental impact. The cave was discovered in the 19th century by the brothers Rómulo and Laureano Calzada, although it was first explored until 1892 by the naturalist José Narciso Rovirosa (Evia 1997). This exploration took several hours and lead to important information on the cavity length of 492 meters, divided into eight rooms with spectacular formations and three interior lakes.

It is possible to visit the Coconá Caves where visitors get amazed by the galleries and limestone formations. The walls covered by stalagmites and stalactites provide a wide variety of speleothemes, commonly known as cave formations, which are secondary mineral deposits in a cave taking their names for their resemblance to man-made or natural objects.

Nowadays, local community is in charge of the administration of the Coconá Caves having local people prepare the guided tours through the interior halls by locating and naming the different cave deposits observed in the interior, which is roughly adapted with stairways and illumination for visitors to be confortable. People of the community face the challenge to be prepared and technically advised to know how to adequately administrate the caves' resources (Jauregui 2003). Also the lack of geological information makes difficult to properly document this study, which in fact turned out to be a field study with the main objective to observe and describe the different cave deposits present in the caves.

In conclusion, based on the spectacular geological formations present in the Coconá Caves and the poor or null information available about how they were formed, a field study will be conducted with the objectives of describing the speleothemes observed inside the eight rooms along the 492 meters long, documenting them with photographs and trying to make this information available for further studies in the area.

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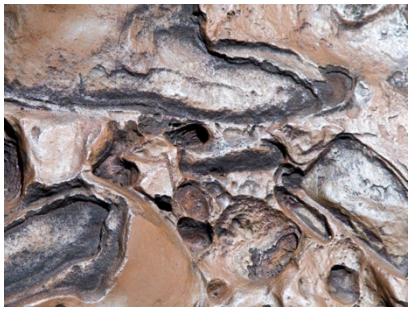

***Left**: Skyline Ouro Preto at dawn; **Centre**: Cu-precipitations, Sete Cidades; **Right**: Minas Gerais cheese; all Brazil*

Hydrogeological aspects of landslides in tropical zones of Ecuador

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Prior to proceed analyzing the influence of climatic factors on landslides, it is necessary to estimate the real amount of water that infiltrates into the ground after rainfall events. For this purpose, calculations need to take into account factors such as the amount of rain and the evapotranspiration, where; a water balance between rainfall and evapotranspiration is needed in order to determine the total amount of surface-runoff and groundwater-runoff and consequently, to estimate the water flow of streams within a landslide area.

Indeed, water temperature measurements will effectively identify the various groundwater-bodies. This information was collected from water springing from pipe-drains, natural springs, and groundwater within exploratory boreholes and from water flowing naturally on the ground.

Physical evidences of groundwater bodies were registered by logging discontinuities of drill cores. Features such rust stains, concretions and Redox (reduction-oxidation) reactions were recorded. Low rock mass quality indexes (highly jointed or weathered areas) were taken as further indicators of the presence of possible groundwater levels. Special attention was given to those drill-cores in which landslide surface's depth had been previously established by inclinometer monitoring, similarly, to those drill-cores in which depth, an unusual hydrogeological behaviour had been recorded during the drilling works.

Further, the results obtained from tests with markers (tracers) together with the analysis of iso-resistivity maps, were used to determine the preferential groundwater flows.

Water amount drained by pipe-drains were recorded especially after intense rainfalls with the purpose to analyze hydrogeological behaviour over time as direct consequence of rainfall events. Rainfall data, such as intensity, duration, and amount of water were also considered for the analysis. On the other hand, while some hydrogeological features were similar in whole area, other features were only relevant within isolated landslide bodies.

To conclude, hydrogeological aspects were correlated with landslide activity. Hydrogeological characteristics of different landslide bodies were set up. Critical groundwater levels, necessary for landslide reactivation, were also determined. Finally, response delay time of groundwater levels after pluviosity variations; as well as of landslide activity after groundwater levels variations were established.

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Quarry farm in protected areas

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In Paraguay the gritty, earthy calcareous substances and materials can be considered of great strategic value use streamlines the construction sector, industry, and commerce, their relative abundance, availability near consumption centers allows a balance in supply and demand. However, it is a well-considered non-renewable natural resource whose exploitation must be sustainable and its use should consider the maximum benefits for the country.

The National Constitution of Paraguay states that the state corresponds to the domain of hydrocarbons, mineral solids, liquids and gases that is naturally in the territory of the Republic, except for the gritty, earthy and calcareous substances. Law 3180 / 07 " Mining " states that gritty, earthy and calcareous substances are not subject to grant by law, but to permit, control and supervision by the mining authorities. Importantly, the relative abundance and its relationship to consumption centers contrast with the present location of future developments poles projecting into the country. While in the Eastern region has exposed rocks of all types, with relative ease for extractions and able to be used at reasonable distances from the centers of consumption in the West region, the reality is different because the situation geological region which greatly limits the presence of materials identified as stony, added to this the geomorphology of the area indicates the lack of outcropping rock materials, which contributes to exploitation.

Investments in the sector consuming industries rocks, both the building, such as limestone, such as cement factories, the lime kilns, and are indicative of a high demand in the near future, which should be prepared providing an opportunity for sector institutions through a modern regulation that allows clear rules on the management of stone resources.

On the other hand, rock outcrops, as well as minerals, occur often in protected areas. Paraguayan law does not allow the sector exploitation of rocks or minerals within the boundaries of parks, protected areas. This statutory provision makes it difficult in many cases to obtain building materials in the areas of demand.

The natural resources of the country and especially non-renewable riches are to be contributing to the development of the country, the quality of life of the population, strengthening the institutions serving the residents, so the general public is conducive to the empowerment of quarrying in protected areas under strict control criteria and sustainably. Today in the Senate in Paraguay, there is a bill whose main objective is to regulate the quarrying of stone materials, earthy and chalky, which is expected, among others, to begin the rational and strict necessity of existing geological resources in protected areas.

On the other hand, it is important to consider that the geological and mining development in the country has its limitations mainly due to the shortage of technical and scientific information of the existing stone resources and mining in the country, which in turn is due to a weakness institutional sector.

The National Geological Survey created under "Mining" Law No. 3180 /07, had the brilliant opportunity to have genuine from the enactment of this Act resources, as will be benefited with environmental institutions, and municipalities to collect fees for services and materials certifications exploited throughout the country. It is expected that the funds raised could be used in the sector by investing in capacity, geological research, capacity building, better and greater control and supervision of the activities of quarrying. Finally, promote the interest and national or foreign private investment companies in the industry and improve the competitiveness of the sector.

Room for your notes

***Top left**: Cotton as a commodity crop in Ceará; **Top right**: Decaying leaves in a stream, MG; Brazil*

More room for your notes

***Left**: Evening mood near Ouro Preto, MG, Brazil; **Right**: Terraced hillside at the Central Peruvian Highlands*

And even more room for your notes




***Top left**: Natural shower; **Top right**: Egrets in front of the Brasilia cathedral:*
***Bottom left**: deeply weathered ferralsol; **Bottom right**: Waterfall in Mato Grosso do Sul*

United Nations Educational, Scientific and Cultural Organization
Organisation des Nations Unies pour l'éducation, la science et la culture

Guidelines and Criteria for National Geoparks seeking UNESCO's assistance to join the Global Geoparks Network (GGN)

(April 2010)

GEOPARKS – *Promoting Earth Heritage, Sustaining Local Communities*

Global Network of National Geoparks - *a landscape approach for geological heritage conservation, research and sustainable development*

Introduction

Geology and landscape have profoundly influenced society, civilization, and the cultural diversity of our planet. Although the World Heritage Convention does recognize geological sites of universal value there is no system of international recognition of geological heritage sites of national or regional importance. Many important geological sites do not fulfil the criteria for inscription on the World Heritage List. The initiative of UNESCO to support Geoparks responds to the strong need expressed by numerous countries for an international framework to conserve and enhance the value of the Earth's heritage, its landscapes and geological formations, which are key witnesses to the history of our planet.

Pursuant with the decision of its Executive Board in June 2001 (161 EX/Decisions, 3.3.1) UNESCO has been invited *"to support ad hoc efforts with Member States as appropriate"* to promote territories or natural parks having special geological features. National Geopark initiatives, which seek UNESCO's assistance, should integrate the preservation of significant examples of geological heritage in a strategy for regional sustainable socio-economic and cultural development, safeguarding the environment.

The present document provides guidelines for developing National Geoparks under the assistance of UNESCO for the inclusion in the Global Network of National Geoparks - generally referred to as the *Global Geoparks Network* (GGN). The guidelines include criteria which aspiring Geoparks adhere to through their voluntary participation in the GGN. Applicants for membership of the GGN should respect the terms of the present guidelines. UNESCO and supporting independent expert advisory groups will refer to these guidelines when assessing proposal applications for membership of the GGN.

The protection and sustainable development of geological heritage and geodiversity through Geoparks initiatives contributes to the objectives of Agenda 21, the Agenda of Science for Environment and Development into the twenty-first century adopted by the United Nations Conference on Environment and Development (UNCED, Rio de Janeiro, 1992) and which was reconfirmed by the World Summit on Sustainable Development 2002 in Johannesburg. The Geoparks initiative adds a new dimension to the 1972 Convention concerning the Protection of the World Cultural and Natural Heritage by highlighting the potential for interaction between socio-economic and cultural development and conservation of the natural environment.

The GGN operates in close synergy with the World Heritage Convention, the Man and the Biosphere (MAB) World Network of Biosphere Reserves, and with national, international, non-governmental organizations and initiatives active in geological heritage conservation. For national Geoparks in Europe, UNESCO has established a partnership with the *European Geoparks Network (EGN)* in 2001. As a result, the EGN coordinates membership of the Global Geoparks Network within Europe. UNESCO recommends the creation of related regional Networks, reflecting local conditions, elsewhere in the world. Networking among Geoparks is an important component of the GGN. UNESCO encourages many forms of cooperation, especially in the fields of education, management, tourism, sustainable development, and regional planning among GGN members.

Part I - Criteria

1. Size and setting

- A Geopark seeking to become a member of the GGN is an area with clearly defined boundaries and a large enough area for it to serve local economic and cultural development (particularly through tourism). Each Geopark should display though a range of sites of international, regional and/or national importance, a region's geological history, and the events and processes that formed it. The sites may be important from the point of view of science, rarity, education and/or aesthetics.

- A Geopark is a geographical area where geological heritage sites are part of a holistic concept of protection, education and sustainable development. The Geopark should take into account the whole geographical setting of the region, and shall not solely include sites of geological significance. The synergy between geodiversity, biodiversity and culture, in addition to both tangible and non-tangible heritage are such that non-geological themes must be highlighted as an integral part of each Geopark, especially when their importance in relation to landscape and geology can be demonstrated to the visitors. For this reason, it is necessary to also include and highlight sites of ecological, archaeological, historical and cultural value within each Geopark. In many societies, natural, cultural and social history are inextricably linked and cannot be separated.

- If the area of a Geopark is identical to, or partly or wholly overlaps with an area already inscribed, (for example, on the World Heritage List or registered as a Biosphere Reserve of the Man and the Biosphere Programme of UNESCO) it is necessary to obtain prior clearance from the appropriate national bodies of the said initiatives in their Member State before submitting the application. Geoparks may be located on the territory of more than one country.

2. Management and local involvement

- A prerequisite to any Geopark proposal being approved is the establishment of an effective management system and programme of implementation. The presence of impressive and internationally significant geological outcrops alone is not sufficient to be a Geopark. Where appropriate, the geological and non-geological features inside the Geopark area must be accessible to visitors, linked to one another and safeguarded though a clear responsible management body or partnership that has demonstrable local support. The management body or partnership should have an effective management infrastructure, adequate qualified personnel, and sustainable financial support.

- The establishment of a Geopark should be based on strong community support and local involvement, developed though a "bottom-up" process. It should demonstrate strong support from local political and community leaders, including in relation to the provision of necessary financial resources. The Geopark should have effective and professional management structures, deliver policy and action for sustainable regional socio-economic and cultural development across the territory where it is located. Success can only be achieved through strong local involvement. The initiative to create a Geopark must therefore come from local communities/authorities with a strong commitment to developing and implementing a management plan that meets the community and economic needs of the local population whilst protecting the landscape in which they live. With a view to fully inform Member States on requests for ad hoc support to UNESCO, it is necessary that in the planning stage the aspiring Geopark keeps the National Commission for UNESCO, and the relevant appropriate governmental authorities linked to UNESCO, briefed on all planned Geopark nominations in the country/countries concerned. Parallel to this the UNESCO Secretariat will systematically inform the embassies and/or Permanent Delegations to UNESCO of the requests from national Geoparks for UNESCO support.

- A Geopark shall involve public authorities, local communities, private interests, and both research and educational bodies, in the design and running of the Geopark and its

regional economic and cultural development plan and activities. This co-operation shall stimulate discussion and encourage partnerships between the different groups having a vested interest in the area and motivate and mobilise local authorities and the local population.

- The identity of a Geopark must be clearly visible for visitors. This should be achieved through a strong presentation and communication strategy including consistent branding of the sites within the Geopark, in all the publications and all activities related to it.

- Sustainable tourism and other economic activities within a Geopark can only be successful if carried out in cooperation with local communities. Tourism activities have to be specially conceived to match local conditions and the natural and cultural character of a territory and must fully respect the traditions of the local populace. Demonstrable respect, encouragement and protection of local cultural values, is a crucial part of the sustainable development effort. In many regions and countries it is vital to involve the indigenous population in the establishment of a Geopark.

- It is essential to seek advice from the Geoparks Secretariat at UNESCO and its independent Bureau during the preparatory phase of an application, and to submit an expression of interest prior to the proposal being lodged. Furthermore, the applicant should seek co-operation with respective national Geological Surveys, local public and tourism bodies, local communities, universities and research bodies, and private interest groups, and to broaden the composition of the start-up team in charge of the Geopark project. These groups should be representative of the scientific, cultural, conservation and socio-economic communities of the area. A wide local consultation process must involve the local population to facilitate local acceptance for the planned Geopark and to develop a strong concept for their Geopark application dossier and the necessary support to achieve its implementation.

3. Economic development

Sustainable development was defined by the World Commission on Environment and Development in *Our Common Future* (1987) as ‘development, which meets the needs of the present generation without compromising the ability of future generations to meet their own needs.’

- One of the main strategic objectives of a Geopark is to stimulate economic activity within the framework of sustainable development. A Geopark seeking UNESCO's assistance serves to foster socio-economic development that is culturally and environmentally sustainable. This has a direct impact on the area involved by improving human living conditions and the rural and urban environment. It strengthens identification of the population with their area, and stimulates “pride of place” and cultural development, which in turn aids direct protection of geological heritage.

- Often, aspects of a region’s cultural heritage are linked to the geological heritage. Respectful of the environment, the establishment of a Geopark shall stimulate, for example, the creation of innovative local enterprises, small business, cottage industries, initiate high quality training courses and new jobs by generating new sources of revenue (e.g. geo-tourism, geo-products) while protecting the geo-resources of the Geopark (e.g. encouraging casting instead of the sale of fossils). This provides supplementary income for the local population and shall attract private capital. 'Geo-tourism' is an economic, success-oriented and fast-moving discipline, a new tourist business sector involving strong multidisciplinary cooperation.

4. Education

- A Geopark must provide and organize support, tools, and activities to communicate geoscientific knowledge and environmental and cultural concepts to the public (e.g. through museums, interpretive and educational centres, trails, guided tours, popular literature and maps, and modern communication media). It also allows and fosters

scientific research and cooperation with universities, a wide discipline of scientists and the local populace.

- The success of Geopark educational activities depends not only on the content of tourism programmes, competent staff and logistic support for the visitors, but also on the personal contact with the local population, media representatives, and decision-makers. The aspects of wide community participation and capacity building on the local level (e.g. training of visitor guides) helps to develop a wide range of acceptance of the Geopark philosophy and transfer of knowledge and information within the community. It cannot be repeated often enough that the involvement of local people is of primary importance for the successful establishment and maintenance of a Geopark.

- Among the instruments available for the transfer of information are events such as excursions for school classes and teachers, seminars, and scientific lectures for the environmentally and culturally interested public and for residents who enjoy introducing their landscape to visitors. One of the main issues is to link geo-education with the local context, thus local students should learn about the importance of their geological heritage inter-related to the biodiversity and local cultural heritage. Creating Earth science curricula for primary and secondary schools, using the local information about geology, geomorphology, physical geography as well as all components of its heritage will help to preserve the Geopark while at the same time reinforcing local awareness, pride, and self-identity. Geoparks should be major educational tools at local and national levels.

- Within the educational concept, museums, 'discovery centres', interpretive centres and other innovative new tools must be developed to promote the principles of geological heritage conservation and the necessity of its safeguarding and protecting. The museums and centres also serve for developing different educational programmes for visitors and the local population.

5. Protection and conservation

- A Geopark is not specifically a new category of protected area or landscape and can be quite different from what is sometimes an entirely protected and regulated National Park or Nature Park, and the branding of an area as “Geopark” does not necessarily affect the legal status of the land. For legal protection for certain geosites within the Geopark, however, the authorities responsible for the Geopark must ensure its protection in accordance with local traditions and legislative obligations. It is the government of the country where the Geopark is situated which decides on the level and measures of protection of certain sites or geological outcrops.

- In accordance with national legislation or regulations, a Geopark shall contribute to the conservation of significant geological features including:

representative rocks and in situ exposures
minerals and mineral resources
fossils
landforms and landscapes

which provide information on various geoscientific disciplines such as:

solid earth sciences
economic geology and mining
engineering geology
geomorphology
glacial geology
physical geography
hydrology
mineralogy
palaeontology
petrology
sedimentology
soil science
speleology

stratigraphy
structural geology
volcanology

A Geopark explores and demonstrates methods and best practise in conserving geological heritage.

- The management authority of the Geopark ensures adequate protection measures, in consultation with relevant statutory bodies, to guarantee effective conservation and ensure physical maintenance, as appropriate. Those sites remain under the sole jurisdiction of the country (or countries) in which the Geopark is situated. It is each country's responsibility to decide how to protect the particular sites or areas, in conformity with national legislation or regulations.

- A Geopark must respect local and national laws relating to the protection of geological heritage. In order to be seen to be impartial in its management of the geological heritage, the Geopark managing body must not participate directly in the sale of geological objects* within the Geopark (no matter from where they are sourced) and should actively discourage unsustainable trade in geological materials as a whole, including the selling of Earth heritage, minerals and fossils. Where clearly justified as a responsible activity and as part of delivering the most effective and sustainable means of site management, it may permit sustainable collecting of geological materials for scientific and educational purposes from naturally renewable sites within the Geopark. Trade of geological materials (in accordance with national legislation on Earth heritage conservation) based on such a system may be tolerated in exceptional circumstances, provided it is clearly and publicly explained, justified and monitored as the best option for the Geopark in relation to local circumstances. Such circumstances will be subject to debate and approval by the GGN on a case by case basis.

**Geological objects refer to specimens of rock, minerals and fossils of a type that are commonly sold in so-called "rock-shops". It does not refer to material for normal industrial and household use which is sourced by quarrying and/or mining and which will be subject to regulation under national and/or international legislation.*

6. The Global Network

- The GGN provides a platform of cooperation and exchange between experts and practitioners in geological heritage matters. Under the umbrella of UNESCO and through cooperation with the global network partners, important local, and national, geological sites gain worldwide recognition and benefit through the exchange of knowledge and expertise, experience and staff between other Geoparks. This international partnership developed by UNESCO, brings the advantage of being a member of, and profiting from, this worldwide network, as compared to a local isolated initiative. It allows any participating Geopark to benefit from the experience and knowledge of other members of the Network.

- The Network comprises all regions of the world and brings together groups that share common values, interests, or backgrounds, to develop a specific methodology and management practices. It further serves to develop models of best practice and set quality - standards for territories that integrate the preservation of geological heritage in a strategy for regional sustainable economic development. The establishment of a Geopark aims to bring sustainability and real economic benefit to the local populations, usually through the development of sustainable tourism and other economic and cultural activities.

Geoparks that are part of the GGN:

1) preserve geological heritage for present and future generations

2) educate the broad public about issues in geological sciences and their relation with environmental matters

3) ensure sustainable socio-economic and cultural development

4) foster multi-cultural bridges for heritage and conservation and the maintenance of geological and cultural diversity, using participatory schemes and co-partnership

5) stimulate research

6) contribute actively to the life of the Network through joint collaborative initiatives (e.g. communication, publications, exchange of information, twinning, participation in meetings, common projects)

7) contribute articles to the GGN Newsletters, books and other publications.

- UNESCO supports the development of this initiative, among others, in order to establish the geosciences on the agenda of politicians and decision-markers at international, national and local levels, as well as promoting awareness within the private sector. A large number of activities within Geoparks are being developed worldwide to increase partnership with the private sector, e.g. the tourism industry. The private sector often requests an international cooperative framework that UNESCO can offer. UNESCO's umbrella also assists in raising the interest of government sectors in this effort. UNESCO has a strong awareness-raising role through informing the Ambassadors of the different Member States about Geoparks. This in itself will lead to a much better understanding of, and support for, local initiatives that want to join the GGN.

- The inclusion of an aspiring Geopark into the GGN is a sign of recognition of excellence in relation with the present guidelines and in no way implies any legal or financial responsibilities on the part of UNESCO. This relates also to the use of UNESCO's name and logo, which needs a special authorization respecting the regulatory framework of sponsorship of the Organization. For approved network members, a special logo was created for the GGN. It is important to understand that this logo and the mentioning of membership in the GGN can only be used after the successful evaluation of the application, and upon receipt of the official letter of approval from the Global Geoparks Network Secretariat. Further, the use of this common logo linked to the identity of the GGN Members is strongly recommended and is essential to create a common image for all Geoparks throughout the world.

- Should a member of the GGN wish to use UNESCO's logo ("temple logo") and name for a specific event or activity, it can obtain patronage through the National Commissions for UNESCO, or by special permission of the Director-General, which must be expressly authorized in advance and in writing. It is the responsibility of the managing body of the Geopark to avoid any misunderstandings with anyone in this regard. Directives concerning the use of the name, acronym, logo and internet domain names of UNESCO can be obtained at the following website: http://www.unesco.org/new/en/name-and-logo/

Part II - Reporting and Periodical review

- Geoparks that are a member of the GGN should represent quality in everything they do including conservation, tourism, education, interpretation, development. The specified processes of evaluation and revalidation help ensure the maximum level of quality in our Geoparks.

- The status of each Geopark, of its management and performance, shall be subject to a periodical review within 4 years. This review is based on a progress report prepared by the designated management body of the Geopark in cooperation with respective authorities that signed the original proposal, and forwarded to the Geoparks Secretariat at UNESCO. An expert mission is sent to review the status of the Geopark.

- If on the basis of this report, and examination of the Geopark by an expert mission, the independent expert group of UNESCO considers that the status or management of the park is satisfactory since it was designated or last reviewed, this will be formally acknowledged and the Geopark will continue to be a member of the GGN.

- If it is considered that the Geopark no longer fulfils the criteria of the GGN set out in the present guidelines, the management body of the Geopark will be recommended to take appropriate steps to ensure the accepted standards are adhered to and maintained. Should the Geopark not fulfil the criteria within two years, it shall be removed from the members' list of the GGN and cease to benefit from all the privileges associated with the Global Geopark Membership including the use of the GGN logo.

- UNESCO shall notify the management body of the concerned Geopark, the National Commission for UNESCO and relevant governmental authorities in the country of the outcome of the periodical review.

- Should a Geopark wish to withdraw from the GGN, its management body shall notify the Geoparks Secretariat, its National Commission, and relevant governmental authorities in the country concerned, and it is requested to give the reasons for its withdrawal.

- At any time it is possible for an existing Geopark to seek to modify its boundaries, which should first be approved by the Geoparks Bureau. Only following this approval may the GGN logo be used within any new enlarged territories. A request to change the boundaries should be notified to the Geoparks Secretariat of the GGN at UNESCO with details of the present and new boundaries, appropriate maps, and reasons for, and benefits from, the proposed change.

- The designation of an area as a member of the GGN shall be given appropriate publicity and promotion by the management body of the Geopark concerned. It shall also keep UNESCO regularly informed about the ongoing progress and developments in the Geopark. This refers to special events (e.g. twinning, inaugurations, etc.) and their promotion through appropriate publicity, including website links that can be easily connected and reach a worldwide public.

Annex - Application procedure - a step-by-step procedure on how to become a Global Geopark Network member

- A Geopark under preparation can refer to itself an “Aspirant Geopark” or a “Geopark Project.” It is necessary to respect the use of the term “Geopark”, and to safeguard the reputation of Geoparks to ensure that they reflect quality in all aspects of their heritage, products and services. As such, areas applying to become members of the GGN should refrain from calling their areas “Geoparks” until such times as their membership application has been approved.

- In order to guarantee a balanced geographical representation of countries the number of active Geopark applications is restricted to two per country at any one time. Three Geopark applications at the same time can be permitted for countries, which apply for the first time, and are not yet participating in the GGN.

1. Submission of an application dossier

- Geoparks seeking UNESCO’s assistance must contact the Geoparks Secretariat at UNESCO, and submit an expression of interest prior to the submission of any application dossier.

Geoparks Secretariat
Global Earth Observation Section
Division of Ecological and Earth Sciences
UNESCO
1, rue Miollis
75732 Paris Cedex 15
France
Phone: + 33 (0) 1 45 68 41 18
Fax: + 33 (0) 1 45 68 58 22
e-mail: m.patzak@unesco.org
www.unesco.org/science/earth

- The Geoparks Secretariat at UNESCO shall verify the contents of the application dossier and supporting materials and, in the case of incomplete documentation, return it to the applicant for completion, with comments on the elements that require strengthening. Applications must be submitted between 1 October and 1 December every year and will be verified by a desk-top evaluation (between 1 January and 30 April) as well as a field evaluation mission (from May onwards), undertaken by independent Geoparks experts who will compile a report for submission to the GGN Bureau. Prior to the mission, the experts will contact the applying Geopark and agree on a mission's programme and itinerary. The application’s documentation and the findings of the expert mission will be assessed by the independent Geoparks Bureau that will meet at least once per year usually in the second half of the year. Membership to the GGN will be invited upon a positive assessment of the proposal. UNESCO shall notify the applicant with an official letter and certificate, as well as the National Commission for UNESCO, and relevant governmental authorities in the country concerned.

- The costs of travel, accommodation and local transportation costs of the experts in charge of advisory missions and on-the-spot evaluation should normally be borne by the country or territory where the Geopark is located, or by any other party or entity formally involved with the Geopark application.

- If in any country a "National Network for Geoparks" exists, then the applicant must first become a certified member of that national network before submitting its dossier for membership to the GGN. Comments made by the nationally competent body during a successful application procedure at the national level could form a valuable contribution to the dossier.

- As part of the application preparation any potential new member may wish to invite an advisor from the network to their area. The costs of such a visit should be borne by the inviting territory.

- The application should be written in English or French and submitted electronically and 1 printed copy (soft cover) should be mailed as well. Where possible, in order to facilitate distribution of the application file among the desk-top evaluators, a link could be provided to download the entire application dossier from the internet.

- With a view to ensure that Member States are fully informed about the application, i.e. the request to UNESCO for ad hoc support in the field of Geoparks, the National Commissions for UNESCO and/or the relevant appropriate governmental authorities linked to UNESCO in each Member State concerned, need to be properly informed and a letter of support from the relevant national authority submitted as part of the application.

2. Application Form

Format of e-file:
Max. 10 MB

Hard copy format:
Application dossier max. 50 pages
Annex 1 - self evaluation document
Annex 2 - an additional and separate copy of section B “Geological Heritage” of the application, prefaced by a geological summary (a maximum of 150 words)
Annex 3 - a letter of support from the relevant governmental authorities linked to UNESCO in the country where the proposed Geopark project is located

The following topics form the guide to prepare the application dossier for the proposed Geopark. The application dossier must precisely follow the format and topics below, highlighting strong and weak points and will be studied by an independent group of experts verifying the Geopark project though a desktop study. The topics will demonstrate whether the applying area is already a de facto functioning Geopark fulfilling the criteria to become a member of the GGN, and whether or not an examination mission should be carried out. If the application dossier is considered to be complete and ready for assessment, the GGN Bureau will approve an evaluation mission to the application area.

A – Identification of the Area
1. Name of the proposed Geopark
2. Surface area, physical and human geography characteristics of the proposed Geopark
3. Organization in charge and management structure (description, function and organigram) of the proposed Geopark
4. Application contact person (name, position, tel./fax, e-mail)

B – Geological Heritage
1. Location of the proposed Geopark (please include a geographical map and the geographic coordinates longitude and latitude coordinates)
2. General geological description of the proposed Geopark
3. Listing and description of geological sites within the proposed Geopark
4. Details on the interest of these sites in terms of their international, national, regional or local value (for example scientific, educational, aesthetic)

C - Geoconservation
1. Current or potential pressure on the proposed Geopark
2. Current status in terms of protection of geological sites within the proposed Geopark
3. Data on the management and maintenance of these sites
4. Listing and description of non-geological sites and how they are integrated into the proposed Geopark

D - Economic Activity & Business Plan (including detailed financial information)
1. Economic activity in the proposed Geopark
2. Existing and planned facilities for the proposed Geopark (e.g. geo-education, geo-tourism, tourism infrastructure etc)
3. Analysis of geotourism potential of the proposed Geopark
4. Overview and policies for the sustainable development of:
   - geo-tourism and economy
   - geo-education
   - geo-heritage

   Please include examples illustrating activities in these sectors
5. Policies for, and examples of, community empowerment (involvement and consultation) in the proposed Geopark
6. Policies for, and examples of, public and stakeholder awareness in the proposed Geopark.

E – Interest and arguments for joining the GGN

Annex 1: Self evaluation document

Annex 2: An additional and separate copy of section B "Geological Heritage" of the application, prefaced by a geological summary of a maximum of 150 words (this will be used only for the geological desktop evaluators from IUGS – International Union of Geological Sciences)

Annex 3: A letter of support from the relevant governmental authorities linked to UNESCO in the country where the Geopark project is located

The full application must not exceed 50 pages (including all photographs, maps, figures and diagrams) and the electronic version must not exceed a file size of 10MB.

2. Application from European countries

- A Geopark located in Europe wishing to become a member of the GGN, is invited to submit a full application dossier to the coordination office of the European Geoparks Network (EGN), which acts as the integration organization into the GGN for the European continent. The GGN and the European Geoparks Network were designed in parallel on a common conceptual basis. Pursuant to this, applications to the Global Network from European countries are implemented through the EGN. As a permanent member of the Advisory Board and expert committees of the EGN, UNESCO participates at every stage in the evaluation of, and decision on the applications.

- UNESCO and the EGN have signed two agreements in this respect, the "Agreement for co-operation between the Division of Earth Sciences of UNESCO and the Network of European Geoparks" (2001, Almeria, Spain), and the "Madonie Declaration" (2004, Madonie Italy). As a result, the EGN coordinates membership of the GGN in Europe.

- The EGN was established in June 2000 by four European Geoparks to: protect geological heritage and promote the sustainable development of their areas; to create a strong European thematic group of territories involved in sustainable development; and to prepare and negotiate new common European Programmes.

- If in any European country a "National Network for Geoparks" already exists, then the applicant must first become a certified member of that national network before submitting its dossier for membership to the European Geoparks Network. Comments made by the nationally competent body during a successful application procedure at the national level could form valuable appendices to the application dossier.

- European candidates must submit their application forms through the Coordination Unit of the European Geoparks Network, Réserve Géologique de Haute Provence, Digne-les-Bains, France from whom up-to-date advice and assistance should be requested in advance.

Coordination Unit
European Geoparks Network
Réserve Géologique de Haute-Provence
BP 156
F-04005 Digne-les-Bains cedex
France

Phone: + 33 (0) 4 92 36 70 72
Fax: + 33 (0) 4 92 36 70 71
Contact Mrs. Sylvie Giraud
E mail : sy.giraud@free.fr
www.europeangeoparks.org