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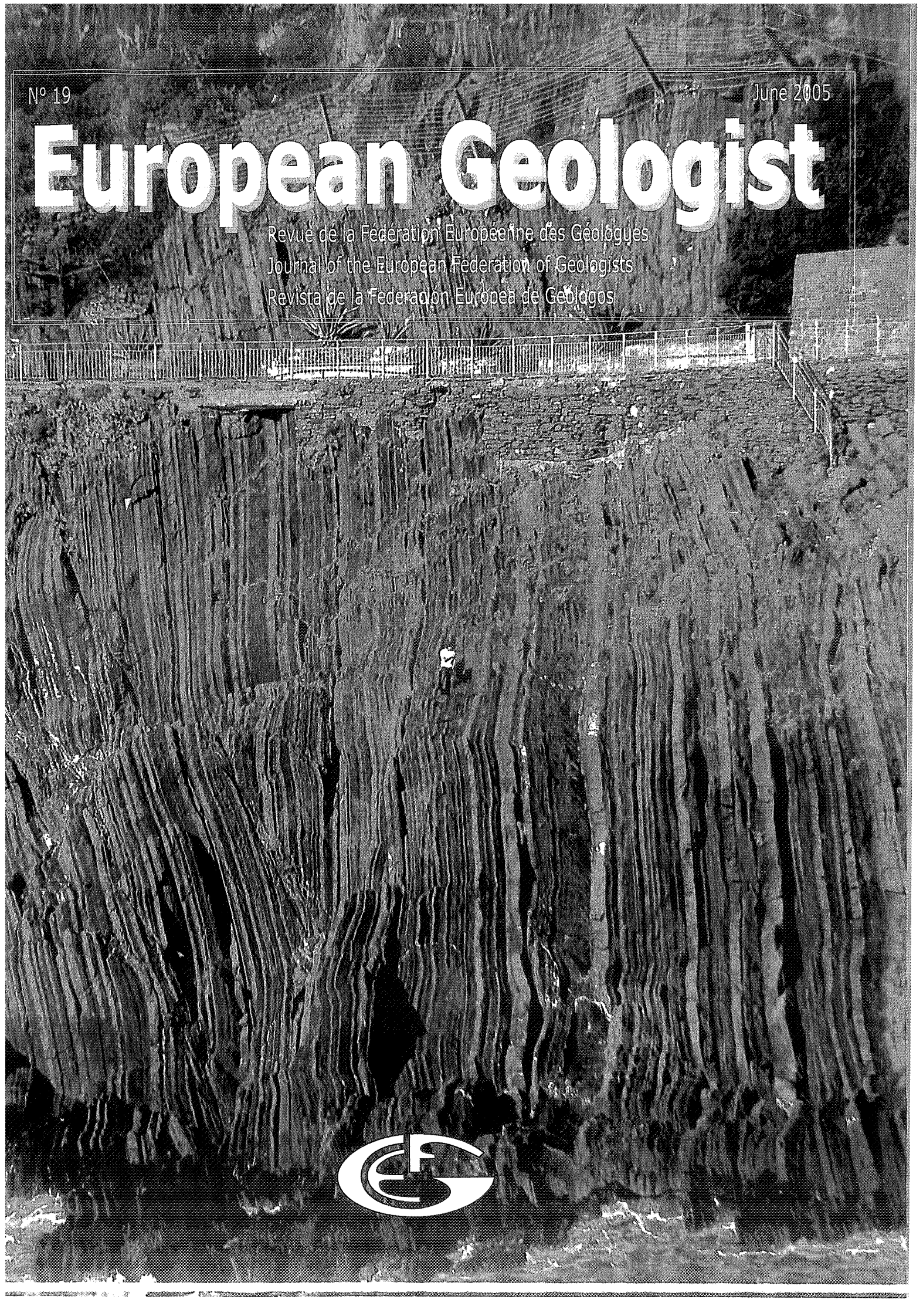

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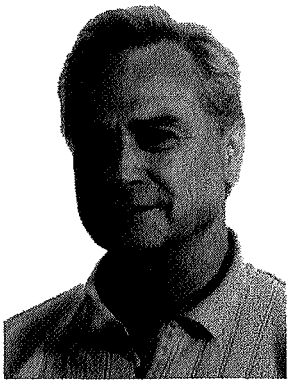
Foreword

Silence is not golden

by Christer Åkerman, President



Some proverbs, however expressive and striking they were when they once were created, are not appropriate or are even wrong today. Times are changing. Society has developed, values have altered, and language has developed. The proverb "speech is silver, silence is golden" may be applied to someone who does not speak unnecessarily, and particularly not if he is not one hundred percent sure of his ground. And certainly there have always existed chatterboxes, giving rise to expressions like "those that talk most, know least".

Although it varies from country to country, I think in general geologists are too silent. It seems there is still a culture favouring silence, partly because the typical earth scientist is not very talkative – he loves his work and his mind is occupied by his fascinating science, and there is always something that one is not sure of. After all, geoscience does involve interpretations, and who wants to have one's name in the newspaper or be seen on television saying something that is found to be questionable or wrong, even if it is caused by misinterpretations by journalists. What would your geologist colleagues say – wouldn't they regard you as a not-so-serious scientist?

But today we cannot afford to be silent. It is no longer a merit. I am reminded of this over and over again. Shortly after the strong earthquake off the coast of Sumatra and the following disastrous tsunami in the Indian Ocean I was asked by economists, lawyers and others in Sweden why geologists are so silent. Swedish newspapers, radio and television were full of daily reports and documentaries, treating different aspects of the natural hazard and the successively increasing number of victims. There were lots of explanations by hard-pressed politicians and decision-makers demonstrating a complete lack of knowledge of such phenomena and understanding of what to do. There were many stories by affected people and rescue teams, and crisis groups were created involving psychologists, doctors, priests and others. But there was almost no sign of geologists. There were sketch drawings in newspapers and on web sites explaining the nature of tsunamis, but I doubt they could be understood by ordinary people – and they appeared after the event. At a lecture by a travel organizer's information manager, a bright woman who was paid a great deal of attention by the media, I asked if it would not be a good idea to provide tourists with some information about natural hazards that might occur at their destination. A video could be shown on the 'plane, leaflets or live information could be distributed on the bus between the airport and the hotel or at an information meeting at the hotel, explaining in a way easy to read, what to observe, how to identify and what to do in case of natural hazards. The information manager answered very quickly and firmly that such arrangements would be too expensive.

This demonstrates several things. It demonstrates that geology and the application of geological phenomena are still unknown to the majority. It demonstrates that if geologists don't speak up other groups of people will just jump in and occupy our area of knowledge, and they can do that because society does not have the knowledge to distinguish true professional geologists from people having a smattering of geology. It demonstrates that it is our duty to speak up and inform society in order to save lives and money, and to promote a sustainable development for society. Nobody will invite us, we have to invite ourselves. Geologists should and must get much more involved in public debate, because it is our responsibility to share with society our expert knowledge concerning natural resources, climate records and so on, and not least civil protection and natural hazards.

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Although the articles in this Magazine are subjected to scientific editing, they are not peer-reviewed.

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Cover photograph
Cinque Terra National Park, N. Italy. The Amore Walk is an ancient track dug into the flysch rock. Here it links the two villages of Riomaggiore and Manarola
(Photo: Walter Bilotta)

Photograph, this page
Strong pressures create fantastic landscapes in Cinque Terra National Park (Photo: Walter Bilotta)

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Professional mobility in the EFG office

by Ana Pazos[1], Alberto Izquierdo[2] and Isabel Fernandez[3]

The European Federation of Geologists' Brussels Office has welcomed the possibility of contributing directly to the mobility of professionals in Geology in Europe. Young geologists benefit from a European dimension to their curriculums and future careers, while at the same time opening their minds as Europeans to new experiences personally and professionally. At the same time, the work of the EFG office has been reinforced thanks to two highly motivated and flexible recent geology graduates. This has permitted the EFG office to expand into new areas of work, promoting the interests of geologists in Europe. With this increase in staff the EFG office has been able to achieve such ambitious objectives as supporting EFG Groups of Experts in commenting on and reviewing the EU Development Policy and establishing links with Hydrogeology.

La Fédération Européenne de Géologues (FEG) a bien accueilli la possibilité de contribuer directement a la mobilité des professionnels de la géologie en Europe. Le bénéfice des jeunes géologues dans une dimension européenne, se base sur l'amélioration de leur curriculum et de leur future carrière professionnelle et, en même temps, acquérir expérience personnelle et professionnelle comment citoyens européens. Le travail au bureau de la FEG a été renforcé grâce à l'aide de deux géologues très motivés et flexibles qui ont permis de réaliser des nouveaux travaux pour défendre les intérêts des géologues en Europe. Sans cette augmentation du personnel du bureau la FEG n'aurait pas pu atteindre ses ambitieux objectifs, comment l'aide aux groupes d'experts à travers d'un Assistant ; ou la révision de la Politique de Développement et ses liens avec l'hydrogéologie.

La FEG colabora directamente a la movilidad de los profesionales de la geología en Europa mediante la acogida de jóvenes geólogos en su oficina de Bruselas. La experiencia profesional adquirida en este contexto, contribuye a la dimensión europea del desarrollo curricular y profesional de estos jóvenes, así como, a adquirir experiencias profesionales y personales como ciudadanos europeos. A su vez, la oficina de la FEG ha sido reforzada gracias a la incorporación de dos geólogos con motivación y dinamismo. Esto ha permitido a la oficina adentrase en nuevas áreas de trabajo, con el objetivo de defender los intereses de los geólogos a escala Europea. Sin este apoyo la oficina de la FEG, no hubiera podido alcanzar objetivos, como la asistencia a los Grupos de Expertos y revisar la Política de Desarrollo y sus relaciones con la Hidrogeología.

During 2004-2005, two recent geology graduates from Spain joined the EFG Office staff in Brussels. Both were funded through the European Project: ARGO. This grant is developed within the framework of the Leonardo da Vinci European Mobility Programme, and is open to graduates of any Spanish university (public or private). The Argo Project is financed by the Spanish Ministry for Education, Culture and Sport and by the European Union Leonardo da Vinci Programme; it is coordinated by the General Foundation of the University of Salamanca.

The ARGO project offers 800 six-month training placements in European companies and provides on-line management to enable users to follow up programme developments and to facilitate access to programme services and automatic processing, independent of the user's location.
http://www.becasargo.net/empresas/en/

On the one hand, this grant helps young professionals to learn about the EFG organization, its structure, members, and objectives, as well as the activities developed since it was established. On the other hand, it develops a greater understanding of European Institutions and European Policies concerning geological issues, as well as the relationships established between these Institutions and the EFG organization.

Supporting EFG Groups of Experts

The training activity started in February 2004 and continued till February 2005, with the aim of improving support and information for the Groups of Experts, established by the EFG in 2003. These groups include geologists from all over Europe who have expertise in one or several geological and environmental specialities. These groups advise and support European Institutions in the development of European Policies.

During the training period, the Groups of Experts' Assistant supported the 13 groups of experts by; administering their databases; working with the expert group co-ordinators in promoting the expert group concept; encouraging new experts to participate; attending meetings and conferences and reporting back to the EFG; assisting the expert groups to arrange meetings to plan future activities; and keeping members of the expert groups informed about:

- New European legislation and documentation, as well as modifications made in the existing policies;
- Events, conferences and meetings that could impact on the activities of the expert groups as well as provide contact with other groups that work with similar objectives and projects.
- Consultations, Call for Proposals, new projects and questionnaires, launched by the European Commission with the objective to prepare new

[1]Assistant EFG Groups of Experts
[2]Assistant Development Policy /Hydrogeology
[3]Director EFG Office

Trainees Alberto Izquierdo and Ana Pazos, to left and right, with Office Director Isabel Fernandez, centre in the Brussels office

communications or to modify the existing legislation.

Each group has a coordinator who is responsible for ensuring that the Group of Experts operates in accordance with the brief established by the EFG Board and Council; that the deliverables are achieved; and that all National Associations are kept informed of the actions and documents prepared. Each Coordinator regularly updates the Groups of Experts' Assistant and communicates the needs of each Panel of Experts. The EFG office, and the Panels of Experts' coordinators, report to EFG Board and Council during the EFG annual meetings.

Due to the participation of geologists from the majority of European Countries, most of the work is done by e-mail, but this year, some of the groups, with support from the Groups of Experts Assistant, like the PE on Natural Hazards or the PE on Engineering Geology in Europe, arranged their first meeting in London, before the International Professional Geology Conference.

These groups of Experts present common positions to the European Commission and the European Parliament, contribute to the setting and implementation of policies with relevance to the geosciences in Europe. These tasks are achieved in three ways:

- Experts present a common position directly, by preparing Advice Documents, Position Papers or European Manifestos, which emphasize the relevance of geology to policy-makers. During this training period, two European Manifestos were presented by different Panels of Experts (see this issue):
- Responding to questionnaires launched by the European Commission in relation to a specific Communication for a new Directive. During the past year, several questionnaires and consultations were responded to, including the Questionnaire on a Thematic Strategy for Soil Protection, the consultation on Future Action on Global Climate Change Regime Post-2012, and consultation on Decoupling and Development of Resource Productivity Indicators.
- Applying for support for specific projects, such as the application by the Panel of Experts on Continuing Professional Development for funding a Life-long Learning Pilot Project through the EC Leonardo Programme; or the PE on Network Thematic in Geology, which applied last year for an Erasmus Network Project.

The development of the related work by the trainees has been a positive experience, allowing them to acquire expertise and knowledge, and improve their personal Continuing Professional Development process.

Development Policy – Hydrogeology

This training activity began in September 2004, with the principal objective to review the European Union Water Management in Development Countries Policy, so as to identify issues of interest for geologists.

This European Development Fund policy ("EDF"), is designed to assist in the optimum management of water resources in developing countries, as a means of achieving the main development goals laid down in the Treaty establishing the European Community. These are:

- Poverty reduction.
- Sustainable economic and social development.
- Integration of developing countries into the global economy.

This policy confronts the challenge of providing water and sanitation to all developing countries now and in the future, particularly in the ACP countries (Africa, Caribbean and Pacific). It is complementary to The Millennium Project, commissioned by the United Nations, to reduce by half, by 2015, the proportion of people without sustainable access to safe drinking water and sanitation.

The principal work was to track the Development Policy and the modalities to create a water fund for the ACP countries. The first step was a review of the policy history from the time of the Communication from the Commission to the Council and to the European Parliament on the future development of the EU Water Initiative and the modalities for the establishment of a Water Facility for ACP countries.(COM/2004/0043). As a result of this review, the EFG has prepared a draft report on the evolution of the development policy.

With this document, the EFG is now stressing to the European Commission the importance of geology/hydrogeology in the Technical Assistance necessary to achieve the objectives of the Communication. In the ACP countries, the Integrated Water Resources Management, groundwater and hydrogeology are considered the principal keys. Geologists in this area, hydrogeology specifically, can contribute their knowledge to evaluation of the groundwater resources, used resources capacity, ground-water protection and environmental protection. To reinforce this policy, a new Panel of Experts Group, Hydrogeology-Development Policy, was established, with specialists from various European countries.

Another activity is to identify projects in European Institutions, and bring them to

the attention of the Panel of Experts. This information has been useful to the NGO Geologos Del Mundo, with the result that they have presented two project proposals - one to the European Commission - Europe Aid, and the other under the first Water Facility for ACP countries.

The EFG is now proposing to nominate three members of the Panel of Experts to join the Working Groups of the EU Water Initiative. The EU launched a Water Initiative (EUWI) designed to contribute to the achievement of the Millennium Development Goals (MDGs) and, the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002, targeting the need for drinking water and sanitation, within the context of an integrated approach to water resources management. The EUWI is conceived as a catalyst and a foundation on which future action can be built to contribute to meeting the water and sanitation MDGs.

Within the DG Environment, the Commission proposed the Groundwater Directive on the protection of groundwater against pollution. The Commission proposed specific measures to prevent and control groundwater pollution by defining common criteria on chemical parameters and on quality trends. During the European Parliament procedure, the EFG presented comment to the amendments on the referred procedure.

The Commission is creating Groups of Experts to support this directive. The Groundwater Working Group is part of the Common Implementation Strategy. It aims both to clarify groundwater issues, and prepare the development of technical guidance documents in the light of the orientations given by the future Groundwater Directive upon its adoption. The EFG is working to nominate experts to this Working Group, and has also advised in the process of amendments.

Conclusions

The work developed was very interesting because of the existing international atmosphere in the EFG organization. This helped the trainees to have a wider view of the profession of geology in Europe, to know more about how the European institutions work, and how scientists and technical professionals advise the European Commission and the European Parliament to improve existing policies.

The trainees are grateful for the support and friendship received from the EFG Board and especially from the EFG Office Director, EurGeol. Dr. Isabel Fernandez-Fuentes.

The EFG Office would like to encourage graduates in Geology from all over Europe to look for information on the existing Leonardo da Vinci European Mobility Programme in their countries, and to come to Brussels and learn more about geology, European legislation and languages, apart from the great personal experience that you could have.

We encourage National Associations of geologists to participate in these mobility projects to use the possibility of receiving motivated young professionals from other European countries.

http://europa.eu.int/comm/education/programmes/leonardo/new/leonardo2/nalist2_en.html

Research funding opportunity for European geologists

SYNTHESYS — SYNTHESIS OF SYSTEMATIC RESOURCES

Europe's foremost natural history institutions invite scientists based in European Member and Associated States to visit and access their collections and analytical facilities[1]. This visiting researcher programme is of high relevance to geologists. Geological collections are accessible at many of the 20 partner institutions via 11 national Taxonomic Access Facilities (TAFs). The TAFs also provide training and supervision on a wide range of analytical techniques. Some partners offer access to state-of-the-art equipment and associated internationally renowned expertise to perform research within the fields of mineralogy and isotope geology. At SE-TAF (Swedish Museum of Natural History, Stockholm), the instrumentation includes among others a high-resolution ion microprobe for in-situ isotope and trace-element microanalysis, TIMS and ICP-mass spectrometers ([illegible]), as well as gas-flow furnaces and ^{57}Fe Mössbauer and FTIR spectrometers ([illegible]). At GB-TAF (The Natural History Museum, London) researchers have access to a wide range of analytical, imaging and X-Ray instrumentation to facilitate geological and environmental studies within Europe, please see following web-site for a list of equipment [illegible]

The SYNTHESYS visiting researcher programme covers costs for research and accommodation whilst based at the institution, plus international travel costs, and offers a per diem to contribute towards living costs during short visits (maximum of 60 working days) at one or more TAF.

Please visit www.synthesys.info for full details on how to apply for funding including a list of all SYNTHESYS partners and their facilities, applicant eligibility criteria and the application form.

The next deadline will be Friday 16 September 2005.

Further calls will be arranged at approximately 6-month intervals until 2008.

SYNTHESYS is a five-year, EU-funded Integrated Infrastructure Initiative within the Infrastructures Programme of FP VI.

[1] Together with networking activities the project aims to create an integrated European infrastructure for researchers in the natural sciences

European Manifesto

on

Earth Heritage and Geodiversity

Earth heritage for our present and our future
Geodiversity links the Earth, its people and their culture. It forms the basis of the European society. Earth heritage including landscapes, landforms, rocks, sediments, soils, minerals, fossils and waters, is an essential part of Europe's natural heritage. A geological, geomorphological and soil heritage that needs to be safe-guarded for present and future generations.

Europe has outstanding examples of earth heritage and geodiversity
Mount Etna of Italy, the Giant's Causeway of Northern Ireland, the Dorset Coast of the United Kingdom, the maar lakes of the German Eifel, the Wadden from The Netherlands to Denmark, the caves of Slovenia, the Troodos Massif of Cyprus, the Curonian Spit of Lithuania and Russia, the High Coast of Sweden, the Finnish Kvarken Archipelago, the Baltic Klint, the glaciers and fjords of Norway, the Alps and the volcanoes and geysers of Iceland are but a few examples of Europe's rich earth heritage.

Earth heritage and geodiversity create opportunities for education, recreation and tourism...
Geological landscapes and sites, by themselves or in combination with their cultural, historical and ecological heritage, offer potential for sustainable tourism, education and landscape appreciation. European Geoparks are examples of the sustainable economic use of this resource.

... and increase the quality of life in rural areas and cities
Landforms, patterns and earth heritage sites contribute to the character of rural areas and cities, and help create a living space and environment of high quality.

The task of the EU: "safeguarding by development, safeguarding by protection"
The EU should incorporate Earth Heritage and Geodiversity in policy, planning and related procedures. Unique earth heritage sites and landscapes should be given protected status. Sustainable development and restoration should respect and reflect the natural patterns and processes: the geology, the geomorphology and the soils.

The EU soil strategy is the instrument to realize these goals!

• EFG	European Federation of Geologists
• EGN	European Geoparks Network
• IAG	International Association of Geomorphology
• ECSSS	European Confederation of Soil Science Societies
• EUCC	European Union of Coastal Conservation
• GEOSEE Task Force	a joint Geoheritage initiative of UNESCO, IUGS and IGU
• IUGS	International Union of Geological Sciences
• Eurosite	European Platform of Nature Management organizations
• IGU	International Geographical Union
• Wadden Sea Team	Environmental organizations along the Wadden Sea Coast
• IUSS	International Union of Soil Sciences

• and many national European organizations for Geoheritage

With reference to Recommendation Rec (2004) 3 of the Council of Europe on conservation of the geological heritage and areas of special geological interest *(Adopted by the Committee of Ministers on May 2004).*

The EU manifesto on Earth Heritage and Geodiversity

by Hanneke van den Ancker

On 18 November 2004 the EU Manifesto on Earth Heritage and Geodiversity was presented to Catherine Day, the DG Environment of the European Commission, and Marjan Sint, the DG Environment of the Dutch Ministry for the Environment VROM. The Manifesto was handed over on behalf of the Working Group on Geoheritage of the European Federation of Geologists. While presenting the Manifesto we were supported by Albert Oost of the European Federation of Geologists, Prof. Winfried Blum, president of the European Federation of Soil Sciences, Prof. Stephen Northcliff, president of the International Union of Soil Sciences and Prof. Pieter Dirk Jungerius, on behalf of the International Geographical Union. The event took place at the "Joint Conference of the Dutch EU Presidency and the European Commission for the Environment", organized to discuss the position and progress of the EU Soil Strategy. The EU Soil Strategy intends to be a framework directive.

For further support of the EU Manifesto, three Dutch student organizations in earth sciences presented a short film showing five characteristic Dutch landscapes and the threats to them. It was a lively interlude that was followed with great interest by the congress members.

In the short speech before handing over the Manifesto, we stressed the concept of soil as part of a system, a product of climate, geology, topography, vegetation and landuse. Looking at the soil as a system has its roots in the Russian school of Soil Science of the 19th century. From this perspective, including geoheritage and geodiversity in the Soil Strategy is a minor step. This broad view on soil was also adopted by our Dutch Ministry for the Environment VROM in their soil protection policy launched in the 1980s. As a consequence of the gigantic soil pollution problems, up to now only these aspects have received full attention.

The idea for the European Manifesto arose through Chrit Schouten, the president of the Dutch geomorphological organization KTFG in spring 2004. It was inspired by the success met by the Dutch Earth Heritage Manifesto, issued the year before. The idea was discussed with several organizations during the 32nd IGC congress in Florence last August. A draft text was composed in cooperation with Patrick McKeever of the European Geoparks Network. Surprisingly, almost all organizations of geologists, geomorphologists, soil scientists and nature organizations, who usually quarrel about details, spontaneously gave support, with little argument about the wording of the manifesto.

We used the word *Earth Heritage*, because for the subscribers of the Manifesto it is an acceptable and neutral term including geology, geomorphology, soils and related processes. *Geodiversity* stresses the system concept, the fact that we not only ask for protection of spectacular and scientific sites but also for the use of geo-values in planning at the rural as well as the urban level and in developing a sustainable landuse.

Earth Heritage and Geodiversity have economical, ecological, social as well as quality aspects, apart from having scientific value. They add quality to our landscapes and living environments and create possibilities for recreation and tourism.

The Manifesto emphasizes the importance of an official position for Earth Heritage and Geodiversity in EU policy and requests the DGs, the EU government and scientific representatives present at the Joint Conference to incorporate Earth Heritage and Geodiversity in the Soil Strategy. The Manifesto refers to the Recommendations on Geoheritage, Rec (2004)3 that were issued in May 2004 by the Council of Europe. Following the Manifesto in January, a meeting in Brussels was arranged by Isabel Fernandez of the EFG office in Brussel. The knowledge of our office on the EU organization and the progress of the different products produced, was very useful. An interesting discussion with Bernhard Berger and Claudia Olazábal, who are responsible for the EU Soil Strategy, followed. It resulted in their request

Handing over the EU Manifesto to Catherine Day, DG Environment of the European Commission and Marjan Sint, DG Environment of The Netherlands by Hanneke van den Ancker European Federation of Geologists.

Pieter Pauw explaining the short film presentation of the three Dutch student organizations in earth sciences Geovusie, Drift and Chaos.

to summarize the discussion in a concise paper which might serve as a contribution to the Soil Strategy. A week ago, we received a letter from Catherine Day, the DG Environment of the European Commission, informing us that the concept of geoheritage will be incorporated in the EU Soil Strategy, and inviting us to continue our dialogue with Brussels.

But this is only the beginning. In London, three European organizations met last week and agreed to support a workshop reviewing the possibilities of the different EU instruments and support programmes for Earth Heritage and Geodiversity and identifying gaps. The workshop aims at issuing a manual, also meant as a gift to our colleagues of the new member states to find their way in the European rules and regulations. It will build on the European geoconservation overview that ProGEO is producing, which will be issued this year.

EFG geoscientific manifesto on Natural Hazards

by Herald Ligtenberg

On 8 February, the European Commission organized a stakeholders meeting on "the future for civil protection and accidents at sea: Towards an EU rapid reaction force", with the objective to present to stakeholders and representatives of all European countries a new instrument addressing prevention of, preparedness for and response to disasters.

The EFG was invited by the EC to participate in this meeting as the sole geoscientific organization. A natural hazards expert from The Netherlands (Richard Rijkers), the director of the EFG office (Isabel Fernandez) and the EFG Groups of Experts assistant (Ana Pazos) attended this meeting with the aim to present the Geoscientific Manifesto on Civil Protection against Natural Hazards, and to make our comments on the consultation paper distributed in advance by the European Commission.

The manifesto was written by the EFG group of experts on natural hazards to emphasize the main issues to be addressed by the EC to reduce the impacts of natural hazards. In addition, the manifesto was supported by EuroGeoSurveys, the International Union of Geological Sciences (IUGS), the European Association of Geoscientists and Engineers (EAGE), the International Association of Engineering Geologists (IAEG) and Geologos Del Mundo, together representing the geoscientific community in Europe.

During the discussion at the stakeholders meeting, Isabel Fernandez presented the Manifesto and made additional comments on the relevance of prevention (not only response to disasters, as is the standard behaviour of policy makers); and the need for distinction between natural disasters, man-made disasters and terrorism, because each require a different approach. She presented the Manifesto as a recommendation in the elaboration of this new EC instrument. Richard Rijkers made comments on the relevance of education and prevention of geo-hazards. Pia Bucella (DG Environment, directorate A5 – Civil Protection) invited the EFG to present a concise document on prevention activities, which could be achieved in geo-hazards.

This concise and concrete advice document has been written by the EFG expert group on natural hazards, coordinated by Herald Ligtenberg (coordinator of this expert group) and Robert Lilljequist (member of this expert group). At the end of March, it was sent to the European Commission. The advice document can be downloaded from the EFG website. As "follow up": on 2 May 2005 a special meeting will be held with relevant EC members and Isabel Fernandez, Herald Ligtenberg and Marino Trimboli (member of expert group) to discuss the relevance of geosciences in relation to taking preventive and mitigation measures against natural hazards and what role the EFG can play in this respect for the European Commission.

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Geo-scientific Manifesto on Civil Protection against Natural Hazards

Being prepared and taking preventive and mitigation measures

The European Federation of Geologists, with support from EuroGeoSurveys, IAEG, EAGE, IUGS and World Geologists, would like to emphasize the importance of geo-sciences in civil protection against natural hazards to policy-makers at world, European, national, regional and local level. Together, these organisations represent the European geo-scientific community, including the community of geological hazards experts.

The number of victims, the devastating destruction of the infra-structure, the effects on social life, and the subsequent significant setback of the economy in case of natural disasters by far outweighs the combined effects of air, marine and traffic accidents.

The recent earthquake and related tsunami disaster in south-east Asia again emphasizes the importance of focussing on reducing the risks from natural hazards. Europe suffered from a tsunami of similar force, initiated by a submarine landslide, offshore of Norway, approx. 8000 years ago. A similar submarine slide could occur again at any time. Also, the increase in the number of natural disasters during the last few decades underlines the importance of taking preventive and, where necessary, mitigation measures against such hazards. Europe is primarily affected by floods, landslides and earthquakes.

There is a tendency at all policy levels to concentrate on reaction to disasters, rather than taking preventive and mitigation measures. This approach only leads to continuous increase in costs, keeping in mind both climate change and the continuous increase of construction activities into vulnerable areas; whereas hazard identification and risk reduction can significantly restrict the costs and effects of natural hazards. The costs of early geo-scientific investigations and hazard/ risk mapping are generally less than 1-2% of the reconstruction costs after a natural disaster.

Therefore we recommend to:

1) **Integrate geology in land-use planning to avoid unnecessary risks**
   Generate hazard / risk maps for guidance to control construction in vulnerable areas, such as on river floodplains, in landslide-prone areas and in earthquake-sensitive zones prior to the disaster. In parallel, legislation should be considered to involve geo-scientific hazard assessments as part of development planning regulations for areas identified to be at risk.

2) **Educate society to improve the understanding of and response to natural hazards**
   Many natural disasters are compounded by inappropriate human actions or decisions. Raising public awareness and increasing the knowledge of geological sciences will assist disaster management teams and rescue operations to better understand the situation and avoid further escalation of the problems. Better insight in the geological sciences will lead to improved policy-making with respect to adopting the best preventive and mitigation measures against natural hazards.

3) **Develop and install early warning systems (geo-indicators) in areas at risk**
   Small-scale geological variations may be identified as precursors to large-scale natural events. Identification and monitoring of precursors at the earth surface, possibly in combination with earth observation from space, may provide indications of pending large-scale natural hazards, allowing mitigation responses to be initiated.

The group of experts on Natural Hazards of the European Federation of Geologists are available to provide all necessary information and to make recommendations from a geological perspective, such that it will lead to a significant reduction of negative effects caused by natural disasters.

EFG Group of experts on Natural Hazards
Brussels, 7 February 2005

Supported by:
- European Federation of Geologists
- EuroGeoSurveys
- International Association of Engineering Geology
- European Association of Geoscientists and Engineers
- International Union of Geological Sciences
- World Geologists

Geological and climatic controls on vineyard terrain: part 2. Climate

by Professor EurGeol. Dick Selley[1]

The quality and character of wine is controlled by geology, climate, grape variety and recipe. There is a huge literature on the last two of these variables, rather less on geology and climate. The interplay of geology and climate determines the landscape in which a vineyard stands, and the soil in which it grows. The previous article described geological controls on viticulture. It showed that though vineyards thrive on rocks of all ages and types, geology closely controls landscape and soil character. This second concluding article discusses the role of climate in general, and climate change in particular. A recent study shows that there is a correlation between the ebb and flow of vineyards across the UK correlative with climate change over the last two millennia.

La qualité et le caractère d'un vin dépendent de la géologie, du climat, des variétés de cep et du savoir faire du vigneron. S'il existe nombre d'ouvrages traitant des deux derniers paramètres, il y a moins d'articles sur l'influence de la géologie et du climat. L'interaction entre géologie et climat façonne le paysage d'un vignoble et est à l'origine du sol qui lui permet de se développer. L'article précédent a mis en évidence le rôle de la géologie sur la viticulture. Bien que les vignobles poussent sur des sols de toute sorte et de tous âges, la géologie est en relation étroite avec les paysages et les sols. Ce deuxième et dernier article traite du rôle du climat en général et du changement de climat en particulier. Une étude récente montre qu'il existe une corrélation entre d'une part le flux et le reflux du vignoble au Royaume Uni, et, d'autre part, les changements de climat enregistrés pendant les deux derniers millénaires.

La calidad el carácter del vino está controlada por la geología el clima la variedad de uva y la receta de fabricación. Hay mucha literatura sobre las últimas dos variables pero mucha menos sobre la geología y el clima. La interrelación de la geología y el clima determina el paisaje en el que se encuentra la viña y el suelo en el que crece. En un artículo anterior se describieron los controles geológicos de la viticultura. Mostró que aunque los viñedos crecen bien sobre rocas de todas las edades, la geología controla las características del paisaje y del suelo. Este segundo y último artículo discute sobre el papel del clima en general y del cambio climático en particular. Un estudio reciente demuestra que hay una relación entre el devenir de los viñedos en el Reino Unido y el cambio climático de los últimos dos mil años.

It is a matter of great current concern whether the Earth's climate is static, warming or cooling, and whether climate change is harmful or beneficial to civilization. The impact of climate change on viticulture is of particular interest to wine lovers. The wine vine, Vitis vinifera, thrives today in the northern and southern hemispheres where average annual temperatures are between 10°C and 20°C. This interest in the effect of climate change on viticulture is not new. Some 2000 years ago, Saserna (cited in Columella, 67AD) attributed the northward migration of viticulture across Europe to global warming (plus ça change, plus c'est la meme chose).

In general terms, the Earth has been cooling down for the last 60 million years or so. This gradual global cooling has plunged the planet into another ice age for the last two million years. There have, however, been alternating cold (glacial) and warm (interglacial) periods. During the glacial maxima most of northern Europe was covered by ice. In Britain, ice sheets extended as far south as the Thames Valley. The most remarkable feature of the climate curve is the thermal stability of the last ten thousand years, an almost unique event in the record. Experience dictates that a climatic fluctuation is imminent; the question is, in which direction. Since we are now in the middle of an Ice Age, albeit enjoying a warm interglacial, it is reasonable to suppose that the next change will be a drop in temperature, and the return of another glacial maximum.

There have been several temperature fluctuations within the last two millennia. There was a warm spell through the Roman and Medieval periods when the temperature was 0.3°C above a reference point at 1900, though with an intervening Saxon thermal sag. During the Little Ice Age from the mid-15th – mid 19th centuries temperatures dropped by nearly a whole degree to 0.6°C below the 1900 benchmark. Temperatures began to rise again in the middle of the 19th century at the commencement of the Industrial Revolution, and have continued upward ever since. There is evidence that bud burst is starting earlier across Europe, as much as two weeks in Austria. Data on the start of the 'Vendage' in France are inconclusive. With all the panic about global warming and its impact on fauna and flora, it should be noted that the temperature has only just got back to where it was in Roman and Medieval times.

The onset of a new glaciation would spell doom for the human race, but then so perhaps does the onset of rapid global warming. Since Saserna, there have been speculations on the influence of climate change on viticulture. Several authors have discussed the effect of global warming on viticulture. Global warming will cause a general shift of wine-growing areas to lower latitudes in both hemispheres, broadly between the 10° and 20°C

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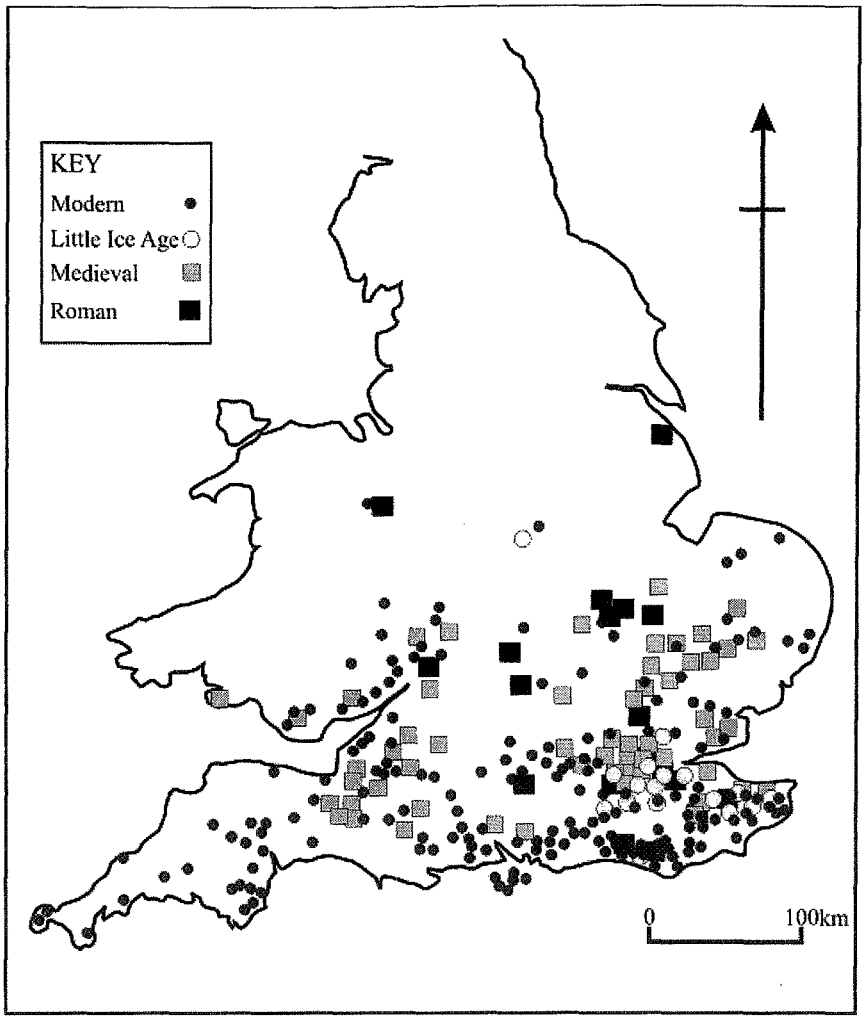

Figure 1. Map showing the distribution of vineyards in Britain differentiated according to climatic phase. Distribution of Industrial Warm Phase vineyards largely from Skelton (2001). Note that there were far more Roman and Medieval vineyards than are currently known (From Selley, 2004 © Petravin).

isotherms. The equatorial margins of wine-lands will be abandoned, and their polar margins migrate poleward. Not only will global warming affect the overall extent of viticulture, but there will be smaller-scale changes too. Pinot Noir in the western USA and Europe may gradually migrate northwards, while Burgundy may become too hot for this vine variety to flourish. In 2004 French Champagne producers were reconnoitering southern England, where the chalk is extensive, for suitable land to buy. Not only wine varieties, but also wine diseases, will also migrate poleward. The effects of global warming on Europe are, however, more complex. It has been argued that the melt waters of the Polar ice cap will flow past northwest Europe, diverting the Gulf Stream to the south and inhibiting excessive heating of the land. Either way, thermal expansion of the oceans, coupled with the melting of the polar ice caps, will result in rising sea level. A rise of 0.5 m per century is currently predicted. Given the presently accelerating rate of melting of the Polar ice cap, this may be rather low. Sea level rose 5 m per century at the end of the last glaciation. As the Gironde estuary is flooded, the vineyards of Bordeaux will be drowned.

The stability of the last 10,000 years is unlikely to continue, and whichever way the climate changes, the short-term future of viticulture in Britain and Scandinavia looks bright, and we should enjoy our liquid assets while we may.

British viticulture shows a correlation with temperature over the last two millenia. There is no evidence of viticulture in Britain until the arrival of the Romans. Archaeological data demonstrate that viticulture was not just the hobby of homesick Roman expatriates, but a commercial undertaking that was carried out even in the far north of the province. Thereafter, though the archaeological and literary evidence is patchy, viticulture has continued in Britain uninterrupted for the last two millennia. Viticulture seems to have declined in the Dark Ages, though the decline may be more apparent than real, due to the paucity of preserved literature. A renaissance begun by the Normans is well documented in the Domesday Book (1086-7). Both the number, and also the size of the new vineyards, shows that they were not being planted for sentimental reasons by homesick Norman knights, but with a view to substantial commercial wine production. The decline of viticulture in the 14th century is generally attributed to the Black Death and other socio-economic factors, but the coincidence of the decline with the advent of the

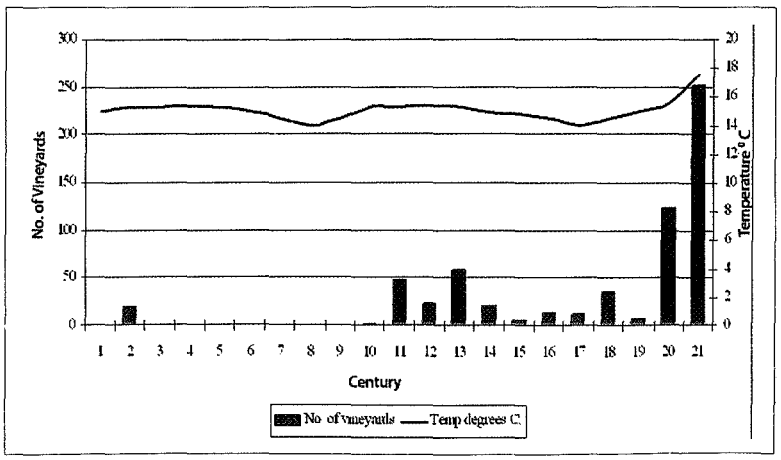

Figure 2. Graph showing the number of vineyards in Britain plotted by century against temperature. A rough correlation is apparent, but the data are progressively 'softer' going back in time (From Selley, 2004 © Petravin).

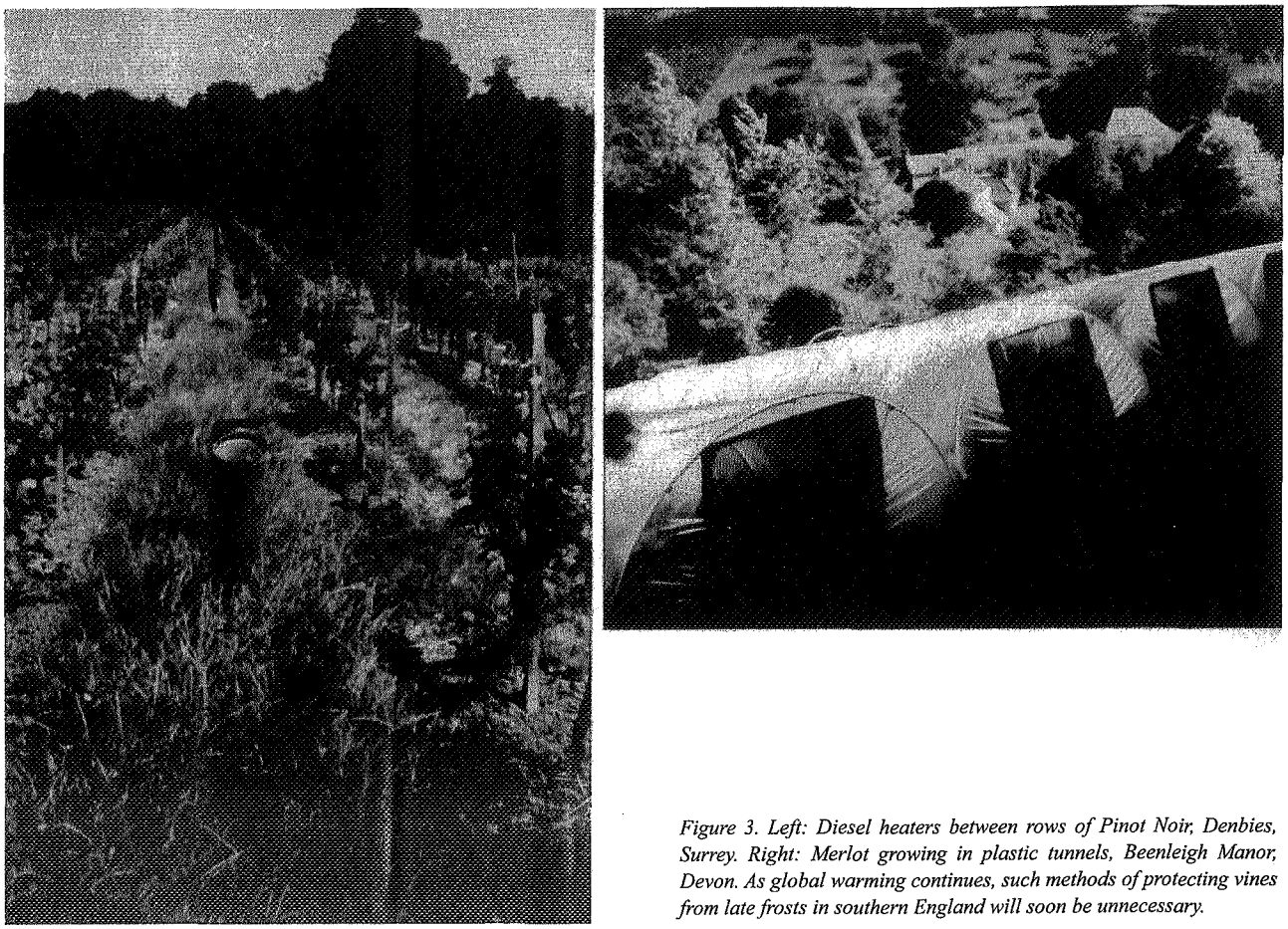

Figure 3. Left: Diesel heaters between rows of Pinot Noir, Denbies, Surrey. Right: Merlot growing in plastic tunnels, Beenleigh Manor, Devon. As global warming continues, such methods of protecting vines from late frosts in southern England will soon be unnecessary.

Little Ice Age points to climate change as another factor.

Likewise, it is interesting to speculate on why the 20th century renaissance of viticulture was concomitant with the rise of the Industrial Revolution, and global warming. Figure 1 documents all known vineyards in the British Isles for the last two thousand years, and differentiates them according to age, Roman, Medieval, Little Ice Age and Industrial Warm Phase.

Intuitively one might expect viticulture to correlate with temperature. Figure 2 plots the number of British vineyards through time against temperature. There appears to be some correlation, but the data are too soft to justify a firm conclusion. Climatic fluctuations cause alterations in the environment that drive socio-economic change including, and inextricably linked with, plant and animal life. Variation of one parameter feeds back into another - Earth system science, or Gaia if you prefer.

Throughout the two millennia during which viticulture has been practised in Britain, it is apparent that geology, as ever, underpins all activity. Throughout climatic fluctuations, well-drained south-facing slopes have been the preferred, though not exclusive, location. It is interesting to note how vineyards have been planted, decayed, and then been replanted on the same site, for geological reasons. Examples include Toppesfield, Essex, planted in the 11th century, Painshill Park, Cobham, Surrey, planted in the 18th century, and Pilton, Somerset, planted in the 13th century. All of these were replanted in the 20th century.

Given that the stable climatic conditions of the last ten thousand years are unusual and unlikely to continue, it is interesting to speculate on the future. If the climate of Britain cools, either through the advent of a new ice age, or, as some computer models predict, because global warming will melt the Arctic ice cap, whose waters will shut off the Gulf Stream, then viticulture is doomed. If, on the other hand, global warming continues, the future of British viticulture is bright, at least in the short term (Fig. 3). Throughout the Industrial Revolution Warm Phase, vineyards have extended from southern England up to a line from the Severn estuary to the Humber. Using the distribution of vineyards mapped in Figure 1, it is possible to delineate the northern limit of viticulture in Britain for the Roman, Medieval, Little Ice Age and Industrial Warm Phase (Fig. 4). This figure shows how it is possible to map the ebb and flow of viticulture across Britain correlative with climate change. The limit of modern Industrial Revolution warm phase vineyards has nearly extended as far north as in the Roman and Medieval warm phases, planted before the advent of the Little Ice Age.

Already it is possible to see how geology determines the development of vineyard terrains similar to the legally-defined Côtes of France. The distribution of vineyards is irregular, however, because they have only been planted where geology is favourable. Integrating geology and climate change allows the recognition of a number of what the French might term 'Pays' or 'Côtes'. The English term 'Terrain' would do very nicely, but one hesitates to use it for fear of confusion with 'Terroir' and a directive from the EU terroiristes in Brussels. Perhaps the best choice is the New World term 'wineland'. Consideration of geology and the resultant landscape and soil make it possible to recognize four British winelands, viz.: ancient winelands that have been abandoned and never replanted,

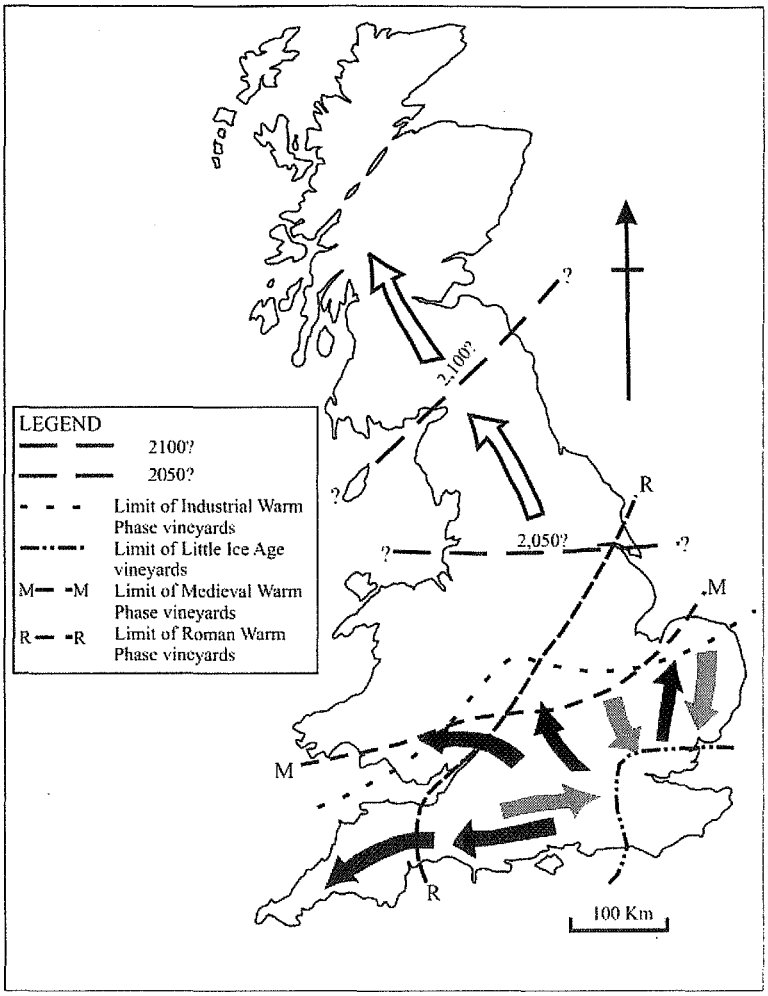

Figure 4. Map of the northern limits of viticulture in Britain for the Roman, Medieval, Little Ice Age and Industrial Warm climatic phases. This shows how the limits of viticulture ebb and flow across the country correlative with climate change (From Selley, 2004 © Petravin).

ancient winelands that have been abandoned and replanted, and virginal (Industrial Warm Phase) winelands. In Franglais these may be termed 'Côtes ancienne abandonne', 'Côtes ancienne renaissance, and 'Côtes virginale' respectively. Franglais is a language fit for this purpose since it originated in the Norman-French of the Medieval Warm Period, when English viticulture was at its zenith. Consideration of geology and the resultant landscape and soil also make it possible to speculate on where vineyards may be established in the future if global warming continues ('Côtes de futur'?).

The future?

If global warming continues, vineyards will advance northwards across Europe into Scandinavia and Scotland. In the highlands of Scotland the Côtes d'Ecossaise will flourish, and wine replace whisky as the refreshment of choice. Scotland consists of rocks of many ages and types, but Pre-Cambrian and Lower Palaeozoic metamorphic gneisses and schist predominate, especially in the northern highlands. First vineyards will be planted on the Lower Palaeozoic slates and greywackes of the south-facing slopes of the Southern Uplands. They will be followed by vineyards planted on Dalradian metasediments on south-facing slopes of the Grampians.

The prime Scottish wine estates, however, will be along the north (i.e. south-facing) slopes of the Great Glen where the geology is similar to the Cape vineyards of South Africa. The midge-misted mountains of the metamorphic Moine Series will provide terrain akin to the Bokkefeld meta-sediments of the Stellenbosch vineyards. The intermittent granite intrusions will provide terrain similar to the Paarl region. The prime estates will be on the north shores of the lochs (Loch Ness, Loch Lochy and Loch Linnhe) where the sunny south-east facing slopes will receive enhanced radiation reflected from the waters of the lochs below. There will be tourist wine trails along the Great Glen on land. Luxury cruises, similar to those of the present-day Rhine and Mosel, will sail along the lochs and the linking Caledonian Canal between Inverness and Oban. Refreshed tourists will report more sightings of the Loch Ness monster than ever before (Fig. 5).

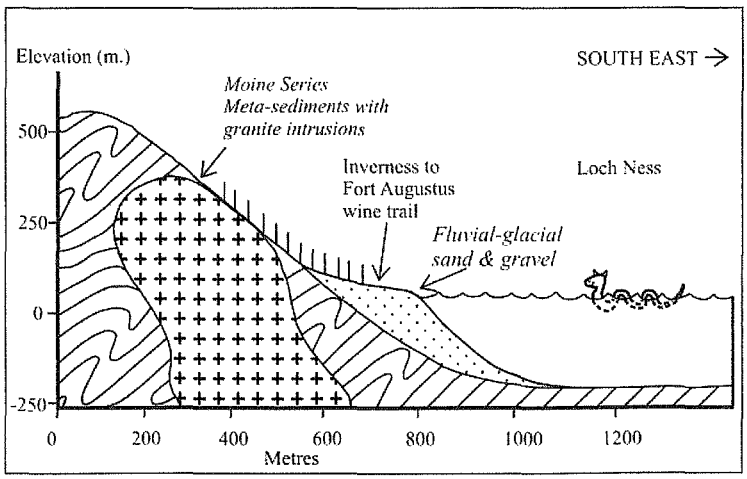

Figure 5. Sketch geological cross-section to show the prime location of the future vineyards of Scotland on the north (i.e. south-facing) slopes of the Great Glen. (From Selley, 2004 © Petravin)

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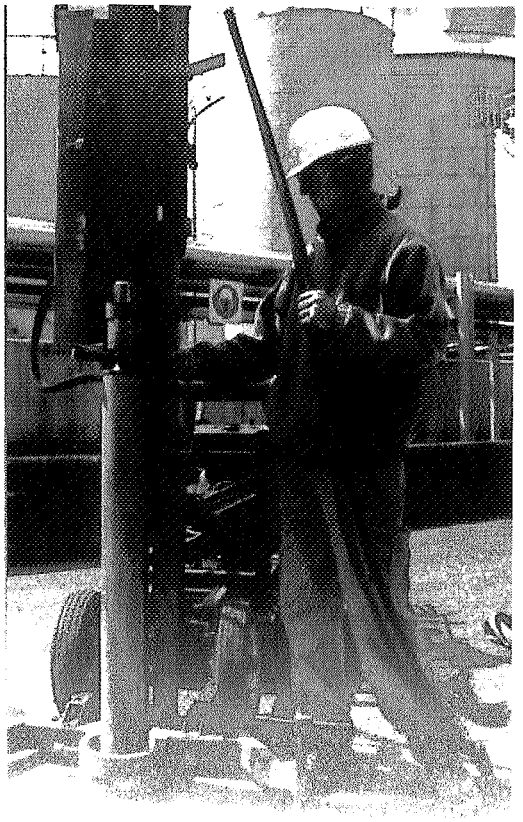
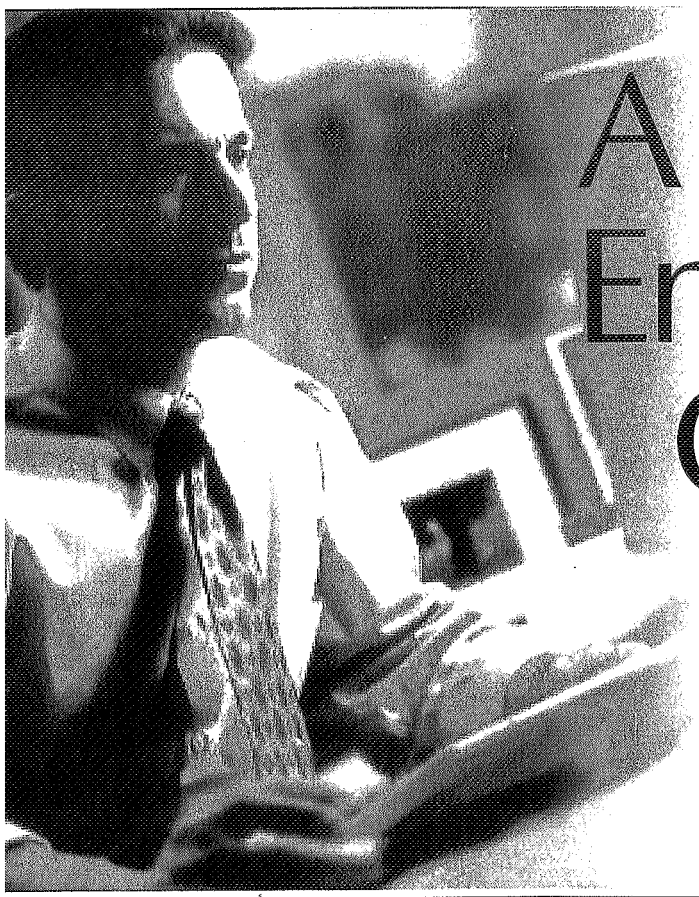
ENVIRONMENTAL

White
Young
Green





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Geólogos Del Mundo in Sri Lanka after the tsunami

by D. Ponce de León Gil[1] and M. Baselga Bacardit[2]

After the catastrophic consequences of the tsunami on December the 26th 2004 along the Sri Lankan coast, and the water supply problems generated by this event, the exploration of new water resources to supply water to the population in the affected areas and to the new resettlements is one of the priorities of Sri Lanka. The study of ground water resources, and their later exploitation might be the most suitable option in some of these areas in order to solve the problem. Therefore, a cooperation agreement has been signed between World Geologists and The Ministry of Urban Development and Water Supply to give support to the National Water Supply and Drainage Board in exploration and exploitation of ground water resources.

Après les conséquences catastrophiques du tsunami du 26 décembre 2004 et les subséquents problèmes d'approvisionnement en eau, il est devenu une des priorités de Sri Lanka l'exploration de nouvelles sources d'eau potable pour approvisionner les populations affectées. La mise en valeur des eaux souterraines est l'une des meilleures options pour résoudre le problème sur quelques-unes des zones affectées. Avec le but d'assister le *National Water Supply and Drainage Board* sur l'exploration et la mise en exploitation des eaux souterraines, un accord de coopération vient d'être signé entre Géologues du Monde et le *Ministry of Urban Development and Water Suply.*

Considerando las consecuencias catastróficas del tsunami acaecido el 26 de diciembre de 2004 y los problemas en el abastecimiento de agua debidos a este evento, la exploración de nuevas fuentes de agua para abastecer a las áreas afectadas y a los nuevos reasentamientos es una de las prioridades de Sri Lanka. El estudio de los recursos de agua subterránea y su posterior explotación puede ser la mejor opción para solucionar los problemas en algunas áreas. Por esta razón, se ha firmado un acuerdo de cooperación entre Geólogos del Mundo y el *Ministry of Urban Development and Water Supply* para apoyar al *National Water Supply and Drainage Board* en la exploración y explotación de los recursos de agua subterránea.

In the aftermath of the tsunami which smashed ashore on 26 December 2004, many Sri Lankans who dwelled along the coastal belt from Jaffna to Negombo, including Eastern and Southern regions, lost their lives and the survivors were left homeless (Fig. 1). The tsunami also affected the entire coastal area for about 0.5 km to 2 km inland.

According to the government, the estimated death toll has climbed to 30,527 and is expected to increase when an accurate census is available. Missing persons are estimated at 3,884. The total number of refugee families was estimated as 178,886. The injured number 15,680. Otherwise, 96,541 houses are completely destroyed and 6,258 houses are partially damaged in this devastation. Hotels, commercial centres and industries have been damaged. Furniture and other appliances in those buildings have been washed away by sea water (Fig. 2). People are still seeking refuge in government refugee camps or with friends or relatives.

Essential services such as telecommunications, electricity and water supply have been severely damaged.

People in the refugee camps are provided with food and clothes either by government, the donations of the public or foreign aid. Limited water supply to these camps is provided by the National Water Supply & Drainage Board, as well as foreign institutions and NGOs. Temporary electricity supply is being provided. Telecommunications are badly affected but are being repaired. Roads have been repaired up to motorable condition, but permanent repairs have to be made. Temporary bridges have been provided for some culverts.

Present status of the water supply

The tsunami has affected the water supply of the entire coastal area. Water pipe-lines have been washed away. Water levels in the distribution towers have dropped due to leakages through the distribution system. Service connections to houses and other places are damaged. They must be re-laid. Temporary repairs to pumping mains, transmission mains and other distribution pipelines were done with available materials. Damaged service connections were end capped until new service connections can be laid. Those temporary repairs have been accomplished but permanent repairs are needed quickly, before the temporary works collapse (Fig. 3). At the same time, most of the existing wells in the tsunami-affected areas cannot be used due to salt water intrusion. Even when they are cleaned, they cannot be used, due to saline water contamination.

The government has prohibited resettlement of displaced people within 300 m of the shore, along the coastal area. Hence, these people will be resettled in new locations inland. Water supply facilities have to be provided for tsunami-affected areas and those resettlement areas. As the construction of permanent houses will take

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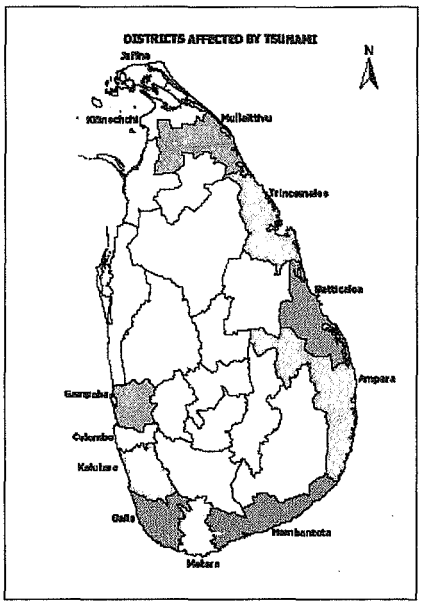


Figure 1. Districts in Sri Lanka affected by the tsunami.

Figure 2. The effects of the tsunami in Batticaloa.

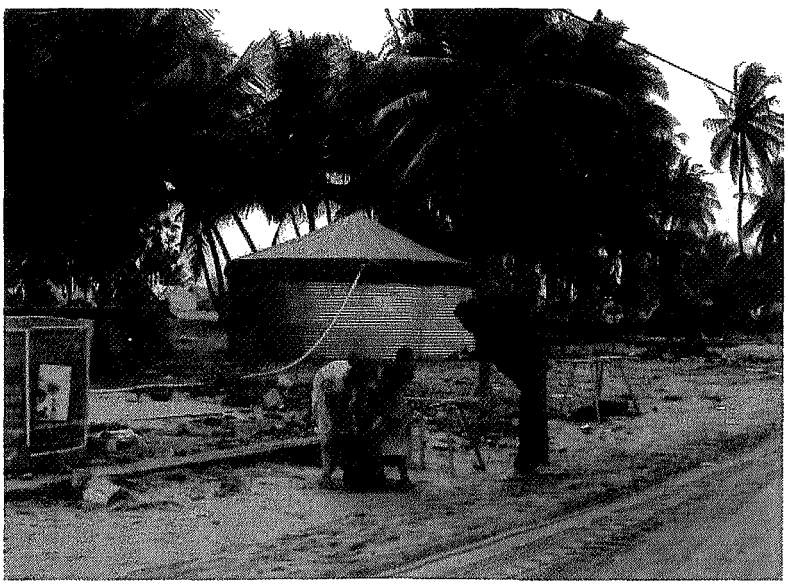


Figure 3. Temporary water supply in Arugam Bay.

6-12 months, all displaced people have to be settled temporarily in transit camps and those camps too have to be provided with a drinking water supply and sanitation facilities.

The National Water Supply & Drainage Board has taken actions to repair distribution systems temporarily to provide a piped water supply to people in transit camps and other affected areas. They have been assisted by foreign institutions and NGOs. In any case, is will be necessary to work on long-term proposals for future water supply. Implementation of all proposed actions will be carried out by the National Water Supply & Drainage Board with the technical and grant financial assistance of Donor Agencies and NGOs.

World Geologists cooperation

Considering the catastrophic consequences of the tsunami and the water supply problems generated due to this event, the exploration of new water resources to supply water to the population in the affected areas and to the new resettlements is one of the priorities.

Local authorities consider the exploration and later exploitation of ground water as the most suitable option in most of the affected areas in order to solve the water supply problem. The Ground Water Section of the National Water Supply & Drainage Board is officially in charge of this task. However, lack of qualified technicians and shortage of funds obstruct the achievement of this task.

Therefore, the Ministry of Urban Development and Water Supply has requested the cooperation services of World Geologists to support the Ground Water Section in order to explore ground water and to construct wells in the affected areas, uniting efforts for a better and quicker result.

A geologist and a mining engineer from World Geologists have been working in Sri Lanka for one month in a visualization project trip to make contact with local institutions, foreign organizations and NGOs. Several proposals have been prepared to collaborate in the reconstruction after the tsunami and a cooperation agreement has been reached with the Ministry of Urban Development and Water Supply for ground water exploration and exploitation.

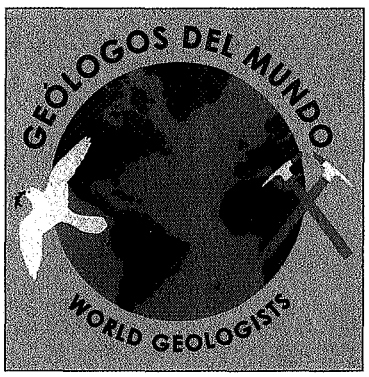
Geólogos Del Mundo projects in 2005

by Ángel Carbayo Olivares[1]

A total of ten separate projects in El Salvador, Equador, Honduras and Nicaraqua have received financing.

- Water supply to three rural villages of the Republic of Mali (Beo, Ealo y Madoulo). Financed by the NGO Manos Unidas and the Polytechnical University of Madrid.
- Strengthening of the environmental units of the municipalities of the metropolitan area of San Salvador (El Salvador). Financed by the Diputación of Barcelona.
- Strengthening in Management of Natural Resources and Geologic Risks in the Municipality of Jucuarán (El Salvador). Financed by the Generalitat of Cataluña.
- Public water supply using underground water for the community of Guaymitas and surroundings, El Progreso, Yoro department (Honduras). Financed by The Nando Peretti Foundation.
- Public water supply using underground water for the community of Sartenejas, El Progreso, Yoro department (Honduras). Financed by The Nando Peretti Foundation.
- Public water supply using underground water for the villages of La Brea and Caribal, in the La Bananera Canton, Municipality of Conchagua, dep. La Union (El Salvador). Financed by The Nando Peretti Foundation.
- Continuation of COSUDE project, with the accomplishment of the hydrogeological map in the countries of El Salvador and Nicaragua. Financed by the Agencia Suiza of Cooperación.
- Water supply to Chumabi (Ecuador). Financed by the Diputación of Zaragoza.
- Enlargement of the project "Strengthening and hydrogeological characterization to the water supply of San Antonio del Monte (El Salvador)". Financed by the Ayuntamiento of Oviedo.
- Identification and characterization of the hydrogeological resources and geological hazards in the mountain range of Mico Quemado. Financed by the Principado of Asturias.
- Achievement of several projects in Sri Lanka. Unresolved financing.

At present, there are five additional projects with unresolved financing to start in 2005.



Acknowledgements
World Geologists is a non-profit, non-governmental organization that aims to provide the service of geologists to the most needy human groups and one of its main aims is collaboration in emergencies with other national and international associations and NGOs providing technical or logistic support.

Therefore, in the aftermath of the tsunami disaster, World Geologists offered its collaboration to Relief Coordinators in Sri Lanka in every aspect of geological risk and groundwater resources management. This collaboration could not be possible without the support of the many members of World Geologists and the *Ilustre Colegio Oficial de Geólogos de España.*

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Grimsel Test Site: challenges for the 21st century and beyond

by Wolfgang Kickmaier[1], Stratis Vomvoris[1], Ian G. McKinley[1], and W. Russell Alexander[1]

The underground test site at Grimsel in the Swiss Alps has now served as a centre for international R&D for 20 years. At a recent workshop, the output from this site, and other similar facilities worldwide, was reviewed and requirements for the future identified. A key priority area for future work will be "demonstration and validation" of components of repository systems - requiring realistic simulation of expected conditions and timescales of decades to allow quantification of slow, highly-coupled processes. More pragmatic - but equally challenging - is development of robust and safe technology for waste disposal and training the future generations of staff who will actually be involved in the implementation of repository projects.

Depuis 20 ans le laboratoire souterrain du Grimsel dans les Alpes Suisses sert de centre international de recherche et développement (R & D). Lors d'un recent «workshop» les résultats de ce laboratoire ainsi que d'autres sites comparables dans le monde ont été passé en revue et à partir de là on a identifié les exigences pour les recherches dans le futur. Une priorité-clé sera attribuée à la «démonstration et validation» de composantes d'un système de dépôt final. Ceci demandera une simulation réaliste des conditions à prévoir dans un dépôt ainsi que des expériences pouvant durer des décades afin de permettre de quantifier des processus lents et interdépendants. Un défi au même niveau - quoique plus pragmatique - se situera dans le secteur concernant le développement d'une technologie robuste et sure pour le stockage, et de même dans le secteur de la formation des futures générations de chercheurs et de techniciens qui seront engagés dans les programmes de réalisations de dépôts.

En los Alpes Suizos, en Grimsel, se encuentra el lugar subterráneo de tests que ha servido como centro para el R&D (investigación y desarrollo) internacional por 20 años. En un taller reciente, los resulatdos de este sitio, y otras instalaciones similares por todo el mundo, fueron analisadas y los requisitos para el futuro fueron identificados. Un área de prioridad dominante para el trabajo futuro será la «demonstración y validación» de componentes de los sistemas de depósito - requiriendo la simulación realista de condiciones previstas y periodos de décadas que permitan la cuantificación de procesos lentos, y altamente acoplados. Más pragmático - pero igualmente desafiador - es el desarrollo de la tecnología robusta y segura para el desecho de residuos radioactivos y el entrenamiento que la generación futura del personal que estará implicada en la puesta en práctica del depósito.

The Grimsel Test Site (GTS) was constructed in 1983 in the Swiss Alps, 450 m below the Juchlistock mountain (Fig. 1). Grimsel is dedicated to applied research related to radioactive waste disposal issues, but is not itself considered as a site for waste disposal. The main tunnel system is approximately 1 km long and was extended in 1995, with the construction of the Full-scale Engineered Barrier Experiment (FEBEX) tunnel, and in 1998, with the construction of the Gas Migration Test (GMT) access drift, cavern and silo. An overview on the GTS facilities and the experimental programme is presented in the GTS homepage: *www.grimsel.com*

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The experienced international teams who lead GTS projects are drawn from 19 partner organizations from France, Germany, Japan, Spain, Sweden, Switzerland, Taiwan, the Czech Republic and the USA, as well as numerous universities, institutes and companies from around the world. The European Union (with the Swiss Federal Office of Education and Science) provide financial support to some projects.

Since the mid-1980s, experiments have focused both on geosphere characterization aspects, as well as on the engineered barrier system (EBS). Large-scale, long-term demonstrations of EBS have gained an increasingly important share in the GTS activities. In addition, the controlled zone at GTS allows the unique ability to perform in-situ experiments with radionuclides, including isotopes of uranium, neptunium, americium and plutonium.

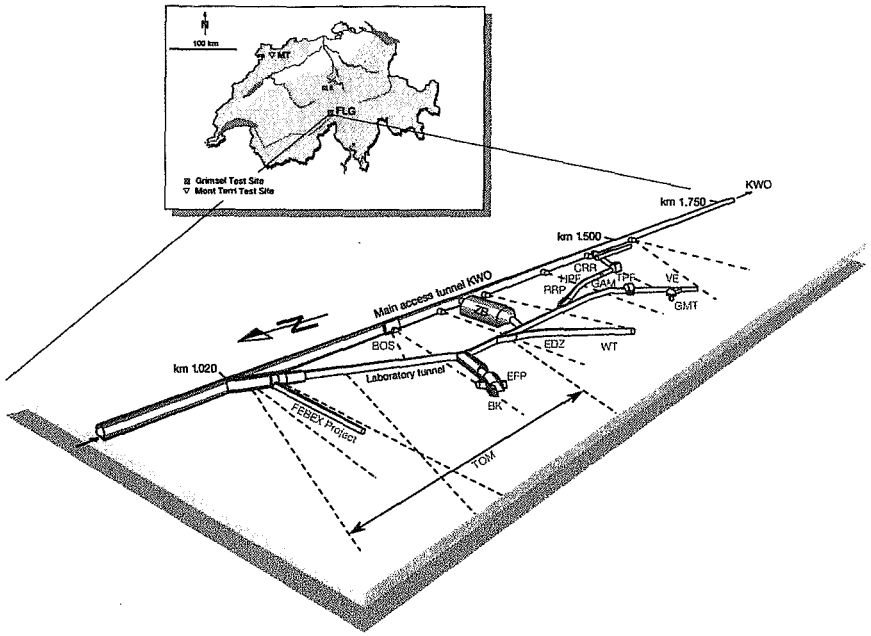
The GTS is run in a flexible manner, which minimizes administration and optimizes the value of collaboration to all involved. Additional participants may join existing projects or establish their own – if necessary with expansion of the underground workings to meet experimental requirements.

The results of projects in the five phases of experimental studies carried out until 2003 have been presented in numerous technical reports and papers in the open literature (bibliography available on the internet at: *www.grimsel.com/general/publication_m_v.htm)*

These can be roughly classified as:

a) Development and testing of site characterization technology; including a wide range of geophysical and hydrogeological methods
b) Evaluation of methodology for repository construction and its influence on the geological barrier – particularly the extent of the excavation-disturbed zone

Figure 1. View of the Grimsel Test Site location and layout of the tunnel system



around underground openings and the consequences of radiogenic heat

c) Development and testing of the procedures for emplacement of the engineered barrier system for high-level waste / spent fuel (HLW/SF) and low / intermediate-level waste (L/ILW) and the models evaluating its evolution with time, considering the coupled processes of saturation, heating, gas pressurization, etc.

d) Rigorous testing of the models and databases used to evaluate radionuclide migration in a fractured host rock – both under natural conditions and considering perturbations such as leaching of hyperalkaline fluids from cementitious structures or erosion of colloids from backfill / buffer materials.

Priorities for Grimsel Phase VI

Following a review of work carried out in Grimsel and other underground test sites, a clear trend was noticeable; the types of question which could be addressed by small-scale, short-duration studies have been repeatedly addressed – remaining major challenges require experiments which move closer to full-scale simulation of repository structures and much longer durations. The timescale issue is particularly critical – to significantly improve on multi-year studies, a step directly to multi-decade project durations is needed. Although such timescales represent new land for the experimental teams, they are quite compatible with the present national timeplans for repository construction, operation and final decommissioning, which generally extend well into the next century. Phase VI was thus launched with an unspecified duration and explicit flexibility to fit in with the requirements of specific projcts. Nagra funding has been assured for, at least, the first decade.

In order to provide efficient support for implementation of national repository programmes, it is important that an integrated approach is taken when developing an R&D programme. Many repository concepts for radioactive wastes (HLW, SF, TRU) were developed decades ago for feasibility studies. Since then, there have been great advances in the understanding of long-term repository evolution, studies to better understand operational constraints and, in particular, a greater awareness

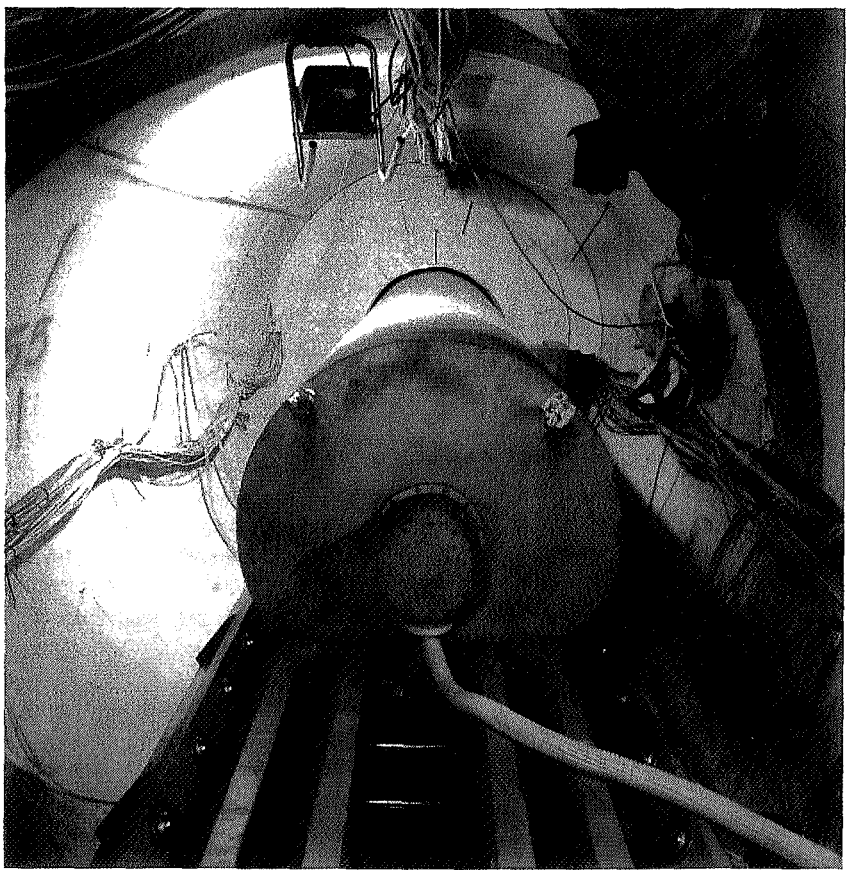


Figure 2. Emplacement of a heater, simulating spent fuel, in the full-scale engineered barrier experiment (FEBEX) run by Enresa

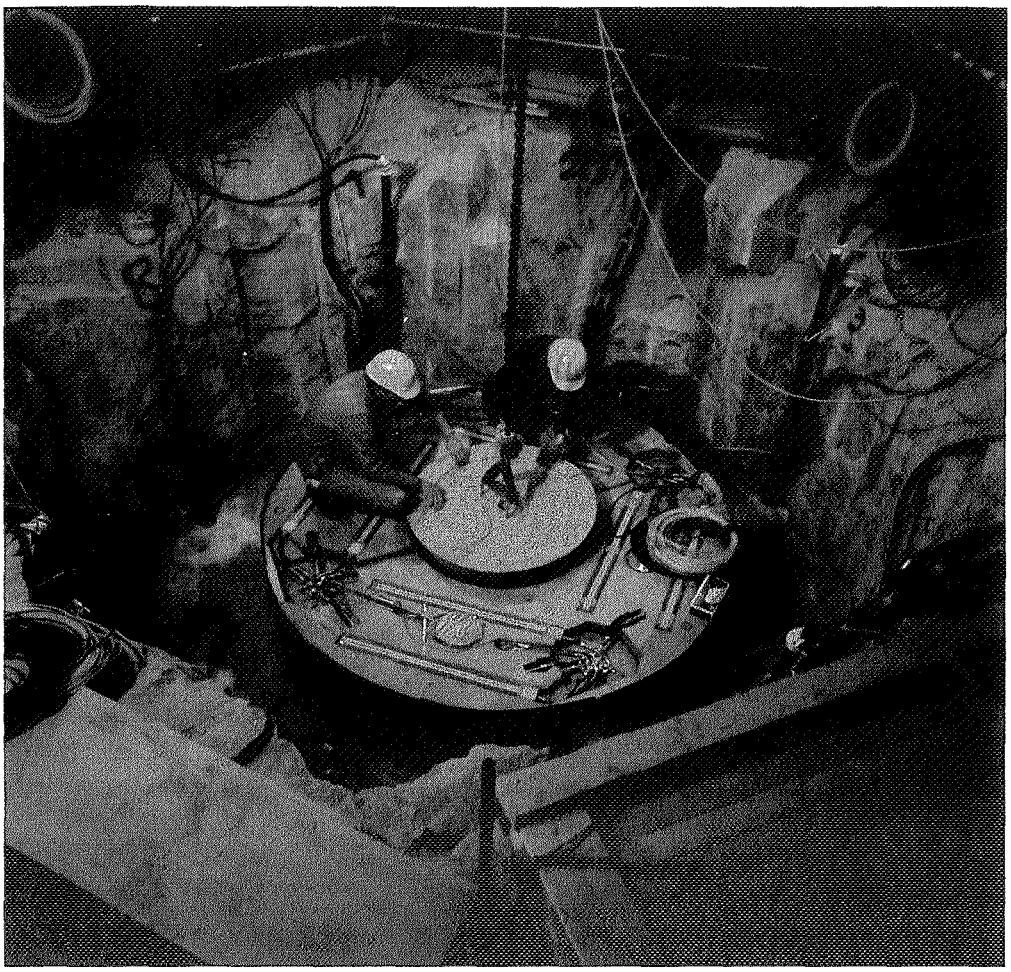


Figure 3. Overview of construction of a simulated ILW / TRU silo surrounded by compacted sand / bentonite buffer in the RWMC Gas Migration Test (GMT)

of the importance of public acceptance (requiring consideration of monitoring/ institutional control, retrieval/reversibility, etc.). Projects can take advantage of a number of synergistic experiments which have been performed at the GTS, and use output from recent total system performance assessments to further develop the concepts for disposal of vitrified HLW, SF and TRU. The latter will then be tested in-situ at Grimsel with respect to:

- Practicality (including remote handling, QA requirements, sensitivity to operational perturbations)
- Monitoring (development of technology, testing of robustness)
- Remediation of any potential defects / retrieval
- Long term performance of the EBS and the surrounding rock under (1) expected evolution scenarios (e.g. stability of EBS materials, migration of safety relevant radionuclides) and (2) perturbed evolution scenarios (e.g. gas effects, high pH plume, colloids, etc.).

The challenge is to integrate the already developed system understanding into a basis for implementation of practicable, safe repository projects which receive wide acceptance from all key stakeholders. To facilitate integration, focus is narrowed to concentrate in particular on the operational and post-closure monitoring phases of repository implementation. Nevertheless, to ensure that optimization preserves the critical long-term safety margins required, key aspects of long-term performance of the EBS and immediately surrounding host rock are also examined.

The evaluation of possible perturbations (earthquakes, floods, strikes, civil unrest, etc.) which could disrupt key services (power, ventilation, drainage, etc.) for extended periods during repository operation is, at present, a greatly neglected area. For such scenarios, the consequences on waste emplacement operations and the procedures needed to recover from such events need to be assessed. Experiments at Grimsel will allow such perturbations to be simulated and the recovery procedures to be tested under the constraints set by underground work. Such experience can provide feedback to develop more robust repository concepts and operational procedures.

Although certainly of relevance for testing that concepts can be implemented on an industrial scale (e.g. considering required throughput rates) with appropriate quality assurance, full-scale demonstration projects tend to have a very large public acceptance impact. Finally, because the work focuses on the EBS, it would be generally applicable to most host rock options considered (with the possible exception of salt). Crystalline and hard sediments are directly relevant and soft sediments can be represented by lined tunnels.

Specific experiments

The general plan for setting priorities provides general guidelines, but already a number of individual projects have been initiated or are in final planning stages. These include continuatoin of three ongoing projects:

FEBEX
(Full-scale Engineered Barrier EXperiment). Under the leadership of Enresa (Spain), a full-scale simulation of the emplacement of spent fuel based on the Spanish concept for a crystalline host rock. Apart from demonstration of emplacement feasibility, this project serves to test coupled thermal-hydraulic-mechanical-chemical models and their associated databases. It also provides valuable information on the performance of long-term monitoring systems (Fig. 2).

GMT
(Gas Migration Test). The RWMC (Japan) study of gas migration through engineered barriers and the surrounding host rock is now in a final "post mortem" decommissioning phase. This will be followed by several years of model testing utilizing the unique experimental database provided by this project (Fig. 3).

HPF
(High-pH Plume in Fractured Rocks). This Nagra-led study aims to quantify the effects of hyperalkaline fluids (as may be produced by concrete structures in a repository) on the transport of radionuclides in fractured rock. Following establishment of a dipole flow of hyperalkaline fluid in a target shear zone, a cocktail of radionuclides was injected and, following immobilization, the altered flow zone containing attached radionuclides was excavated during the summer of 2004. Sample analysis, interpretation and documentation are ongoing.

A number of projects involve continued *in-situ* studies with radionuclides:

PSG
(Pore-Space Geometry). Experimental work is already completed in this Finland-led project using C-14 labelled resin to characterize in detail the geometry of pore space in the rock matrix surrounding fractures.

LTD
(Long-Term Diffusion). An extension of previous studies which combines longer timescale evaluation of diffusion in the connected porosity of rock matrix surrounding fractures in which advective flow occurs.

CFM
(Colloid Formation and Migration). An extension of past work on colloid facilitated transport of radionuclides using more relevant hydrogeological conditions.

LCS
(Long-term Cement Studies). An extension of the work on hyperalkaline plumes, again studying the leaching and transport of radionuclides from a cement-based system under relevant hydrogeological conditions.

At an earlier stage of planning, are projects in two main areas:

- Long-term materials testing, in which potential engineered barrier components can be left in simulated repository conditions for periods of decades to provide confirmation of present corrosion / degradation model (mainly aimed to support future licensing procedures). Materials may be studied in isolation or in appropriate combinations
- Remote handling (full-scale EBS emplacement tests; at present discussions are focused on spent fuel / high-level waste with an emphasis on demonstrating practicality under appropriate operational safety and quality assurance constraints.

The International Training Centre (ITC)
World-wide, there are many initiatives to store or dispose of highly toxic chemical and radioactive wastes in deep underground facilities. Geological disposal is seen as the only safe, practical and sustainable solution for many of the intractable residues. The timescale over which any one of these projects will be developed, and subsequently decommissioned, is typically several decades. In some countries, there is already a problem of maintaining the expertise base and ensuring sufficient trained scientists and engineers.

The ITC, established in Switzerland in 2003, aims to provide a focus for the propagation of knowledge and the continued training of scientists, engineers and decision-makers to meet the future needs of industrial organizations and government agencies world-wide:
www.itc-school.org

The ITC is not biased towards implementer, regulator, research organization or any interest group, but provides a balanced service for all, in the interests of environmentally sound waste management. Courses provide both theoretical and practical training and research in all aspects of science, engineering, decision-making and communication concerned with underground waste management and related environmental issues.

Although independent, the ITC is linked directly to active underground experimental facilities – in particular the Grimsel Test Site. It thus offers the infrastructure and databases of the GTS for professional training at all levels, academic courses and modules in association with universities around the world.

Conclusions
Nagra has launched the next phase of the Grimsel Test Site (Phase VI) with much longer time planning horizons than normally considered in geoscientific R&D. New projects are being planned to address among others, the needs for longer-term process-oriented experiments, full-scale demonstration, know-how maintenance and training. Projects addressing repository implementation issues relating to operational phase conditions, concept optimization and practicability, retrievability and monitoring are also considered as contributions towards ensuring public acceptability. International collaboration and the associated exchange of know-how will continue to play a central role in Phase VI and, presently, 21 organizations are involved in the planning of the specific projects.

Acknowledgements
Nagra would like to acknowledge the support of many partner organizations and a large number of contractors who have contributed to the success of the last two decades of GTS projects and who are taking an active role in approaching the challenges of future decades.

New geoscience surveys in Northern Ireland

by EurGeol. Mike Young[1] and Dr Dermot Smyth[1]

New regional geochemical and geophysical surveys are in progress in Northern Ireland. These will advance the development of the natural resource industry and provide a baseline of information against which to measure environmental change. Soils, stream-sediments and stream-waters are being sampled, according to the G-BASE standard of the British Geological Survey, and analysed by XRF and ICP. The airborne geophysical survey will be flown by a fixed-wing aircraft equipped with magnetometer, 256-channel gamma-ray spectrometer, and electromagnetic systems. The line spacing will be 200 m and ground clearance 55-90 m over rural areas and 250 m over urban districts.

De nouvelles études géochimiques et géophysiques sont en cours en Irlande du Nord. Celles-ci vont permettre le développement de l'Industrie des ressources naturelles et fournir un premier réseau d'information destiné à mesurer leschangementsd'ordreenvironnemental. Les sols, les sédiments et eaux des cours d'eau sont échantillonnés selon la procédure en vigueur au Geological Survey et analysés par méthodes XRF et ICP. Une étude géophysique aéroportée va être effectuée en utilisant un appareil à ailes fixes, équipé d'un magnétomètre, d'un spectromètre rayon gamma avec 256 canaux et de systèmes électromagnétiques. L'espacement entre lignes de vol sera égal à 200 mètres ; l'altitude minimum sera comprise entre 55 et 90 m au-dessus des zones rurales et égale à 250 m en zone urbaine.

Se están llevando a cabo nuevas investigaciones geoquímicas y geofísicas regionales en Irlanda del Norte. Con ellas se avanzará en el desarrollo de la industria de los recursos naturales y proporcionarán la línea base de referencia para medir los cambios ambientales. Se están muestreando suelos, sedimentos de arroyo y aguas de arroyos de acuerdo con la norma G-Base del Servicio Geológico Británico que son luego analizadas por FRX e ICP. El vuelo geofísico se realizará con un aeroplano dotado de un magnetómetro, un espectrómetro de rayos gamma de 256 canales y sistemas electromagnéticos. El espaciado entre líneas será de 200 m y el vuelo se hará a una altura sobre el suelo de 55-90 m en zonas rurales y 250 m en zonas urbanas.

Geological mapping, mineral exploration and environmental monitoring in Northern Ireland will all benefit from a new initiative, the Tellus Project, funded by the Department of Enterprise, Trade and Investment (DETI). The project, managed by the Geological Survey of Northern Ireland (GSNI), comprises comprehensive regional geochemical and airborne geophysical surveys of the whole land area of the country.

The goals of the project are:

- To advance the development of Northern Ireland's natural resource industry through new discoveries and provide the basic geological data and framework for decision-making and development planning;
- To provide a baseline of information against which to measure future environmental change;
- To contribute to sustainable land-use planning decisions by detecting and mapping geological conditions that may be associated with natural hazards and land drainage;
- To detect and map certain forms of industrial and agricultural contamination and the conditions under which these might develop;
- To help government to comply with the requirements of legislation on the assessment and monitoring of natural resources, soils and waters, including European Framework Directives.

[1]Geological Survey of Northern Ireland, Belfast

The Tellus geochemical survey began in the summer of 2004. This is a multi-media survey of soil, stream-sediment and stream-water samples in rural and urban areas. The survey is not constrained to the rural environment and all areas from the centre of Belfast to the remote peaks of the Mourne Mountains will be sampled. Tellus will establish the natural geochemical baseline signature and any anthropogenic overprint, providing data applicable to mineral exploration (Fig. 1) and geological mapping, pollution delineation and monitoring. Soils and stream sediments are sampled at approximately one site per 2 km^2 Soil samples are taken from two depths (20 cm and 50 cm) at each site to provide an insight into vertical geochemical variations (Fig. 2). Urban soils will be sampled at a distribution of four sites per km^2 and will be analysed for inorganic and organic compounds.

Soil and stream sediment samples will be analysed for more than 50 elements by XRF and ICP-MS/ AES, and for platinum group elements by lead fire-assay. Soils will also be analysed by aqua regia digest ICP-MS to provide a dataset relevant to the minerals industry and for environmental assessment. Waters will be analysed by ICP-MS and ion chromatography.

Previous regional geochemical surveys have included a reconnaissance survey of stream sediments by Imperial College, London, in 1969-73; later surveys by the Geological Survey of Northern Ireland; and a nationwide survey of lowland agricultural areas by the Department of Agriculture and Rural Development. The current work will

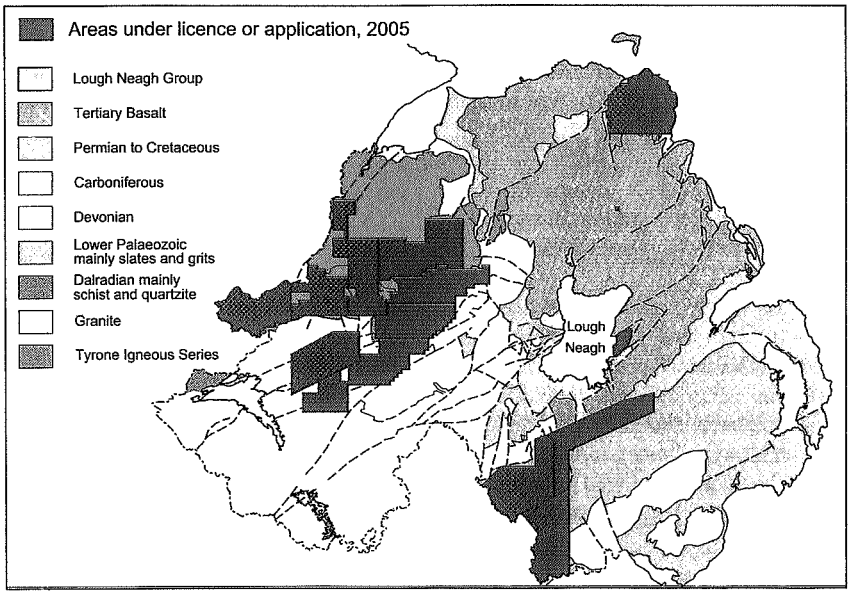


Figure 1. Geology of Northern Ireland, showing the areas licensed for mineral exploration © *Crown Copyright*

Figure 2. Soil sampling survey © *Crown Copyright*

Figure 3. Twin Otter geophysical survey aircraft © *Crown Copyright*

complete the national survey of stream sediment and water sampling begun in 1994 by the British Geological Survey (BGS) on behalf of the Department of Economic Development and Department of Environment. The survey follows the British Geological Survey's Geochemical Baseline Survey of the Environment (G-BASE) standard developed over many years and applied to map the regional geochemistry of the United Kingdom. For Tellus the GBASE specification will be enhanced by additional analyses and elements, including Au, Pd and Pt.

The Tellus airborne survey will be completed over two seasons in 2005 and 2006. The survey will be flown by the Joint Airborne-geoscience Capability, a newly formed partnership of the BGS and the Geological Survey of Finland (GTK). The survey will be flown with a De Havilland Twin Otter aircraft used previously for geophysical surveys in Finland and elsewhere and purchased in 2004 by the Natural Environment Research Council (Fig. 3). The aircraft is equipped with two magnetometer sensors, 256-channel gamma-ray spectrometer, four-frequency electromagnetic system, laser altimeter and GPS navigation system. The line spacing will be 200 m and ground clearance 55-90 m over rural areas and 250 m over urban districts. Data will be processed by GTK and BGS and interpretation will be undertaken by GSNI in Belfast.

The last regional geophysical survey of Northern Ireland was a total-field aeromagnetic survey flown at 2 km line spacing for BGS in 1959-60. The magnetic anomaly maps revealed regional and local faults and fractures, and delineated prominent magnetic lithologies. The new magnetic survey, flown in gradiometer mode at one tenth of the line spacing and at low altitude, will resolve more detailed magnetic

textures, which will assist structural and lithological mapping, particularly of areas covered by glacial materials. The radiometrics will further support geological and soils mapping and provide a detailed baseline on natural and artificial radionuclide distribution. The four-channel EM system will map variations in electrical conductivity in the upper 30 m and contribute to both mineral exploration and environmental mapping.

The results will be interpreted in relation to pre-existing geological, topographical and land use datasets. Data will be made available under licence to academic and commercial users. Existing data are already licensed to mining companies and the project is expected to promote further mineral exploration. The years 2003 and 2004 saw a substantial increase in mineral exploration licensing in Northern Ireland and the area under licence or application is now at its highest level since 1991. Two companies have made significant steps towards commercial gold production and others are actively pursuing exploration programmes.

The survey will establish baseline geochemical and physical characteristics of soils and streams and provide a context for evaluating environmental change. Mapping vital trace elements in agricultural soils and surface waters and measuring levels of natural and artificial contaminants in agricultural and urban areas will contribute significantly to land-use planning. The airborne EM and radiometric surveys will also contribute to mapping certain classes of ground conditions, notably ground and groundwater salinity, acid drainage from old mine sites and radon susceptibility.

A substantial programme of public information is underway to raise public awareness of Tellus and its value for planning and development. In addition to presentations to government departments, local councils and environmental organizations, several innovative events and initiatives have generated a wider interest in geology and the environment in schools and colleges throughout Northern Ireland.

Environmental monitoring in Slovakia : geological hazards

by Alena Klukanová[1], Peter Wagner[1], Lubica Iglárová[1], Peter Labák[2], Pavel Liščák[1]

Since 1992 the Partial Monitoring System of Geological Hazards in Slovakia has become a component of the national monitoring system (consisting of 10 subsystems). It is focused on deleterious natural or anthropogenic geological processes, which pose a threat to the natural environment, and to humans. To a certain extent, the established monitoring network is able to characterize any given site and to apply this to a larger region with similar geological conditions. The established monitoring system gives feedback for environment creation and protection, which provides the basis for decision-making in recent land-use activities as well as envisaged trends.

Depuis 1992, le Système de Surveillance Partiel des Risques Géologiques de Slovaquie est devenu une composante du système de surveillance national (constitué de 10 sous-systèmes). Il est orienté sur les processus géologiques naturels déletères ou anthropogéniques qui sont une menace pour l'environnement naturel et les hommes. Le réseau de surveillance mis en place est capable de caractériser de manière relativement fiable une superfice donnée et à un degré plus haut une région plus grande. Le système de surveillance mis en place donne des informations sur l'environnement et sa protection qui permettent de prendre des décisions sur les activités récentes et les orientations à envisager pour le futur.

Desde el año 1992 el Sistema Parcial de Control de los Riesgos Geológicos en Eslovenia se ha convertido en un componente más del sistema nacional de control (que consiste de 10 subsistemas). Está enfocada hacia materiales deleznables o procesos geológicos antropogénicos que representan una amenaza para el medio ambiente o los seres humanos. En cierta medida la red de control establecida permite caracterizar cualquier lugar determinado y aplicar dicha caracterización a una región más amplia con condiciones geológicas similares. El sistema proporciona retroalimentación para la creación y protección de ambientes, lo que sirve de base para la toma de decisiones en las actividades de usos del suelo recientes así como de las tendencias previstas.

The monitoring system (hereinafter PMS GH) observes and assesses the mechanisms of negative changes in the geological environment. The selection of the environmental criteria requires an individual approach by each country, derived from differing natural (climatic, hydrologic, geologic etc.), demographic and socioeconomic conditions. In the mountainous morphology of Slovakia, slope deformation dominates other geodynamic processes among the geological factors.

The PMS GH is co-ordinated by the Geological Survey of the Slovak Republic. At present, the design of individual monitoring subsystems is at various levels of development. Some are at the level of primary inventory measurements where single factor occurrence and monitoring parameters and measurement steps are defined. To this group belongs, for instance, the Territory Tectonic Activity. Monitoring of slope deformation activity is carried out by adjusted measuring of defined frequency, which has been modified according to the significance of the factor. In the majority of subsystems, a permanent design is established, for instance Weathering Processes, Seismic Phenomena, Quality of Alluvial Sediments, Snow Pack Quality, etc. The structure of the PMS GH is shown in Table 1. From the socioeconomic point of view, the worst geological hazards in the natural conditions of the Slovak Republic are slope deformation, volume unstable sediments, seismic and tectonic activity (Klukanová, 2002).

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Landslides and other slope deformations

Landslides and other slope deformations are the most widespread geodynamic phenomena (around 3.7% of the total territory) and, from a human point of view, among the most hazardous. Formerly, monitoring of slope movement was concentrated in the main engineering regions of Slovakia, where the principal types of slope failure included sliding, creeping and falling. Now, priority is given to areas where there is the greatest risk of human impact.

Among applied monitoring methods are geodetic and inclinometric measurements, measurements of surface residual stress magnitude, geophysical measurements of the PEE (Pulsed Electromagnetic Emissions) field and regimen observation of groundwater level changes and discharge of dewatering systems.

At the sites of rockslide movements of the creep type, TM-71 dilatometers are applied and for movements of the fall type, 3D measurements of monitoring points has been developed at GS SR.

The set of monitored localities represents a dynamic system, which is amended, according to the interests of the community,

N°	Name of subsystem	Solved issues
01	Landslides and other slope deformation	Continuous site monitoring of selected sites at exactness level corresponding to the site significance and its localisation within regional geological units. Extrapolation of acquired results to territories with analogous geological setting and climatic conditions according to defined criteria. Monitoring of territories prone to hazardous landslides and verification of corrective measures issues.
02	Erosion processes	Study of genesis, trends and dynamics of processes influencing the relief evolution at present geomorphologic cycle with consequences on changes due to construction impacts prognosis
03	Weathering processes	Issues of road–cuts stability influenced by contribution of weathered material from non–protected rocky walls, study of changes in mineral/isotope composition and physical/mechanical properties
04	Voluminal unstable sediments	Issues of behaviour of volumetric unstable sediments, in which due to over–moisturising normal over–load deterioration of their structure and voluminal changes take place
05	Impact of mining activity upon the Environment	identification and monitoring of damages in environment due to mining activities (manifestations of undermining and sinking of territory, cave-ins, changes in hydrogeologic water regime, chemical composition of waters in the vicinity of deposits and treatment plants)
06	Changes of anthropogenic sediments	Study of changes in fine–grained materials of tailings of various origin
07	Stability of massifs underlying historic objects	Study of the activity of slow slope gravitational phenomena, evaluation of causes of their origin and specification of secondary influences (climatic)
08	Covered anthropogenic sediments	Identification of empty spaces after exploitation filled with wastes of various types: communal and industrial wastes, materials from mining and treatment activities
09	Tectonic and seismic activity of the territory	Territory monitoring and assessment of movements activity of geological structures and of the relative rate of movements along faults
10	Monitoring of snow pack quality	Territory evaluation of chemical composition of the snow pack in Slovakia focusing on its influence on accumulation of reserves and chemical composition of groundwaters, acidification of soils, degree and character of contamination of the environment of SR.
11	Monitoring of seismic phenomena	Continuous registration of seismic events on the territory of SR
12	Monitoring of stream sediments	Monitoring of anthropogenic loads of active river sediments and their influences upon the quality class of surface streams
13	Monitoring of the radon volume activity	Radon contained in soils is monitored in selected cities with prognosis of increased radon risk, radon in waters of selected mineral and thermal springs, radon along faults.

Table 1. Structure and content of the PMS Geological Hazards

by new, actual localities and monitoring frequency at sites of diminishing importance, is gradually reduced. At the most important sites, several monitoring methods are used with greater measurement frequency. Primary measurement results are stored within an object-oriented database. This database enables interactive manipulation of the primary data, its processing in the form of secondary parameters and visualization in the form of dynamic charts. By December 31 2004. the database contained 238,213 records, acquired from monitoring measurements taken since 1993 (comprising also the data from automatic water stage indicators records).

Monitoring results and their utilization

The most important achievements of the monitoring up to the present are:

- A three-level assessment scale has been designed for evaluation of results, which were acquired using various monitoring facilities;
- In the case of several methods of monitoring, where measurements have reached level 3 (indicating distinct change in manifestations of the monitored parameter), we can estimate the probable activation of the slope movement as highly feasible;
- Statistical methods are used for annual complex processing of results of all monitoring measurements at the most significant sites (Veľká Čausa, Okoličné, Fig.1), utilizing zoning maps, which depict the territorial sliding activity level;
- Simplified results, based upon the primary data collected are made available to a wide range of users and customers on the Internet.

Volume unstable soils

These are soils, whose internal structural properties differ markedly before and after failure, or where excessive volume changes occur during the alteration of their structure. The volume instability is revealed either by volume decrease - collapse, or by volume increase - swelling.

Typical representatives of volume unstable sediments in Slovakia are collapsible soils (Quaternary aeolian sediments), swelling clays (Neogene or Quaternary clays) and strongly overconsolidated clayey soils of clayey shale and claystone character.

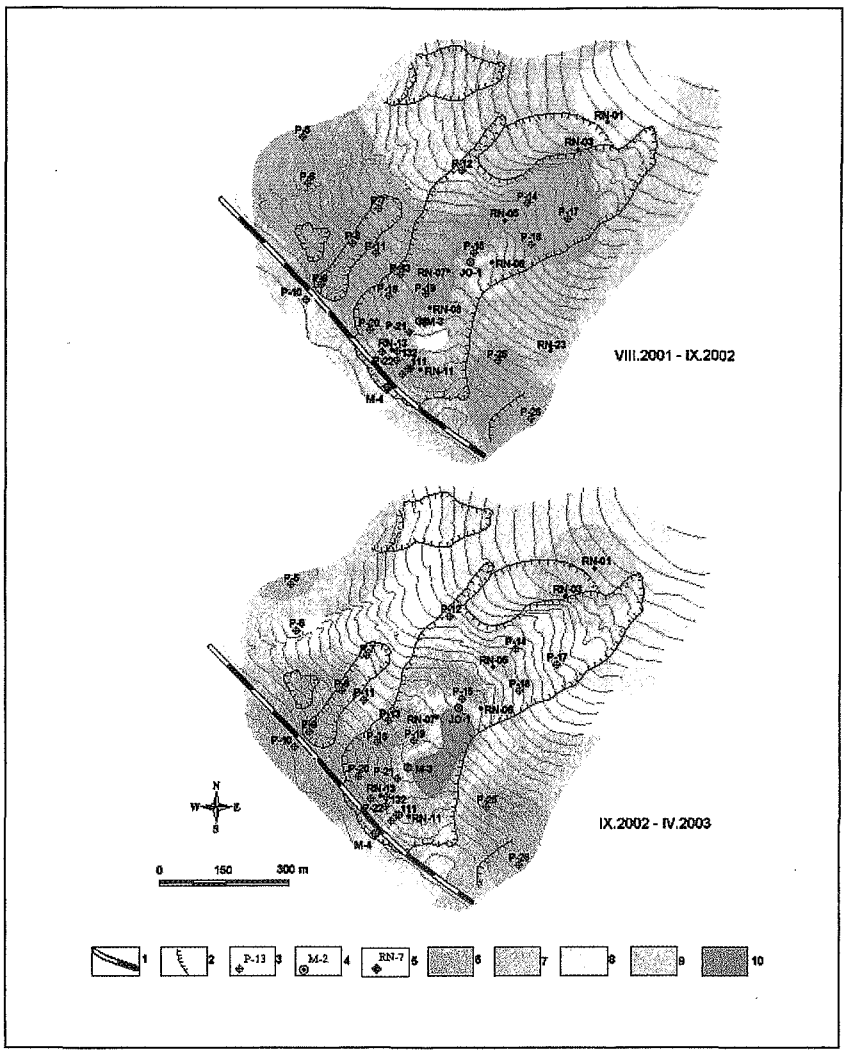
Construction failures due to subgrade instability are so common that an inventory of such failures in the most affected regions has been carried out. In the territory of the Podunajska nížina Lowland, failed objects were registered in 72 municipalities, and in 54 municipalities in the territory of the East Slovakia Lowland. Inventory sheets record registered damaged objects, their location, description, cause, course of failure, foundation soil profile, foundation construction and depth of each object, data on groundwater level, properties of foundation soil, analysis of external factors of collapsibility or swelling. The inventory also gives information on the value of relative swelling B_0, magnitude of swelling pressure P_n and its time-dependent course – these values were acquired using oedometric testing procedures. The shrinkage value was determined on clay samples, mainly from the smectite group. Deformation properties characterized by deformation modulus and filtration coefficients of selected soil samples were also determined.

Monitoring of seismic phenomena

The National Seismic Stations Network consists of the following sites (Fig. 2): Bratislava – Železná Studnička (ZST), Šrobárová (SRO), Hurbanovo (HRB), Modra (mod), Vyhne (vyh) and Košice (kos), Červenica (CRVS), Kečovo (KECS), Likavka (LIKS), Kolonické sedlo (KOLS), Iža (SRO1), Moča (SRO2) a Stebnícka Huta (STHS). Apart from the seismic station Hurbanovo, all stations are equipped with three-component short-period seismometers and digital apparatus. The seismic station Bratislava – Železná Studnička is the only station equipped with three-component wideband apparatus. The objective is to observe and analyse seismic phenomena:

- Monitoring, analysis and localization of earthquakes with an epicentre in the territory of Slovakia or earthquakes macroseismically observed in the Slovak territory
- Monitoring and interpretation of teleseismic events at seismic stations, --

Figure1. Complex assessment of acquired results – the Okoličné site encompassing the years 2002 and 2003. 1 – railway, 2 – borders of landslides, 3 – geodetic network, 4 – inclinometric boreholes, 5 – points of surface residual stress measurements, 6 – stabile parts, 7 – signs of slide movement activity, 8 – moderately active slide, 9 – active state, 10 – very active state



which are registered within ISC

- Monitoring, analysis and localization of industrial explosions.

Only two of the seismic stations (ZST and mod) provide data in almost real time (so-called on-line stations). Data from the other stations are collected with a delay of a few days to two weeks (so-called off-line stations). The present National Seismic Stations Network does not cover the territory of Northern and Eastern Slovakia. Localization of an earthquake within these regions is only possible if there are available data from seismic stations in neighbouring states. We observe earthquakes with macroseismic effects in Slovak territory, for which there exists only macroseismic localization. There have been only a few of such earthquakes.

Conclusions

From the review of the present state and perspectives of individual subsystems, it follows that monitoring observations significantly contribute to the knowledge of the present-state of the environment. It enables a timely identification of changes in the environment, which in some cases may lead to serious emergency events with negative economic consequence. The prediction of such events and timely corrective measures are more appropriate preventive forms than the reparation of accidents.

Among the issues raised by the monitoring solution is the transition to continuous observation with the creation of warning signals systems as well as legislation to monitor response once a problem has been identified.

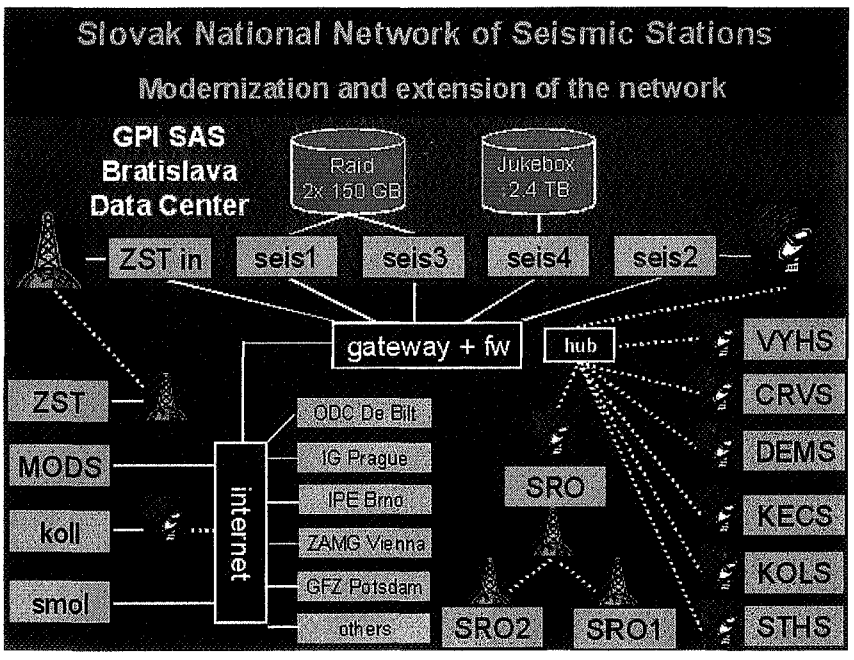


Figure 2. Diagrammatic representation of recorded data transmission

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Klukanová A. 2002. (Ed.) Čiastkový monitorovací systém – geologické faktory *(Partial Monitoring System - Geological Factors)*. Geologické práce, Správy 106, Dionýz Štúr Publishers, pp 1-145. ISSN 0433-4795.

Around the Earth in 500 pages

Book review by David Harper[1]

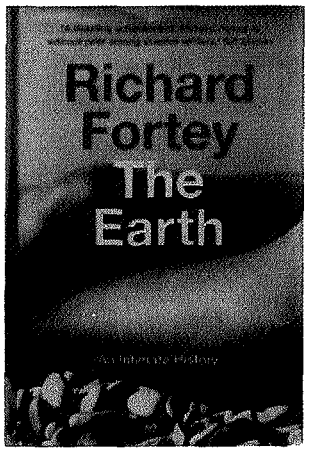
Richard Fortey is no stranger to the big concept. During his scientific career he has tackled the classification and phylogeny of a number of major groups of fossil animals, established their life styles, habitats and geographic patterns in an Early Palaeozoic world far removed from our own. His popular scientific writing has taken him from the 'The Hidden Landscape' through 'Trilobites! Eyewitness to evolution' to 'Life: An unauthorized biography'. All are best sellers and have established Fortey as a leader in this genre. Nevertheless, his most recent popular book with the unpretentious title 'The Earth' is undoubtedly his most ambitious project to date. Within 501 pages Fortey takes us on a carefully planned tour of the Earth's surface, developing the concepts and observations on which understanding of the composition, structure and workings of our planet are based. As we read through the beautifully narrated pages, we begin to appreciate and understand many of the unique aspects of the geology of our planet: the differences between continental and oceanic crust, the building of the world's huge mountain belts, the significance of major faults and zones of volcanic activity and what may actually be happening deep beneath the crust are explained during a leisurely odyssey that begins and ends around the historic environs of the Bay of Naples.

The framework for Fortey's journey is, of course, plate tectonic theory arguably the largest conceptual breakthrough since Darwin. The surface of our planet is and has been a mosaic of restless tectonic plates moving past, into, under or over each other. But the evidence for this elegant model is in the rocks themselves: Critical is the careful mapping of, for example, lava flows around the Bay of Naples and on Hawaii, the thick flysch and limestone successions of the Alps, and the ancient gneisses of the NW Highland of Scotland. Fortey's book takes us around the world to these key geological localities, many of both geological and historical importance, where the working of the Earth is vividly brought to life both in the text and in the many colourful illustrations. There is much scientific information in the book, with useful references for further reading and a comprehensive index.

Despite the wealth of detail and erudition, it is nevertheless impossible for the reader to lose that sense of wonder for our beautiful planet displayed in this splendid book.

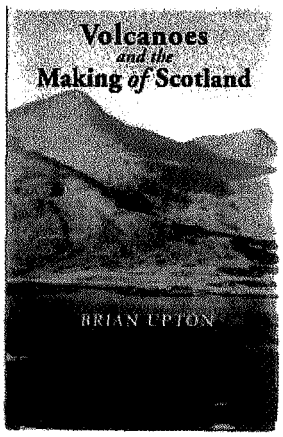
The Earth. An intimate history by Richard Fortey.

Published by HarperCollins Publishers
ISBN: 0-00-257011-4
Date: 2004. pp 501
Price: 25 Stg (37 €)



Scotland's fiery past

Book review by David Harper[1]



Volcanoes and the making of Scotland by Brian Upton.

Published by Dunedin Academic Press
ISBN: 1 903765 40 4
Date: 2004. pp 247
Price: 16.95 Stg (25 €)

The beauty of Scotland's mountains and glens markedly contrasts with the nation's violent past, through a history marked by the first Mesolithic settlers on Rum to the recent establishment of a Scottish Parliament in 1999. The Massacre of Glencoe and the brutality of the Battle of Culloden still lie deep in the consciousness of most Scots. Brian Upton, however, in this lucidly written and beautifully-illustrated book, extravagantly demonstrates that such violent events go much farther back in time: back to at least 2 billion years ago. Volcanoes and associated volcanic events have played a significant part in the development of Scotland's long geological history and in shaping the country's magnificent and unique scenery.

The first four chapters include much background and introductory material explaining clearly the various types of volcanoes and their products, their geological settings and the relationship of volcanic deposits to magma types more deeply rooted in the Earth together with an outline geological history and terrane structure of Scotland. The core of the book is a sequential journey back in time from the Cenozoic to Precambrian, charting the evidence for

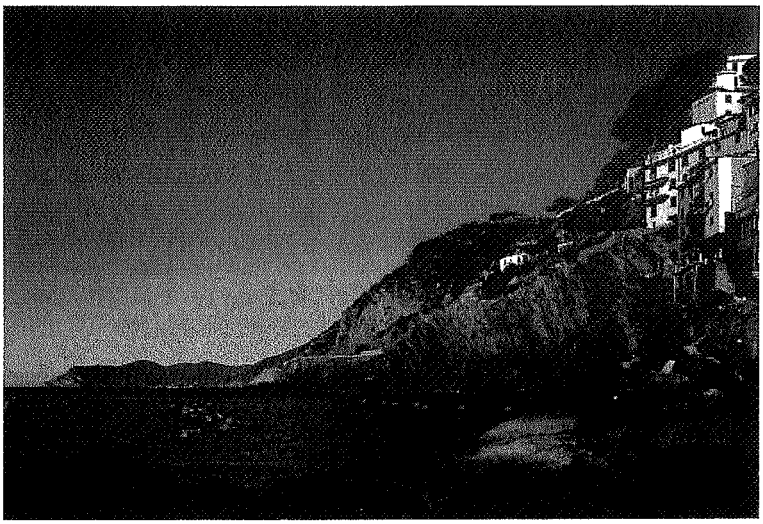
volcanoes and volcanic processes in the creation of Scotland's basement. This journey takes us first to the impressive Paleogene volcanic fields of western Scotland, including the islands of Mull, Rum and Skye, associated with the opening of the present North Atlantic. But volcanism was also important during the late Carboniferous and Permian development of central Scotland and in the post Caledonian (lower Carboniferous and Devonian) deposits of the Midland Valley creating for example Dumbarton Rock, the Heads of Ayr, the environments of some early terrestrial vertebrates in East Kirkton Lake and of course Arthur's Seat and Salisbury Crags, the last a focus for James Hutton's support for the 'Vulcanist School' rather than Werner's 'Neptunist School'. Devonian volcanism was widespread across much of the Scottish part of the Old Red Sandstone continent, providing the peaks of Ben Nevis and Glencoe while volcanic activity probably sustained the life of the remarkable Rhynie biota. Farther back in time, the extent and evidence for volcanism is less clear. It played an important part in the development of the Early Palaeozoic Iapetus Ocean; volcanic associations are exposed in the classic Girvan district and in the Southern Uplands of Scotland. Volcanic assemblages can probably be tracked back to at least the Loch Maree Supergroup (1700 Ma) in the scenic NW Highlands. This is not in itself remarkable since perfectly preserved pillow lavas are present in the Isua Complex (3800 Ma) in west Greenland. But in Scotland too, volcanic processes probably operated during the development of the Lewisian Complex. For many, the word geology is only associated with 'dinosaurs and volcanoes'. Brian Upton's book more than satisfies our continued appetite for the latter. But more importantly, this book charts the history of one of the most significant crustal processes through the geological development of a country and its scenery. It demonstrates the importance of careful documentation, analyses and interpretation of our bedrock in the understanding key geological processes that, too, can violently impact on our daily lives.

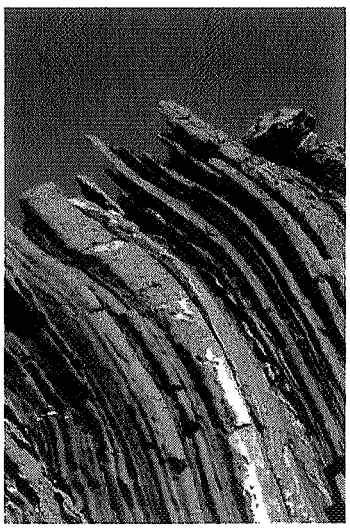
[1]EurGeol. David Harper is Professor of Palaeontology, Natural History Museum of Denmark, University of Copenhagen

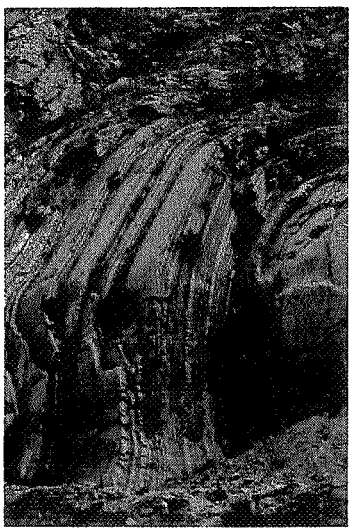
Cinque Terra National Park, N. Italy

History of a landscape by Attilio Casavecchia and Enrica Salvatori
61 pp
parconazionale5terra@libero.it

The first booklet 'History of a landscape' in a series designed to help local residents and visitors appreciate the complexity of this World Heritage site - National Park and protected marine area - deals with the historical trades of the Cinque Terra - viticulture and fishing. Subsequent guides will deal with settlement and historical monuments; cultural and culinary traditions; and flora and fauna.







Top: The village of Riomaggiore from the sea. Bottom left and right: Deformed flysch formations. The poet Byron spent many hours exploring this area and wondering at these superb natural rock formations.

Professional practice of engineering geology in Europe

by EurGeol. EurIng David Norbury[1]

Continuing internationalization of the construction industry in which Engineering Geologists work has resulted in significant changes in the way we work, in the need for us to demonstrate to others our ability to do the work, and the environment in which the works are to be constructed. The pace of these changes is increasing and they are coming increasingly to affect our daily lives. The formalization of engineering geologists' work and reporting has come about through increasing codification of technical activities, which has also seen the introduction of minimum qualifications for practitioners. This links with moves towards the international recognition of professional qualifications through European Directives. These changes are summarized in this paper, and the additional question of whether there is a need for Registration is also considered.

L'internationalisation croissante de l'industrie de la construction pour laquelle travaillent les géologues du Génie civil a provoqué un changement significatif de notre façon de travailler, face à la nécessité de démontrer à autrui notre capacité à faire le travail en tenant compte également des conditions environnementales propres à la construction. Ce changement qui va en augmentant affecte de plus en plus notre vie de tous les jours. La formalisation de l'activité des géologues de Génie civil (travaux de terrain et rapport) est passée par une codification croissante des travaux techniques qui a également conduit à la mise en place d'un minimum de qualifications pour ces professionnels. Cela est en relation avec les actions en faveur de la reconnaissance au niveau international de qualifications professionnelles par l'intermédiaire de Directives européennes. Cet article résume les divers changements avec en plus, prise en compte de la question relative à la nécessité éventuelle d'une inscription officielle.

La continua internacionalización de la industria de la construcción en la que el trabajo del ingeniero geólogo ha dado como resultado cambios significativos en la manera en la que trabajamos, en la necesidad de demostrar a otros nuestra capacidad para hacer el trabajo y en el ambiente en el que las obras se van a construir. El ritmo de estos cambios se acelera y cada vez afectan más a nuestras vidas cotidianas. La formalización del trabajo y los informes del ingeniero geólogo ha surgido a base de un aumento de la codificación de las actividades técnicas que también ha visto la introducción de las cualificaciones mínimas para los técnicos. Esto se une a movimientos hacia el reconocimiento internacional de las cualificaciones profesionales por medio de Directivas Europeas. Estos cambios se resumen en esta artículo en el que también se considera la pregunta adicional de si es necesario un sistema de certificación de profesionales.

Engineering Geologists practise engineering with, on or in geological materials. Such Ground Engineering is of considerable economic importance and benefit to society in providing the means for the development of efficient structures and the sustainable use of resources and space.

This fundamental input to the welfare and protection of society includes:

- safety of structures,
- supply of energy and resources,
- mitigation of hazards, and
- contribution towards a sustainable environment.

[1]Secretary General, European Federation of Geologists, and Associate Director, CL Associates, UK

Ground Engineering is based on the professional input of geologists and engineers, and specifically includes the scientific disciplines of engineering geology, soil mechanics, rock mechanics, and related disciplines such as hydrogeology and mining geomechanics. The execution of projects in or on the ground requires the input of a range of scientific and engineering specialities, and these specialists have to be able to communicate in order to agree on theoretical models, and parameters within the models. In addition, and perhaps even more important, is the need to communicate with other interested parties, who are often not scientifically trained and would include at least the owner of the project.

The practice of Engineering Geology requires compilation and communication of the ground model. This communication has to be unambiguous and clearly understood if the works are to proceed smoothly. In these days of engineering projects becoming increasingly international, this clear communication also needs to take place between practitioners from different countries using a common international language. National codification of description terminology and field and laboratory test procedures has been appearing over the last thirty years, but these national standards are now being overtaken by international standards.

As with other professionals, Engineering Geologists need to demonstrate that they have obtained sufficient and suitable training and experience to act as competent professionals to practise in the public domain. There has recently been a major shift towards more transparent professionalism, in particular in the areas of competence and responsibility. There is an increasing need for professionals

delivering to the public (senso lato) to set, measure and demonstrate attainment of acceptable standards.

The ultimate demand for such recognition is from clients and Society as a whole, but the recognition of such attainment levels comes from peer review within the profession. Peer-reviewed titles have been available through national institutions in a number of countries for several years. Although the titles may be similar, it is not easy for other parties, such as clients in one country, to appreciate a qualification from another country. These practical difficulties limit mobility and international professional practice, and it has long been an aspiration to have some form of international qualification or professional passport. This concept is being brought forward by the European Parliament with the upcoming Directive on Mutual Recognition of Professional Qualifications. This Directive defines the Common Platform concept of professional competence, with the intention of achieving genuine mobility of professionals.

Codes in engineering geology

Engineering Geology as a professional practice has been in existence for as long as man has been carrying out engineering works in and on the ground, but with an almost complete lack of codification up to about 1970. Before then, the small number of practitioners readily communicated amongst themselves in terms of standard procedures and meanings of words and results, but this became increasingly difficult as the industry grew.

There is now an increasing range of guidance offering the opportunity for standardization of practice in two distinct areas. Many of the procedures to be used in the field and in the laboratory were standardized, if informally, at an early stage. Most such guidance was prepared at national level, with limited co-ordination between countries. However, the description of soils and rocks, which arguably forms a foundation stone of all engineering geological studies and investigations, did not achieve the same early progress in this sense. Our ability to communicate at this basic level is still limited and, as construction projects and engineering geology have become increasingly international, the need for common procedures and practices increases. Over the last 25 years there has been much work ongoing to prepare international standards. The Standards bodies responsible for co-ordinating and delivering this work are the Comité Européen de Normalisation (CEN) and the International Standards Organization (ISO).

Codification of description

Before about 1970, there was no standard terminology allowing communication of descriptions of geological materials or their properties. This limitation was not too severe initially as the embryonic stage of the science required much closer co-operation than is possible in these increasingly hectic times of major projects and international practice.

The use of undefined terminology has caused confusion and ambiguity in communication and, as a result, frequent contractual arguments and claims based on unexpected ground conditions. This can hardly be surprising as, if the terminology is variable and undefined, there will always be an alternative reading of the ground conditions available. For instance, terms such as highly fissured, or moderately jointed were not defined and therefore meant different things to different readers. This situation was untenable, and the nettle was grasped by the Engineering Group of the Geological Society of London who published, in the early 1970s, Working Party Reports on Core Logging and on Preparation of Maps and Plans (Anon 1970, 1972). These Reports formed the basis of UK practice and, as it turned out, international practice in many regards. Similar activities on the international scene resulted in a number of publications up to 1981 on field investigation, geological mapping and soil and rock description (Anon 1977, IAEG 1981 and ISRM 1978).

In the UK this decade of guidance culminated in BS 5930 (1981), the seminal National Standard in site investigation and engineering geological activities. It is important to note that this British Standard (and its successor in 1999) was designated as a Code of Practice, that is the guidance being advisory rather than normative (compulsory). In practice though, the Code is referenced in contract specifications, and in legal arguments about claims or failures the courts will expect the national guidance to have been followed. Therefore the position, at least by default, is for such Codes of Practice to operate as normative Standards.

There has been a good deal of inclusion of practices from one country into that of another country, and hence the preparation of international codes has not been as difficult as might have been anticipated. However, the historic development of local codes has tended to reflect and emphasize local geological conditions, and codification of classifications was more difficult to bring together into an international standard.

For example, the Scandinavian countries have different soils (coarse glacial deposits and quick clays) from Japan (volcanic soils, silts and sands liable to liquefaction) which national practice has, for sound technical reasons, needed to incorporate (SGS, 1981; JGS, 2000). Other National Standards on the description and classification of soil include ASTM D2487 (1993), D3282 (1993), DIN 4022 (1987) and DIN 18196 (1988). Guidance on the description and classification of rocks for use in engineering applications include Anon (1995), ASTM D5878 (19995) and D4879 (1989).

However, it has been possible to prepare international standards incorporating the best of national practices, and these are nearing completion, publication and implementation, at least as far as the description of soils and rocks is concerned (ISO 2003 a, b, c).

Codification of field and laboratory testing

Just as important as the codification of the primary communicator – the description – is the standardization of field and laboratory procedures. This includes all aspects relating to forming the hole or exposure, the execution of field tests, the recovery of samples and the carrying out of laboratory tests. If the results of any of these activities are to be applicable and relevant in the minds of others, the procedures used need to be clearly identifiable and standardized.

The codification of general investigation procedures was started at an early stage of the industry with the early practitioners formulating procedures and practice. The procedures required included everything from how to drill a borehole, to the basic field tests, to the taking and description of samples, their storage and transport and laboratory testing. Methods of field investigation vary from country to country (influenced in part by geology) but, with the basic principles having become common over the years, standardization is possible.

In laboratory testing, however, national practices were well advanced before the need for international standardization was recognized. As a result, the differences between countries are such as to have delayed achievement of the Eurocodes. Codes on soil testing are therefore in preparation, but only initially as advisory documents.

Italy	• each region has its own Order of Geologists who administer the system • geologists must be a member of the Order to legally practise • foreign academic qualifications have no legal validity	It is virtually impossible for qualified professional geologists from other EU States to practise in Italy
Spain	• Either obtain recognition of academic title by the Ministry of Education, Culture and Sports • or be governed by the terms of the free movement directive and operated by the Ministry of Science and Technology	On receipt of official authorization, the Official Association of Spanish Geologists (ICOG), registers all geologists. In order to practise the professional must register in the association. Persons holding the EurGeol. title are recognized by ICOG as national geologists
United Kingdom	• the regulated title "Chartered Geologist" is conferred by The Geological Society of London • application for this title can be made from a migrant who is a national of a Member State	Market forces reign, and no qualifications are required to practise
Ireland	• A "qualified person" has a recognized geoscience degree • at least 5 years experience in the relevant field, and • is a member of a relevant recognized "professional association" that admits members on the basis of academic qualifications and experience, requires compliance with professional codes of ethics, and has disciplinary powers	Reports submitted to government under the requirements of the Mining Act and to the Environmental Protection Agency will only be accepted if signed off by a suitably "qualified person".
Other	• market forces govern the situation • anybody can call himself a geologist and practise as such without professional qualifications • where qualified employment is involved, however, non-nationals may come up against the problem of the *de facto* recognition of their qualifications and diplomas	Problems have arisen in Belgium, Germany and Denmark where qualifications from other countries have not been recognized for minor reasons, and with no allowance being made for professional experience

Table 1 Summary of the regulatory position in a selection of European countries.

The testing of rocks in commercial practice, on the other hand, started slightly later, by which time the potential need for international co-operation was better appreciated before national practices had developed. It was therefore possible for the rock testing procedures to be better organized with the International Society of Rock Mechanics taking the lead by producing a series of Suggested Methods (ISRM, 1978). As there were no precedent procedures in place, these were rapidly taken up by the professional community and became internationally recognized without the involvement of national standards bodies.

Codification of qualifications

A further aspect of codification that applies in any subject is the identification of the qualifications and experience necessary for those who plan, carry out and interpret ground investigations. The guidance documents and codes prepared up to the end of the 1980s did not try to lay down rules on the qualifications and experience needed from those working as specialists in engineering geology. In the very early days, this was felt to be unnecessary. This position has become increasingly untenable, and it is now necessary to define the roles and the allowable practitioners. It is interesting to consider who benefits most from such codification. Is it the client, who can feel better protected with proper professional advisors; the insurers who feel they have lower exposure; the individual practitioners who feel this improves their status in society; the employers who can recognize a qualified practitioner; or the companies who can see a market with fair competition? The truth is probably a bit of all of these. The position taken by the Standards institutions is based on the last two views, and Standards documents currently in preparation include definitions of specialist practitioners. These definitions will therefore become normative requirements in the practice of Ground Engineering.

Codification now

After 25 years in preparation, the suite of Eurocodes is becoming a reality. These Eurocodes bring together codes of practice for building and civil engineering structures, and provide a world-class standard for all aspects of construction. Included with Eurocode 7: Geotechnical Design, are elements of codes on the description and classification of soils and rocks, field investigation methods, field and laboratory testing, assessment of engineering parameters and design procedures. For the first time, engineering geologists throughout Europe will be talking a common language in reporting the findings of their work. However, this improvement is even more widespread as, in accordance with the Vienna agreement, the standards drawn up by CEN and ISO undergo parallel voting procedures for common adoption. Thus, for example, the proposals for the description of soils and rocks, prepared by ISO (2003a, b, c), will be incorporated also into Eurocode 7. It will now be the case that Engineering Geologists around the world will be able to pass on their geological information, without misunderstanding and ambiguity. The brown sandy clay of the Japanese will be the same as the brown sandy clay of the Swedish geologist. Similarly, the results of field or laboratory testing will be transferable around the world. Major exceptions to this rule are China and the USA, who are not members of either of these Standards bodies, and who have had no input to the drafting of the Codes.

The Eurocodes do not however, completely subsume national practices built up over the years. This is right and proper given that variations in engineering geological practice have a base in the different geological conditions in different countries. For instance, the geological conditions in Northern Europe, with extensive shield rocks and quick clays, vary widely from the liquefaction prone sediments of the Pacific rim, and the deep weathering profiles of the tropics. These conditions require different approaches to investigation and testing. National differences in approach can be incorporated into National Annexes, which allow key safety and technical issues to remain a national responsibility, and allow geological and climatic variations to be taken into account. However, these National Annexes are enhancements, rather than local rewrites, of the overarching international codes.

The professional geologist as a competent person

Much of today's geological practice affects the health, safety and welfare of the public, and protection of the environment, as well as the economy and feasibility of engineered works. Mining, quarrying, construction, geotechnics, development of water resources, waste disposal and flood avoidance measures are just a few examples of activities that may significantly change the landscape and the quality of life of local inhabitants. It is essential in fulfilling these roles that the professional work of the geologist is always of the highest possible standard.

Much of the early geology was carried out by geologists who qualified in European universities, but our industry is becoming increasingly international. Technical and

Remediation of a Brownfield site, with geological input in protecting ground and surface waters

financial assistance comes from a range of sources, training and research facilities are available in all countries, and consultants from across the world fly in to provide advice to clients and funders. In addition, many modern infrastructure projects traverse national boundaries, e.g. Channel Tunnel, Storebelt Link, Rhinebraun Coal and its dewatering effects.

This globalization requires the training and experience of professionals to be recognizable as equal. It is essential that some form of international qualification passport is recognized - the "Competent Person" concept - that will allow practice in a range of jurisdictions.

Recent developments within the international mineral markets increasingly require that technical reports be signed off by a "qualified person". This applies particularly to the natural resource and finance sectors when reporting on a company's mineral resource assets. The Canadian Securities Administrators specify (Toronto Stock Exchange, 1999, National Instrument 43, 2001) that a qualified person

- must be a geologist or engineer;
- must be an individual, not a firm;
- must have at least five years of experience relevant to the particular project; and
- must belong to a regulatory organization with disciplinary powers (a "professional association").

Similar requirements are insisted upon by other Stock Exchanges and by various government bodies responsible for licensing and regulation of mineral exploration and development. These institutions have published lists of professional titles that they recognize. In many jurisdictions, the EurGeol. and EurIng. titles are so recognized, subject to the individual having the relevant experience. Certain national organizations are similarly recognized.

The Reporting Code (2001) set a new and very specific definition for Competent Persons, which require the experience both to be sufficient, and for that experience to be relevant to the report being signed off.

Definition of a competent person

A Competent Person is a corporate member of a recognized professional body relevant to the activity being undertaken, and with enforceable Rules of Conduct. A Competent Person should have a minimum of five years experience relevant to the style of mineralization and type of deposit under consideration. If the Competent Person is estimating or supervising the estimation of Mineral Resources or Mineral Reserves, the relevant experience must be in the estimation, evaluation and assessment of Mineral Resources or Mineral Reserves respectively.

The implication of this specific definition is that all professionals signing off reports will have to examine their competence to do so. A reasonable test might be whether the signatory would feel comfortable justifying their competence to their peers, or under cross examination by an aggressive lawyer. For instance, can an Engineering Geologist remain comfortable in signing off a report with a significant hydrogeological content ?

Mobility of professionals

Access to employment in another Member State is a fundamental aspect of the free movement of persons within the European Union. The European Union policy objectives are to

- increase the community's workers' chances of finding work and adding to their professional experience;
- encourage the mobility of workers, as a way of stimulating the human resource response to the requirements of the employment market;
- develop contacts between workers throughout the member states as a way of promoting mutual understanding, creating a community social fabric and hence "an ever closer union among the peoples of Europe,

The geological profession is regulated in a small number of countries within the European Union. Where Member States do regulate, each one does so by reference to the diplomas and other qualifications obtained in its national system of education and training. The situation in a selection of countries is summarized in Table 1. In Greece, the situation is more serious as, although these problems do not arise, the statutory authorities only accept geological reports when engineers sign them. It is difficult to reconcile this requirement with the Competent Person concept outlined above.

In an attempt to overcome, or at least to minimize, these problems the European Commission has encouraged national professional organizations to co-operate at the European level (European Directives 89/48/EEC and 92/51/EEC). For example,

the Commission has welcomed the contribution that Common Platforms and initiatives taken by the private sector can make to genuine mobility of professionals. It has also been noted that such initiatives might be particularly valuable in the field of non-regulated professions, which includes both geology and engineering.

In order to facilitate mobility of workers, internationally recognized qualifications have to be available. The Directive on Mutual recognition of Professional Qualifications, which should be enacted by the end of 2005, intends that practitioners will be able to practise, at least for limited periods, in any EU country, by the holding of such a recognized qualification. This qualification is likely to be the Common Platform of the European Federation titles of European Engineer (EurIng), awarded by the European Federation of Engineers (FEANI), and European Geologist (EurGeol.), awarded by the European Federation of Geologist (EFG).

Such titles show that the bearer has undertaken appropriate tertiary level study, carried out appropriate training and gained sufficient experience, all over a combined minimum total of eight years, to be able to act as a professional engineer or geologist, and that this record has been submitted to his or her peers for validation. The holder of such a title agrees to work within the Code of Conduct operated by the awarding Federation. As a result, they will be able to work in any European country without the need to qualify separately in that country. These are major developments in providing commonality of professional standards, and represent developments hoped for by ISO and CEN now being driven forward by the European Commission.

An outstanding difficulty is the equivalence of academic qualifications – this is currently being considered by the tuning committees in operation around Europe. The importance of agreement being reached and implemented on this matter cannot be overstated.

Registration

Does the approach of the Common Platform concept go far enough, or should the profession be pushing for Registration?

A recent meeting considered the difference between statutory title and voluntary regulation (Davies, 2003). As most governments where regulation is not already in place are anti-regulation, legislators are unlikely to be persuaded of the benefits of statutory imposition, unless on grounds of public safety, value for public money or national wealth. There is widespread uncertainty as to whether Registration, or Licensing, should be of the professional practice, or whether it is simply another form of protectionism towards the professional title. One of the most common justifications in favour of registration is on the basis of enhancement of status. Although this appears spurious, in that status comes from performance, not from imposition of title, those countries which operate Registration would suggest that enhancement of status arrives with registration.

The current arrangement is of self policing by competent nominated authorities (such as the EFG or FEANI). Members are required to practise in accordance with the Code of Ethics, but this will only be challenged when a complaint is made to the authority or in the courts. The European Federation of Geologists has put in place a system of mandatory CPD, with the records of individual members being audited on a regular basis. Any higher level of regulation requires a bureaucracy to police the industry. Although governments might consider that this should be transferred to civil servants, this scenario is unlikely. This leaves the currently operating national and European institutions to consider how they might operate Registration if the need arises.

Recent correspondence on the subject in the UK has tended towards the greater use of titles to show the public that they are dealing with a competent professional. Thus, all work would need to be signed off as suitable in terms of the core design and safety requirements by a titled Engineer or Geologist. These professionals would need to meet the requirements of a Competent Person. This is similar to the requirements that already exist in the UK for dams and nuclear structures, so this could be readily extended to encompass the signing off of ground engineering aspects of projects. It is not clear why this is not routinely required already. This also comes close to the requirements of those countries, such as Italy and Spain, in which the industry is currently regulated.

Concluding remarks

Over a remarkably short period, engineering geology has gone from the small number of early professionals who managed without codes, to today's world where we are being increasingly controlled by codes. The codes coming into place in the 2000s define how we drill holes, take and test samples, describe soils and rocks. Perhaps the biggest change however is that we will have to carry internationally recognized qualifications if we want to be able to practise wherever we want, and that this will be possible.

Acknowledgements

I would like to thank the many people with whom I have held discussions, sat in meetings and generally evolved the ideas presented in this paper. In particular, I would identify fellow members of the EFG Board, John Clifford particularly, and Helmut Bock and Rodney Chartres from the Joint Working Group. The ideas presented in this paper are mine, and do not necessarily represent the views of either the EFG or my employer, both of whom I thank for permission to publish this paper.

Introduction to geological mapping

Book review by Manuel Regueiro[1]

Geologists have very few activities where no other professional can claim knowledge or capabilities resulting from their academic education. One of them may be their specialist training in observing and understanding Nature, more precisely Geological Mapping.

I am one of those geologists who has learnt to love our field job thanks to that magnificent and special tool that requires a complete geological knowledge to produce a comprehensive 2D interpretation of the geological landscape.

In my career, I have reviewed many papers for a variety of scientific journals and I have seen how my colleagues, particularly from academia, tend to forget to include a geological map of the area investigated, substituting instead spectacular tectonic illustrations or graphs of all sorts. I have always claimed, not always with success, that the geological map should be given its proper place. In my opinion, there would be more geological discoveries all over the world if geological mapping was taken more seriously.

It is therefore essential that geologists learn good geological mapping techniques, but unfortunately there is not a lot of didactic literature covering this area of knowledge.

To fill that gap was the primary reason why the authors of this book decided to combine their working knowledge and their personal teaching experience with undergraduate students in a book whose targets are students and teachers of introductory courses in University but also those in High School.

The book dedicates its first five chapters to spatial orientation of geological elements, projection systems and interpretation of some projection cases. In chapter 6, 7 and 8, a brief description is given of map interpretation symbols, cartographic elements and main types of contacts and structures. Chapters 9 to 12 are the practical part of the book with a series of cutout models, geological cross sections, geological maps with simple structures and topographic base and advanced geological maps.

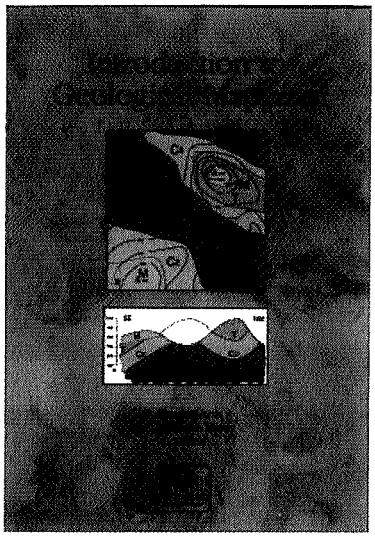
The student is guided though all these examples in order to develop first a spatial view of cartographic problems, then a geological events sequence to be able to work with the introductory geological maps and the advanced geological maps which become increasingly more complex.

The book is thus simple in conception and, due to its progressive complexity, can be used with students of all levels.

The original Spanish version of this book is now in its 4th edition and that extraordinary success prompted the authors to produce this English version so as to reach an increasing number of readers.

I am sure that for the academic world, but also in High School, this new English version will be of extraordinary help in providing natural sciences students and future geologists with an amusing and didactic way of acquiring a good knowledge of geological mapping.

[1]Prof. Manuel Regueiro y González-Barros
Geological Survey of Spain.
Dept of Crystallography and Mineralogy. Complutense University of Madrid



Introduction to geological mapping by Ramón-Lluch, R., Martínez-Torres, L.M. & Apraiz, A.

Published by Universidad del País Vasco. Servicio Editorial
www.ehu.es/servicios/se_az
luxedito@lg.ehu.es
ISBN: 84-8373-628-1
Date: 2005. pp 214
Price: 21.25 €

News and events 2004 - 2005

News from UK

Professional initiatives

The Geological Society of London has launched a number of new initiatives aimed at further enhancing the professional services it offers to its Fellows

The year 2004 has seen very encouraging progress on several of the projects that the Professional Committee, the Fellowship and Validation Panel and the Accreditation Panel have been working on, in addition to their regular work of these committees. Overall, we are aiming to improve the support offered to Chartered Geologists, to promote the highest standards of professionalism and practice, and, particularly, to raise the profile of professional geologists and their status as compared with engineers and other scientists and technologists. These aims do, of course, present advantages to individual Chartered Geologist, but there are equally important, outward looking, reasons for working on these issues, for the benefit of society generally.

The public has a right to expect that appropriate professionals are engaged to undertake work on construction, mining and quarrying, remediation of contaminated land, natural hazard identification and other projects involving the ground. Where problems occur associated with ground conditions or failure to recognise natural hazards these can often be traced back to failure to include an appropriately qualified and experienced geoscientist in a project team or failure to allocate sufficient time and resources to this area of work. Many of our initiatives to support geoscientists throughout their careers have, as a spin-off advantage, improvements in general public understanding and awareness and that of other professionals.

To this end, the Society has now launched its new Continuing Professional Development (CPD) scheme. This is the result of detailed research and discussion carried out by the Geological Society's Professional Committee, chaired by Ruth Allington. The formal recording and monitoring of CPD acknowledges the responsibility of Chartered Geologists (and those intending to become chartered) to maintain and develop standards of technical and professional competence inherent in the designation of CGeol. Previously, the Geological Society operated an optional scheme for use only by its chartered Fellows. The new scheme is still optional but is now open to *all* Fellows. Those preparing to make a Chartership application in future are especially encouraged to get into the habit of recording CPD now. European Geologists and Chartered Scientists will also be able to use the CPD records they build up under the new scheme to maintain those titles.

A key element of the new scheme is the facility for Fellows to record and report their CPD activity online, at *www.geolsoc.org.uk*. To do so, Fellows need to log in through *Fellows' Login* button on the left hand side of the Site's front page. First, they select the initial year of the reporting period, which will consist of three calendar years. Full notes on the new scheme and the online reporting mechanism are provided, and Fellows are advised to read them carefully before starting to enter activities. This scheme has spinoff benefits for the management of the activity, making it much more streamlined and cost-effective. In fact, the Society will not accept paper records after the end of 2004.

This online CPD reporting facility is already being used enthusiastically by a growing number of our Chartered Geologists and others. This is a huge step forward in that it opens up the possibility for much higher take-up of the scheme and extension as a training and development tool for those working towards Chartered status, without an associated increase in administrative inputs from our staff.

A small group of members of the Professional Committee and F&V under the chairmanship of David Shilston is working on clear guidance for those working towards an application to become Chartered Geologists. From this group, overall guidance in the form of a flow chart will shortly emerge and, in the course of 2005 and 2006, specific training guidance is planned for key disciplines, adapting and building on the model pioneered by the Engineering Group. This will meet a need that is most frequently expressed by young geoscientists when they tell us what we should be doing to support their career development and progress.

We are also launching a mentoring scheme for geologists working towards CGeol (or CSci) in 2005, and a Fellowship Questionnaire sent out recently has called for potential mentors to come forward. This, together with the ongoing work of the Regional Groups should support and promote the creation of lifelong professional networks. In terms of raising public awareness and attracting young people to come into geology, the Accreditation Panel continues its work and is actively considering how to support improvements in numeracy among geology graduates. Careers days organised by the Regional Groups and the annual event organised by the Geological Society are important in promoting geological careers to graduates and school students. We are keen to get more involved at secondary school level and we are looking for opportunities to widen involvement with the UK Government's SETNET and other SET outreach initiatives that among other things, send scientists and technologists into schools to enthuse young people about their subjects.

All in all, the Geological Society of London (which celebrates its 200th birthday in 2007) is entering its third century with a new confidence that it can and will deliver professional services to all its international Fellowship.

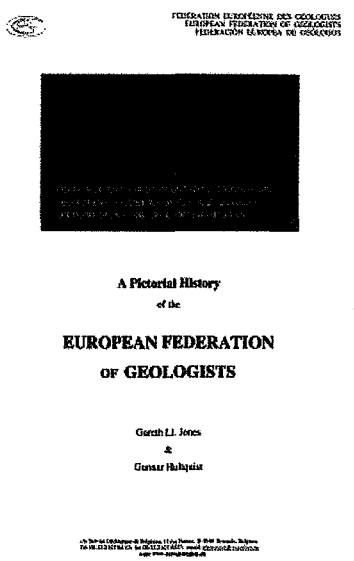
Dr Ted Nield
Science & Communications Officer

News from Serbia

I would like to inform you about two events which will held in 2005. First of all, there is 14th Congress of geologist of Serbia & Montenegro (with international participation) - Novi Sad, October 18-20, 2005. More details anf first circular you can see on www.nsgd.org/14thcongress. Also, this spring (May or June) will be organized international field trip: Neogene of the southern part of Paratethys (stratigraphy & paleontology). Organizer: Serbian Geological Society with colleagues from Austria. More details will be on www.nsgd.org during the February, 2005.

Prof. Ljupko Rundic
President of Serbian Geological Society

News from EFG



A Pictorial History of the European Federation of Geologists
G. Ll. Jones, & G. Hultquist,

Gareth Ll. Jones and Gunnar Hultquist, both Past Presidents of the EFG, have produced a 102 page history of the Federation, mostly in pictures, but also with reproductions of many of the early documents They detail how the Federation was first the brainchild of Gerald Clement of the UFG and from 1978 to 1980, with geologists from the professional bodies of Spain, UK, Portugal, Italy, Belgium and Luxembourg, they drafted the Statutes and planned the organization of this new representative body. It was launched in Paris in July 1980 at the 26th International Congress of Geology.

It is interesting to see the geologists involved and the roles that they played in getting the new body functioning and producing dossiers on various topics. Early in this work was the strong move towards professionalism with the drafting of a Code of Ethics or Deontology.

It can be seen that the role of the UFG in providing a home for the EFG was pivotal in ensuring its success, until a move to Brussels became imperative. This helped the national associations to grow their own professional standards. The growth of relations with our cousins around the world is also seen, and this reflects the way in which we have been able to help each other with our own experiences.

Gareth Jones

News from France

Created in 1975, the "Union Française des Géologues" (UFG) aimed at gathering all the professionals working in the Earth Sciences, including geologists belonging to oil, mining, water and civil engineering companies along with geologists from the academic sector. The objective was -and still is- to defend and promote professional geology through the broad domain of geological activities; exploring or producing natural resources; investigating the soil before construction; risk assessment in land planning; and reducing human and environmental impact in the face of natural hazards.

On May 19, 2005, the UFG's 40th anniversary, the community of geologists met in Paris at the Ministry of the Environment, with the theme "Geosciences and Society - The geologist, key man of Planet Earth" Alain Perrodon, first UFG President, and Jean Dercourt from the French Academy of Sciences, presided over a technical programme on oil & mining exploration, followed by round tables dealing with land planning, environmental risks and water management.

The role of the Geologist within Europe and CPD was not forgotten. EFG attended this meeting and was represented by Isabel Fernandez, Carlo Enrico Bravi and David Norbury.

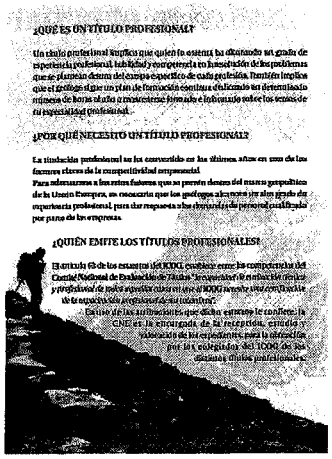
Antoine Bouvier

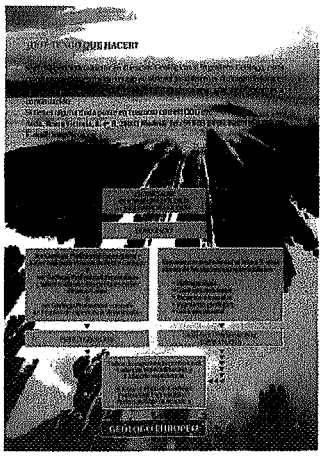
News from Spain

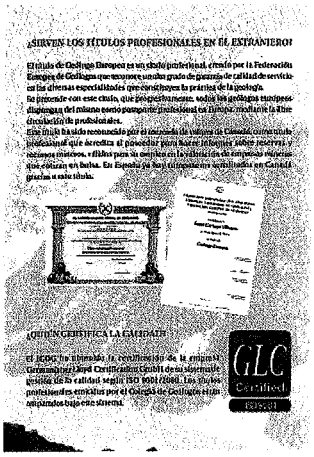
ICOG (Colegio Oficial de Geólogos de España). has produced a number of leaflets concerning the Professional title under the following headlines.

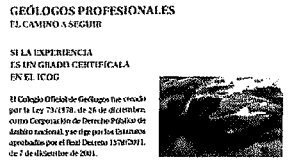
Professional Geologists: the road to follow
What is a Professional Title?
Why do I need a Professional Title?
Who issues the Professional Titles?
Are the Professional Titles acceptable abroad?
Who certifies the quality?
What do I have to do?
Routes of entry
These are available from:
icog@icog.es

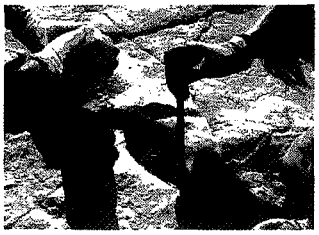
Translation of ICOG leaflet from Spanish by Christer Åkerman, EFG President











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

Prices for advertisements

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6500 issues of European Geologist are distributed among professional geologists all over Europe. They are sent to the European countries National Federations of Geologists, and these national organisations distribute them to their members. These include geologists working in companies as well as at universities.

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Dr. Maureen Mc Corry
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Tel: 0045 45831970

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.

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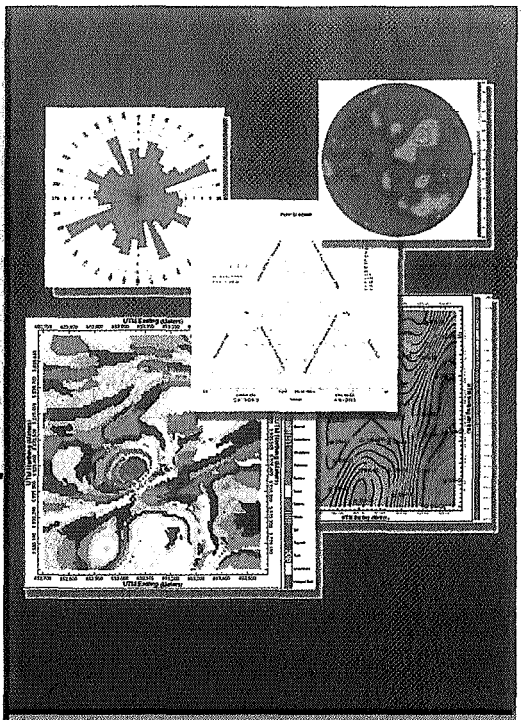

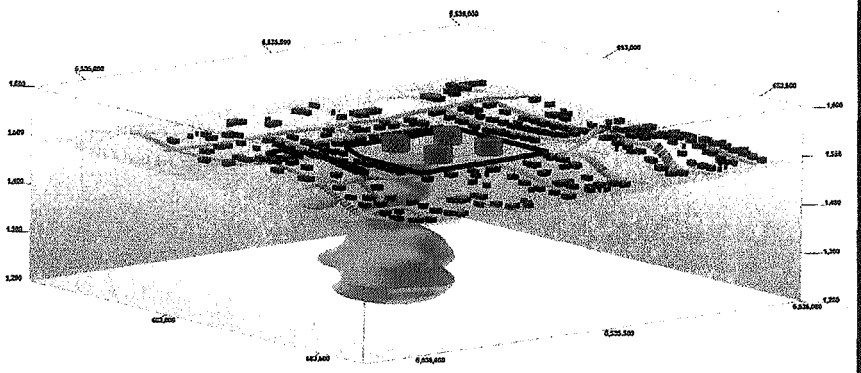

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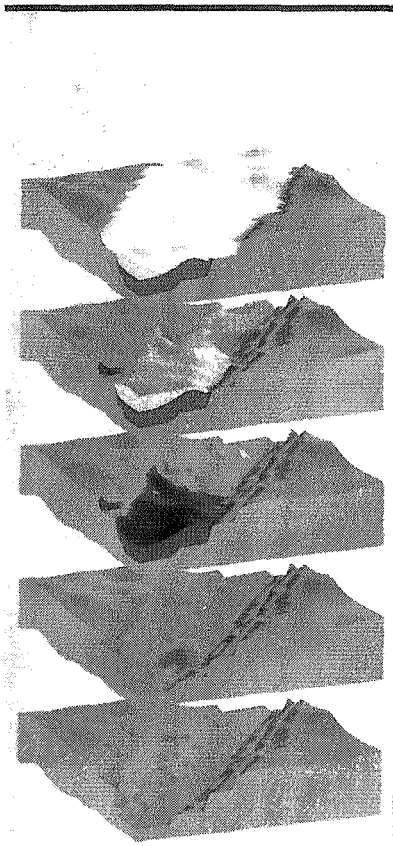

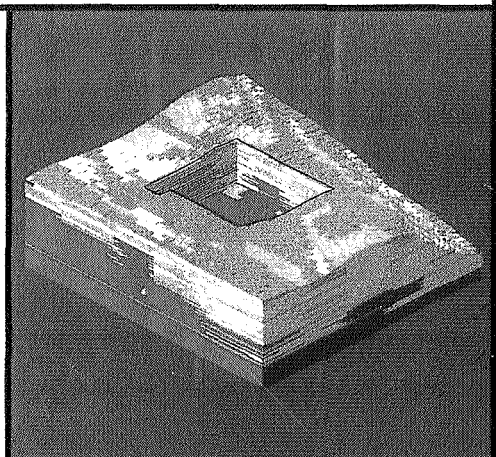

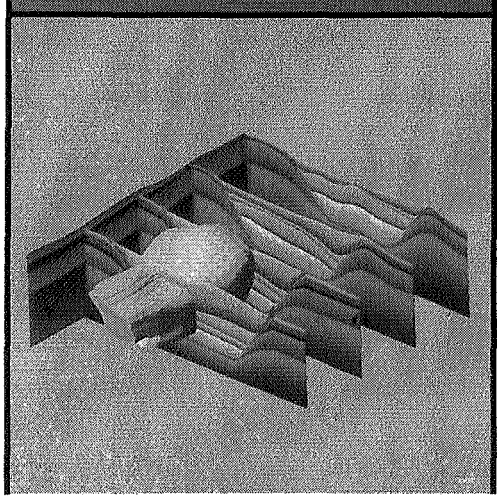

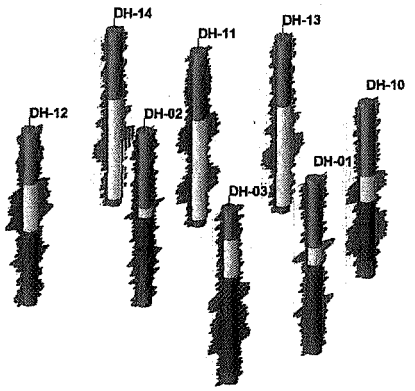

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