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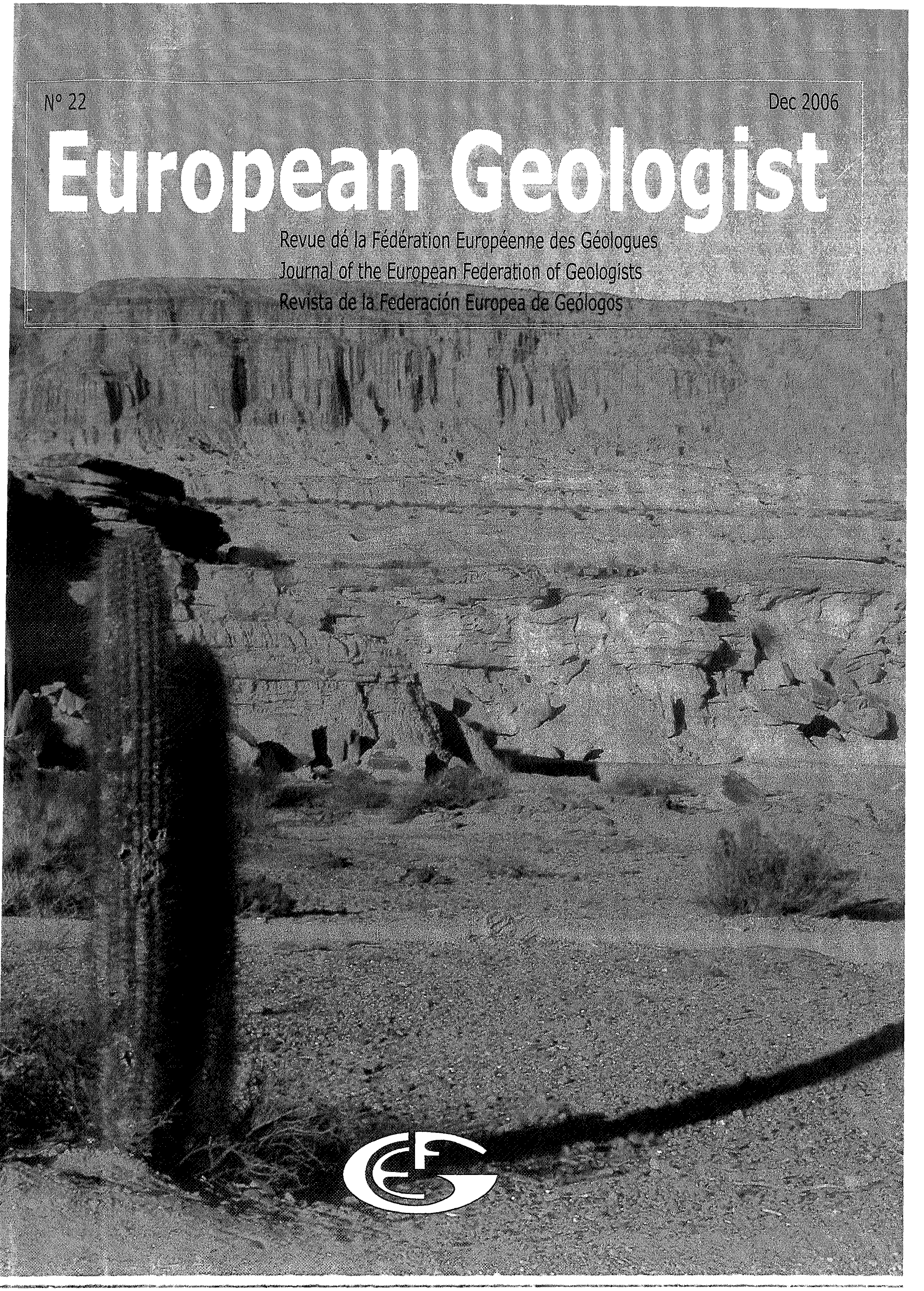

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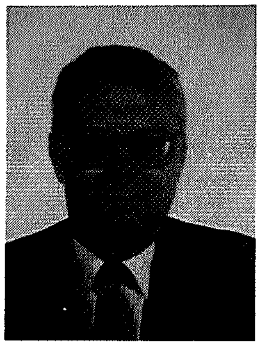
Foreword

Four Cornerstones

by EurGeol. Prof. Dr. István Bérczi, President



Dear Readers,

The Council Meeting in Porto summarized what we are going to do to transform the EFG into a strong civil organization. Four cornerstones have been identified as follows:

- Sustainability: efforts to maintain, cultivate and develop the organization as a safeguard of professional excellence
- Visibility: extend our national influence and reach
- Credibility: observe rules of professional ethics in the practice of the profession across international boundaries
- Portability: achieve global recognition of our professional credentials.

Responsibilities of Council Members, National Associations and EurGeols in improving the position of the EFG, have been defined as follows:

- Participate/assist in identifying additional financial sources for EFG
- Participate/assist in the implementation of action plans nominating responsible persons and deadlines
- Assist the permanent dialogue developed and cultivated by the Board and the Brussels Office with fellow European/global organizations active in the field of Earth Science and engineering (Eurogeosurveys, Euromines) as well as DGs of the EC and Committees of the EP
- Assist the Board/Brussels Office with revising, commenting on electronically distributed documents timely and professionally
- Assist the Editor of the Magazine with recruiting articles, advertisers, sponsors, and publicize the new issues
- Assist the Electronic Communication Manager in distributing, publicizing EU documents, EFG documents, e-newsletter in the respective countries.

Simultaneously. the weaknesses as barriers in implementing the ambitious goals of the Federation have been identified as follows:

- the lack of consistent/determined efforts to find additional sources for the budget, as demonstrated by the spectacular failure of the Fund Raising Campaign which had been launched in Prague with acclamation and now phased out after exponentially declining enthusiasm
- poor personal connections to/poor networking channels towards the decision makers
- poor publicity for the Federation within the terrains of the NAs is the main reason for the difficulty in finding national sponsors for the NAs to contribute to the Federation's budget. International visibility and participation in paying actions cannot replace the national contributions.

Consequently, our strategic actions should be re-arranged to give priority to those improving the financial/budget position of the Federation as follows:

- Start the e-learning platform of the web page: www.eurogeologists.de
- Devise a clear CPD programme to increase the number of active and long term Euro Geologists
- Organize conferences/courses as opportunities to achieve CPD related and budgetary targets
- Introduce corporate membership within EFG
- Retain EFG reputation achieved by corresponding WGs in the fields of Resources and Reserves Reporting and Natural Hazards
- Set ambitious targets for other WGs particularly in topics of the Soil Initiative and Water Resources Management.

Are these points too much or too few? It

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Cover photograph
Ischigualasto National Park, northwest Argentina is a World Heritage site. These arid badlands of sandstone and mudstone contain some of the oldest known dinosaur remains (Photo: Manuel Regueiro)

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The European - Unesco Geoparks network: tourism, geoheritage and landscape

by Hanneke van den Ancker[1]

Until recently Earth scientists, unlike biologists, did little to promote public interest in geology. This was changed by the Geopark initiative from four European countries. Now, six years later, more than twenty four countries are involved worldwide, and many more are expected to follow. This article gives an impression of what a Geopark is and what is needed to become one. Geoparks, apart from bringing entertainment and education, assist the regional economy, while focussing on sustainable development, public participation and preservation of scientifically valuable sites and landscapes. The role Geoparks can play in raising public awareness for Earth Sciences and issues such as sustainable land management and landscape quality should not be underestimated

Jusqu'à une époque récente, les géologues, à la différence des biologistes, n'étaient guère impliqués dans la promotion de la géologie auprès du grand public. Cela a changé avec la création de parcs géologiques, initiatives prises au départ, par 4 pays européens. Aujourd'hui, six années plus tard, plus de 24 pays dans le monde ont suivi cette initiative et beaucoup d'autres pays vont suivre cet exemple. Cet article indique en quoi consiste un parc géologique et que faut-il pour en créer un nouveau. Les parcs géologiques, en dehors de leur apport au niveau loisir et éducation, ont un impact sur l'économie régionale tout en mettant l'accent sur le développement durable, la participation du public et la préservation des sites scientifiques remarquables et des paysages. Le rôle que les parcs géologiques peuvent jouer pour l'éveil et la sensibilisation du public aux Sciences de la terre et aux thèmes tels que la gestion durable en matière d'équipement ainsi que la préservation des paysages classés n'est pas à sous estimer.

Hasta hace poco los científicos del campo de la ciencias de la Tierra, hicieron bien poco para promover el interés del público en la geología. Esto cambió gracias a la iniciativa de los Geoparques de cuatro paíse4s europeos. Hoy, seis años después, están implicados más de veinticuatro países de todo el mundo y se espera la participación de muchos más. Este trabajo da una visión de lo que son los Geoparques y lo que hace falta para convertirse en uno. Los Geoparques, además de traer diversión y educación, ayudan a la economía regional al mismo tiempo que se centran en el desarrollo sostenible, la participación ciudadana y la conservación de lugares y paisajes de valor científico. El papel que pueden jugar los Geoparques para aumentar la percepción pública sobre las Ciencias de la Tierra y temas como la planificación sostenible del territorio y la calidad del paisaje no se debe subestimar.

Only geoparks belonging to the networks can use these logos. The trademark European Geopark is protected and registered in all European countries, which does not apply to the simple term geopark which anybody can use.

From 17 - 21 September 2006 a very lively and successful 2nd Unesco Geopark Meeting took place in Belfast, N. Ireland. The fast-growing European Geoparks network took off in 2000 with four geoparks in Germany, Greece, France and Spain, respectively. The quality and success of the European Geoparks encouraged China and Unesco in 2004 to join the geopark initiative. The standards of the European network were more or less copied and both networks started a close cooperation. Within half a year it was agreed that the European Geoparks had enough geoheritage quality to receive the Unesco Geoparks label.

Now, six years later, there are 50 Geoparks of which 30 are located in Europe (Fig. 1). Most other Geoparks are found in China. During the latest meeting, South America's Brazil was added to the global network. New territories expected to join the network within the coming years are Australia, Canada, India and Africa. In Europe, Kvarken Archipelago in Finland, already a World Heritage Site, Kerry in Ireland and Magma Geopark in Norway can be expected to join the network, while many regions in Eastern Europe are working towards membership. Some countries are considering copying the initiative on a national level. Over the last year Germany added national geoparks in a national geopark network.

Success brings new views: regulations to join become more strict and candidate regions have to function as geoparks for

[1]Coordinator EFG expert group: Geological Heritage and Soil Protection

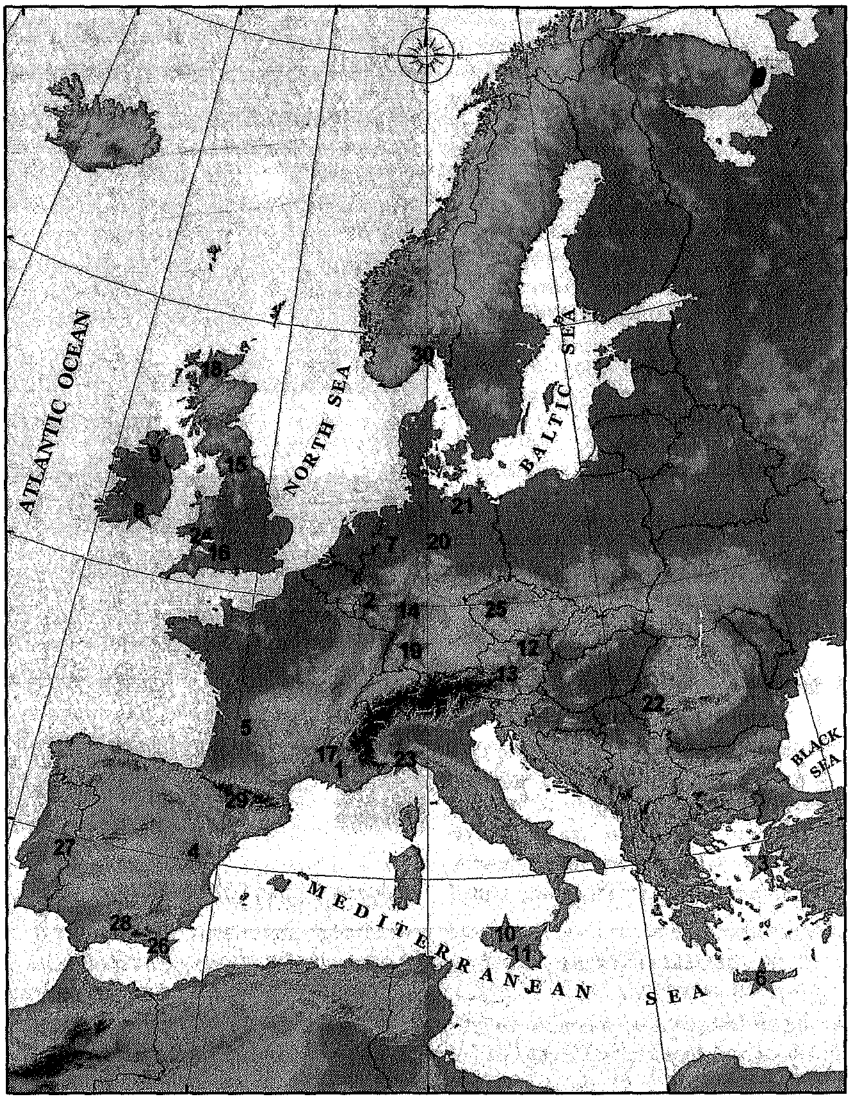


Figure 1. The location of the European Geoparks

some time before being admitted to the network. In the future, with so many new regions interested in the EU support funding that follows, it will become more difficult to acquire European Europark status and regions may have to compete. The fast developments are one of the charms of this practical network; new solutions are constantly sought and one wonders where these networks will bring us in three years time. If things move on as fast as they have done in the past, more then 200 Geoparks might then have joined and a worldwide regional geopark network would then have developed.

What is a Geopark?

Geoparks are communal products centred around sustainable rural development of tourist and educational projects, with world quality geology and scenic landscapes, combining archeological, ecological, historical and cultural values. Other preconditions for recognition as a Geopark are the active participation and involvement of the local population in decision making and an economically and scientifically sound management. There are no size restrictions; some parks are hardly larger than an urban park such as Hong Kong (according to my perception this area is not yet recognized as a geopark but is working hard to become one), whereas others can be about the size of a province.

The Geopark initiatives are primarily financed through local and national efforts and supported by regional development funds of the European Union. Primarily the European Union programmes Interreg II and III and Leader+ have helped this network to emerge.

How to qualify as a Geopark?

It is not so very easy to qualify as a Geopark member. Self-evidently, a European and Unesco Geopark needs to possess world quality geoheritage and landscape. But as mentioned already, apart from this a geopark has to meet the standards set by the development of sustainable management of tourism and education, the continuous improvement of products, an economically sound management plan, the active involvement of the local community and the support of the local government. The standards take local conditions into account. It is clear that criteria in densely populated areas differ from those in remote areas such as Northwest Scotland and Finland. The Odenwald Geopark for example has an easy access to academics interested in guiding tours because of the three universities situated near this region, which in the north of Scotland will be difficult to find. Here, first aid and the safety of visitors during excursions get more attention.

Another important prerequisite is that each Geopark has to provide two participants in the network meetings organized twice a year. One person attending should have management expertise, the other has to be knowledgeable in earth sciences and landscape matters. The network is proud of its open and transparent structure directed at giving mutual support to members. The meetings are also the focal points of decision making, sharing information and expertise, solving problems, improvement of tools and search for new possibilities. The two coordinators of the European Geopark network are Patrick McKeever of the Geological Survey of Northern Ireland and Nicolas Zouros of the Natural History Museum of Lesvos Petrified Forest (Fig.2). They prepare these meetings and participate in the evaluationswith the active support of their home institutes. Driving forces behind the realization of the Unesco Geopark were Dr. Eder of Unesco with the support of Dr. Janoschek of IUGS, the International Union of Geological Sciences, both now retired but still participating in the network.

Quality performance: Green - Yellow - Red cards

The performance of a Geopark is evaluated every fourth year. An expert panel of the European Geopark Network and the Unesco Geopark Network will screen its books and products and will visit the area. The costs of the evaluation are carried by the geopark. A green card and award are given to those geoparks functioning according to the rules set by the network. A yellow card means that the aims set were

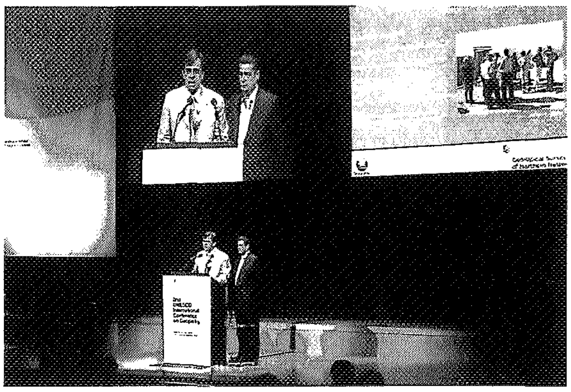
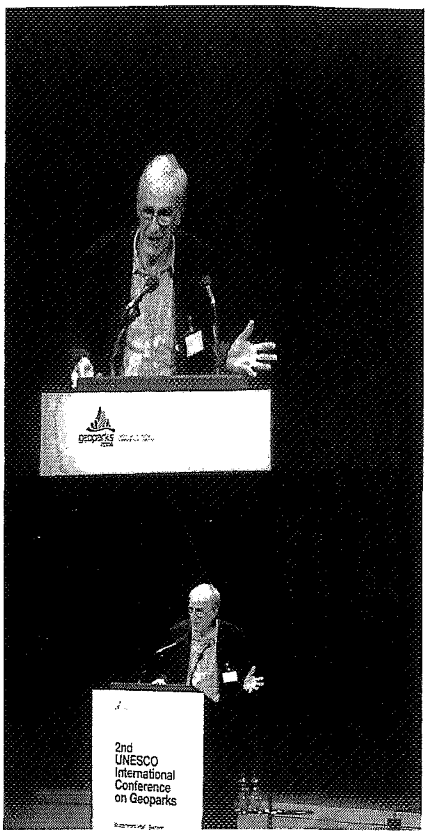


Figure 2. The two coordinators of the European Geopark network Dr. Patrick McKeever of the Geological Survey of Northern Ireland and prof. Dr. Nicolas Zouros of the Natural History Museum of Lesvos Petrified Forest.

Figure 3. Prof. dr. Aubrey Manning, broadcaster for several popular BBC television programmes, one of which was Landscape Mysteries, stressed the importance of caring for our Earth. He concluded his lecture citing Edmund Burke 'he who did do nothing because he only could do little', encouraging us to keep going even if we think it is of little importance.



not fully reached, whereas a red card means the network is not functioning properly. It then gets a four year period to improve before it is disqualified. Within its recent history two members received a red card, of which one was readmitted this year.

Meetings and Workshops

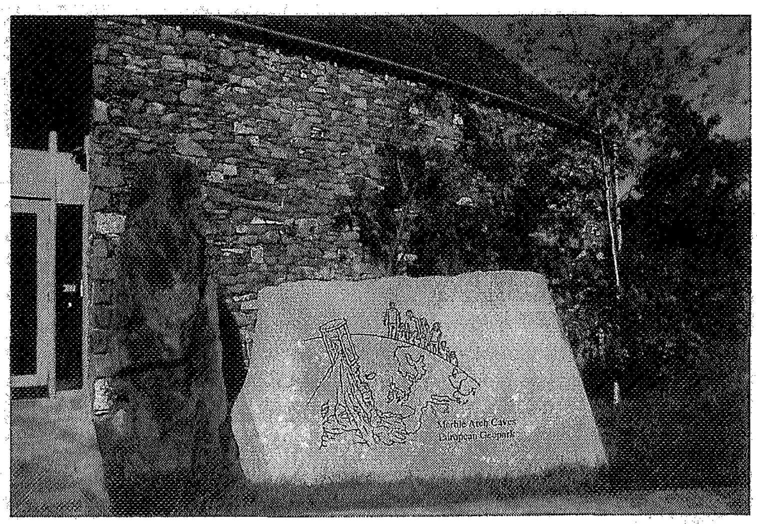
The meetings and workshops organized during the meetings are central to the Geopark process. In this 2nd Unesco Geopark meeting, nine thematic workshops were organized to tackle actual problems in the network. Each theme was discussed in two sessions. The results were reported and discussed in the general meeting on the last day.

How to get more information on the European - Unesco Geopark Network?

More information on the geoparks network can be found on the website www.europeangeoparks.org. The application forms for the network will be sent to you on request by Sylvie Giraud from Reserve Geologique de Haute Provence, e-mail address: s.giraud@resgeol04.org

Marble Arch Cave

Marble Arch Geopark in Northern Ireland hosted the 2nd Unesco Geopark conference. With its characteristic image of extensive acidic peat bogs one does not easily associate Ireland with karst phenomena, but in fact half of the island is underlain by limestone. In order to be nominated as a European Geopark the visitor centre was improved, as was the quality of the guided tours, the infrastructure within the cave and the educational materials. To achieve these goals, the area received EU funding. Within the visitors centre a range of educational materials for children and adults can be bought which bear relationship to the geopark. The exhibition focusses on how this specific cave and its environment developed, who discovered the cave and how research and research attributes changed over the years.



A special corner of the visitor centre is dedicated to the European and Unesco Geopark Network. A geologist of the Geological Survey of Northern Ireland is attached to the geopark. Marble Arch was already a popular attraction, but the number of local and international visitors has increased because of its improved quality. This is true for all geoparks, even more so for the Chinese.

The terrains surrounding the cave show limestone geomorphology with a range of typical karst phenomena and related biodiversity. Local farmers are involved in the sustainable management of the environment. The Marble Arch Geopark was recently enlarged with the high and very scenic Mc Cuilcagh Mountain bordering the area and having thick blanket peats on its slopes. A bog restoration project was started in recent years. Marble Arch cave is special in that a river flows through the cave and that its walls seem hardly touched by humans, showing a characteristic round evaporation pattern. Part of the visit to the cave has to be made by boat, which children think is the most exiting part. The entrance to the caves gives one the impression that few visitors come here whereas in fact this is one of the biggest tourist attractions of the region. Can there be a better standard for sustainable management?

Selling fossils?

During the meeting there was much debate on whether the selling of fossils could be allowed in Geoparks. It is now prohibited and considered a form of non-sustainable use. It was pointed out that collecting fossils is an effective way to raise the interest of children and adults in geology and landscape history and for some fossils there would not be any objection at all to do this. Another point is that selling fossils could bring important economic revenue to some geoparks. Because this is difficult to control, the restriction on the selling of fossils was maintained. Audrey Manning (Fig. 3), the BBC television ecologist, remarked that geologists are lagging behind in this discussion. With biologists, the issue has been settled: collecting plants and animals is prohibited in all Nature Parks.

Over the last few years particularly, the Geopark Odenwald in Germany and the Psiloritis Natural Park in Crete have developed a range of products to raise the interest of children in fossils. Replicas in soft fabric, plastic and ceramic are sold and visitor programmes have been developed in which children make 'fossils' of clay or draw them with the landscapes they lived in. Psiloritis NP Crete recently invited well-known artists from other Geoparks to inspire their local artists to improve the quality of tourist products for adults.

Thematic promotion on cross-border geotourism - the ice marginal project

The European Federation of Geologists participated in the 2nd Unesco Geopark meeting with the poster presented on the next page: how to work towards the development of cross-border thematic geotourism brochures in a cooperation connecting all European earth science organizations? The ProGEO Nordic Group is currently starting off a project for its ice-marginal heritage (see poster). But other geothemes could be worked out as well, for example mountains, rivers, karst and caves, moors, dunes, coasts. Each country involved should present itself in the brochure with its quality geoparks, geological sites and landscapes worth the detour or the journey in Michelin guide terminology. At the location itself more information and materials should be available. The cross-border and thematic approach of ice margins helps the public to perceive the spatial relationships in the history of our European landscapes. It also links up less spectacular but scientifically valuable regions with more spectacular landscapes. Another advantage is that geoparks as well as geosites can be integrated in this approach.

Geodiversity should be part of the Quality Coast Label

Another discussion EFG started off during the Unesco Geopark conference is the integration of geodiversity and geoheritage in the Quality Coast Label.

EUCC - the Coastal Union (EUCC changed its name from Eur. Union on Coastal Conservation to this shorter name) - noticed that people search the internet for Blue Flag beach sites and that local officials and politicians are keen to acquire this label for their resorts. The Blue Flag is developed as a quality symbol for beach resorts and marinas meeting hygienic standards, having scenic quality and an ecological management. An illustration of its importance is the problem raised between the water management board and the community council of two beach resorts along the Dutch coast. During heavy rains, polluted water from the hinterland is drained into the coastal waters, for which reason these resorts cannot acquire a blue flag. The community councils have considered suing the water management board, but as both parties are governmental organizations this is a difficult matter.

The success of the Blue Flag inspired EUCC to start developing a Quality Coast Label as a symbol for quality tourist sites and proper coastal management. EUCC agrees that geoheritage and geodiversity should be part of this label. In fact both aspects are part of the EUCC mission statement, but in practice the organization lacks the expertise to give this a follow-up. The EUCC is however interested in cooperating with European geo-networks in taking this matter further. The Quality Coastal Label could include the establishment of a network of Geosites Monuments, an example being the granite exposure in the harbour of Oporto presented in one of the last EFG journals (EG 21).

Of all the European organizations on geoheritage and geodiversity, the European Geopark Network seems best equipped to support the development of the Quality Coast Label. They are interested in participating in such a project but not willing to take the initiative. Thus EFG will take it up and seek further cooperation.

Those interested in joining the development of both initiatives are asked to contact:

Hanneke van den Ancker, EFG coordinator Geoheritage and Soil Protection Group, Geoheritage NL, Oude Bennekomseweg 31, 6717 LM EDE

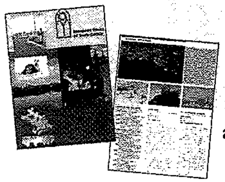
Tel: +31 318 626164 / 638478

e-mail: juan.GenL@inter.NL.net

or

Isabel Fernandez of EFG head office in Brussels.

Cross-border promotion of thematic geotourism



The countries around the Baltic Sea promoted their Brick Gothic Heritage (Hanse Period) in a EU sponsored project. A website, a brochure and national tourist products were produced.

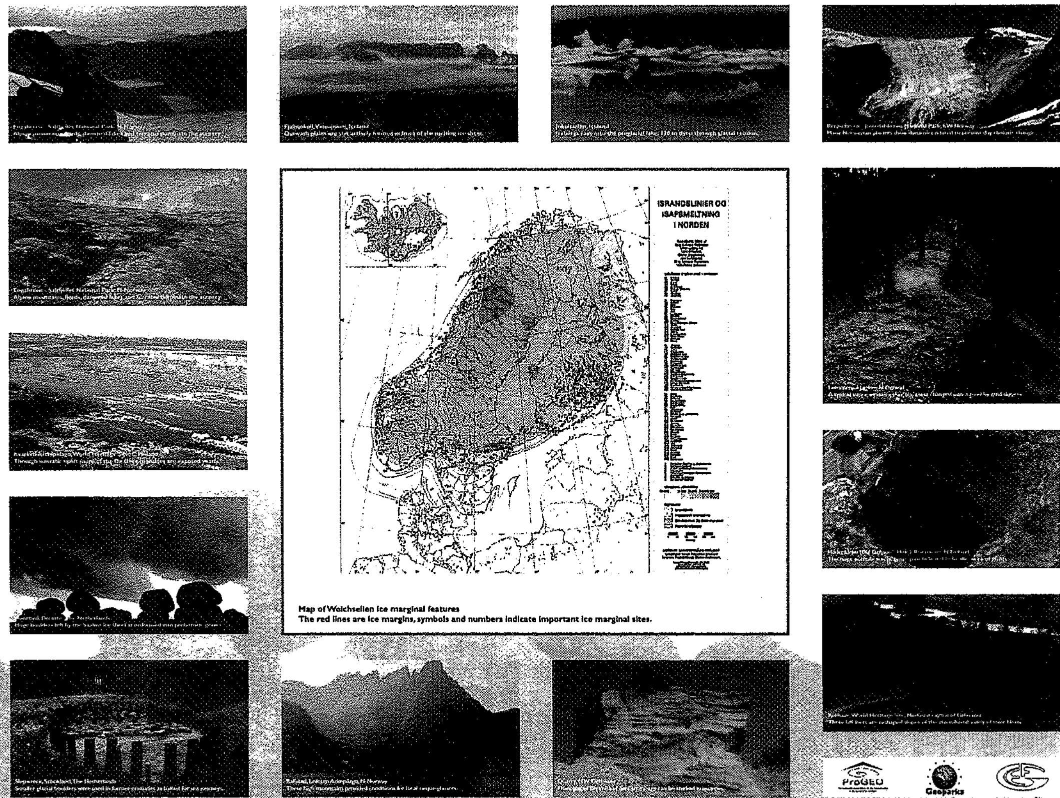
Members of the ProGEO Nordic Group agreed to try and promote their ice-marginal heritage in a comparable cross-border project. Sweden, Norway, Finland and Denmark already did an inventory and classification of their ice-marginal sites.

The European Geoparks Network through its network and experience can give important impetus to the promotion of cross-border thematic geotourism combining geosites and geoparks.

The European Union for Coastal Conservation is willing to cooperate in a thematic approach promoting coastal geoheritage.

Other cross-European themes could be considered: caves and karst phenomena, moors, volcanoes, mountains, gorges and rivers.

These projects could be combined with cross-European correlation and qualification of geosites.



Colofon
Contributors: ProGeo Nordic Group: dr. Lars Erikstad - Norway, dr. Peter Johanson - Finland, dr. Carl Erik Johansson - Sweden, dr. Grazina Skridlaite - Lithunia, drs. Hanneke van den Ancker & drs. Enno Bregman - The Netherlands; dr. Andreas Buddenbohm, EGN - Germany.
Support: dr. Isabel Fernandez - EFG Office Brussels, drs. Herald Ligtenberg - EFG Board, drs. Albert Salman - EUCC
Realisation: drs. Hanneke van den Ancker - coordinator working group geoheritage and soil heritage - EFG, Johan Leonhardt, *lay-out*
Photographs: contributors, Pieter Dirk Jungerius and Gerard Koopmans
Map: Weichselien Ice Marginal Features GEUS - Geological Survey of Denmark
EFG = European Federation of Geologists; EGN = European Geoparks Network; EUCC = European Union of Coastal Conservation

The EFG poster presented at the 2nd Unesco Geopark meeting inBelfast, N. Ireland

Geodiversity and Geoheritage in the EU Soil Strategy

by Hanneke (J.A.M.) van den Ancker[1] and Pieter Dirk Jungerius[1]

Soils systems and modern spatial planning

Perhaps because of the huge problems of chemical pollution of soils as well as the making of a uniform global soil classification, the broader perspective of soil as soil, including systems was somewhat overlooked over the last few decades in soil science. This also applies to the role of earth sciences in spatial planning. In modern times the restraints set by the land can be overcome using various technical measures. But it is becoming more and more evident that these measures when applied without knowledge of the functioning of the soil system produce unforeseen effects and problems and may unnecessarily destroy part of our earth and landscape heritage.

Geoheritage and geodiversity in the EU Soil Strategy of September 2006

Eleven international organizations handed over the EU Manifesto on Earth Heritage and Geodiversity to Mrs. Catherine Day, Director General, Environment of the European Commission, in November 2004 (see EG 20, 2005). These included geological, geomorphological, soil science as well as nature management organizations. In March 2005, a letter from the European Commission of Environment was received agreeing to include the subjects geodiversity and geoheritage within the EU Soil Strategy.

The text of the EU Soil Strategy released in September 2006 indeed names both subjects. Already in the introduction to the Strategy, the importance of soil for landscape and heritage functions is mentioned. We cite Article 1 of the proposal for the *directive of the European parliament and of the Council establishing a framework for the protection of soil and amending Directive 2004/35/EC* which is most important in this respect:

[1]Foundation Geomorphology & Landscape, Oude Bennekomseweg 31, 6717 LM Ede, The Netherlands.
e-mail: juan.GenL@inter.NL.net

"Article 1 This Directive establishes a framework for the protection of soil and the preservation of the capacity of soil to perform any of the following environmental, economic, social and cultural functions:

(a) biomass production, including in agriculture and forestry
(b) storing, filtering and transforming nutrients, substances and water
(c) biodiversity pool, such as habitats, species and genes
(d) physical and cultural environment for humans and human activities
(e) source of raw materials
(f) acting as carbon pool
(g) archive of geological and archeological heritage.

To that end, it lays down measures for the prevention of soil degradation processes, both occurring naturally and caused by a wide range of human activities, which undermine the capacity of a soil to perform those functions."

In the Executive Summary, the relevance of Earth heritage values are brought to the attention of the national governments as well as their importance for tourism. It is adviced " to improve the public awareness of the values of soils, among others as part of our geoheritage, and to achieve this by providing funding for the production of publicly accessible information on soils and their interpretation. These have to be locally produced to be relevant".

In Vol 6 on *Cross-Cutting issues and Research* we quote the soil strategy "the concept of soil as a natural system is even more fundamental within the modern perspective of sustainable development, either from an ecological, economical or aesthetical point of view. The need to integrate these objectives in spatial planning strategies and in land use into line with soil characteristics asks for new terminology. In this communication when referring to the sustainable use of soil system in spatial planning the terms ***geodiversity*** and ***geoheritage*** are introduced.Research is needed to aim at a unique solution to describe the variables geodiversity and geoheritage, and some additional inventory is needed to that end ".

Geoheritage and geodiversity in more operational terms

In June 2005 Scape, the scientific network of European soils scientists who support the development of the EU Soil Strategy (see www.scape.org) invited us to participate in the final Scape meeting and to write a position paper to start making the concepts of geoheritage and geodiversity operational for soils.

Geoheritage and soils

Concering *Geoheritage,* we propose to discern and conserve four categories of soils. The first category is *natural soils,* soils to be set aside for scientific and educational purposes as benchmark and reference soil systems and landscapes. Then there are *special soils* of interest for scientific research such as for example soils under burial mounds and earthen walls. Under these earthen structures soil formation stopped and new soil formation restarted on their surfaces. Then *sustainable cultural soils* such as dehesa soils and essen should be safeguarded as part of our soil heritage. The last category of soil geoheritage is nature areas, soils are an integral part of *the biodiversity of nature areas,* including the soil fauna. Some examples of the complex interaction between the geological history of ecosystems and the biotic values are given in the Green Week article on page 16 of this magazine.

Geodiversity and soils

Geodiversity, apart from the setting aside of the geoheritage areas, is concerned with the sustainable planning of soil use, a use in line with the spatial diversity, qualities and potentials of the soil system while minimizing adverse effects and keeping the soil system as a quality of our living environment as well as that of future generations. New tools should be developed to make such modern planning systems operational, to visualize the impact of measures and involve the public in the decision making process.

The geological and geomorphological heritage in the EU Soil Strategy

Although conservation and a sustainable use of geological and geomorphological geodiversity to a large degree already is guaranteed through soil system conservation, both geology and geomorphology present different perspectives of the land. Then their interests by tradition are safeguarded by different groups of earth scientists. For this reason in the position paper we recommended incorporating geological and geomorphological geoheritage and geodiversity as separate issues in the Soil Strategy, preferably to be addressed in dedicated articles.

The examples given in the boxes below are from The Netherlands as we are best acquinted with the situation there, but similar situations occur elsewhere in Europe.

Acknowledgements

We wish to thank the Scape network for giving us the opportunity to bring the concepts of geodiversity and geoheritage for soil and EU Soil legislation one step further and to present these ideas to an international soil community. We specially thank Anton Imeson, Jose Rubio, Winfried Blum, Stephan Northcliff, Ben Boer and Ian Hammond for their support and/or discussions on the ideas developed. To the other participants of the Iceland Selfoss workshop we are grateful for acting as a sounding board. On the international level our thanks go to the DG Environment of the European Commission and Mrs. Catherine Day for including these subjects in the EU Soil Strategy. A remarkable effort was also made by the chairpersons and secretaries of the 11 organizations supporting the EU Manifesto on Earth Heritage and Geodiversity within the short period available.Together with Patrick McKeever, Hanneke drafted the text of the EU Manifesto. Murray Gray played an important role in making geodiversity a worldwide topic through writing the first book on this subject. Together with Murray we wrote the first EU document on this subject supported by a temporary EU working group on Geoheritage. On an organizational level we express our thank to Sanneke van Asselen, Ton Dietz, Isabel Fernandez, Herald Ligtenberg, Albert Oost, and Johan Veenhuis and many others who supplied us with relevant information.

Geoheritage: the plaggen soils and landscape

The thick 'plaggen soils' in the eastern part of The Netherlands originated from spreading a mixture of sheep manure and sods of heath, and sometimes grassland, on nutrient-poor sandy fields. Over the centuries this gave rise to low dome-shaped landscape forms, so called essen (see photograph) and typical soil profiles. The structure and water and nutrient holding capacity of the soils greatly improved through the addition of the mixture of manure and sods. As fimic Anthrosols, these plaggen soils form a separate category on the FAO Unesco Soil Map of the World. It is estimated that more than 80% of these soils are located in the eastern part of The Netherlands. Regionally different types of plaggen soils are distinguished. Most are also rich in archeological finds and many fall within the Convention of Malta (Treaty of Valetta).

Because these soils are located near villages and towns many have been built over (sealed) during the past decades. The harvesting of modern agricultural products such as lilies and trees remove large quantities of the plaggen material which took centuries to accumulate. The yearly amounts of soil thus removed list among the highest rates of soil erosion in Europe.

Cultural elements within the direct vicinity of the plaggen soils are old hedges on earth embankments, oak coppice woodland, lanes of oaks, specific types of land parcelling, old settlements and farm buildings. They belong to the history of this soil landscape or soil system. A hedge on a wall and a small cliff originally marked the boundaries of these soils. Few remnants of these are present and restoration could be considered on some locations.

Photograph of an 'es' in the province of Overijssel.
Photo: Pieter Dirk Jungerius

Geodiversity: In search of a sustainable use of the Dutch peat meadows

Up to the 1960s-70s land use in The Netherlands was largely dependent on soil type. Now grasslands and maize are grown everywhere independent of soil type. Growing maize is considered normal even on low-lying alluvial grounds bordering brooks, or on peat soils as is shown in the photograph in the province Noord-Holland.

Setting and oxidation of peat soils can only be limited if water levels, also in summer, are within 25 cm of the ground surface. But water levels are kept lower for purposes of grass production and carrying capacity. Oxidation is a rapid process and over the past decades has been in the order of about 1 cm annually or even more. Many peat meadows are at the moment 1.5 metres below sea level. Through oxidation, a considerable percentage of the lowland peat areas is also in danger of disappearing within the next few decades, including the important geological information they contain about sea level and climatic changes and their ecological functions. Increased CO_2 production, sea level rise and encroachment of settlements are some of the other problems the peatlands are facing.

While once cattle from Denmark and the North of Germany were brought here to be fattened up for the markets of Holland and even Antwerpen, now economic production is hardly possible in many of the peat areas because of the many ditches. Sheep instead of cows now dominate these characteristic Dutch peat-grasslands. Even nature organizations have financial problems managing these areas and consider turning them into forest swamps and reed lands. Although this is a more sustainable use from the point of view of peat restoration and preventing oxidation, CO_2 production and loss of geological information, many of these grasslands are Natura 2000 areas for meadow birds such as the black-tailed godwit of which a large percentage of the European population breeds in The Netherlands. Furthermore, reeds favour methane production while these meadow landscapes are one of our most traditional and characteristic Dutch landscapes, often having preserved their Early Medieval parcelling and old peat brooks. Photo: Jo van Es / Hanneke van den Ancker

Combining geoheritage and geodiversity in a sustainable touristic management of spectacular and scientific sites

Over the last years touristic products have been developed informing the public about spectacular and scientifically valuable sites and improving public knowledge on the origin of the landscapes of Europe. One of the most succesful initiatives in this respect is the European-Unesco Geoparks Network (see previous article).

Information panel in the Eifel Geopark Germany explaining the origin of the present landscape. The paper in the hand of the guide shows the present landscape. Photo: Pim Jungerius

Geodiversity, geoheritage, geoconservation

Since the 1990s the concepts of geodiversity, geoheritage and geoconservation have been thoroughly discussed in geological conservation circles. In his book '*Geodiversity - valuing and conserving abiotic nature*' Murray Gray (Gray, 2004) gives an overview of the subject. Geodiversity, geoheritage and geoconservation are defined as follows:

"Geodiversity is the natural range of geological, geomorphological and soil features. It includes their assemblages, relationships, properties, interpretations and systems."

This definition refers to topography, structure, pattern and form of larger tracts of land as well as to features at a specific site. It includes their relationship with the (semi-) natural vegetation, the modern and historical use of the land and cultural aspects such as stories and festivities relating to geophenomena. All are considered to be part of our geodiversity. The definition of Gray is a slight modification of the definition that was proposed by Sharples in 1993 which he improved on in 2002 (Sharples, 1993 & 2002).

"Geoheritage comprises concrete examples of geodiversity which may be specifically identified as having conservation significance."

Sites or tracts of land can be assigned heritage value because of the scientific, educational, touristic, aesthetic and health functions they represent for society, but also because they are part of the quality of our daily living environment.

"Geoconservation is the endeavour of trying to conserve geodiversity and geoheritage."

Many European and international earth science organizations are actively promoting the inventory and conservation of geoheritage values. They endorse nature and park management, land use and city planning and land management that takes account of geodiversity and geoheritage values.

When specially referring to soil we use the terms soil geodiversity and soil heritage.

A controversy to be bridged - driving forces, pressures and responses

As governments and earth scientists we strive to keep the soil system in its totality in good health, thus safeguarding future agricultural production, quality of water, nature, heritage and landscape. For example, in the 2004 Conference on The politics of European Values, respect in dealing with our environment was one of the issues. Smits, 2004 argues the soil system to be part of our common social-cultural heritage for which new standards and methods need to be developed.

On the one hand our knowledge of the functioning of the soil system and instrumental skills have considerably advanced over the last century, thus making soil conservation and sustainable use of soil technically possible.

On the other hand EU market prices, policy and competition force farmers to produce at increasingly lower costs. And in general farmers do not judge soil erosion, loss of structure, sealing, oxidation and setting and loss of ecological, historical and landscape qualities to be serious problems. Some of the reasons for not seeing them as problems are: these processes occur slowly and changes are hardly perceived; direct financial losses are relatively low; the main problems occur outside their lands e.g. in nature areas, rivers and water reservoirs and rural areas; farmers and society are educated to live by maximizing profit instead of sustainable use of the land. Although loss of landscape, ecological quality and floods are regretted by many farmers, they indicate that without governmental regulations and compensation they do not have the need or financial means to act otherwise.

References

Anon. 2003a. Resolution of the European Parliament on the Commission communication 'Towards a Thematic Strategy for Soil Protection' (COM(2002) 179 _ C5_0328/2002 _ 2002/2172(COS)).

Anon. 2003b. Working Group on the Geological Heritage - Report of the meeting. *Committee for the activities of the Council of Europe in the field of biological and landscape diversity.*

Anon. 2004b. Recommendation Rec (2004)3 - *Committee of Ministers, Council of Europe.*

Gray, M. 2004. *Geodiversity valuing and conserving abiotic nature.* Wiley, London.

Gray, M., Jungerius, P.D. & van den Ancker, J.A.M. 2004. Geodiversity and Geoheritage as features of Soil Protection. *Communication advice of the Temporary Expert Group Geodiversity and Geoheritage of the European Union Soil Thematic Strategy.*

Hannam, I. & Boer, B. 2004. Drafting Legislation for Sustainable Soils: A guide. *IUCN Environmental Policy & Law Paper* no. 52. IUCN-ELP.

Imeson, A.C. 2004. The use of indicators in soil erosion and protection. *Briefing Papers of the 2nd Scape workshop in Cinque Terre (IT)*: 195-200.

Jungerius, P.D. & Imeson, A.C. 2005. Globalisation, sustainability and resilience from the soil's point of view. *Briefing Paper of the 5th Scape Workshop on Iceland.*

Parkes, M. (Editor) 2004. Natural and Cultural Landscapes - The Geological Foundation. Proceedings of a Conference 9-11 September 2002, Dublin Castle, Ireland. *Royal Irish Academy.*

Sharples, 1993. A Methodology for the Identification of Significant Landforms and Geological Sites for Geoconservation Purposes. *Forestry Commission, Tasmania.*

Sharples, 2002. Concepts and Principles of Geoconservation. *Tasmanian Parks & Wildlife Service.*

Smits, A. 2004. Sociaal-culturele waarden van de bodem. In: *Bodem* no. 6, pp 229 - 231.

Aplicaciones del estudio del patrimonio geológico

por Luis Carcavilla Urquí[1]

The study of geological heritage searches to identify, evaluate, preserve and popularize those places with a special interest for Earth Sciences. Far from being only theoretical, it also has an applied interest. Moreover, the protection of the geological heritage should be a priority in Nature conservation policies as it is an essential part of the natural heritage.

L'étude du patrimoine géologique cherche à identifier, mettre en valeur , conserver et divulguer les endroits qui détiennent un intérêt élevé en relation avec les Sciences de la Terre. Loin d'être purement théorique, il possède aussi un aspect appliqué. En plus, la protection de ce patrimoine doit être une des mesures prioritaires au sein des politiques de conservation de l'environnement

El estudio del patrimonio geológico busca identificar, valorar, conservar y divulgar aquellos lugares que posean un elevado valor en relación con las Ciencias de la Tierra. Lejos de ser algo teórico, tiene una vertiente aplicada. Además, su protección debe ser una prioridad en las políticas de conservación de la naturaleza como parte importante del patrimonio natural.

El estudio del patrimonio geológico figura entre las más recientes áreas de investigación incorporadas al ámbito de la geología. Es el resultado de una nueva manera de entender el papel del hombre en su relación con la Tierra. Con el paso del tiempo, esta nueva percepción ha ido calando en la sociedad, que ya considera un derecho, una necesidad y un deber proteger el medio ambiente, promover un desarrollo sostenible y dejar para las generaciones futuras un entorno bien conservado, incluyendo los elementos geológico de interés excepcional.

El patrimonio geológico es un término que tiene actualmente cierto éxito. Desde hace unos años proliferan las publicaciones referidas a alguno de los aspectos con ellos relacionados, y su difusión es cada vez mayor. Pero, ¿cómo se afronta su estudio y qué aplicaciones tiene?

El estudio del patrimonio geológico

El origen de la preocupación por la conservación y valoración del patrimonio geológico surgió de la conciencia conservacionista iniciada en algunos países a finales del siglo XIX y principios del XX, que entendía que ciertos enclaves naturales poseen un notable valor por sí mismos y que, por lo tanto, deben ser protegidos y conservados. Dentro de estos iniciales movimientos conservacionistas del medio natural, fue la protección de ciertos elementos geológicos la que adquirió mayor relevancia, debido a su alto valor escénico. Sin embargo, en cierta medida esta preocupación e interés por la conservación de afloramientos y elementos geológicos tiene un origen anterior, arraigada en las primeras etapas de la Geología como ciencia moderna, pues está implícita en los trabajos de investigadores como Hutton (1726-1797) o Lyell (1797-1875).

A pesar de este antiguo origen, la realidad es que el estudio sistemático del patrimonio geológico es relativamente reciente. En algunos países pioneros como Gran Bretaña se inició a mediados del siglo XX, si bien en la mayoría de Europa no ha gozado de un verdadero reconocimiento hasta finales del siglo XX. Incluso a día de hoy se sigue considerando al patrimonio geológico como la "cenicienta" de las políticas de conservación de la naturaleza, pues es a menudo eclipsada por el interés suscitado por otros aspectos bióticos del medio natural.

Actualmente se asume que el patrimonio geológico está formado por todos aquellos lugares o puntos de interés geológico (conocidos internacionalmente como *sites* o *geosites*), cuyo valor geológico les hace destacar del entorno circundante, por su interés científico y/o educativo. El estudio de este patrimonio es complejo porque en él se conjugan aspectos científicos, técnicos, culturales, económicos, estratégicos, recreativos y sociales. Incluso éticos y filosóficos, ya que lo relacionado con la conservación de la naturaleza posee un profundo trasfondo ético y un desarrollo filosófico importante cuyo conocimiento se hace fundamental para entender su significado.

Actualmente, el estudio del patrimonio geológico busca identificar, valorar, conservar y divulgar aquellos lugares que posean un elevado valor en relación con las Ciencias de la Tierra. Estos cuatro objetivos deben, además, realizarse en ese orden si se quiere conseguir que la gestión sea adecuada. A nivel europeo, es la Asociación Europea para la Conservación del Patrimonio Geológico, más conocida como ProGEO, la sociedad científica que recoge las experiencias realizadas en los diversos países miembros. Además, al no existir otra asociación similar en otros contextos geográficos, constituye, cada día más, el foro de discusión y la referencia mundial para el desarrollo de aspectos relacionados con el estudio y conservación del patrimonio geológico.

Aplicaciones del estudio del patrimonio geológico

El interés del patrimonio geológico a menudo supera el ámbito científico y natural y se aproxima a otros aspectos científicos, ecológicos o culturales. En muchas ocasiones el patrimonio geológico guarda una estrecha relación con el patrimonio

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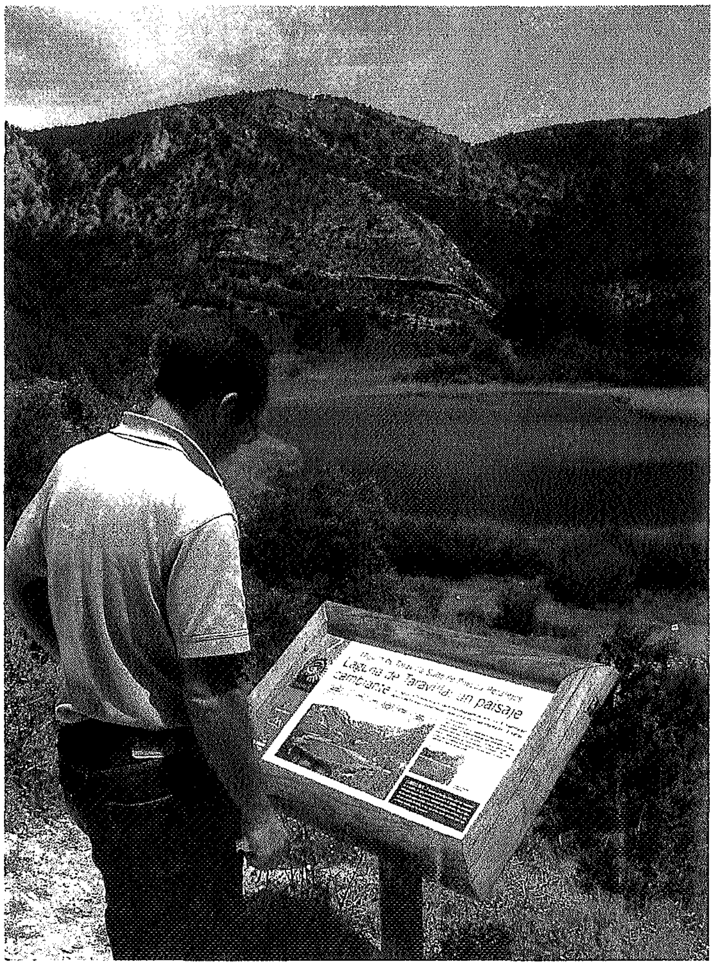
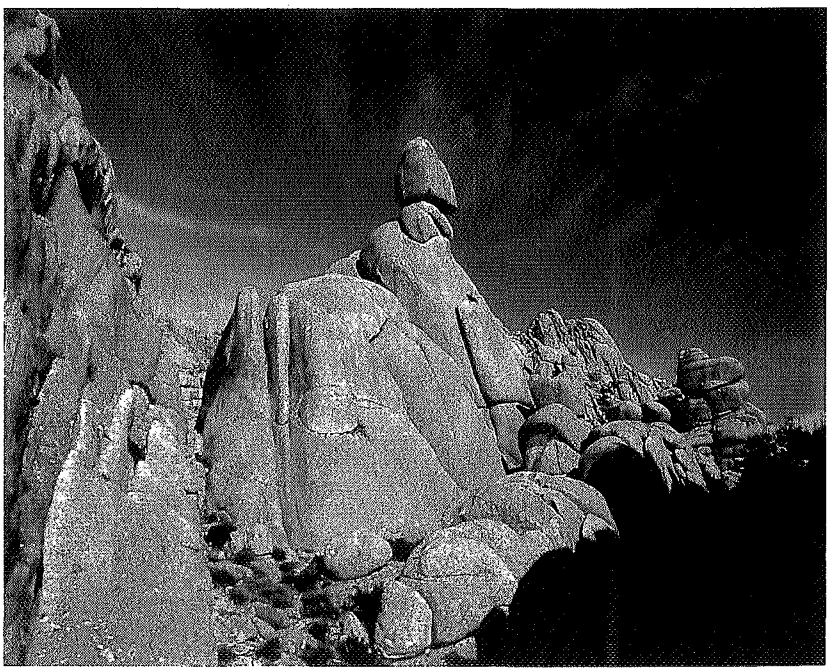


Alto Tajo (Castilla-La Mancha). La divulgación de los recursos geológicos es un objetivo prioritario en los estudios de patrimonio geológico.
Popularization of geological heritage is a priority target. Alto Tajo Natural Park, in central Spain.

La Pedriza (Madrid). El modelado granítico adquiere gran desarrollo en la zona central de la Península Ibérica. La Pedriza es un buen ejemplo y está declarada Reserva de la Biosfera.
Granitic landforms in La Pedriza, near Madrid, one of the Spanish Biosphere Reserves.



histórico-artístico, con las tradiciones, creencias y folklore de algunos lugares, e incluso puede tener una importante significación religiosa o convertirse en signo de identidad local. Existen infinidad de ejemplos de elementos geológicos que poseen un elevado valor natural que es complementado y aumentado por su interés cultural, que le añade un valor más que puede incluso superar al propio interés geológico.

Además, el patrimonio geológico constituye un importante recurso didáctico. Conscientes de que sólo se aprecia y valora lo que se comprende, la divulgación es un objetivo primordial de la gestión del patrimonio geológico.

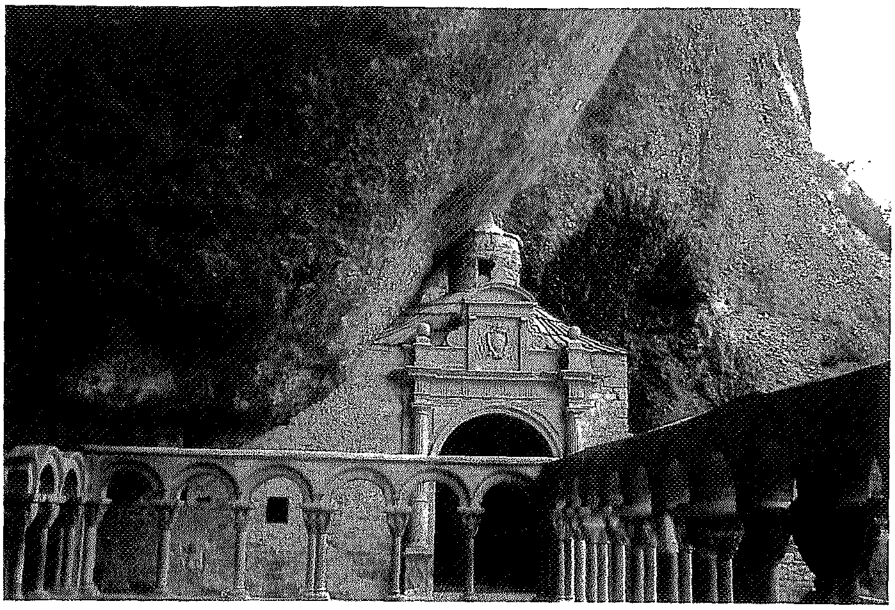
El estudio del patrimonio geológico, lejos de ser algo teórico, posee una notable aplicación e incluso puede constituir un aprovechamiento potencial (y real) que hace que pueda servir como motor del desarrollo socioeconómico local. En esta línea se crearon los *European Geoparks*, iniciativas orientadas a promover el desarrollo sostenible, la conservación de los recursos geológicos, y la divulgación de su interés e importancia. A día de hoy, la red europea de Geoparks está formada por 25 geoparques, a los que sumar los declarados fuera el ámbito europeo, como los 8 geoparques chinos.

Otra iniciativa internacional relacionada con el patrimonio geológico es el proyecto *Global Geosites*, auspiciado por ProGEO, la UNESCO y la Unión Internacional de Ciencias Geológicas (IUGS). En este proyecto se busca identificar los enclaves que mejor ilustran los diferentes episodios en la evolución de la Tierra, con objeto de crear una red de lugares (tanto puntuales como zonas más amplias denominadas genéricamente contextos o "*frameworks*") representativos de la geodiversidad mundial.

Por otro lado, un objetivo intrínseco del estudio del patrimonio geológico es promover su conservación. Y más teniendo en cuenta que la mayoría de los enclaves de alto valor geológico son recursos no-renovables, por lo que su destrucción es irreversible. Sin embargo la conservación de los elementos geológicos tiene una peculiaridad: a menudo su interés surge por la existencia de una transformación que permite observar su estructura interna, por ejemplo en una cantera o en el talud de carretera. Por ello desde hace unos años se habla de geoconservación, en referencia a las técnicas de conservación del patrimonio geológico que a menudo difieren de las utilizadas en otros aspectos del medio natural.

Por otro lado, el estudio del patrimonio geológico guarda una estrecha relación con los espacios naturales protegidos. Esta relación se basa en que el patrimonio geológico forma parte del patrimonio natural y, por lo tanto, es susceptible de ser protegido mediante las leyes y mecanismos de conservación de la naturaleza. Además, algunos elementos geológicos poseen un valor paisajístico y escénico que atrae a un gran número de visitantes a los espacios naturales.

En resumen, que la conservación del patrimonio geológico constituye una responsabilidad y una obligación por parte de las administraciones públicas y de la sociedad en general, debido a su valor intrínseco y a sus posibles utilizaciones. Al fin y al cabo, está formado por los ejemplos más representativos, singulares o exclusivos del registro geológico. Es una herencia que recibimos y que debemos transmitir a las generaciones futuras para el mejor progreso social y científico. En palabras del secretario de ProGEO, W.A.P. Wimbledon: "*sin puntos de interés geológico, no hay ciencia*". Es decir, un elemento esencial del patrimonio natural.



Monasterio de San Juan de la Peña (Aragón). Ejemplo de la relación entre patrimonio geológico y cultural al pie de los Pirineos.
The relationship between geological and cultural heritage is in some places evident. San Juan de la Peña Monastery (Aragón).

The EFG stand in Green Week: Geo-diversity = Biodiversity

by Higinia Torregrosa, Isabel Fernández and Hanneke van den Ancker

The European Federation of Geologists participated in Green Week (30 May - 2 June 2006). This event, entitled "Biodiversity is life!", was organized by the European Commission' s Directorate-General for the Environment. Some 4000 participants, including politicians, civil servants, business people and conservation groups from around the globe gathered in Brussels to examine biodiversity from a wide range of economic, social and environmental angles. Under the title "Geodiversity = Biodiversity", EFG presented a stand which attracted very extensive public interest. In this stand, our own association showed the implementation of these concepts as a key to understanding how to reduce the biodiversity loss.

La Fédération Européenne des Géologues à participé à la *Semaine Verte*, tenue à Bruxelles, entre le 30 mai et le 2 juin 2006. Cet événement avec le titre : *la Biodiversité, c'est la vie*, était organisé par la Commission Européenne, Direction Générale de l'Environnement. Quelque 4000 participants dont des politiciens, des fonctionnaires, des hommes d'affaires et des représentants des Associations de la Conservation de la Biodiversité, venus du monde entier, se sont réunis pour traiter de la biodiversité avec une approche large, touchant les volets économique, social et environnemental. Sous la dénomination : la *Géodiversité = la Biodiversité*, la FEG a disposé d'un stand qui a suscité un grand intérêt de la part des visiteurs. Sur ce stand, la FEG a fait la démonstration pratique de la mise en oeuvre de ces concepts en tant qu'outil de compréhension pour aider à la conservation de la biodiversité.

La Federación Europea de Geólogos participó en la Semana Verde (30 Mayo – 2 Junio 2006), organizada por la Dirección General de Medio Ambiente de la Comisión Europea. El título bajo el que se presentó este evento fue "Biodiveristy is life! ". 4000 participantes, incluyendo políticos, representantes tanto del sector público como del privado y asociaciones conservacionistas de todo el mundo se dieron cita para examinar la biodiversidad desde un amplio rango de aspectos económicos, sociales y medioambientales. Bajo el título "Geodiversity = Biodiversity", la FEG presentó un stand que obtuvo muy buena acogida. En este stand nuestra asociación mostró la implementación de ambos conceptos como clave para la reducción de la pérdida en biodiversidad.

The EU's annual Green Week (30 May - 2 June 2006), Changing our Behaviour, which took place in Brussels, set its focus on halting biodiversity loss in Europe. Biodiversity constituted a high priority on the agenda of the past Austrian EU Council Presidency and the new Finish Presidency plans to take up the Commission's recently released Communication on biodiversity. This major document is entitled "Halting the loss of biodiversity by 2010 and beyond; sustaining ecosystem services for prosperity, security and quality of life" and responds to the 2010 biodiversity target set by EU Heads of State.

In Green Week 2006, EFG participated with a stand highlighting the concept *Geodiversity = Biodiversity*, a concept not widely recognized but which matched the context perfectly while increasing the visibility of geology. The proposal for the stand came from the EFG Office. Dr. Isabel Fernández proposed that the stand should be organized by the EFG Panel of Experts on Soil Protection and Geoheritage. Dr Hanneke van Ancker of Geoheritage NL was coordinator.

EFG wanted to demonstrate through this stand that biodiversity has always had a natural geological basis. The only way to seriously examine biodiversity loss is by taking care of all the different aspects of interaction with a biotic nature. There are clearly related paths between geodynamic and biodynamic phenomena, within internal as well as external processes. For example, soil is part of a system, a product of climate, geology, topography, vegetation and land-use. In relation to this concept of soils, desertification is not simply a "natural" process that cannot be influenced. It is all about land degradation, the loss of the land's biological productivity, caused by human-induced factors and climate change. There are also threats issuing from soil loss and the problem of water availability. This affects one third of the Earth's surface and over a billion people and it has potentially devastating consequences in terms of social and economic costs. 2006 has been declared the year of the desert and desertification by the United Nations.

Through the EFG stand we introduced other points of view on traditional environmental concepts to visitors from many different backgrounds. Among the distinguished visitors was the Environment Commissioner, Stavros Dimas, who visited the Green Week exhibition, including our own stand. We were also making links and increasing our own network with a variety of companies, organizations and governmental institutions that explained to us their sustainable actions in the field of applied geology. Examples are: *Lafarge*, with 900 quarries in 76 countries around the world, which worked with WWF to develop a biodiversity management tool kit, to enhance biodiversity, working with local partnerships; *Lodos Secos S.L*, who work on the management of sludge from

Photo 1. The EFG stand in Green Week.. Left to right: Peter Pauw, Hanneke van Ancker, Isabel Fernandez

mining and building industries; and governmental initiatives of the *Andalusian Regional Ministry of the Environment*, which published a geosites inventory. EFG achieved in this event one of its principal targets: increase the visibility of the Federation, the geological sciences and the profession by participating in an international and EU-hosted event.

The exhibition included a large-scale geological map and various posters showing examples from all over Europe (Photo 1). Thanks to the excellent contribution from some experts from the Panel of Experts on Geoheritage and Soil Protection, visitors had the opportunity to see that geodiversity and biodiversity are closely linked concepts. The posters included the following examples:

United Kingdom Examples

Tufa dams in the Teme Valley, UK

Malvern Hills, UK

by Dr. Murray Gray, Queen Mary College, University of London – Yorkshire Dales;

Dr. Cheryl Jones & Rona Davis, EGN - Abberley and Malvern Geopark.

Slovakia Examples

Caves and Bats in Slovakia

by Dr. Pavel Liščák – EGN - GSSR, EFG.

The Netherlands Examples

Active drift sands, The Netherlands

by Dr. Hanneke van den Ancker & Prof. Dr. Pieter Dirk Jungerius, EFG - Geoheritage NL.

Lithuania Examples

Karst sinkholes and waterplants, Lithuania

by Dr. Jonas Satkunas, ProGEO Nordic Group – Lithuania.

Germany Examples

Maars transforming to moors, Germany

by Dr. Andreas Schüller, EGN - Geopark VulkanEifel.

Norway Examples

Vegetation patterns in the Oppdal, Norway

by Dr. Lars Erikstad, ProGEO Nordic Group – Norway.

Switzerland Examples

The Ar du Tsan marsh, Switzerland

by Prof. Dr. Emmanuel Reynard - president IAG – Switzerland.

Other support was given by: Dr. Peter Scharek, Hungarian Geological Survey, Dr. Herald Ligtenberg - EFG Board and Dr. Kristine Asch, BGR Bundesanstalt für Geowissenschaften und Rohstoffe who provided the geological map. Photographs other than from contributors: Marijn Nijssen (Stichting Bargerveen); Ido Borkent (Stichting De Marke); Centre for Rural Research. Support on the stand during the exhibition was also given by: Peter Pauw –(GeoVUsie, Amsterdam) and Higinia Torregrosa, (EFG) (Photo 1).

We distributed information about the EFG and the European Geoparks Network, which successfully attracted the interest of many visitors. This interest indicates that geoheritage is an important field of future development, and that Geoparks Network and Geosites will increase in number over all European countries.

To conclude the EFG's performance in Green Week 2006, the leaflet (pages 18 and 19) was distributed during the exhibition.

GEODIVERSITY = BIODIVERSITY

Care for Europe's biodiversity implies care for Europe's geodiversity, its geology, its geomorphology and its soils, i.e. its abiotic nature.

Natural and semi-natural biodiversity are closely interlinked with the rich differentiation in geological substrata and topography. A differentiation caused by geological and geomorphological processes. Differences in soil development further enhance biodiversity.

The relationships between abiotic and biotic nature are still poorly understood. They often receive attention only in terms of nutrients and acidity. Some examples of the interaction between geodiversity and biodiversity are given.

***Although rocks, landforms, muds and soils may seem very robust, they are susceptible to man-*made changes. Geological formations and landforms may have taken thousands of even millions of years to develop. Processes may never occur again. Soil profiles formed in tens, hundreds or thousands of years.**

When safeguarding biodiversity, safeguarding geodiversity too should be given attention.

Active drift sands, The Netherlands

The largest remnants of active drift sands in Western Europe are located on the Veluwe. These Atlantic deserts are a geologically young landscape. They originated from re-activation of sand dune deposits of the last Ice Age, and are known to occur for about the last two thousand years.

Differences in topography, wind and water erosion, mass-movements, geological materials and soil formation cause small-scale variations in abiotic conditions. Especially the initial phases of succession are of ecological interest. Natura 2000 and Red List species include vegetations of grasses and lichens, insects and birds.

Grey Spider Wasp; Pompilius cinerea) *Zandoorworm (Tawny Earwig; Labidura riparia).* Beide foto's van Marijn Nijssen (Stichting Bargerveen)

Quarries, Eifel

Quarries are even younger landforms: many are no more then a few decades old, some date back to prehistoric times. When left unattended and unfinished the steep and bare quarry walls, the hills of sorted materials, the chance occurrence of mounts and pools on impermeable layers and numerous soil forming processes cause these quarries to house special types of amphibians, reptiles, birds, insects and plants.

The Eifel Maars, Germany

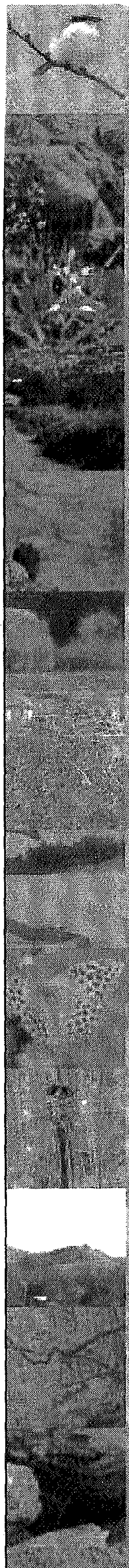
Maars are lakes that originate through volcanic explosions during Quarternary times. About every 1500 years a Maar was formed. The maars gradually transfer to moors with typical plants such as: Andromeda polifolia, Oxycoccus palustris, Eriophorum vaginatum, Sphagnum spec.

Foto's van Ido Borkent (Stichting de Marke)

Abberley Hills, UK

Silurian Limestones, some 450 million years old, form the bedrock of several of the hills in the Geopark including the Abberley Hills shown here. Permian sandstones add to the diversity of the flora but the area is renowned for its lime-loving flora. The Rock Rose, Carline Thistles, Wild Thyme and Dyers Greenweed and at least eight species of orchid including the common spotted, bee, butterfly and pyramidal orchids grow in the Geopark.

<<common spotted orchid.jpg>> <<Bee Orchid.jpg>> <<Walsgrove Hill.jpg>>
Common Spotted Orchid
Bee Orchid (copyright English Nature)
Walsgrove Hill (Abberley Hills)



Hartlebury Common, UK

Hartelbury Common is one of the most important areas of dry dwarf shrub heathland in the Geopark. It lies on wind blown sand covering two river terraces of the River Severn overlying Triassic Sandstones. Sand loving plants such as heath dog violet and tower mustard grow here. The Common is also home to all three British Newts and is an important habitat for butterflies and moths.

<<Great Crested Newt.jpg>> <<Hartlebury Common .jpg>> <<Emperor Moth.jpg>>
Great Crested Newt (copyright English Nature), Hartlebury Common, Emperor Moth (copyright English Nature)

Karst sink holes, Lithuania

The North Lithuania karst landscape is dotted with sinkholes of different age. The water filled sinkholes are identified as habitats of European significance. The chemical composition of the water enriched by SO4 and Ca ions favours rich populations of sulphur bacteria and specific water plants such as Chara globularis, Chara contraria, Lemna trisculca, Sparganium erectum.

Oppdal, Norway

The vegetation pattern on the foreground is a fine grained mosaic governed by Quaternary deposits, river erosion and soilfluction. In the background bedrock structures and glacial erosion determine the vegetation pattern.

The Ar du Tsan marsh, Switzerland

This marsh has developed in a glacial valley where differential erosion has produced several topographical steps separated by steep rocky walls. In the depressions marsh biotopes have developed relationship with fluvial processes and landforms such as meanders, oxbow lakes, alluvial fan. Because of high biodiversity and landscape value the area is protected by several Swiss several legal ordinances.

Forests on Mesozoic escarpments, Luxembourg

Weathering and soil formation in the Mesozoic formations of southern Luxemburg have been active since Miocene times, 10 million years ago. Weathering gave rise to different soil forming processes. Earth worms (Lumbricus spec.) prefer the clay soils derived from the Keuper shales. Their appetite causes the forest floor to be bare of litter for a large part of the year. This favours natural soil erosion by rain resulting in lowering the Keuper slopes. In contrast, earth worms cannot live on the calcaric sands of the Luxembourger sandstones. A thick layer of leaves prevents soil erosion of the forest floor. The differential soil lowering, active over millions of years, explains more than 30 metres of the steep escarpment slope between the Luxembourger sandstone and the Keuper shales.

Yorkshire Dales, UK

Limestone pavements in the Yorkshire Dales National Park, UK. Limestone pavements are important for both geomorphology (glacial erosion of surface soil and sediment cover followed by joint weathering of the limestone) and ecologically (a rare ecosystem exists within the cracks (grykes) as a result of the damp, sheltered, calcareous habitat) IMG

Colofon

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Emergency project in El Salvador

by Carolina Torrecilla[1] and Margarita Zango[2]

Among the projects carried out in El Salvador in relation to the damage caused by the Stan tropical storm in October 2005, World Geologists has accomplished one with the title "Rehabilitation project of the river Maicillera bridge, La Libertad Department, Municipality of Huizúcar (El Salvador)", financed by the Nando Peretti Foundation.

Entre los proyectos desarrollados en el Salvador en relación con los daños producidos por la tormenta tropical Stan, que tuvo lugar en octubre de 2005, Geólogos del Mundo ha terminado el titulado "Proyecto de rehabilitación del puente del río La Maicillera, Departamento de La Libertad, Municipio de Huizúcar. El Salvador", financiado por la Fundación Nando Peretti.

Parmi les actions réalisées à El Salvador (Amérique Centrale) liées à la réparation des dommages dus à l'orage tropical Stan d'octobre 2005, Géologues du Monde a exécuté le projet intitulé»Project de rehabilitation du pont riviére La Mancillera, Départament de La Libertad, municipalité de Huizúcar, El Salvador, financé par la Fondation Nando Peretti

The village Cantón Ojos de Agua (413 families), Huizúcar town centre (over 600 families) and Cantón Tilaza (200 families) were exposed to a high risk due to the damaged bridge over the river Ojos de Agua. The bridge was almost totally blocked with river-bourne materials and there was also partial scouring of the bridge foundations (Photo 1).

Objectives

This project proposed to carry out the mitigation and rehabilitation works proposed in a field study carried out in the area.

The specific objective was to improve the conditions of the bridge (River Ojo de Agua), where its water gates were blocked by materials and its foundations were partially scoured, to minimize flood threats for over 1213 families.

The activities to be carried out were the following:

- Works design – detailed definition of the work
- Community organization for the execution of the work
- Subcontracts (machinery) and materials purchase.
- Carrying out the work
- Work inauguration.

[1]Delegate of the NGO in El Salvador
[2]University Pablo de Olavide (Sevilla)

Achievements of the project

The results of the work were: improvement of the bridge by means of cleaning and reinforcement and minimizing risk for two Cantones and a town centre affected by the STAN tropical storm.

Description of the project

During the months of July and August the project was executed in two phases:

1- Organization of the participants:

During this phase several meetings between World Geologist, ACUA (Community Associations Unified for the Water and the Agriculture), the municipality of Huizucar and the communities took place to define features of mutual interest such as the budget of the project and the hiring of an engineer as project manager.

The hiring of staff, materials acquisition and the contribution of each stakeholder was planned.

2- Execution of the project:

This phase was carried out during a period of six weeks as detailed below:

- Cleaning and eliminating material from an obstructed sewer, resulting from landslides generated by the Stan storm (Photo 2)
- Terrain levelling to install reno type gabions in areas eroded by the river action
- Installation of two reno gabions at the sewer exits
- Installation of 10 gabions at the sewer exits
- Brickworks at the rainwater discharges of the road towards the river (Photo 3)
- Clean-up of the water course upstream
- Installation of 7 gabions upstream to prevent future landslides from obstructing the structure again.

Photo 1. Before the work

Photo 2. Community dwellers cleaning the obstructed sewer.

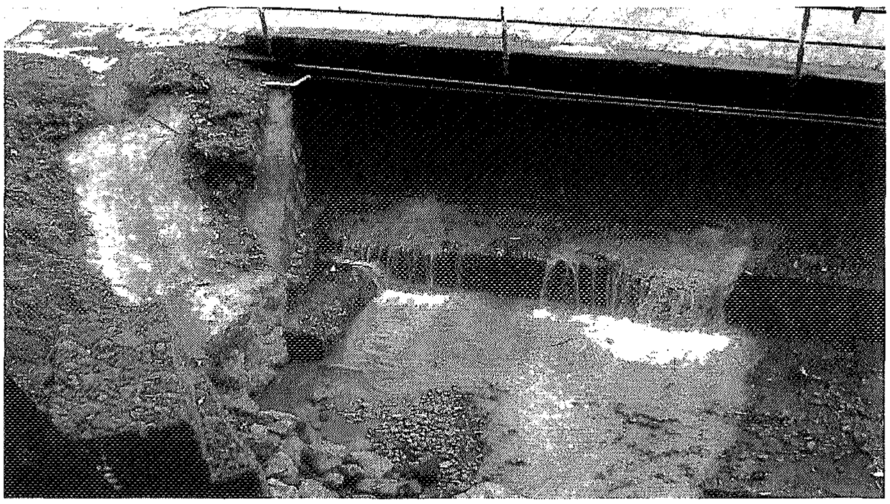

Photo 3. Masonry works in the rain drains of the street to the river.

Photo 4. After the work

Results of the project

For a comparison of before and after the work see photos 1 and 4.

Conclusions and recommendations

This project was possible thanks to the support and participation of the different stakeholders, providing the resources available. Thanks to this joint collaboration we not only carried out the work planned, but we also achieved the protection of the sewer entrance against potential land slides.

Employment was generated for the local inhabitants not only in masonry work but also in transportation work.

This project helped to develop in the community a consciousness of potential hazards, their prevention and mitigation by maintaining the structure now available.

In the same way as this project was developed, we can coordinate the benefited communities and the Municipality of Huizucar to provide the structure with regular maintenance.

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Geologists Without Borders (GSF)

by EurGeol. Antoine Paul Bouvier[1] and EurGeol. Carlo Enrico Bravi[2]

The first Water supply Project in Mali (Africa)

In March 2005 a new humanitarian organization in the field of Geology was founded in Madrid (Spain): Geologos Sin Fronteras, Geologi Senza Frontiere in Italy and Geologues Sans Frontieres, in France.

The founders were senior geologists, hydrogeologists and geophysicists from different countries, each with more than forty years of professional experience in various continents and countries of the world.

Some of the founders had previously organized and carried out a few Water Supply Projects with the NGO "World Geologists" (Geologos del Mundo).

The most significant mission of this new organization is to have a practical Board of Directors, deciding quickly, reducing operating costs and dedicating most of the project total investment (more than 50%) to the beneficiaries.

The authors of this article had the opportunity of being in contact in Paris with the Malian Migrant Association ADVM (Association for the Development of Madalaya Village).

This Association is supporting several projects in Madalaya and surrounding Villages: Djanfa, Tamaratinti, Tifè, Yainanè. They have already built a School and a Communal Health Centre, as well as several other initiatives.

At the end of 2005, a tremendous shortage of drinking water over the whole Madalaya region was announced during a number of meetings held in Paris.

A water supply project was thereafter designed and presented for funding to the Italian Nando Peretti Foundation in Rome.

The necessary grant was obtained in January 2006 and the project started through a first preliminary reconnaissance mission in March-April 2006.

Field operations (Hydrogeological investigation and geophysical survey) started at the end of April and went on until mid-June, when the project had to stop, due to the rainy season.

It is foreseen that the Project will go on and be completed by March/April 2007.

The Madalaya area belongs to the Kaarta region which depends on the district (Cercle) of Bafoulabé.

This area corresponds to a 2500 km^2 sized volcanic plateau composed of dolerite, a hard green rock, the weathering of which produces green clays. Usually impervious, the dolerite if fractured contains some water but the yields are usually weak, a few cubic meters at best.

Despite an annual rainfall of 800 mm between June and October, there is a chronic shortage of water starting in February because the water level in most of the traditional wells is then below the well bottom (Fig. 1). At Madalaya and Tamaratinty, there are also boreholes which were fitted with a hand pump but the pump continuous use, combined with the lack of maintenance and spare parts, made them unworkable.

The villages are built along valleys between dolerite hills where transitory rivers or brooks are supplied by heavy rains (Fig. 2).

The possibility of having a local aquifer lies only within the alluvial deposits, if thick enough, and eventually into the fractured fringe at the top of the volcanic bedrock.

The water table is about 10 m deep and water analysis from existing wells has shown that the water is fresh, the dissolved salt content (NaCl) being less than 1 gr. per litre.

GSF has recommended a reconnaissance survey of the water potential in the five villages including geophysical measures of ground resistivity and magnetic susceptibility to detect the thickness variations of the humid alluvium and locate local zones characterized by fractured dolerite.

A resistivity survey associating electrical soundings and profiles (Fig. 3) was deemed appropriate because there is a strong resistivity contrast between the alluvial overburden, composed of sandy clays with gravels and boulders, (up to a few tens ohm.m) and the hard dolerite, the resistivity of which reaches several thousand ohm.m.

Figure 1. Traditional well

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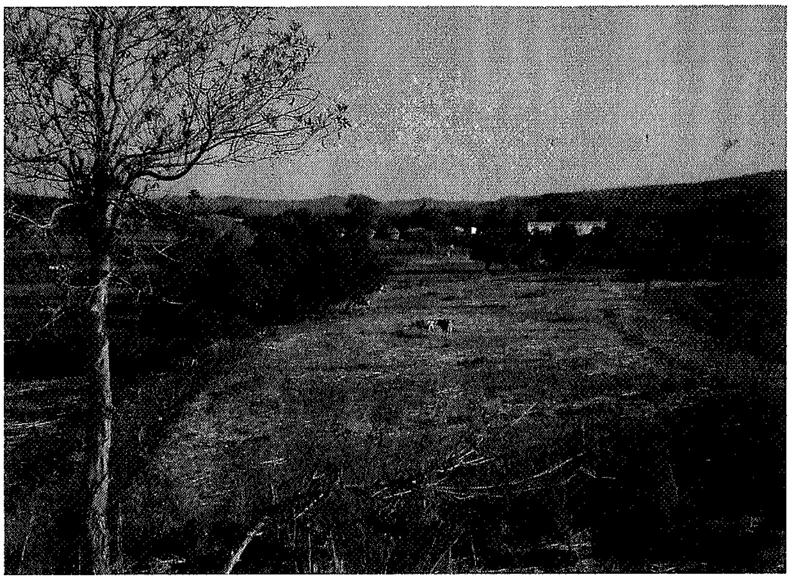

Figure 2. View of the Madalaya plain

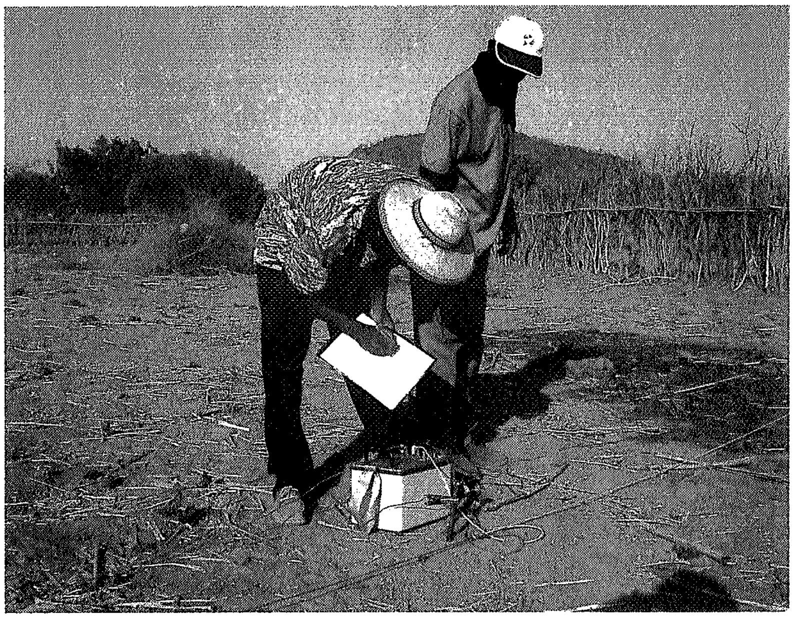

Figure 3. Electrical measuring

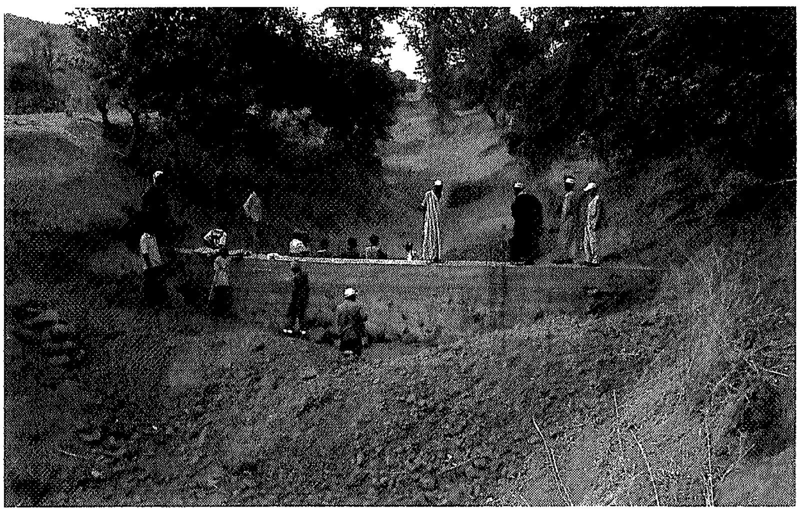

Figure 4. Concrete dam under construction

The fractured fringe of dolerite shows intermediate resistivity values equal to several hundred ohm.m and this layer will be detected on the ES diagram only if its thickness is large enough (several meters).

Magnetic measures were recommended because the magnetic susceptibility of dolerite is at least 10 times higher than that of the alluvial deposits. The aim was to give a reliable picture of the substratum top and confirm the presence of channels or folds affecting the dolerite top.

At Madalaya, where 32 wells are distributed over the inhabited valley, (c.500 m wide and more than 1 km long), a concrete dam (Fig. 4) was built on the river to allow, during the rainy season, a water storage facility which will have a triple objective: feeding the alluvial aquifer to prevent the late drying up of the wells, cattle watering and brick-clay manufacturing (house construction).

For each village, the electrical prospecting of the first 30 m of ground has been represented on a resistivity map where the thicker alluvial deposits are represented by conductive zones while areas of shallow dolerite behave as resistive areas.

The interpretation of the electrical soundings carried out within the conductive anomalies have shown that the alluvial deposits are at best a dozen m thick and the fractured dolerite fringe does not exceed 10 m.

The results allowed making a distinction between data favourable for either a drill hole (aquifer made of humid alluvium and fractured dolerite) or a well (local development of humid alluvium).

Selected targets for drill holes and wells will be tested in November 2006. To guarantee a longer use of the wells and holes, solar pumps and water tanks will be installed to provide fresh water to critical sites, the health centre and the mosque particularly.

The additional supply of water will allow gardening activity by the women who plan to have an income from selling vegetables.

The most valuable achievement at mid range will consist of halting the emigration of young people and attracting back Malian expatriates who can help to develop their native region.

For further information visit: www.geologossinfronteras.org

What the EC should do about Geothermal Energy

by Gareth Ll. Jones[1] and Herald Ligtenberg[2]

The European Federation of Geologists (EFG) established panels of experts to provide high quality response to the European Commission and Parliament. At the end of 2005 the EFG gathered together an expert panel on Geothermal Energy, with a subgroup on CO_2 sequestration – now known as Carbon Capture & Storage. In conversations with Jeroen Schuppers (DG Research) we determined that it would be desirable to make a submission to the draft of the Seventh Framework Programme (2007 – 2013) from our expert group and to identify a strategic research agenda for the Geothermal Energy sector. Thus began our work on the submission. It speedily became clear that the European Geothermal Energy Council (EGEC) was already active in the area and that we had an overlap in members with them. It was agreed to mutually support each other's work where appropriate.

In early 2006 a draft of our submission was circulated through the working group of 20 experts and by April 2006 it was ready for submission to the European Commission's Seventh Framework drafting panel. We hope that our submission will have helped the development of EC geothermal priorities and look forward to the publication of the 7th Framework Programme. Below you will find a summary of the most important issues addressed. The full version can be obtained from the EFG Brussels office.

Our document 'Geoscientific recommendations regarding geothermal energy to be considered in the Seventh Research Framework Programme' contained several general issues as well as geothermal specifics.

The general recommendations are also applicable to other fields of research, and hopefully will be considered for adoption in FP7. An example is a good integration of different disciplines, which should be a driving force in research. Combining these would result in an overall better end-product, since they are complementing each others work. To understand the geothermal resources available, geothermal geologists are essential. They need to collaborate with geothermal engineers for the exploitation of the heat, whilst geothermal economists need to assess the financial aspects of each project. Cross-discipline integration should also be considered: for example, a lot of knowledge on reservoir modelling, reservoir engineering and fluid flow modelling is already present in the oil industry. It would be worthwhile to establish research exchange and collaboration between geothermal energy research and oil industry research.

Establishing an improved European network of researchers that are working on the same issues is recommended, as well as striving towards closer collaboration. A good step forward in that direction would be to develop a Network of Excellence in geothermal energy. The EFG can assist in building this European research network, using its extensive networks of geoscientists in Europe.

A lot of geothermal energy research has already been done at, among others, national geological surveys, at research institutes and universities. The available results and techniques should be inventoried, collected and subsequently harmonized. This should be placed in a GIS data

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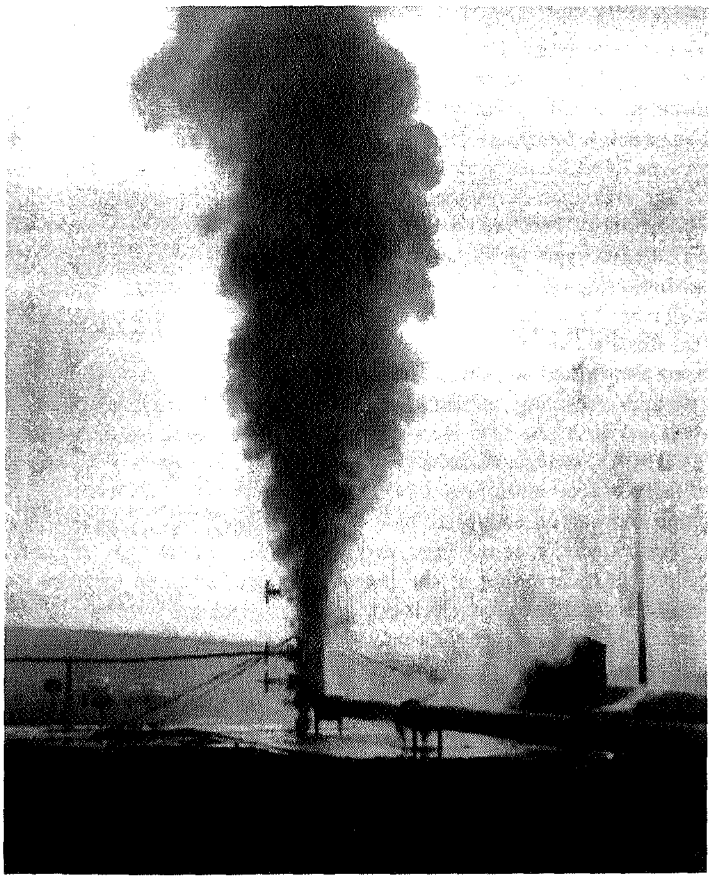
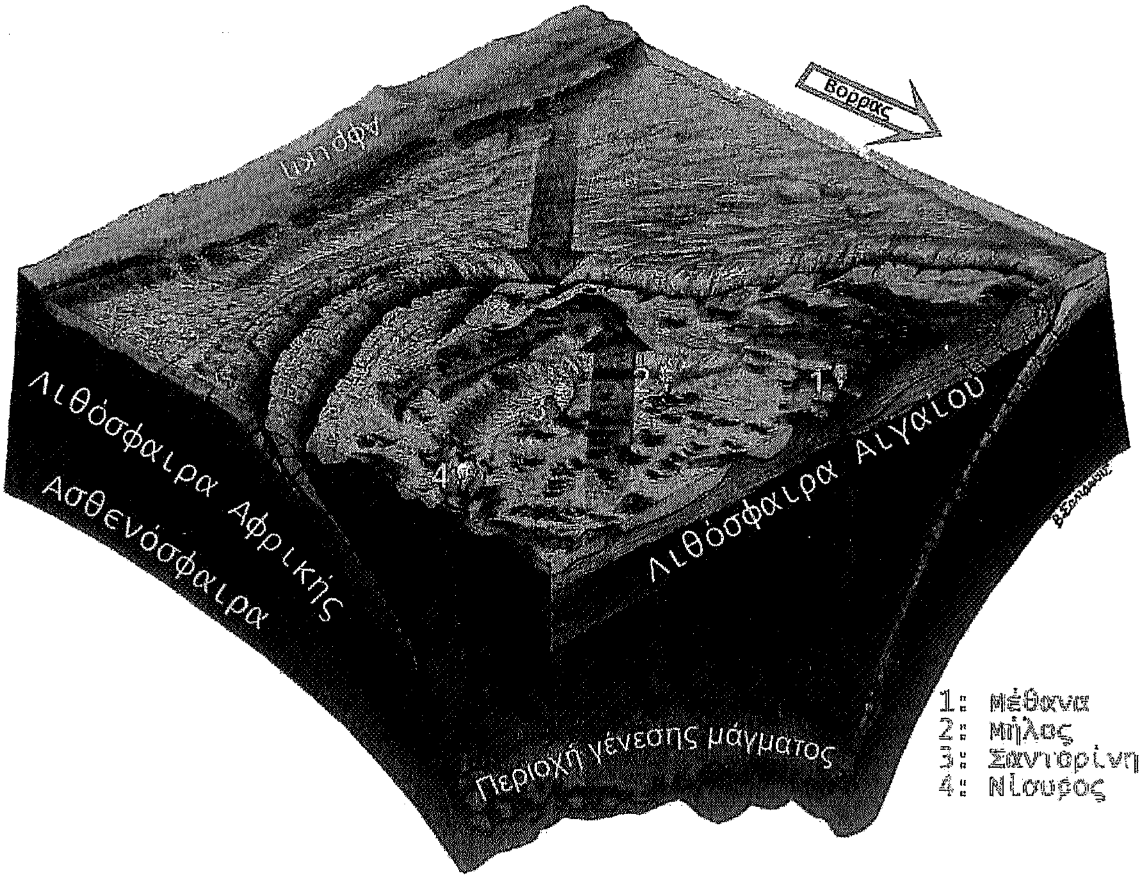


Steam from the production testing of the Milos high temperature field.



The Aegean subduction zone where two low (Methana and Santorini) and two high (Nisyros and Milos) temperature geothermal fields are located.

base to be made available as an ongoing product, able to be updated with new work. Incoming countries, joining the EU should also be able to integrate their data into it. It must be INSPIRE compatible.

The evaluation of resources should be a high priority. They need to be accurately classified with appropriate parameters, definitions, categories, *et cetera*. This should preferably be harmonious with the current Reserves and Resources definitions, being established worldwide for natural resources including metalliferous ores, coals and oil & gas. EFG is a stakeholder in CRIRSCO and can advise on this aspect. EFG is also a participant in the UN working group on resources and reserves.

Furthermore, it is recommended that people be made aware of the potential resources available for electricity and heating, so as to awaken their interest in exploring available opportunities. Especially worth attention are education and policy, and above all decision makers.

European Commission direction

The European Commission intends to concentrate on two areas: A) renewable electricity and B) renewable heating and cooling.

A) Renewable Electricity

This requires long-term research to focus on electricity production, although this can of course be optimized with heating and cooling use. The focus would be on advanced methods for power production from various geothermal sources. In this aspect we should consider three types of geothermal settings: deep systems, medium depth systems and high enthalpy areas.

A1 – deep systems

The European Federation of Geologists would like to see continued support of Enhanced Geothermal System development from depths of 5 km or more, that will lead to more efficient heat exchange and enhanced recovery for hot dry rock systems.

In the light of advances in this field it is time to re-assess the hot dry rock potential of regions where initial research was abandoned in the mid-80s. At the moment, geothermal electricity generation is not really on the agenda for the UK, Ireland and other countries, but perhaps European funding could stimulate this area. There are many crystalline basement regions, where local people favour the installation of electric power from geothermal energy, but conventional high enthalpy resources have not yet been identified.

Furthermore, focus should also be directed to the development of systems utilizing new processes to produce power from low / medium temperatures.

A2 – medium depth systems

The emphasis is on the development of medium depth systems from 1 to 4 km, where temperatures may vary from 60° to 150° C. The concept of underground thermal energy storage (which has obvious synergies with CHP electricity production) should be addressed.

A3 – high enthalpy fields

We must not exclude conventional high enthalpy fields where a lot of research needs to be carried out in order to make their use acceptable to the public and to improve more efficient and environmentally friendly exploitation.

A4 – geothermal licensing

Increased development may produce a situation where there is not enough high enthalpy heat for closely spaced systems. This is not a problem in most countries at present where projects are rare, but it could become a problem in the future where one system will take a neighbour's heat. Are there any licensing arrangements in Europe? It is probably very important given the increased scale of investment required. Investors will not easily commit funds if security of supply is not assured. The European Commission should be involved in producing guidelines that could be incorporated into national legislation in the future.

B) Renewable heating and cooling

This requires shorter - term research and will focus more on heating and cooling, possibly integrated with other renewables.

There are varying scenarios for this area, and in many ways this is more important with the potential to supply greater energy in the short to medium term. One example is the need to solve heating and cooling of complexes with a heat demand of 5 to 20 MWt by a combination of thermal water withdrawal and of heat pumps. There is probably a greater priority to focus on the direct use of heat, rather than on electricity generation. We should be looking at new exploration models for direct and indirect use of geothermal energy, new materials and process cycles for energy conversion (thermal and electrical) and methodologies to improve the sustainability of the use of existing new technologies: Ground Source Heat Pumps and other geothermal technologies. Cooling is a very large area to be addressed and needs to be included in all large schemes.

Regarding licensing, the increased spread of Ground Source Heat Pumps raises the spectre of there not being enough low enthalpy heat in the near surface for closely spaced systems. This is not a problem in most countries at present, but it could become a problem in the future where shallow emplaced systems will take a neighbour's heat. In this case, guidelines are again strongly recommended.

The installation of Ground Source Heat Pumps requires a lot of geological work (hydro-geological, soil and rock properties, effects of heating and cooling on soil and water contamination in open systems, among others) and the legislation is not adequate in many countries. The production of guidelines from the EC as directives to be incorporated in national legislation is very important.

Members of the EFG Expert Panel include: D. De Costa, K. Piessens, Belgium; P. Frykman, P. Johannessen, Denmark; C. Boissavy, France; B. Sanner, D. Doherr, Germany; G. Hatziyannis, Greece; A. Kujbus, J. Szanyi, T. Tarnai, Hungary; G.Ll. Jones (Convenor), R. Goodman, Ireland; R. Cataldi, Italy; H. Ligtenberg, H. Pagnier, Netherlands; S. Komatina, Serbia; J.A. Sanchez Navarro, Spain; M. Erlström, Sweden; J.P Busby, P. Younger, UK. Members of the CC&S subgroup are: K Piessens, Belgium; G. Hatziyannis, Greece, N. Riley, UK; N. O'Neill, Ireland.

Ground movement risks identified by Terrafirma

Ground movements are responsible for hundreds of deaths and billions of Euros annually, and the threat they pose is increasing due to urbanization and land use. ESA's GMES Service Element Programme is backing a project, Terrafirma, to help mitigate these risks. To address these issues, Terrafirma is providing a Pan-European ground motion hazard information service to detect and monitor ground movements in relation to building stability, subsidence and ground heave, landslides, seismic activity and engineered excavations.

For over 15 years, Synthetic Aperture Radar Interferometry (InSAR) has been providing ground deformation data at centimetre precision. In the past five years, however, new ways of processing satellite radar images have been developed using Persistent Scatterer Interferometry (PSI) that allow ground movements over wide areas to be detected and monitored with even greater sensitivity.

Recent statistics show that 50% of the world population already live in cities, and megacities (over 10 million) are now commonplace. As the trend toward urbanization continues, most major towns will undergo construction to accommodate new developments for newcomers. New construction requires solid foundations to avoid costly planning mistakes, and underground works and metro-tunnelling have some surface effect that needs remediation and monitoring. The Terrafirma services can provide information to locate low-risk foundation sites and help save money on the remediation of existing structures.

Land movement in the form of earthquakes and landslides poses a threat to large populations around the world. Within the Terrafirma project some focus has been placed on cities which have a long history of seismic activity, such as Istanbul, Turkey.

Turkey's location has made it vulnerable to earthquakes with the 1000-kilometre-long Northern Anatolian fault located just 15 kilometres south of Istanbul. It is also located on the relatively small Anatolian plate, which is squeezed between three other major tectonic plates – the African and Arabian plates to the south, and the Eurasian plate to the north. The combination of these plate movements has been the source of eight earthquakes of magnitude 7 or greater in the last century.

The 1999 earthquake in Izmit, about 80 kilometres east-southeast of Istanbul, had a magnitude of 7.6, initiating efforts to assess the risk in urban areas. The new PSI studies have yielded a subsidence map giving first-hand evidence of the high degree of spatial variability of the ground conditions throughout Istanbul's urban area, and have contributed to a re-definition of their seismic risk maps. Another urban area being studied for earthquake risk within the Terrafirma project is Lisbon, Portugal, where devastating earthquakes have occurred. The unique information being provided by InSAR in these and other areas is causing seismologists to re-evaluate their data to incorporate new information and refine their estimates of the likely repeat cycles for earthquakes and the future possible epicentre locations. The sophistication of the refinements is likely to lead to a widespread requirement for InSAR data across all areas of seismic risk.

Landslides are another type of ground movement which cause enormous economic losses and claim thousands of lives every year. The cost due to landslides in Italy is estimated to be between €1 and 2 billion annually over the last century, and they have resulted in an average of 60 deaths per year. Terrafirma is examining landslide sites, with the PSI information going to the national geoscience centres and engineers for expert interpretation using their own data and expertise.

Terrafirma monitored the Cutigliano village in Italy's Tuscan Apennines for landslide risks. The use of PSI allowed the identification of more than 200 measurements along the village's slope. By combining InSAR measurements with ancillary data such as aerial photos and topographic and geomorphologic maps, Terrafirma was able to provide an accurate analysis of the landslide's spatial distribution and state of activity and identify unknown unstable areas.

Within two years, Terrafirma, which was initiated by Nigel Press Associates under ESA's GMES Service Element Programme, will provide satellite radar coverage processed to reveal small ground movements for at least one city in every European Union country. Observing the Earth http://www.esa.int/esaEO/index.html

Ground motion (uplift) in the centre of Brussels related to groundwater recharge

by Xavier Devleeschouwer[1]

Radar interferometry (PSI technique) has been applied in and around Brussels. The total area investigated amounts to 900 km² with the ERS satellite datasets covering the time span 1992-2003 being exploited. Seventy-four scenes of data were used and around 173,000 Permanent Scatterers (PS) were identified that could be used for ground motion time-series analysis. Several ground motion processes have been observed for the first time in this urban environment; the most spectacular concerns uplift located in the centre of Brussels along the Senne River. This example highlights the value and potential of the PSI technique for the detection and monitoring of ground motion affecting urban areas.

L'interférométrie radar (technique PSI ou *Persistent Scatterer Interferometry*) a été mise en œuvre *à* Bruxelles et dans ses environs. L'aire totale concernée représente 900 km2 et les données satellite ERS ont fait l'objet d'une exploitation sur une période de 10 ans (1992-2003). Soixante quatorze plages de données ont été étudiées et environ 173 000 échantillons de référence (PS) identifiés pour le suivi dans le temps des mouvements du sol. Plusieurs phénomènes de mouvement du sol ont été observés pour la première fois dans cet environnement urbain. Le plus spectaculaire d'entre eux est le soulèvement enregistré dans le centre de Bruxelles le long de la rivière Senne. Cet exemple met en relief l'intérêt et le potentiel de cette technique pour la détection et le contrôle des mouvements du sol qui affectent les zones urbaines.

Se ha aplicado la técnica de interferometría radar (técnicas PSI) en Bruselas y sus alrededores. La superficie total investigada alcanza los 900 km2 con el empleo de una cobertura de los datos del satélite ERS del período 1992-2003. Se utilizaron 74 escenas y se identificaron alrededor de 173 000 dispersiones permanentes (DP) que podrían utilizarse para el análisis de series de movimiento del terreno. Se han observado varios procesos de movimientos del terreno por primera vez en este ámbito urbano, siendo el más espectacular el que afecta a una elevación en el centro de Bruselas a lo largo del río Sena. Este ejemplo ensalza el valor del potencial de la técnica PSI para la detección de los movimientos del terreno que afectan a las áreas urbanas.

Interferometric Synthetic Aperture Radar (InSAR) is a microwave imaging system of the Earth surface. SAR interferometry is a highly effective spatial technique using data acquired by the European C-band ERS1/2 and ENVISAT-ASAR satellites. Because of regular acquisitions since 1991, the fifteen years archive of the SAR images have been used largely in order to detect and measure, with millimetre accuracy, ground movements in many European cities in the framework of the Terrafirma programme.

Subsidence caused by compaction of overdrafted aquifer systems is a problem in urban areas heavily dependent on groundwater supplies, such as in the US basins: Las Vegas, Nevada, Santa Clara Valley, San Francisco Bay of California. Pumping of groundwater results in surface deformation and raises critical issues from the standpoint of public protection and economic impact. On the contrary, only a few publications are available on uplift phenomenon caused by aquifer recharge.

Cities faced with a rising water table are known in several European countries such as in Spain, Barcelona, Germany, Dessau, United Kingdom, London and Italy, Milan. The main purpose of this

Brussels Parliament

[1]Geological Survey of Belgium

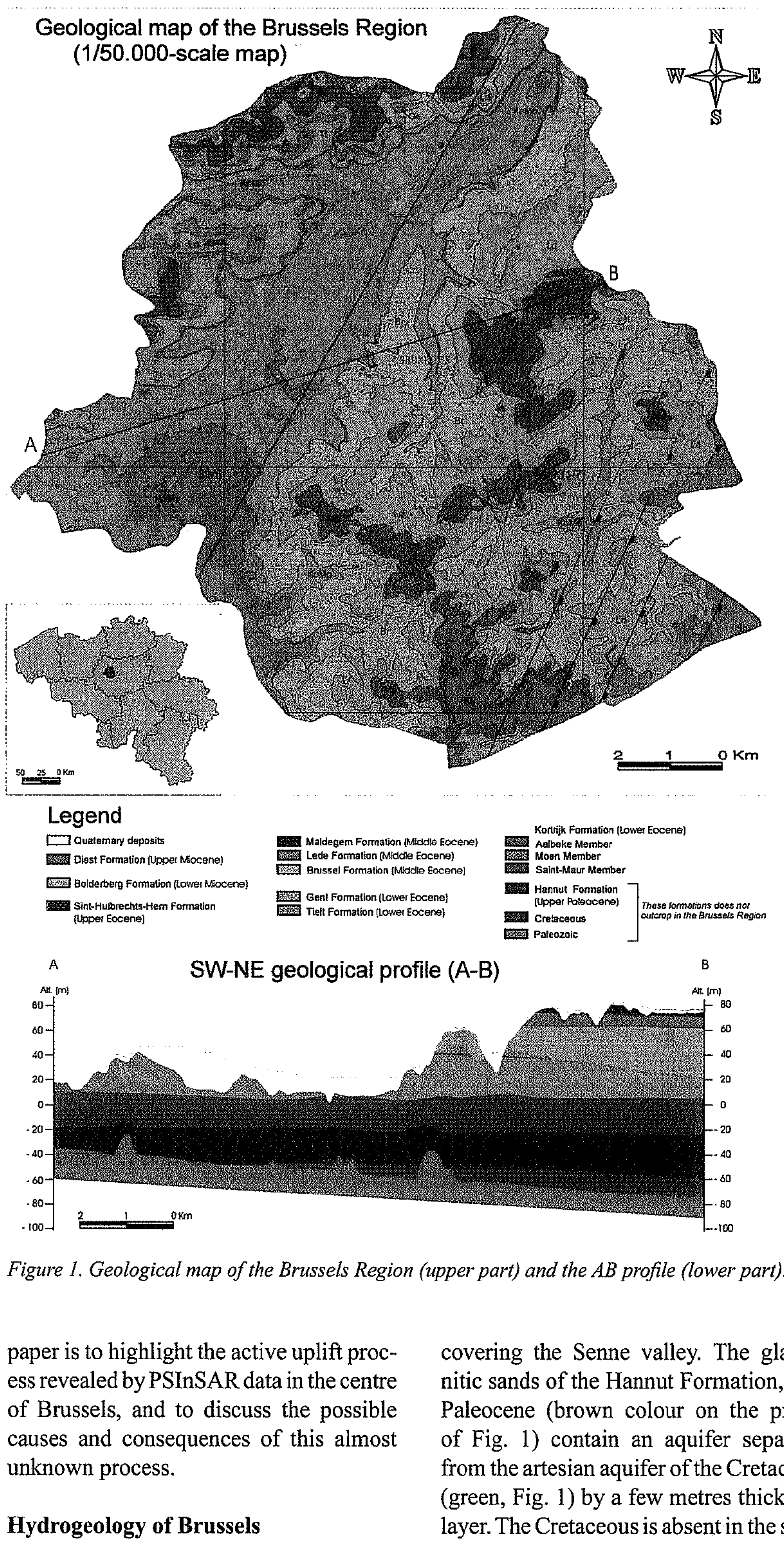


Figure 1. Geological map of the Brussels Region (upper part) and the AB profile (lower part).

paper is to highlight the active uplift process revealed by PSInSAR data in the centre of Brussels, and to discuss the possible causes and consequences of this almost unknown process.

Hydrogeology of Brussels

A large plain, gently inclined towards the north and formed by the alluvial deposits of the Senne river, is situated at an altitude ranging between 19 m in the south to 13 m in the north. The hydrogeological structure of the area is marked by the occurrence of several superposed aquifers separated by variable thicknesses of clays. The alluvial aquifer lies in the Quaternary deposits covering the Senne valley. The glauconitic sands of the Hannut Formation, Late Paleocene (brown colour on the profile of Fig. 1) contain an aquifer separated from the artesian aquifer of the Cretaceous (green, Fig. 1) by a few metres thick clay layer. The Cretaceous is absent in the south and south-western parts of Brussels. The artesian aquifer of the Cambro-Silurian basement (grey, Fig. 1) corresponds to the main aquifer body in the southern part of Brussels. This aquifer is sometimes separated locally from the Cretaceous aquifer if the shales of the basement are sufficiently altered and thick when they constitute a barrier. In other places, where no aquitard level is present, we will use the term "Cretaceous-Paleozoic basement" aquifer.

PS data overview

The processed area covers a surface of 900 km² from Ternat-Vilvoorde-Zaventem (north side) to Halle-Louvain-la-Neuve (south side). The area contains 173,767 identified Permanent Scatterers (PS) corresponding to a density of 193PS/km². This density is highly variable spatially (Fig. 2).

Ground motion observed in the centre of Brussels (Figs 2 and 3), and revealed by the IDW interpolation, corresponds to a large outer elliptical zone (mauve colour) characterized by average velocities ranging between 1.2 and 2.3 cm during a period of 11.5 years. This area covers a surface of 48 km². A second, inner elliptical (blue colour), and smaller area (4 km²), centred on the historical centre of Brussels, indicates positive ground deformation with average velocities ranging between 2.3 and 5.7 cm during the same time-span.

Groundwater evolution

Water was pumped from the Cretaceous chalk aquifer in the centre of Brussels from the beginning of industrialization in the late nineteenth century, and up to the mid-twentieth century. During the early years, the artesian wells were used for industrial purposes (breweries, dyeing, distilleries, refineries, etc). The increasing number of artesian wells and the increasing water need, led progressively to pumping at greater depths. The old artesian wells inventoried in Geological Survey archives have been plotted on the interpolated colour zones corresponding to the uplift (Fig. 3). Artesian wells are specifically located along the Senne axis. Most of them (more than 50) are present in the uplifting zones. Thirteen wells are included in the blue interpolated zones with the highest uplifting velocities.

There are a limited number of available piezometers (6) but they are distributed over the whole area. The "Gieterij" piezometer (Fig. 3, northern part of the map), related to the Cretaceous aquifer, shows a net increase of the piezometric level of 35 m before the 1980s, then relatively stable conditions during the eighties, and a 30 m increase of the piezometric level starting in the middle of the year 1992 to nearly the end of 2001. These data indicate that the Cretaceous aquifer has experienced a positive evolution of the piezometric level of more than 65 m during a period of 23 years. The "Lavallée" piezometer

(Fig. 3, centre of the image) indicates a 7 m increase of the piezometric level of the Hannut Formation aquifer during the time-span 1998-2004. These data indicate that two different aquifers (Hannut and Cretaceous) record an increasing trend of the piezometric level.

Conclusions

Extensive groundwater pumping led to a subsiding and compacting basin from industrialization in the late 1800s. Since the 1950s, industry progressively disappeared from the centre of Brussels, and the wells were progressively abandoned. This situation led to the reverse phenomenon that corresponds to the recharge of the groundwater aquifers. Consequently, groundwater level rises in the local aquifers resulted in several centimetres of elastic rebound. These ground motions affect the buildings in the centre of Brussels as attested by the cracks observed in the walls of several buildings. Elsewhere, subsidence has also been detected in several places in Brussels and mostly related to alluvial plains, peat, and water extraction.

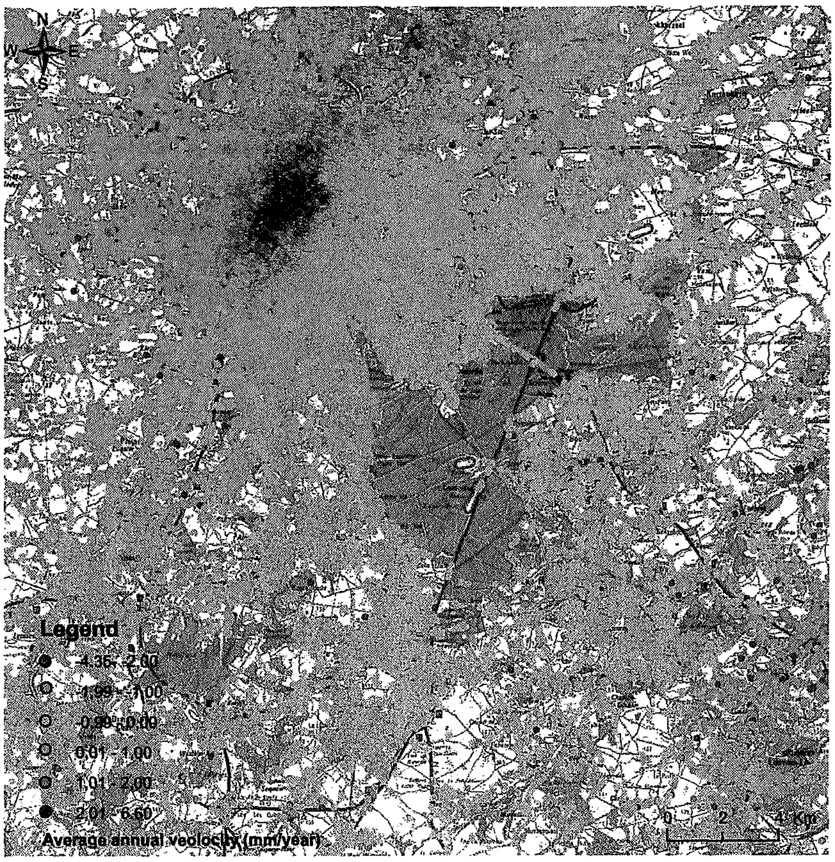


Figure 2. Processed area with the 173.767 PS colour classified based on the average annual velocity (mm/yr). Blue and mauve colours indicate uplift processes and orange to red colours correspond to subsidence.

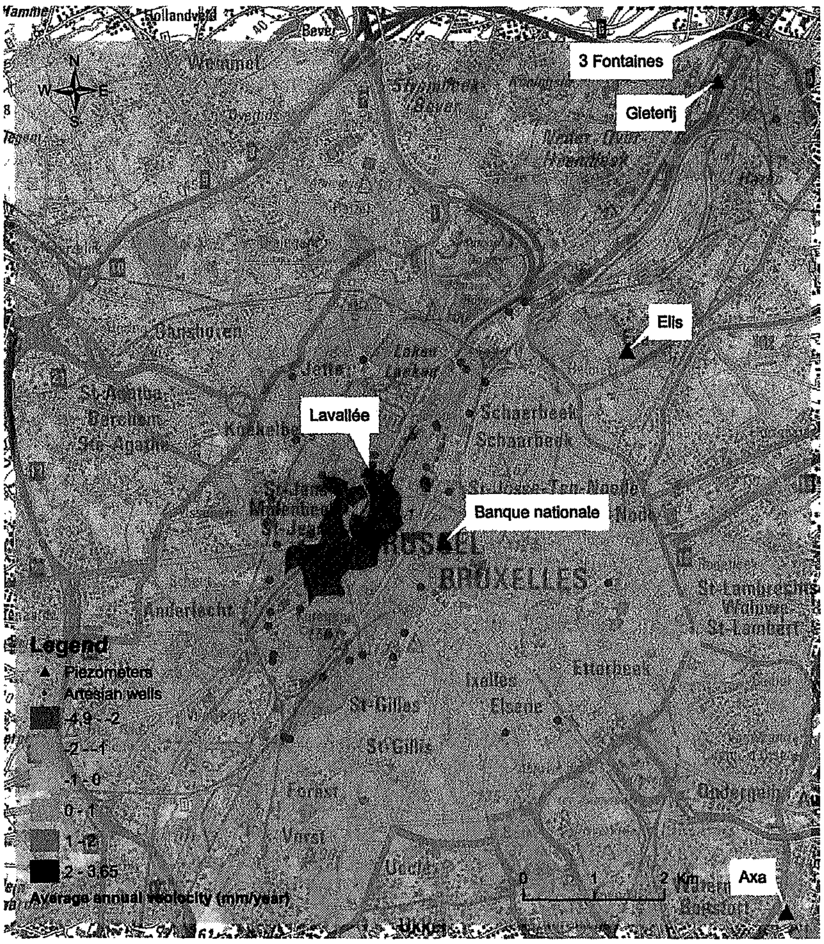


Figure 3. The uplift phenomenon revealed in the centre of Brussels along the Senne valley. Artesian wells (red points) and six piezometers (black triangle) are located on the map.

Geochemistry-based modelling of hydrocarbon contamination

by J. Tóth[1] and Dr. E. Török[2]

This article describes a laboratory model in which geochemical and geostatistical analyses were conducted to acquire new information for hydrocarbon pollution in the natural environment, especially for types of gasoline. Gasoline was chosen as the experimental material because it can very frequently be recognized in hydrocarbon contaminated areas. The gasoline compounds were identified using gas chromatography with flame ionization detection and mass spectrometry. The composition of the clay and sand, which were used for the model, was investigated by XRD and DTA methods. Grain size distribution and carbonate determination were also carried out. Based on the results of the measurements, useful data can be recognized related to the volatility of the gasoline compounds and to the adsorbtional character of the clay.

L'article décrit un modèle expérimental dans lequel les analyses géochimiques et géostatistiques ont été effectuées pour obtenir davantage d'informations sur la pollution de l'environnement naturel par les hydrocarbures et en particulier l'essence. L'essence a été choisie comme matière d'expérimentation parce qu'on la retrouve très fréquemment dans les secteurs pollués par les hydrocarbures. Les composants de l'essence ont été identifiés après utilisation de la chromatographie en phase gazeuse avec un détecteur à flamme ionisante et de la spectrométrie de masse. La composition de l'argile et du sable utilisés pour le modèle a été étudiée par les méthodes XRD et DTA. Une étude granulométrique et une analyse des carbonates ont également été réalisées. En se basant sur les résultats des mesures, des données très utiles ont été enregistrées en matière de volatilité des composants de l'essence et d'adsorption de l'argile.

El presente artículo describe un modelo de laboratorio en el qué se realizaron análisis geoquímicos y geoestadísticos para obtener nuevos datos sobre la contaminación del medio natural por hidrocarburos, especialmente algunos tipos de gasolinas. Se ha elegido la gasolina como material de experimentación por su frecuente aparición en áreas contaminadas por hidrocarburos. Los compuestos de gasolina se han identificados usando cromatografía de gases con detección por ionización de llama y espectrometría de masas. La composición de la arcilla y de la arena utilizada en el modelo se ha investigado por RX y DTA. Se han realizado también granulometrías y determinación de carbonatos. En base a los resultados de las mediciones realizadas, se han obtenido datos de utilidad en relación con la volatilidad de los compuestos de la gasolina y el carácter absorbente de la arcilla.

In the last few decades there has been an increase in the accumulation of contaminants in our environment. In connection with industrial development, anthropogene activities play an increasingly important role in the pollution of our environment resulting in considerable risk to soil and groundwater. Environmental protection has come into focus during the last few decades in Hungary. Protection of groundwater and soils is extremely important from this point of view. The drinking water supply in Hungary is derived almost entirely (97%) from groundwater; consequently its protection is strongly monitored.

Sub-surface pollution cannot easily be observed; thus its effect can be more serious. Hydrocarbon pollution in our environment occurs frequently in connection with various industrial activities. In many contaminated areas, the hydrocarbon pollution sources may originate from sites where crude oil or derived oils are being stored. These sites are, for example, oil refineries, filling stations, underground pipelines or railway stations.

Site investigations have revealed gasoline type pollution in most cases. Gasoline, as one of the most mobile pollution agents, can easily spread to the groundwater; moreover it also means high risk for human health. That was the main reason why this compound was chosen for our laboratory modelling.

Problems in the risk assessments of HC-contaminated sites

In Hungary, hydrocarbon contaminated soils and groundwaters at exploration and production sites have been managed based on their total petroleum hydrocarbon (TPH) content. Measuring of TPH contamination is not sufficient for environmental and human health quantitative risk assessment because it does not give information about the compounds within the hydrocarbon mixture. There are three methods of risk assessment. The best known uses some indicator compound (e.g. PAH or BTEX) in order to characterize the risk. The second procedure applies a substituting compound, e.g. benzene. In the total product method, which is a modified type of the latter procedure, the total TPH is dissociated to fractions. These fractions (e.g. aromatic, aliphatic) have similar mobility and toxicity properties. The third method applies the combination of the indicator compound and the substituting compound (involving the total product) procedures mentioned above.

In our opinion it can be useful if we have a thorough knowledge of every component of the TPH. In connection with this, the aim of our modelling is to aquire more and

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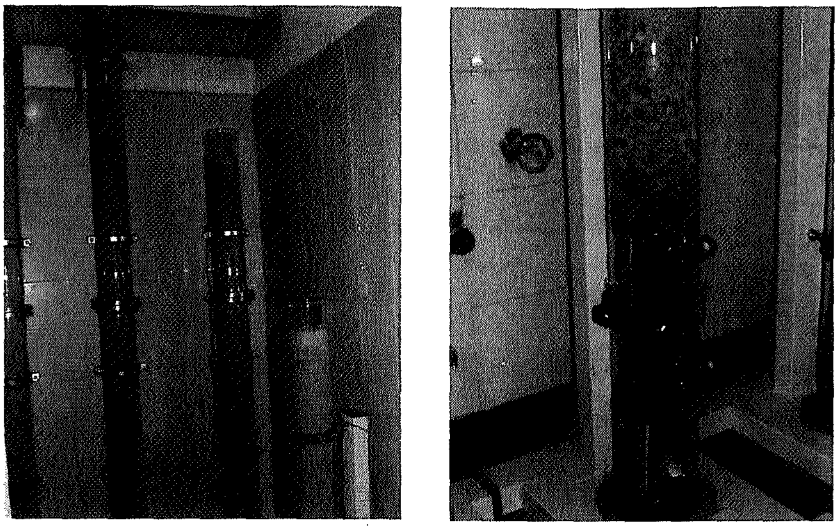

Figure 1a, b. The special glass tubes used for the modelling

more exact information for the frequent hydrocarbon pollution in the natural environment, connected to both oil industry and transport.

Details of the model

Eight specially constructed glass tubes were installed in an isolated room in order to provide standard circumstances during the modelling for the long duration of the study. Pairs of tubes - 50, 100, 150 and 200 cms in height - were filled with homogeneous sand. One tube from each pair was covered additionally by a clay layer. Tubes were equipped with a thin steel sieve directly below the filling material in order to prevent the sand grains from falling into the liquid gasoline. Samples were taken from the liquid gasoline below the fillings, from the vapour phase above the liquid gasoline, from the sand/clay fillings and from the air above the fillings. Samples were taken weekly in the initial period of the experiment; later - based on the results of the measurements - the sampling period was altered to monthly frequency.

Analytical methods for TPH analyses – and for our model

The more common methods for TPH analyses are solvent extraction followed by infrared spectroscopy or gas chromatography. There are some standard methods for TPH analyses, but there is not an accessible universal method. These are modified versions of the gas chromatographic methods. In most cases we use gas chromatographic analyses for the contaminated samples. We have chosen the methods for our model in order to gain comparable results to the data aquired from contaminated sites.

Gas chromatographic analyses were carried out as the main analytical method for determination and identification of the HC components in the experiment. Eight liquid samples were taken through the septum of the lower pipe (Fig. 1) each time. Three parallel analyses were made from these samples resulting in 24 measurements every time. Air samples were taken after six and twelve months, while the vapour phase was sampled after one year. A FISONS MEGA2 HRGC type GC-FID apparatus was used for the analyses of the gasoline and vapour samples using the following analytical materials and conditions: injector temperature of 310° C, constant pressure of 200 kPa, splitless mode, injected volume = 0.5 µl, the GC oven was programmed from 60° C (3 mins) with 20° C/min ramp rate to 310° C (30 mins), HP-1 column (50m length, 0.32mm inner diameter, 1.05 µm film thickness, dimetil-polisiloxan) and FID temperature of 310° C.

For the air-space samples an ATD-GC-MS apparatus was applied with the following technical data: Gerstel TDS A2, A3, oven was programmed from 60° C (0 mins) with 60° C/min ramp rate to 310° C (10 mins), standard measuring method, split mode, delay time of 0.5 min, transfer temperature of 300° C, CIS4 CO_2 cooling, Carbotrap B adsorbent bed, oven was programmed from -20° C (0 mins) with 12° C/min heat up rate to 300° C (10 mins). The GC part was operated using the following: CIS split ratio set to 20:1, split = 8.7ml/min, pressure of 100 kPa, He, total flow of 12.1 ml/min with constant flow measuring method, HP-PONA column (50m length, 0.2mm inner diameter, 0.5µm film thickness, 100% dimetil-siloxan), the GC oven was programmed from 40° C (4 mins) with 10° C/min ramp rate to 170° C (1min), and to a final temperature of 300° C with a 15 min. hold time after 60° C/min ramp rate. The MS detector technical data were: 1.2 min. of solvent delay, scan = 33-550 amm, threshold = 150, with scan measuring method = 2.85 scan/s.

Filling materials were sampled after six and twelve months to determine the adsorptional features. Samples were taken from the homogeneous sand from every tube. In the case of the clay capped tubes both the clay and the sand below the clay were sampled. From the samples three parallel measurements were carried out using ATD-GC-MS equipment with the same technical circumstances as mentioned above. As the volume of the clay may alter during analyses, thermoanalytical, X-ray diffraction, grain size distribution and carbonate content measurements were performed to determine the main features. The measurements were carried out with an admixture of a 10% inert component in order to avoid the analysing problems of the expanding clay minerals. Average values, calculated from the parallel measurements, were the bases of the trend determinations.

Initial compositions

The term gasoline refers in the Hungarian oil industry to a special raw condensate which contains HC types to C19 in general. In our modelling the C19 component was also detectable in the starting compound. Gasoline is a complex mixture of a number of organic compounds including: alkanes (normal, branched and cyclo-), alkenes (normal, branched and cyclo-), alkylbenzenes, polynuclear aromatic hydrocarbons, elemental compounds and additives (Odermatt, 1993). Consequently, several definitions refer to the gasoline fraction. We have used in our modelling a natural gas based liquefied HC mixture, without any unsaturated components.

The chromatogram of the starting composition can be seen in Figure 2. Based on the analytical results, three groups could be distinguished according to the volatility of the components (highly volatile, less volatile and aromatic groups). 71% of the measurable components proved to belong to the highly volatile groups, including 9% of aromatic HCs, while the residue 29% could be ranged into the less volatile group. The boundary between the highly and less volatile group could be drawn at octane, taking into consideration the analytical results gained during the experi-

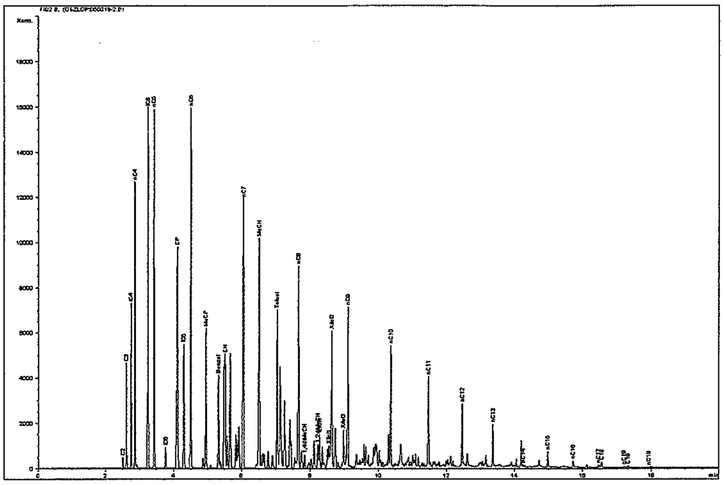

Figure 2. Chromatogram of the starting composition of the gasoline

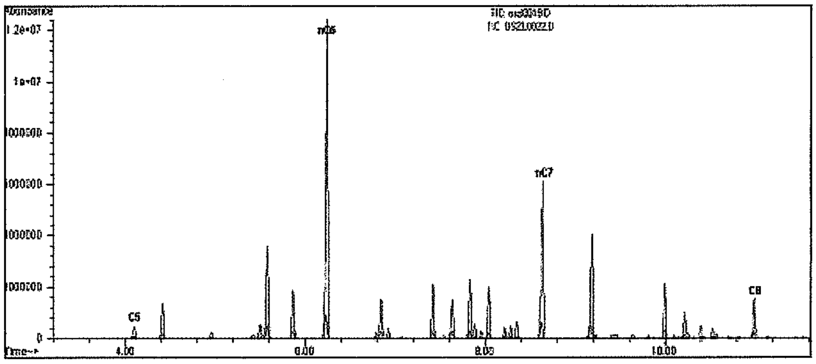

Figure 3. Superimposed chromatograms of the air-space samples taken after half year. Red line represents the pure sand fillings and blue line shows the clay-capped tubes.

ment. It can be seen from the chromatogram that pentanes, hexanes, heptanes and with its significant quantity (11.6 mol%) of normal-octane predominate in the starting compounds. As for the less volatile group, their quantity reduces proportionally with the carbon number. Components to C39 were determined in all measurements because the gasoline was enriched in the less volatile components parallel with the escaping of the highly volatile types of HC from the system. Consequently the C32 is present in a measurable amount after one year (Toth et al., 2006).

X-Ray diffraction analyses, thermoanalytical measurements, as well as grain size distribution analyses were also performed in order to characterize the sand and clay used as filling materials in the modelling. In the sand the dominant grain size is between 100 and 1000 μm. Abundant quartz, less potassium feldspar (albite), very little dolomite and calcite were detected in the semiquantitative X-ray diffraction analyses. Muscovite, chlorite, kaolinite and amphibole could also be traced. Grain size of the grey clay is between 0.4 and 355 μm, but the ratio of the larger grains (fraction above 100 μm) is merely 1.85%. The mineralogical composition of the clay is as follows: quartz, muscovite, and calcite abundant, dolomite, chamosite medium. Some nontronite and feldspar in traces could also be detected. Besides the XRD analyses additional thermoanalytical investigations were performed on the clay sample. The result are: 11-22% montmorillonite, <12% chlorite, ?% illite, 10% calcite, 6% dolomite, 2% goethite, and detectable quantities of muscovite, quartz, amorphous phase (Toth et al., 2006).

Results

We have used the given gas chromatograpic data in various ways. In one respect we compared the chromatograms of the same phase samples taken at the same time from different tubes with each other. We gained much useful information from the superimpositioned chromatograms. Firstly, in respect to the hydrocarbon adsorption properties of the clay fillings. Adsorbed components from toluene to C10 predominate in the samples from the shortest (50 cm) tube. The measured carbon numbers of the components decreases as the tube heights increase; e.g. in the case of the one metre high tube, components with C7 to C9 are dominantly present. Total peak areas gradually decrease towards the higher tubes; the least adsorbed components could be detected in the specimens from the highest, two metre high tube. These features could be detected after six and twelve months. Differences were observed in the composition of the adsorbed hydrocarbon types, namely o-xylene, C9, C11 components could be measured in the clay samples only after one year.

Data from the air-space samples show similarity in the quantities of the measurable components, depending on the kind of filling used above it. The quantities decrease with increasing tube height. C5-C8 components could be measured above the pure sand fillings and in the case of the clay-capped tubes also, but in different amounts as shown in the superimposed chromatograms of Figure 3.

We made comparisons among the different phase samples taken at the same time from the same tubes. In order to achieve comparable units it was necessary to use corrections for the data. Data derived from the same measuring methods are represented in mol% (Fig. 4). We applied the total peak area for plotting in the cases of the results derived from different analytical apparatus (e.g. GC-FID or ATD-GC-MS). We plotted the unified analytical results in MS Excell and afterwards examined them.

The results of the same phase samples taken at the same time from different tubes have also been compared with each other in mol % using MS Excell. We plotted the data continuously for each compound. To date, we have more than one and a half years analytical data on the volatility of gasoline compounds. Trends have been recognized in the quantity variance of each compound and it can be stated that the composition of the filling materials does not radically affect the concentration changes of the highly volatile components in the liquid phase. The changes are in connection rather with the heights of the tubes. The four tubes with medium heights show transitional features in the concentration changes between the shortest and longest tubes. At the same time a slight relative enrichment can be observed in the case of the aromatic HC components. Because the

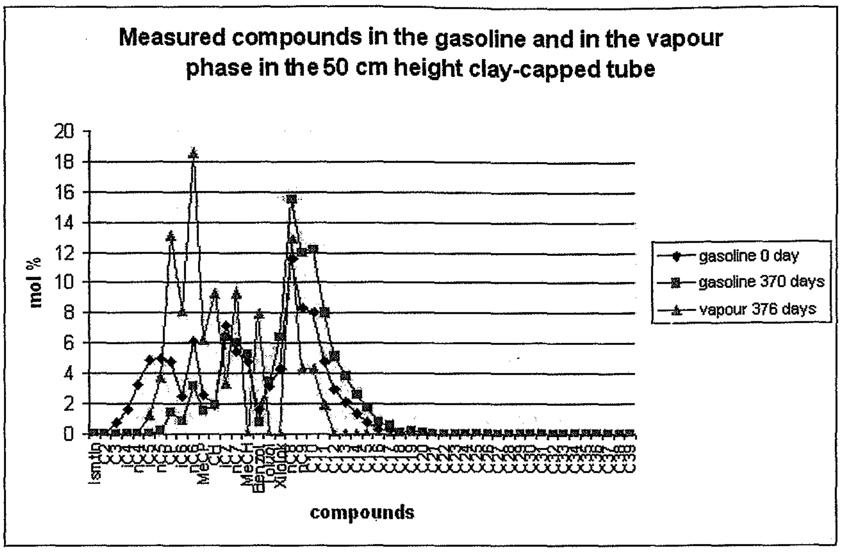

Figure 4. Comparison between the different phase samples taken from the same tubes.

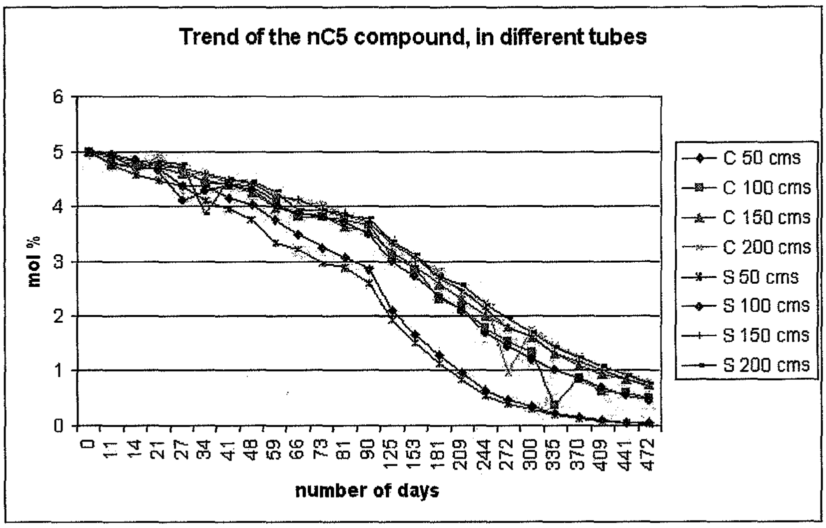

Figure 5. A part of the trend analysis datum - the trend of the volatility of normal-pentane. C, the clay/capped tubes and S, the pure sand filled tubes.

aromatic HC components show different behaviour from the others, we are examining these compounds in detail. We have presented a trend about one compound in Figure 5, in order to demonstrate a part of the trend analysis datum.

Conclusions

Three groups could be distinguished with regard to the trend in change concentation with time. A gradual decrease in the concentration can be observed for the highly volatile components. The intensity of this decrease is connected to the carbon number of the components – the smaller the carbon number, the more intense the volatility. As was expected, higher amounts of the components have evaporated from the tubes filled by homogeneous sand, for each tube-pairs of equal height. A relative increase in the concentration could be observed for the less volatile components.

Quantities of the components, measured in the air-space samples, depend on the heights of the tubes. C5-C8 components could be measured above both the pure sand and clay-capped fillings, but their concentrations were different. Clay-capped fillings adsorbed components from C7 to C11; their concentrations depend on the heights of the sand below the clay.

Preliminary results of the modelling indicate that consideration of the trend of changing concentration with time can be an effective tool in the remediation of a gasoline polluted area. Based on the modelling, it can be seen that the most dangerous period in gasoline pollution is the first 21 days after the beginning of the pollution. In this period the highly volatile compounds can evaporate. After this period the evaporation speed of the volatile components decreases. Decomposition of the gasoline occurs at a lower rate than has been suggested in most of the quantitative risk assessment of contaminated areas. Investigations of the volatility of the components and the relationships between the revealed trends will be continued by means of geochemical and geostatistical methods (trend analyses and correlation measuring).

Acknowledgements

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References

Odermatt, J.R. 1993. Natural chromatographic separation of benzene, toluene, ethylbenzene and xylenes (BTEX compounds) in a gasoline contaminated ground water aquifer. *Organic Geochemistry,* Vol. 21, No. 10/11, pp 1141-1150

Toth, J., Kallai, M. 2006. Gasoline pollution modelling in laboratory. *Geological Research, (Földtani kutatás, in Hungarian),* in press

Toth, J., Kallai, M., Lukacs, A.2006. Gasoline pollution modelling in laboratory. *19th General Meeting of the International Mineralogical Association, Japan* (presentation and abstract)

Soil loss calculation and sediment analyses in Galgaheviz, Hungary

by Csaba Centeri[1] and Márton Vona[2]

Extreme erosion occurs in the hills surrounding Galgaheviz village. Our measurements on the hillside soils (0 -100 cm depth) and at the foothill's sediment (0-240, 0-320 cm) have shown that there are high amounts of soil nutrients (1000 mg kg^{-1} < P_2O_5). Soil research can help farmers optimize their land and fertilizer use. It leads to an improvement in the quality of the Galga Creek that flows at the foothill. Nearby slopes are monitored to explore the changing amount of artificial fertilizers and their migration from arable land, their hazardous effect on the watercourses and indirectly on natural conditions and human health.

Une très forte érosion affecte les collines qui entourent le village de Galgaheviz. Les mesures de sol effectuées sur les pentes (à une profondeur comprise entre 0 et 100 cm) et sur les sédiments, au pied de la colline (à des profondeurs comprises d'une part entre 0 et 240 cm et d'autre part entre 0 et 320 cm) ont montré qu'il existe d'importantes quantités de substances nutritives (1000 mg*kg-1 < P2O5). De telles recherches peuvent aider les fermiers à optimiser l'utilisation des sols et des engrais. Cela va également conduire à une amélioration de la qualité du cours d'eau Galga qui coule au pied de la colline. Les pentes avoisinantes font l'objet d'un contrôle pour étudier les variations de la quantité d'engrais artificiel, leur migration à partir des terres cultivées, leur effet aléatoire sur les cours d'eau et indirectement sur l'environnement naturel et la santé humaine.

En las colinas que rodean el pueblo de Galgaheviz se produce una erosión extrema. Los análisis realizados en los suelos de las laderas (0-100 cm de profundidad) y en los sedimentos del pie de la colina (0-240, 0-320 cm) muestran que hay una elevada cantidad de nutrientes en el suelo (1000 mg kg^{-1} < P_2O_5). La investigación edafológica puede ayudar a los agricultores a optimizar el usos de sus tierras y de los fertilizantes. También contribuirá a la mejora del arroyo Galga que discurre al pie de la colina. Se están investigando también las laderas cercanas para analizar los cambios en las cantidades de fertilizantes y su migración de los terrenos arables, sus efectos peligrosos en los cursos de agua e indirectamente en las condiciones naturales y la salud humana.

The studied area lies c. 70 km southeast of Budapest, along the Galga Creek (Fig.1). Our target area is situated on the northern side of the railway. Arable lands surround the river, roads and railway lines running parallel to the river valley. There is intense agriculture; local farmers produce everything for their own needs and extra for nearby city markets. There is also a wetland environment with meadows containing protected plants. This peaty meadow has a high nature protection value. Cash crops are corn, sunflower and sometimes sugar beet. Farmers combine cash crop with cereals.

Due to the structure of crop rotations and tillage practice, there is a lot of soil loss on the slopes facing the Galga Creek. Measurements on two arable foothills proved the humic layer to be 3.2 and 2.4 m respectively. Cultivation is down the slope.

Galgaheviz is a valuable natural area where hundreds of protected plants grow (Vona and Falusi 2005). It is understandable that the natural area should be properly protected from the negative effects of nutrient runoff from arable lands.

Soil erosion models are basic tools for calculating soil loss. It is easy to calculate nutrient loss by measuring basic soil parameters (Penksza et al. 2003). The most widely used and well-known soil loss estimation model is the Universal Soil Loss Equation (Wischmeier and Smith 1978).

Our aims within the research were to prove that the area is suffering from the effect of serious erosion; the thickness of the accumulation at the bottom of the slope proves that erosion processes occur over the slope and basic soil chemical parameters prove that the origin of the sediment comes from the arable land above the accumulation zone.

Materials and methods

Soil profiles (0-100 cm) were fully described in the field. Soil profile sites were chosen by the Pürckhauer type core sampler (100 cm long, ~3 cm in diameter). The examined soils were Cambisols (FAO).

We investigated the deeper horizons down to 3.2 m to measure the nutrient and soil loss from arable farming. We had shallow drillings on the arable field facing Galgaheviz and took soil samples every 20 cm. The laboratory experiments were carried out according to the Hungarian regulations of the Institute of Soil Science and Agricultural Chemistry, Hungarian Academy of Sciences.

We used the USLE model to calculate the potential soil loss that might have uploaded to the sediment area.

USLE uses physical factors (Wischmeier and Smith, 1978) to quantify the amount of soil lost per hectare per year. Its well known equation is: $A = R . K . L . S . C . P$

Procedure for using the USLE

1. Determine the R Factor.

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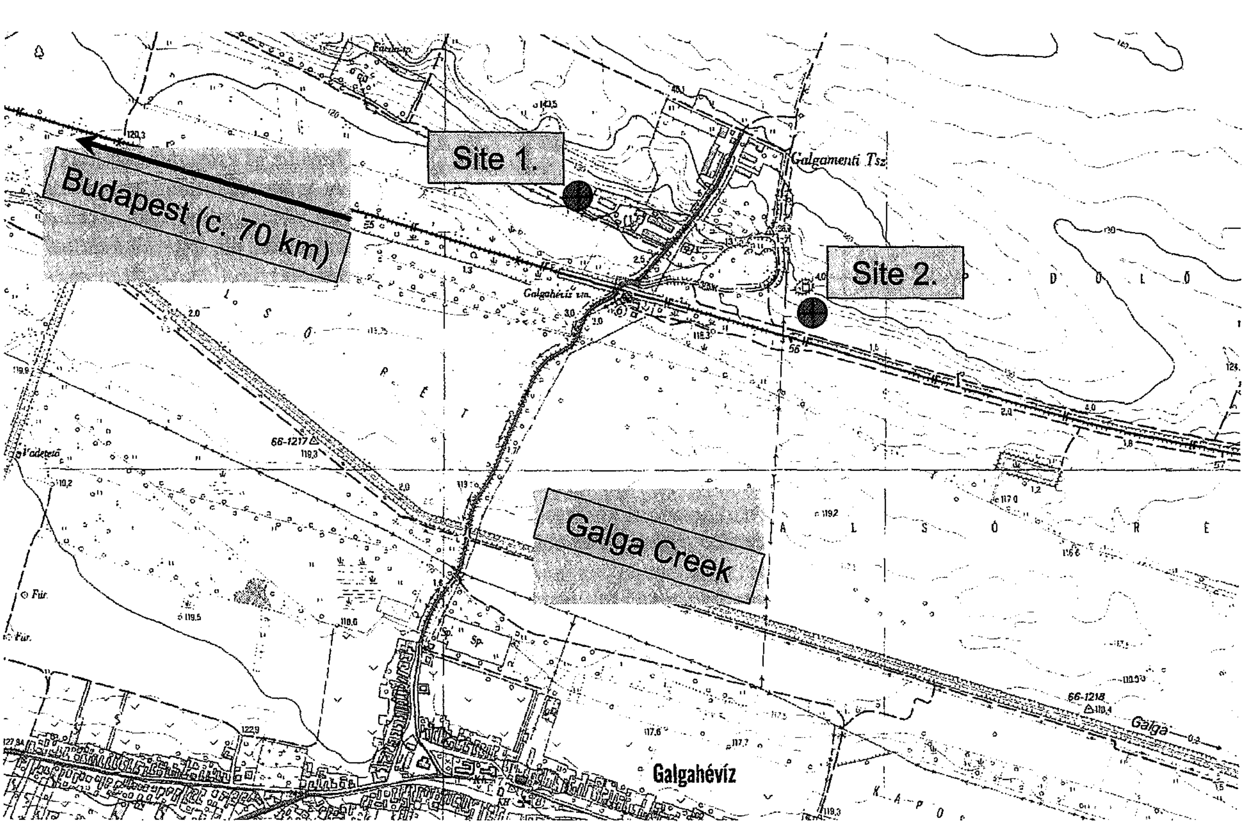


Figure 1. Location map for Galgaheviz, showing the position of the Creek and Sites 1 and 2

A = Soil Loss ($t * ha^{-1} * y^{-1}$)
R = Rainfall Erosion Index ($MJ * mm * ha^{-1} * h^{-1} * y^{-1}$)
K = Soil Erodibility Factor ($t * ha * h * ha^{-1} * MJ^{-1} * mm^{-1}$)
L = Slope Length (dimensionless)
S = Slope Gradient Factor (dimensionless)
C = Cropping Cover Management Factor (dimensionless)
P = Agricultural Practice Factor (dimensionless)

2. Determine the K value (based on Hungarian measurements under artificial rainfall (Centeri 2002)).
3. Divide the field into sections of uniform slope gradient and length. Assign an LS value to each section.
4. Choose the crop type factor for the crop to be grown.
5. Select the P factor based on the tillage practice to be used.
6. Multiply the 5 factors to obtain the soil loss per hectare.

Laboratory results of basic soil parameters

For soil loss measurements it is important to prepare a soil profile description and analyze basic soil parameters (Table 1). Based on the laboratory experiments, the examined sites were quite different, except for the pH values.

"Site 1" has smaller amounts of calcium carbonate in the upper soil layer, but has very high amounts of P_2O_5- (Table 1), about 16 times more than "Site 2". There is a difference in K_2O content (Table 1) but it is not so significant; only about twice as much K_2O can be found in "Site 1" than in "Site 2". The pH can be described as similar.

Laboratory results of basic chemical soil parameters of shallow drillings

The most complicated part of the erosion mapping works is calculating the rate of soil formation and sedimentation. To provide data for the estimation of the rate of sedimentation we analyzed the bottom of the slope of the chosen hillsides. We reached the parent material (in this case loess, the basis of soil formation) at a depth of 320 cm, that is at least three times the depth of the original soil profile at Site 1. We can state that approximately 220 cm of sediment had accumulated at the bottom of the slope at Site 1. At Site 2 we reached the parent material at a depth of 240 cm.

We analyzed the basic soil parameters of this sediment in the two selected sites to the depth of the parent material (Table 2).

The Ca content is mainly shadowing the pH values. It shows a greater amount of disturbance at Site 1. The Ca content tells us that we are reaching the Ca rich parent material where values are above 7 on both Sites 1 and 2 .

The amounts of AL-P_2O_5 were above calibration. Usually – for samples from arable land – technical equipment is calibrated for the highest value of 1000 $mg*kg^{-1}$. In the present case they had to be re-calibrated because we had readings as high as 2455 $mg*kg^{-1}$ on Site 1.

There is more change on Site 2 than on Site 1. At a depth of 100-120 cm, the AL-P_2O_5 content is 1304 $mg*kg^{-1}$ while at

	pH (KCl)	pH (H_2O)	SOM	$CaCO_3$	AL-P_2O_5	AL-K_2O
			%	%	$mg*kg^{-1}$	$mg*kg^{-1}$
A horizon (Site 1)	7,03	8,05	2,67	4,9	1767,32	199,31
A horizon (Site 2)	7,02	8,1	1,38	14,85	112,76	86,77

Table 1. Laboratory results from the A horizon of Site 1 (soil profile examination)
SOM = Soil Organic Matter, AL = ammonium-lactate

Code	pH (KCl)	pH (H_2O)	SOM (%)	Ca %	AL-P_2O_5 mg*kg^{-1}	AL-K_2O mg*kg^{-1}	NO_3-N mg*kg^{-1}
0-20	7.98	7.25	3.05	2.25	1944	334	3,43
40-60	8.02	7.23	1.79	1.74	1968	295	6,86
60-80	7.97	7.07	2.73	1.21	2247	283	6,86
80-100	8.09	7.30	2.40	1.34	1950	277	3,43
100-120	7.78	8.42	1.04	0.90	2221	320	3,43
120-140	8.01	7.29	0.00	1.00	2455	357	3,43
140-160	7.47	8.10	0.24	1.39	2284	353	3,43
160-180	8.12	7.32	0.95	0.70	2204	379	<KH
180-200	8.23	7.44	1.86	0.71	2040	355	6,86
200-220	8.30	7.48	0.80	0.77	1291	312	3,43
220-240	8.10	7.40	0.04	1.76	941	262	10,3
240-260	8.26	7.43	0.00	2.68	834	253	<KH
260-280	8.27	7.35	0.00	2.15	706	217	6,86
280-300	8.33	7.45	ND	2.27	502	222	6,86
300-320	8.62	7.63	0.17	7.48	182	107	3,43

Table 2. Laboratory results of the drilling West of the center of the cooperative (Site 1)
ND = no data, KH = limit of measurability, B = cereal, SOM = Soil Organic Matter, AL = ammonium-lactate

Code	pH(KCl)	pH(H_2O)	Humus (%)	Ca %	AL-P_2O_5 Mg*kg^{-1}	AL-K_2O mg*kg^{-1}	NO_3-N mg*kg^{-1}
0-20	8.12	7.40	2.03	ND	ND	ND	ND
20-40	8.09	7.20	2.60	133	1266	383	6,86
40-60	7.72	7.16	5.35	131	1283	430	6,86
60-80	8.02	7.15	2.39	1.06	1371	272	10,3
80-100	7.95	7.20	1.72	0.82	1540	294	6,86
100-120	7.91	7.19	1.78	1.03	1304	392	3,43
120-140	8.32	7.56	1.28	1.03	392	407	6,86
140-160	8.22	7.52	0.00	1.21	660	424	3,43
160-180	8.37	7.67	0.00	2.10	669	478	10,3
180-200	8.47	7.79	0.28	3.39	1012	438	17,2
200-220	8.46	7.95	0.85	6.08	863	329	10,3
220-240	8.48	8.15	1.01	7.29	895	246	24,1

Table 3. *Laboratory results of the drilling, east of the center of the cooperative (Site 2)*
ND = no data, N = sunflower, SOM = Soil Organic Matter, AL = ammonium-lactate

Sample site	pH (KCl)		pH (H_2O)		SOM (%)		$CaCO_3$ (%)		AL-P_2O_5		AL-K_2O	
	2004	2006	2004	2006	2004	2006	2004	2006	2004	2006	2004	2006
UST	6,7	6,9	7,2	7,8	2	2,2	7,63	7,57	1523,5	819,9	218,4	185,9
LST	6,9	6,9	7,2	8,1	1,5	2,4	3,66	3,85	1322	1652,8	218,4	197,8

Table 4. *Monitoring of basic soil parameters from the upper and lower third of the slopes on the examined arable land, Galgaheviz, Hungary (2004 and 2006)*
UTS=Upper Slope Terrace, LTS=Lower Slope Terrace, SOM = Soil Organic Matter, AL = ammonium-lactate

120-140 cm it is low (392 mg*kg^{-1}) but is rising again until a depth of 180-200cm (1012 mg*kg^{-1}). At the deepest layer it is 895 mg.kg^{-1}. These values are very high.

AL-P_2O_5 values are high on Site 1, too. The amount of AL-P_2O_5 remains above 1900 mg*kg^{-1} until a depth of 180-200 cm. It is obvious that we reached the parent material because the amount of AL-P_2O_5 drops from 502 to 182 mg*kg^{-1}.

Farmers should start mining this soil and spread it as fertilizer but would not need to use phosphorus fertilizer in the following years. On the other hand, if the sediment reaches the river this high phosphorus load might cause serious damage in nearby meadows. The distribution of AL-K_2O is almost even.

The other good indicator of former heavy fertilizing is the amount of NO_3-N. On Site 1 the amount of NO_3-N often exceeds 6 mg*kg^{-1}, reaching 10 mg*kg^{-1}. On Site 2 the amount is even higher, often exceeding 10 mg*kg^{-1} and reaching 24 mg*kg^{-1}.

Results of erosion modelling

As indicated in the title of our research, we were dealing with soil loss. We calculated the soil loss with the USLE model.

~~1.~~ In the present simulation we used the following R factor: 670 MJ * mm * ha^{-1} * h^{-1} * y^{-1}.

2. The K value of the chernozem brown forest soil was 0.0162 t*ha*h*ha^{-1}*MJ^{-1}*mm^{1}.

3. We used an average slope gradient (12%) and length (100 m). The LS value was calculated by the RUSLE model's manual because USLE does not take rill and interrill erosion into account. RUSLE does. We used Table 4-2. from the RUSLE manual that showed a value of 3.81 for a 12% slope that is about 130 m long and there is a moderate rate of rill and interrill erosion.

4. C factor was calculated by the surface cover, dominated by cereals and corn/sunflower, so the average value used was 0.25.

5. The tillage practice was both up and down the slope so it was constant = 1.

According to the calculations the average soil loss per year is 10.34 t*h^{-1}*y^{-1}. This means that the sedimentation area (10 m by 100 m = 0.1 ha) was built up from this material on our sample slope. The calculated 10.34 t*h^{-1}*y^{-1} soil loss was deposited on this 0.1 ha area. This means a 0.66 mm.h^{-1}.y^{-1}, that is, 6.6 mm/0.1 ha upload. If the original soil profile was 80 cm deep and is now covered by 220 cm of sediment, then 333 years of erosion had to occur to build this amount of sediment (220 cm).

Since there has not been arable (and not so intensive as in the last 50 years) farming in the last 333 years, the rate of erosion must had been two or three fold, the opposite of that calculated with the model. The reason for the low calculated soil loss figure can be a result of the low calculated C factor (so there should have been more plants with low erosion protection value) or the local rainfall intensities were much higher than calculated by the small scale erosion map.

Monitoring of soil parameters

We collected samples from the upper and

lower slope terraces to see the difference in the basic soil parameters. Our hypothesis was that in the lower terraces of the slope there should be more AL-P_2O_5 and more AL-K_2O as was the case in many other sites. In this case, on Site 1 we found that the results were the opposite, proving our basic assumption that the area suffered from heavy fertilization. With this amount of accumulation where there is a large quantity of fertilizer at deeper layers, up to 300 cm, it is obvious that greater amounts of fertilizer on the upper terraces of the slope can only mean more fertilizing on that part of the slope.

The $CaCO_3$ content of the different parts of the slope, however, proves the presence of erosion. It is higher on the upper terraces. The reason for this is that the parent material has a high $CaCO_3$ content and as it gets closer to the surface by erosion and tillage, more $CaCO_3$ can reach the upper horizon.

After two years, we repeated the measurements but the pattern did not change. We found changes only in the case of phosphorous. It is clear that the amount of AL-P_2O_5 is not decreasing (from 1523 to 819 in a two year period) because of the severe erosion. There must be another reason.

We have other sites where we have measured these basic soil parameters. In the case of abandoned arable land where no fertilizer is used, the soil has very low amounts of phosphorous. The general result is that there is a higher amount of P_2O_5 and K_2O at the bottom of the slopes. In the present study, on Sites 1 and 2 there is heavy fertilizing that causes the higher amount of fertilizers on the upper slope terraces.

It is important to monitor the effects of fertilizing, the effects of land abandonment and effect of vegetation re-growth on arable lands. It is important for our future to find out how soil reacts to these changes and how fast it can regenerate!

Conclusions

We found a layer, more than 200 cm thick, with high soil organic matter content at the bottom of the slope. It proved the high erosion rate. Basic soil chemical parameters proved that the origin of the sediment is the arable land above the accumulation zone since it included high amounts of fertilizer, not present in the parent material.

Acknowledgements

We are thankful to the Institute of Physical Geography, Hungarian Academy of Sciences (HAS) for the measurements of the particle size distribution and to the Department of Agrochemistry and Soil Science, Szent Istvan University, for soil analyses.

References

Centeri Cs. 2002. A talajerodálhatóság terepi mérése és hatása a talajvédő vetésforgó kiválasztására. *Növénytermelés*. 51(2): 211-222.

FOMI archive 1989. M = 1:10000 scale map, Nr.66 – 121 (Institute of Geodesy, Cartography and Remote Sensing).

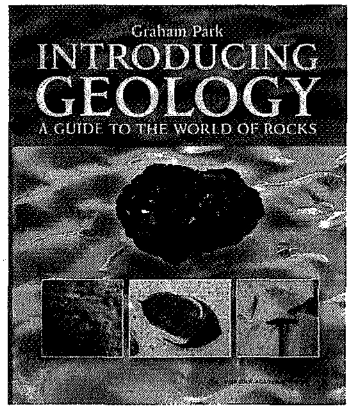
Penksza K., Barczi A., Néráth M., Pintér B. 2003. Hasznosítási változások következtében kialakult regenerációs esélyek a Tihanyi-félsziget gyepeiben az 1994 és 2002 közötti időszakban. *Növénytermelés* 52: 167-184.

Vona, M., Falusi E. 2005. Examination of the soil-plant relations on the Galgahévíz peaty meadow; effects of nature conservation measures on the vegetation. *Transport of Water, Chemicals and Energy in the Soilplant-Atmosphere System* pp 580-588.

Wischmeier, W. H., Smith, D. D. 1978. Predicting rainfall erosion losses. *USDA Agriculture Handbook* 537, p 58.

Introducing Geology: Welcome to the World of Rocks

Book Review by David Harper[1]



Introducing Geology. A guide to the World of Rocks
by Graham Park

Published by Dunedin Academic Press
Soft bound, ISBN: 1-903765-64-7
Date: 2006, 134 pages
Prices: £9.99 (€15)

Forty-five years ago, Derek Ager published his version of 'Introducing Geology'. It was a delightful romp through the world of geology and geologists and encouraged many generations to take out their hammers and hand lenses and crack open and examine the Earth's crust. Geology is now quite different. We have experienced the 'plate tectonic' revolution and there has been a strong move from specimen-based research to more process-based programmes. These trends are reflected in Graham Park's Introducing Geology, a splendidly illustrated paperback that has a wealth of information for all of us curious about the Earth and its history. The first few chapters have taken some of the traditional areas of geology, minerals and the main rocks types, and revamped them. We have chapters on 'crystals, minerals and gemstones', 'volcanoes and melted rocks', 'shaping the land' and 'mud, sands and other deposits'. Having set the scene with the basics about igneous and sedimentary rocks, we move onto plate tectonic processes, earthquakes and faults and the deformation of rocks. Geological time and the age of Earth chapter discusses the concepts of deep time and stratigraphy, paving the way for the next chapter on fossils and the history of life. Another chapter introduces 'geology and industry' and the final chapter 'turning the pages –Earth history' is synthetic, taking us through the early history of the Earth to the present by way of a clear set of palaeogeographic maps. Throughout the book, processes are emphasized, from the magmatic processes that built volcanoes, the tectonic processes that built mountains and generated earthquakes to the biological processes that drive organic evolution.

Introducing Geology is a graphic description of the Earth, its composition, structure and history. Although much has been compressed into 130 or so pages, the book is lucidly written and not overly dense with information. The illustrations are well-produced and carefully chosen. The book concludes with a useful glossary of terms, referred to the relevant pages and figures in the text. Yes, Geology has changed in forty-five years but it is still very much the study of the 'World of Rocks'.

[1]EurGeol. David Harper is Professor of Palaeontology and Deputy Head of Geology, Natural History Museum of Denmark, University of Copenhagen

Edinburgh 450-300 million years BC: The foundations of a capital city

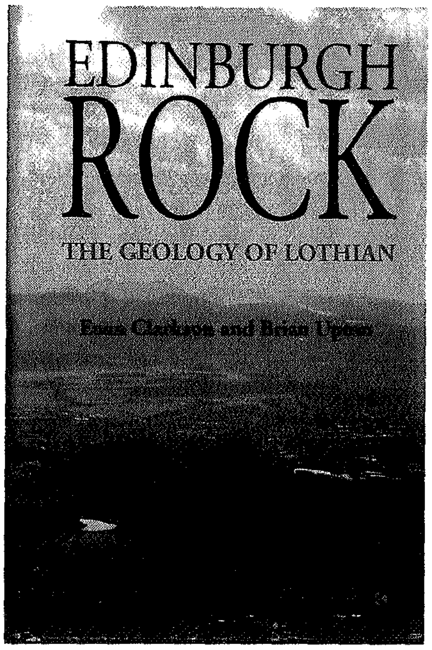
Book Review by David Harper[1]

Edinburgh Rock: The geology of Lothian
by Euan Clarkson and Brian Upton

Published by Dunedin Academic Press
Hardbound, ISBN: 1-903765-39-0
Date: 2006, 239 pages
Prices: £17.95 (€26.5)

Scotland's majestic capital city, Edinburgh, often described as the Athens of the North, has long been known as a centre for the arts and culture. It has, however, a very special place in the history of geological thought; events in the city during the late 1700s helped develop the basis of modern geology. Three key ingredients combined: The genius of James Hutton, the rich intellectual environment of the 'Scottish Enlightenment' and of course the diverse geology of Edinburgh and its environs. A number of key localities in the region such as the unconformity at Siccar Point and Carboniferous sill of the Salisbury Crags helped Hutton develop such diverse concepts as deep time and the plutonic nature of igneous rocks. The area in and around Edinburgh has a remarkably varied geology, beautifully exposed and easily accessible. Euan Clarkson and Brian Upton, two of Britain's most experienced and knowledgeable geologists, take us on a fantastic voyage through geological time in and around the city itself. In some 240 pages with over a hundred excellent illustrations, we start with a brief introduction to the rocks and structure of the Edinburgh district, a beautifully illustrated chapter on Palaeozoic plant and vertebrate life and then we jump to the oldest rocks in the region, the Ordovician-Silurian strata of the Southern Uplands and the richly fossiliferous Silurian rocks of the Pentland Hills. A selection of important fossils is illustrated and some are combined in a rather eerie seascape, quite different from the seafloors we have today. The sediments and volcanics of the Old Red Sandstone continent are charted and the later Palaeozoic environments, dominated by lagoons and volcanoes, graphically illustrated. Volcanic activity was sporadic and spectacular, forming key features such as Arthur's Seat and Castle Rock, while many rather special environments were home to many strange creatures. The conodont animal, discovered first in Scotland by the senior author, occurred together with an incredible variety of shrimps in the rocks at Granton, forming part of Scotland's Carboniferous Lake District; a little later at East Kirkton, some remarkable limestones have yielded giant water scorpions, early amphibians and 'Lizzie the Lizard'. The succeeding coal-swamp forests of the late Carboniferous hosted the giant and scary millipede *Arthropleurella,* attaining a length of some two metres, associated with gigantic clubmosses. There is not much evidence of Mesozoic and Cenozoic deposition in the region until the landscape was sculpted by the Pleistocene ice ages, providing a rich tapestry of geomorphological features.

This book tells the story of an important part of the Earth's crust through some 450 million years of geological time. The quality of production is high with clear illustrations ranging from maps, field and fossil photographs to the splendidly evocative land and seascapes of the past. The authors have combined to produce a lively and readable text based on astute field observations by themselves and others. It has a comprehensive list of figures, an index of both place names and geologists and a useful selected bibliography guiding the reader to the main field guides for the geology of the region.



[1]EurGeol. David Harper is Professor of Palaeontology and Deputy Head of Geology, Natural History Museum of Denmark, University of Copenhagen

News and events 2006 - 2007

News from Ireland

SGA Meeting
Dublin, 18 – 24 August 2007
Session: Resource Estimation – Classification Systems

Background
The Irish Association for Economic Geology (IAEG) has been selected by the SGA to host its 9th biennial meeting in Dublin between August 18th and 24th 2007. The Local Organizing Committee, supported by SGA Councilors, are preparing a programme for the meeting which will make the Dublin meeting the place to be in 2007 for researchers, industry personnel, and minerals geologists in general.

The Committee is preparing a meeting that will include technical sessions, a technical discussion forum, poster sessions, workshops or short courses, field trips, exhibition and social events. It is proposed to devote one of the sessions to the issue of mineral resource - reserve estimation and classification systems. Further details on the Conference and associated events can be found at the Conference website:

www.cpregistrations.com/sga2007

Proposed Agenda
1.Workshop on Resource – Reserve Reporting.
A Workshop on mineral resource - reserve reporting in the international sphere is being considered for the Saturday August 18, depending on the level of interest. The Workshop would have the following agenda:

-Reporting Regulations and Guidelines:
London – AIM
Canada – NI43-101
Australia – JORC/ASX
South Africa – SAMREC
USA - SEC

-The role of the Committee for Mineral Reserves International Reporting Standards ("CRIRSCO"), the Pan-European Reporting Committee ("PERC") and the other National Reporting Organizations
The Reporting Code
The Competent Person
Resource Financing Implications

2.Technical Session
Resource and reserve estimates are heavily reliant on geological interpretation and imprecisely understood geological controls. Unfortunately, we are all too well aware of cases where poorly interpreted geological models and/or poor communication between professionals – geologists, geostatisticians, mining and mineral processing engineers – have resulted in projects under-performing or even being financial and/or technical failures. In reviewing cases of both under-performance and failure, it is considered that three distinct reasons can be identified. These are:

-Failure to make grade – generally due to imperfect geological interpretation and resource estimation

-Failure to achieve designed tonnage throughput – generally due to imperfect understanding of the orebody characterization and shape

-Failure to achieve recovery – generally due to unidentified mineralogical problems

At this conference, which deals with applied geology, it is proposed that the emphasis should be on the importance of geology in the estimation process. The Conference organizers therefore invite practitioners to present case studies which highlight the importance of, for example:

-Data acquisition, recording and storage
-Analytical data – biases, problems and pitfalls
-Deposit characterization - grade, metallurgical, mineralogical, geotechnical, geochemical, environmental, and hydrological
-Geological Interpretation – The Three G's

Geological Contacts
Geometallurgical Contacts
Grade Cut-off Contacts

Submission of papers
Presenters are invited to check the Conference Website for details of the templates to follow in the preparation of abstracts and papers.

Registration is now available on line at:
http://www.cpregistrations.com/sga2007/

Looking forward to seeing you in Dublin.

John A Clifford and Gordon Riddler
Technical Session Conveners.

News from EFG

EuroGeoNews, electronic newsletter: contact Dr. Isabel FERNANDEZ FUENTES, Director of the Brussels Office, *efgbrussels@gmail.com*
European Magazine, hard copy journal of the Federation, contact: Maureen McCORRY, *Harper-mccorry@tele2adsl.dk*
Web page: *www.eurogeologists.de*
Contact: Dr. Detlev DOHERR, *ddoherr@fh-offenburg.de*

Submission of articles to European Geologist Magazine

The EFG calls for quality articles for future issues of European Geologist. Submissions should be in English and between 1000 and 3000 words, although longer articles may be considered. An abstract of between 100 and 120 words should be included in English, French and Spanish. Articles should be sent via e-mail to the Editor at Harper-mccorry@tele2adsl.dk or on disc to Vordingborgvej 63, 4600 Køge, Denmark. Photographs or graphics are very welcome and should be sent to the Editor as tif or jpg files in CYMG colour. Further details may be found on the EFG website: www.eurogeologists.de

Deadline for submission 30 March and 30 September.

Advertisements

Contact:

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European Federation of Geologists (EFG)

The European Federation of Geologists was established in Paris in 1980 during the 26th International Congress of Geology. In the same year the Statutes were presented to the European Economic Community in Brussels.

The Council of the EFG is composed of the representatives of the national associations of geologists of Belgium-Luxembourg (UBLG), Czech Republic (CAEG), Finland (YKL), France (UFG), Germany (BDG), Hungary (MFT), Iceland (GSI), Ireland (IGI), Italy (CNG and ANGI), Netherlands (KNGMG), Poland (PTG), Portugal (APG), Slovakia (SGS), Slovenia (SGD), Spain (ICOG), Sweden (N), Switzerland (CHGEOL), United Kingdom (GS), whilst the American Institute of Professional Geologists (AIPG) is an Associate Member. The EFG currently represents about 40,000 geologists across Europe.

Mission

To promote the profession and practice of geology and its relevance.

Objectives

1. To promote and facilitate the establishment and implementation of national arrangements for recognizing geologists who, through academic training and appropriate periods of relevant experience in the profession and practice of geology, are qualified to be designated as EurGeol.
2. To organize meetings and conferences to discuss issues related to the profession and practice of geology.
3. To co-ordinate the activities of member national organisations in preparing briefing papers on geological issues and presenting these to European bodies, national governments and other relevant organisations.
4. To maintain contact with the European Commission and respond in timely manner to requests for information.
5. To communicate, through meetings and other means, the relevance of geology to the resolution of issues of concern to society.
6. To promote the establishment of best practice for training of geologists.
7. To safeguard and promote the present and future interests of the geological profession in Europe, including:

- to guarantee the free movement of geologists in Europe, with the mutual recognition of their academic and professional qualifications by the adoption of the title of European Geologist (EurGeol.).
- to promote the harmonisation of education and training.
- to define and protect the title of geologist and related professional titles.
- to promote the code of professional ethics of the EFG.
- to provide advice and assistance to constituent member National Associations.