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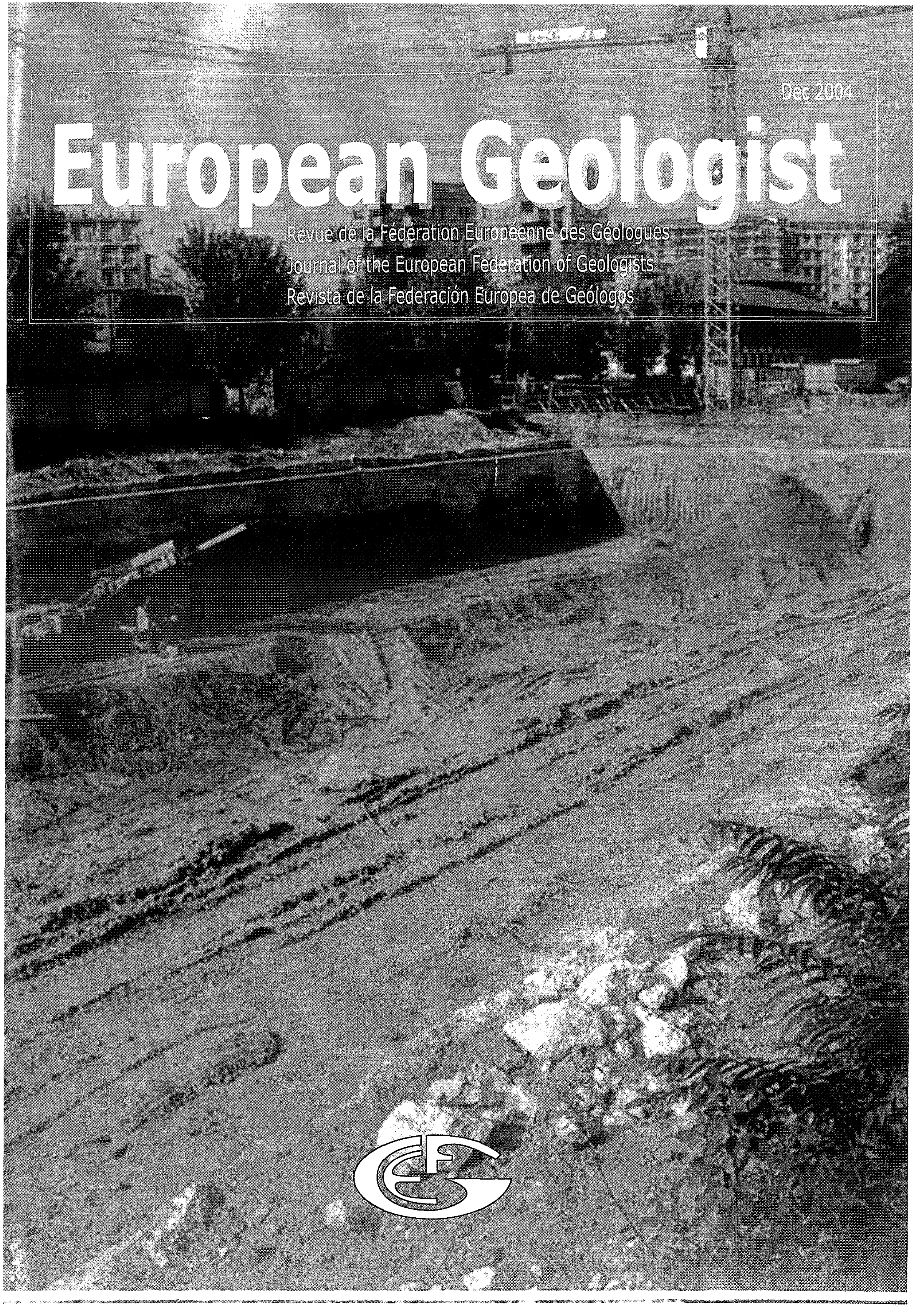

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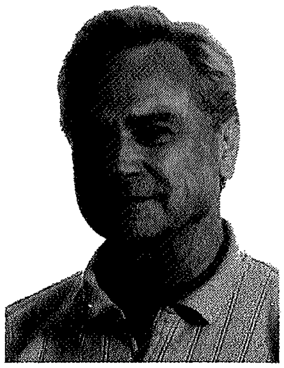
Foreword

The drawback of possibilities

by EurGeol. Christer Åkerman, President

I strongly believe geology and geoscience will play an important role in society in the future. Just thinking of the top-priority subject on the European Union Agenda - sustainable development - and considering the global importance of environmental issues, should lead anyone to the conclusion that the geological profession has a prosperous future.



But, not surprisingly, the path is full of holes and detours. EFG, and other organizations, have a lot of work to do, to inform politicians, decision-makers and society in general that geologists are here, qualified and ready to take on some of the most important tasks facing us today. By demonstrating the importance of what we do, what we can do, and what we should do, and how money can be saved by employing geologists, by showing means of guaranteeing high quality, we can raise the status of our profession, and only then can we raise the salaries.

A big problem today is getting through the background noise, being heard. Or rather, ensuring that your input stays in the consciousness of the stakeholder and is not drowned in the vast flood of information and offers. It is tough to attract attention, in competition with all the other interests and possibilities of our modern society, and from the constant flow of information. People have signed away their lives. Young people are already tied up! But young people do care about salaries - much more than my generation did.

This was touched upon in London recently, at the EFG Council meeting 12-13 June, and the connected Second International Professional Geology Conference (2nd IPGC) 14-15 June. The Council meeting was attended by 30 people from 15 countries with some 60 attending the 2nd IPGC. The fact that London is one of the most expensive cities in the world today must surely have scared away a few potential participants, but the main reason for so few people coming most certainly was that they had other commitments at the same time. And yet, what could be more important than meeting colleagues and delegates from other countries to find ways of promoting the geological profession, and discussing "The Professional Geologist in the 21st Century - Challenges and Demands"?

There were many happy moments at the Council meeting, like the return to the Federation of Consiglio Nationale dei Geologia (CNG) from Italy, and the reports on the recognition of EFG by European Commissionaires and others, due to the work of the Brussels office, the EU delegate and working groups. The increase of EurGeol. title holders, the break-even situation 2004 for the European Geologist magazine, the award of the EFG Medal of Merit to Richard Fox (see this issue), and the interest shown by several of the new European Union countries in becoming members of EFG, were other pleasing subjects. Voting for a new Board and Chairman of the Registration Authority was executed in a peaceful way. I pity those who missed the wonderful tour to view London building stones, under the guidance of a fantastic Eric Robinson. We even passed the EFG Bank!

And how is it possible that not every young and curious geoscientist was there to listen to a group of well-known and skilful speakers from around the world?! The talks treated issues concerning Infrastructure Development (planning of major projects, railroad tunnels, flood embankments), Extractive Industries and Sustainability, Management and Protection of Water Resources, Ethics of Professional Practice, Continuing Professional Development (CPD), and Licensure and Society.

The answer seems to be that today is more important than tomorrow!

Table of Contents

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

EUROPEAN GEOLOGIST

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The greatest show on Earth

by Ted Nield[1]

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Earth Sciences for Society
2005 - 2007

Plans to gain UN backing for 2006 as the International Year of Planet Earth mark the most ambitious scientific and outreach programme ever devised by any discipline.

Momentum is growing behind an ambitious new international multidisciplinary Earth science initiative. The International Year of Planet Earth project was conceived by the International Union of Geological Sciences (IUGS) representing about 250,000 geoscientists across 117 countries, and was promptly endorsed by UNESCO's Earth Sciences Division. It now enjoys the backing of all IUGS's sister unions in related disciplines#, and has won the full political backing of the People's Republic of China, India, Russia, Argentina, Brazil, Jordan, Italy, and the scientific backing of many more.

The aim of the Year is simple, but crucial – to build awareness of the relationship between humankind and Planet Earth, and to demonstrate that geoscientists are key players in creating a balanced, sustainable future for both.

Although 2006 will be the officially endorsed year, the whole project will begin in 2005 and run through to 2007. The main reason for this is that its ambitious objectives cannot be achieved in twelve months. For this is an international year with a difference. First, it aims to raise a staggering $20m, making it one of the biggest such enterprises ever attempted. Second, it aims to divide this sum equally between the support of research, and the support of what it terms "outreach" activities – broadly, educational, public relations and other avenues of mass communication to bring the main message of the Year - and its research results - home to billions of people worldwide. No UN year has ever operated at quite this sort of scale.

After several years planning (the initiative first got going in 2000 with initial seed corn money supplied by IUGS, UNESCO and Shell Exploration & Production BV), the project has now developed a Web site at www.esfs.org and published a prospectus *Planet Earth in our Hands* setting out the eight major research themes under which it will invite bids for support. It has also produced a flier, which will be making its appearance at conferences worldwide shortly.

Although the research themes provide the Year with a clear focus, the Year will operate entirely responsively, building on demand from the research grassroots. The eight themes have been chosen for their societal impact, their potential for outreach, as well as their multidisciplinary nature and high scientific potential.

Groundwater - towards sustainable use. Nearly all the potentially drinkable water on the Earth exists as groundwater. New techniques of exploration and production, and improved understanding of the dynamics of natural water reservoirs, are helping Earth scientists find this most precious of all commodities.

Hazards - minimizing risk, maximizing awareness. The Earth can be a dangerous place, and is often made more dangerous by human intervention. Crucial to minimizing the hazard potential from different geological threats facing people all over the world, is the accurate assessment and communication of risk.

Earth &Health - building a safer environment. Everyone who lives in a polluted city appreciates that where you live affects your health. Much, if not most, of the control over whether an environment is healthy or not lies beneath your feet, the environmental geochemistry of your habitat.

Climate - the 'stone tape'. Understanding climate trends, so vital to our stewardship of Planet Earth, relies heavily upon the preserved record of sedimentary rocks of many types. However, these records are rare and precious and must be conserved before development destroys them forever.

Resources - sustainable power for sustainable development. Earth scientists have consistently confounded gloomy predictions about the exhaustion of resources, by improving their understanding of the Earth and of how potentially useful minerals accumulate. However, this does not absolve the world of responsibility to use these resources intelligently, or to find new, cleaner ways of liberating their energy.

Megacities - going deeper, building safer. Urban areas, often concentrated on narrow coastal strips, are running out of space and the price of land is sky-high. More and more, architects will

[1]Chair of the Outreach Programme Committee. Science and Communications Officer for the Geological Society of London, www.geolsoc.org.uk where he edits and is subeditor of the monthly magazine Geoscientist.

wish to switch from building high to building deep.

Deep Earth – from crust to core. All of the Earth's long history and evolution right up to its current condition is really but scum on the surface of a vast heat-driven engine. Consisting of a central nickel-iron core and the mantle, this motor is what makes our planet "alive".

Ocean – abyss of time. The oceans, which began to be scientifically explored 200 years ago, hold the key to how the Earth works. Although our improving knowledge of the oceans has revolutionized our understanding of the planet as a whole, much more remains to be discovered.

To this list may be added a ninth theme, on soils – reflecting yet another crucial issue facing humankind.

The Outreach Programme is faced with a particular challenge of scale. With a potential $10m to spend, it is inconceivable that it could operate in a prescriptive way. No individual or committee can think of enough wise ways of spending that sort of sum globally. So the Outreach Programme will, like the science programme, operate as a funding body, receiving bids for financial support – for anything from web-based educational resources to commissioning works of art that will help reinforce to the general public the central message of the year. It will enable things to happen locally under the umbrella of an international scheme, lending profile and coherence.

All the efforts of the organizers were focused on preparing prospectuses for the research themes in time for the 32nd International Geological Congress (Florence, August), and in building political support ahead of the UN General Assembly this autumn. There, China is expected to table the motion for full UN backing, and pledges of full political support – or of no overt opposition – are being eagerly sought from governments worldwide.

To find out more about this exciting initiative, visit www.esfs.org There, you can read Web versions of the Year's publications, or download them as PDF files. But the message now is – watch out. The International Year of Planet Earth looks set to be the greatest scientific show on the planet.

 # the International Union of Geodesy and Geophysics (IUGG), the International Geographical Union (IGU), the International Union of Soil Sciences (IUSS) and the Scientific Commission on the Lithosphere-International Lithosphere Programme (SCL-ILP). The International

Water wells and statistics

by EurGeol. Antoine Bouvier

At the end of the last century the fresh water shortage that followed several years of drought, endangered the lives of hundreds of thousands of sub-Saharan villagers. During the 'water decade' (1980–1990), many village water projects were financed by international funds. After a few months of investigation using hydrogeology, geophysics and drilling, it became obvious that the rate of success (the number of new productive wells) was the only key to getting money for an extension or a new project. Statistics were not always easy to sort out since cultural and human factors were mixed with technical know-how and geology.

A la fin du siècle dernier, le déficit en eau qui a suivi plusieurs années de sécheresse a menacé la vie de centaines de milliers de villageois vivant en zone subsaharienne. Durant la « décade de l'eau » (1980–1990), de nombreux Projets d'hydraulique villageoise ont été financés sur des fonds internationaux. Après quelques mois de recherche d'eau associant hydrogéologie, géophysique et forage, il est apparu que seul le taux de succès (nouveaux forages productifs) était pris en compte pour le financement d'une extension de projet ou d'un nouveau projet. Les statistiques n'ont pas toujours été faciles à détailler car des facteurs humains et culturels sont venus interférer avec le volet technique et la géologie.

Al final del siglo pasado la escasez de agua potable que siguió a varios años de sequía puso en peligro las vidas de cientos de miles de habitantes subsaharianos. Durante la "Década del Agua" (1980–1990), muchos proyectos de agua de los pueblos se financiaron con fondos internacionales. Tras unos meses de investigación hidrogeológica, utilizando, geofísica y sondeos, quedó claro que el coeficiente de éxitos (número de pozos productivos nuevos) era la única llave para obtener dinero para ampliar el proyecto o conseguir uno nuevo. Las estadísticas no fueron fáciles de establecer dado que los factores culturales y los humanos se mezclaron con los conocimiento técnicos y la geología.

During the 1980s many projects were financed by international funds (PNUD, World Bank, BID, BAD and Cooperation funds) to find fresh water for village people of poor sub-Saharan countries: Mauritania, Mali, Burkina Faso, Niger and Chad.

They aimed at finding fresh water at reasonable depths (between 15 and 50 m), with a minimum yield of 1 m³/hr for a hand pump installation and over 5 m³/hr for a solar pump fitting. The average depth of hammer-drilled wells was in the order of 60 m. When a first well was found productive, a second borehole was bored a few meters away to be used as a spare well in case of pumping problems or breakdown at the first one.

In most of the survey areas, soft sands or hard lateritic latosoil and silts prevented field hydrogeologists from getting a clear understanding of hydrogeological conditions needed to select directly favourable drilling targets. Geophysical surveys were then carried out to detect fracture zones or eruptive dykes under the sandy overburden since most of the aquifers were of the discontinuous type.

To minimize project costs, local personnel with enough training and competence were hired. A local survey team included one hydrogeologist and one geophysicist, assisted by technicians, drivers and helpers. This team was able to provide drilling sites for three drilling teams. A few expatriate experts were controlling the work whilst also training local technicians and engineers.

The investigation process started with an analysis of existing aerial photos to detect possible geological structures: lineaments, faults linked to topographical tops or bottoms and location near to a village. Then a field reconnaissance of the village surroundings was made by the hydrogeologist who focussed on lithology, water table location and water salinity provided by existing wells. This allowed a reconnaissance programme to be built for the geophysical team.

The basic programme at each selected survey site consisted of measuring apparent bedrock resistivities along three parallel profiles 150–200 m apart, along with rock magnetic susceptibility, whenever an igneous formation was supposed to exist. Electrical soundings were performed at locations where significant conductive anomalies were encountered. A conductive anomaly about 50 m wide, seen with constant characteristics on each profile, was deemed interesting. A diagrammatic analysis of each electrical sounding showed the depth of the conductive source (mostly fractured zones) and confirmed the drilling target if the source was found deep enough i.e. within the water-bearing formation.

After geophysical data interpretation, each favourable site to be drilled was marked by a concrete bench mark. The location of the mark was shown to the village chief to prevent it being moved or destroyed accidentally and to guide the drillers to the right place a few days later.

On each project, the ratio of positive versus negative wells was calculated, to determine the cost of one positive well and to define both the water potentiality of the area and the quality of the teams. In areas with a discontinuous aquifer, the drilling success ratio, using only hydrogeological information ranged from 25% to 30%; adding a geophysical investigation was intended to raise the success rate to over 50% to avoid questioning from financial backers. In a few project areas, this rate was never reached and a thorough investigation of dry well causes was instructive, although never detailed in official statistics.

At project start, there was often a con-

Figure 1. Zebus coming back from the grazing fields

cealed rivalry between the hydrogeologist and the geophysicist, each one providing strong arguments in favour of his own drilling targets and seeking to quickly make a name for himself. This rivalry accounted for a few percents in the negative wells scoring. After a few dry holes and a good talking-to from the Project Manager the problem was settled through a common understanding of the hydrogeological and geophysical conditions, leading to a logical selection of drilling test sites, one or two per village.

Other local parameters responsible for an estimated 15% of negative wells were never brought to light because they are of human and cultural origin and hardly believable.

Among them:

- the intervention of the village chief

After the geophysical survey the village chief sometimes, at night, moved one bench mark from the selected drilling site to a place within his own property hoping to get water for himself. The move became obvious when the well log data were found to be very different from those deduced from the geophysical interpretation. Sometimes, the move was done by the witch doctor fearing retaliation from tribal ancestors in front of a nearby sacred site.

- the driller comfort

Sometimes, for driller convenience and comfort (drilling site access, uneven surface of the ground, shadow from a shea-tree), the well was drilled a few meters from its original location. In a fracture aquifer or close to a lineament, moving the drilling site by a few meters is often the cause of reduced yield or even a dry well.

- the living conditions of local teams

As a rule during these water projects, the drillers, working between a few days and one week in the same village, were accommodated and fed by villagers. Of course, in a village with abundant food, meat particularly, the drillers were eager to stay as long as possible, multiplying the productive or dry boreholes. The same result occurred when the drillers had the opportunity to find local girls.

In a village where the food was mainly of vegetarian type or where the communication with villagers was quite poor, the drillers were ready to leave as early as possible, speeding up the drilling or even botching it. Sometimes they were shortening the expected borehole depth, claiming that very hard quartzite or dolerite was encountered earlier than expected.

Drilling of a second well, close to a first positive one (5 - 10 m away) with the intention of replacing the first one in case of pumping problems, was a main cause of negative wells. I remember the case in Mali of a first productive well with a 6 m^3/hr (6,000 l/hr) yield surrounded by three declared negative boreholes (only a few hundred litres per hour). The unhappy drillers in their frenzy to leave the village did not spend the required time to develop the wells, which were clogged by weathered clays during a hurried boring.

- the distorted data

During the course of drilling with air as the drilling fluid for the transport of cores, drill cores were collected every meter and placed on the ground so that the hydrogeologist could see the succession. Sometimes, within much fractured quartzite or with cavities (case of total loss event), no cores were coming up. Then the junior hydrogeologist, anxious about this potential gap in the core set, added heaps made of soil borrowed from upper layers to conceal the gap.

Elsewhere hard dolerite was often encountered and it was always difficult to drill into. The Atlas Copco compressor was running at full power to help the boring to progress. Where a sill was encountered, a few meters thick, fresh water with a good yield was usually found at the lower interface but in the case of a batholith, drilling through ten or more meters of dolerite proved itself a time consuming and negative operation. Sometimes the driller lied about the final depth of the borehole saying that he had drilled through the dolerite to 3 or 6 m (one or two drill stems) deeper than the depth checked by the hydrogeologist. This extra drilling was intended to balance the consumption of gas oil used for other purposes than drilling.

All these faked data were hampering the adjustment of the initial interpretation provided by the geophysicist. For a water project lasting several months, however, increasing control by the hydrogeologist kept these wrongdoings to below 5%.

Inversely, when all the investigated sites were found negative, the driller, before moving to another village was sometimes authorized to drill in the village centre, at the market place for example. When the borehole was productive, the hydrogeologist and geophysicist were quick to enter it into their success accounts.

Figure 2. A water well used by humans and animals

Community legislation and best practices in the field of land restoration for the extractive industry

Report on TAIEX Workshop. February 3 – 4, 2004, Ljubljana, Slovenia

by Paul Anciaux[1] and Slavko V. Šolar[2]

The aim of the workshop "Community legislation and best practices in the field of land restoration for the extractive industry", held in Ljubljana, Slovenia in February 2004, was to provide a forum, particularly for representatives of the newly joined (accession) countries, to explain and discuss existing and forthcoming EU legislation (the 'acquis communautaire') which impact on the extractive industry, in particular in relation to land rehabilitation, and to consider examples of good practice in this area.

L'atelier « Législation et règles de l'art dans le domaine de la réhabilitation des sols, liée à l'industrie extractive, s'est tenu à Ljubljana, Slovénie, en Février 2004. Par l'intermédiaire d'un forum où, en particulier, se trouvaient conviés les représentants des pays ayant récemment rejoint l'Europe, l'objectif était à la fois d'expliquer et de commenter la législation européenne existante et à venir (*l'acquis communautaire*), qui régule l'industrie extractive et plus spécialement la réhabilitation des sols, et de mettre l'accent sur les cas de bonne pratique en ce domaine.

El objetivo de la jornada técnica "*Legislación comunitaria y mejores prácticas en la restauración del terreno para la industria extractiva*" que tuvo lugar el Lubliana (Eslovenia) en febrero de 2004, fue proporcionar un foro, en especial para los representantes de los países de reciente adhesión a la UE, para explicar y debatir la legislación existente y la futura de la UE (el '*acquis communautaire*') que afectan a la industria extractiva, en particular en relación con la restauración del terreno y para analizar ejemplos de buena práctica en este campo.

This Workshop was organized by the Geological Survey of Slovenia and the Directorate General Enterprise of the European Commission, with financial assistance from the Technical Assistance Information Exchange Office (TAIEX)# of the European Commission; DG Enlargement.

Its aim was to provide a forum, particularly for representatives of the accession countries, to explain and discuss existing and forthcoming EU legislation (the 'acquis communautaire') which impact on the extractive industry, in particular in relation to land rehabilitation, and to consider examples of good practice in this area.

There were 65 delegates from 16 countries (Belgium, Bulgaria, Czech Republic, Estonia, Germany, Greece, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, Slovenia, Spain, Sweden, and United Kingdom).

As noted above, the main sponsor of the workshop was TAIEX (represented by Mrs. Danielle Picot, Mrs. Aude Bezler). Support was also provided by the Ministry for Environment, Spatial Planning and Energy (Mrs. Urska Skraba, Mr. Primoz Bizilj), European Commission, Directorate General: Enterprise (Mr. Paul Anciaux) and the Geological Survey of Slovenia (Mr. Slavko Solar).

Meeting programme

The programme for the two-day workshop comprised keynote presentations, discussions, and a half-day field trip. Fifteen keynote presentations were grouped into three half-day sessions covering: "Legal aspects", "Technical and environmental aspects", and "Issues of abandoned mine sites".

The workshop, chaired by Tom Simpson (EU Commission, DG Enterprise), began with Opening Addresses and formal welcomes from the Slovenian Understate Secretary of the Ministry for Environment, Spatial Planning and Energy (Mr. Primoz Bizlij), and the Director of the Geological Survey of Slovenia (Mr. Bojan Ogorelec).

The first session "Legal Aspects" started with a presentation on EU mining policy in an enlarged Europe. This was followed by two talks dealing with the proposal for an EU directive on the management of waste from the extractive industry and the existing directive on the assessment of the effects of certain public and private projects on the environment (commonly known as the EIA Directive). The session was concluded by a presentation on the development of guidance on the best available techniques for the management of waste from the extractive industry, and in particular, the approaches for decommissioning mine sites.

The afternoon Session focused on technical and environmental issues. An example of a brownfield remediation programme in the Ruhr river industrial area of Germany was presented. This was followed by a presentation on the environmental impacts of metal mining and quarrying, based on case studies from Slovenia. The European trade associations for the aggregates and industrial minerals sectors then gave a presentation on the importance of a sustainable approach to mineral extraction and on their experience in land restoration. A representative from the Minerals Industry Research Organization (MIRO), stressed the importance of having the correct skills

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#The TAIEX office provides technical assistance and advice on transposition, implementation and enforcement of the Acquis in the form of expert missions, seminars, workshops, study visits, evaluation and analysis reports.

when managing mining waste facilities.

The third session focused on the issue of abandoned mine sites. It started with an overview of the 'Pecomines project', an EU project being undertaken by the Joint Research Centre in Ispra, to develop a methodology to identify active and abandoned mine sites which are causing or have the potential to cause, severe environmental impacts. This was followed by a presentation on the problems of, and options for, dealing with abandoned mine sites in Asturias, Spain. The remediation of a former uranium mine in Slovenia was presented as a case study. The importance of maintaining appropriate soil physical properties to enable vegetation establishment and groundwater recharge when restoring gravel pits was then considered. The final presentation showed the process of restructuring the Lusatian mining landscape to facilitate its future development.

In the afternoon, participants were taken on a half-day field trip to a quartz sand pit at Morav e, near Ljubljana, to look at the successful rehabilitation of active and abandoned quartz sand pits. The day and trip ended with a farewell dinner, at which individual contribution to the workshop was recognized.

The following section provides brief summaries of the presentations.

Workshop keynote presentations
I^st^ session "Legal Aspects"

Mining policy in an Enlarged Europe - *Paul Anciaux, European Commission, DG ENTR, Brussels, Belgium*

The extractive industry is facing a range of challenges which potentially impact on its competitiveness. These include issues such as having to operate to higher environmental standards, increasing difficulties obtaining access to new areas of land and higher societal expectations which require companies to gain and maintain a good public image. These issues are being addressed at EU level, although there is also an important role for national authorities and individual companies.

At the EU level, a number of actions and initiatives are being developed within the policy frameworks of sustainable development and industrial policy. In recent years an increasing number of legislative

Figure 1. One of the keynote presentations at the workshop

initiatives have been taken by the Commission which impact on industry. It is the Commission's policy that when developing new initiatives, full consideration is given to the balance between the environmental, social and economic objectives of sustainable development. However, in many cases, it is possible to achieve the same objectives using non-legislative initiatives, such as voluntary initiatives.

Such issues are discussed at the EU level with Member States, the extractive industry and other stakeholders through a stakeholder group (the Raw Materials Supply Group), chaired by the Directorate General Enterprise.

Proposal for a Directive COM(2003)319 on the management of waste from the extractive industry - *Fotios Papoulias, European Commission, DG ENV, Brussels, Belgium*

This Proposal is one of the three priority actions which were announced in the Commission's Communication of October 2000 on "Safe operation of mining activities: a follow-up to recent mining accidents". It is intended to improve the management of waste from the extractive industries, which has the potential to create very long-term and widespread environmental and human health impacts, especially in case of accidents. The proposed Directive aims to minimize the effects of polluted drainage from waste management facilities (heaps and tailings ponds) and to prevent, or minimize, the impacts of accidents. Measures to be introduced cover the planning, licensing, operation and eventual closure and aftercare of waste facilities, including the establishment of sufficient financial guarantees to ensure their eventual full reinstatement. Together with the revised Seveso II Directive on major industrial accidents, and a Best Available Techniques document on tailings and waste rock, the proposed Directive will provide a sound framework for sustainable management of extractive waste throughout the EU.

Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment - *Tom Simpson, European Commission, DG ENTR, Brussels, Belgium*

This Directive, commonly known as the Environmental Impact Assessment (EIA) Directive, aims to identify, during the early stages of project planning, the potential effects of the proposal on the environment. This enables early consideration to be given to mitigating measures, and gives the competent authority the relevant knowledge to enable them to take a decision on a specific project in full knowledge of the project's likely significant impact on the environment. The assessment is required to consider the effects on human beings, fauna and flora, soil, water, air, climate and the landscape and material assets and the cultural heritage.

Relevant projects are divided into two categories which are set out in Annexes to the Directive. Annex I includes those projects which are subject to an assessment in every case. In the context of minerals extraction, this includes quarries and open-cast mining where the surface of the site exceeds 25 hectares, or peat extraction, where the surface of the site exceeds 150 hectares. Annex II lists projects for which the Member State must determine whether an assessment is necessary through either a case-by-case examination or thresholds or criteria set by the Member State. This includes quarries, opencast mining and peat extraction sites not in Annex I, underground mining and the extraction of minerals by marine or fluvial dredging.

Guidance on selection criteria is provided in Annex III to the Directive.

The BAT approach to decommissioning of mine sites – incorporation of the life cycle framework - *Nils Eriksson, Seville, Spain*

The Joint Research Centre based in Seville has been developing a reference document on Best Available Techniques (BAT) for the management of tailings and

Figure 2. Workshop participants listening carefully to a presentation

waste-rock in mining activities, with the assistance of a Technical Working Group (TWG) comprising representatives of the extractive industry, Member States and the Commission. Preparation of the document started in June 2001 and the final document is scheduled for publication in April 2004. It covers 14 metals and 12 minerals and covers the management of waste-rock and tailings resulting from mineral extraction or processing.

II^nd^ Session "Environmental and technical aspects"

Brownfield Development – Experiences in the industrial area of the River Ruhr - *Thomas Neteler, Deutsche Montan Technologie GmbH, Germany*

The area along the River Ruhr in Germany is an excellent example of structural change in a highly industrialized region, where the major industries of coal and steel were previously located and where brownfield areas were abandoned after they closed. The aim of giving accompanying scientific and technical support to brownfield development projects is to reconcile the ideas of the landowner or seller on the one hand and those of the buyer on the other. The "use-oriented rehabilitation concept" is an essential tool for achieving the best possible environmental and economic solutions. A description was given of the methods used and some examples of the successful utilization of former industrial sites adopting a systematic approach with elements of guidance.

Environmental impacts of past metal mining in Slovenia - *Mateja Gosar, Geological Survey of Slovenia*

Mining is a process that begins with exploration for, and discovery of, mineral deposits and continues through ore extraction and processing to closure and remediation of worked-out sites. The potential environmental impacts of mining that occur at all of these stages were explained.

In Slovenia there were many small as well as a few large ore deposits. Some were under exploitation from the Roman era up to recent times. There were 49 places identified where underground and open pit mining for non-ferrous metals was in operation; 25 of them used flotation and smelters for processing the ore. The largest of these are in Idrija (Hg), Mežica (Pb, Zn), Litija (Pb, Zn, Hg and Ag) and Žirovski vrh (U). Case studies showing the environmental impacts of the Idrija mercury mine and Mežica lead-zinc mine were presented.

Environmental impacts of quarrying in Slovenia - *Slavko Solar, Geological Survey of Slovenia*

Access to a secure supply of aggregates is fundamental to the achievement of national sustainable development goals. Conversely, the costs of providing aggregates, in terms of negative social and environmental impacts, are often borne locally rather than nationally. Although the impacts of quarrying are typically benign, in contrast to those associated with metal mining, the potential for serious environmental damage at the extraction site and along transportation routes remains. These negative impacts can be tracked and reported at the national scale. An indicator of sustainable aggregate supply on the regional and national scales is presented. It was developed in the context of the draft Slovenian National Mineral Resource Management Plan, and clearly shows a negative trend in the percentage of material coming from quarries deemed socially acceptable. A comprehensive aggregate management plan will be needed in order to deal fairly with the tradeoffs between national benefits and local costs of production.

Land restoration in the aggregates industry - *Gregoire Poisson, UEPG (European Aggregates Producers), Brussels, Belgium*

Aggregates are the most frequently used construction material worldwide. They are a granular material used in construction to make houses, roads, railways etc. Aggregates may be natural, artificial or recycled. The most common natural aggregates are sand, gravel and crushed rock. The European Aggregates industry is the largest non-energy extraction sector in the EU, both in terms of annual tonnage (more than 2,600 million tons) and sales revenues (35,000 million). It has approximately 20,000 extraction sites across Europe. A majority of operators are Small and Medium sized Enterprises (SMEs).

Since 1987, the European Aggregates Association has promoted the interests of the European Aggregates Industry by representing its 16 Member Associations. Restoring extraction sites is a priority. For example, Lafarge transformed its quarry in Baudreix, France, into a successful recreation area for the local community. UEPG members operate restoration award schemes, as an incentive to their company members. It has been very successful.

Sustainability concepts in reclamation of mining disturbed land – *Mrs. I. Bardiani, IMA Europe, Brussels, Belgium*

S&B Industrial Minerals S.A. applies sustainability concepts to their environmental rehabilitation management activities on the island of Milos (Greece). The reclamation of disturbed mining land is a multi-staged process. The rehabilitation of sites should already be considered at the site planning stage. 3D models can be used to help visualize the gradual shaping of the land from the active working to the fully restored site. Different quantities of organic mineral wastes are increasingly being used as a replacement for topsoil. An analysis of seeding and planting processes during the period 1990-1996 identified problems related both to the harsh climatic conditions and poor soil conditions. In the following years a variety of steps have been taken to improve the situation. The construction of a nursery and the breeding of plants that can withstand salty conditions contributed to a significant increase in the percentage of native species used for seeding as well as in the number of species used for seeding.

The Importance of Skills Levels in the Effective Long Term Management of Mining Waste Facilities Sites - *Gordon Riddler, Mineral Industry Research Organization, United Kingdom*

Good design and operation is a key element of a successful mining waste facility. Analysis shows that the principal cause (90%) of mining facility failures reflects poor management. Poor management relates to a lack of skills training and a lack of access to comprehensive standards and good practice. Skills levels are therefore crucial to the effective long term sustainable management of waste management facility sites. The acquisition of necessary and appropriate skills depends on several factors: a comprehensive set of parameters and standards by which to understand risks; a training resource available to all stakeholders and an information network that provides current good practice. Effective and long-term sustainable development can be assisted by a social enterprise model that engages the local community and by more SME participation in European R&D. The TAILSAFE Project, and new initiatives including STRETDAM, EDEN–CGPMR and PROMISS address the issues of risk assessment/availability of standards, a training resource, information on good practice, engaging with the community/implementation and participation in European R&D respectively. Given adequate financial support these projects will do much to inform all stakeholders, reduce hazards, prevent future accidents and see the implementation of sustainable solutions for land restoration for the extractive industry.

III$^{rd.}$ Session "Issues of abandoned mine sites"

The Pecomines project: creating an inventory - *Stefan Sommer, Joint Research Centre, Ispra, Italy*

The PECOMINES inventory is a collation of site specific information from existing data bases in the candidate countries, which is harmonized through the PECOMINES questionnaire and put into a relational database.

Linked with the physically based remote sensing mapping of mining related anomalies, the database provides a spatial dimension and coherence. The independent remote sensing identification of sites which are characterized by anomalous concentrations of both ferro-oxi-hydroxides (Fe-ox) and secondary layer silicates (i.e mainly clay minerals) is carried out on a country-wide scale. Co-occurrence of both types of anomaly is significantly indicative in most cases of waste material from metal mining or ore processing, but also for other types of mineral deposits where pyritic material is frequently associated (e.g. lignite) leading to acidification.

Figure 3. Workshop participants on the field trip

The remote sensing anomalies, being obtained independently from existing ground truthing, adds value by filling in gaps in existing records and databases and by improving the knowledge of the spatial distribution of material which possibly bears the threat to release or mobilize environmental contaminants.

This is considered an important step towards the development of concepts for regional environmental impact assessments at the catchment scale as needed for the integrated assessment of EU policies related to waste management, environmental protection (e.g. of water and soil resources) as well as environment and health aspects.

The availability of EU-EEA IMAGE 2000 geo-referenced mosaic of Landsat-TM data, covering the entire area of the EU and of the Candidate Countries, makes it a realistic option to allow for a relatively swift application of the approach to the entire region. Further details may be found on http://viso.ei,jrc.it/pecomines_ext/index.html

Problems and options in relation to abandoned mine sites in Asturias (Spain) - *Jorge Loredo, University of Oviedo, Oviedo, Spain*

Asturias (Northwestern Spain), has an extensive mining history, but of all the extractive activities, Hg mining constitutes the most important pollution source, increased by the presence of As (realgar, As-rich pyrite, arsenopyrite) associated with the mined ore. Abandoned mines and spoil heaps of different dimensions remain as the legacy of mining activity. Mining and metallurgical wastes, which are usually heterogeneous in size, mineralogy and metal concentrations, reach up to 62,196, 50,919, and 22,667 $mg.kg^{-1}$ As, Hg and Pb respectively. In the humid environment characteristic of the region, the instability of sulphides leads to the production of As-rich leachates which infiltrated or are incorporated into the surface waters, which show up to 17,742 g.l-1 As and 14 g.l-1 Hg. Total As concentrations of up to 23 $g.l^{-1}$ have been found in groundwater. According to geochemical data it is evident that abandoned Hg mine workings are important pollution sources, and the containment of mine wastes in safe landfills could be the best available technology, if technically and economically feasible.

Remediation of uranium mine Žirovski vrh - *Zmago Logar, Rudnik Žirovski vrh v zapiranju, Slovenia*

The company has performed management activities to close a former uranium mine since 1990 when production ceased. There will be three structures left permanently after remediation of the former production site for institutional care:

the underground mine with mine water discharge,

the mine waste pile with drainage water outflow, and

the mill tailings with drainage tunnel water outflow and tailing drainage outflow as well.

The remediation of the mill tailings is the most challenging project due to the instability of the material and high construction costs. The total remediation costs are assessed to be 37 million Euro including company operations and taxes. The plan is to implement all remediation works by the end of 2006. The ore processing facilities and land have already been decommissioned and a part of the land has been transferred to the local community for the economic development of the area.

During the production period the annual effective dose contribution was ca 0.5 mSv/a. During the idle period it has been 0.2 – 0.4 mSv/year. The authorized dose limit after remediation is below 0.3 mSv/a.

The importance of soil physical properties for vegetation establishment and groundwater recharge when restoring gravel pits - *Karin Palmqvist Larsson, Royal Institution of Technology, Sweden*

The removal of vegetation and the upper soil layer decreases the groundwater protection in gravel deposits. Present gravel pit restoration methods often do not result in establishment of sufficient vegetation or groundwater purifying processes.

The objective of this study was to improve restoration methods to protect groundwater. The focus was on the importance of soil physical properties. The physical properties of possible topsoils were determined. A physical simulation model, CoupModel, was used to demonstrate their influence on transpiration, soil evaporation and deep percolation. Plants with shallow roots were most sensitive to water deficit. The unsaturated conductivity played an important role in the plant-water supply. The transit time for groundwater recharge was significantly increased by the presence of a vegetation cover and a high water-holding capacity of the soil.

The model was useful in predicting the impact of the different soils and quantifying their influence on vegetation establishment and groundwater recharge.

The role of REKULA in the process of restructuring the Lusatian mining landscape - *Thomas Worms, IBA Fürst-Pückler-Land GmbH, Germany*

The Interreg III b Project REKULA - Restructuring of cultural landscapes - deals with the rehabilitation of cultural landscapes that were grossly changed and disturbed by industrial uses like mining, within short periods of time. Under the lead partnership of IBA Fürst-Pückler-Land GmbH several partners from Poland, Italy and Germany are collaborating on different components within the project.

The components include:

- Landscape revalorization by innovative forms of settlements
- Management for the protection of natural resources and the revalorization of the landscape
- Landscape revalorization under economic aspects of efficient reuse as energy gardens and with studies of networking into optimized transport concepts

The IBA Fürst-Pückler-Land GmbH is dealing with post-mining landscape and the pertaining rehabilitation process. Examples of their work are:

- Visitor Mine F 60 - The Lying Eiffel Tower
- Hiking tours through abounded open cuts
- Floating Houses

Summary of key points from the presentations

The two day workshop provided an important opportunity for the sharing of knowledge on EU policy and legislation relating to the extractive industry, and on the particular issue of the rehabilitation of land once extraction has ceased.

The extraction of minerals in the EU and accession countries is vital to the success of the wider EU economy, because of the value added and jobs it directly provides, and more importantly, because of the basic raw materials it provides to the downstream manufacturing and construction industries. It is therefore recognized in EU industrial policy that decisions affecting the extractive industry must be considered in the context of sustainable development, through achievement of a balance between social, environmental and economic considerations.

There are already a number of EU legislative instruments which directly affect the industry, including the EIA Directive, which seeks to ensure that the environmental implications of a proposed mineral extraction operation are fully considered at the outset, and that measures to minimize effects are identified before a permit is issued. More specific legislation which will control the management of mining waste is in preparation. This will provide a more consistent system for the management of such wastes across Member States, and ensure that waste management facilities pose a minimal risk to the environment or to human health.

The importance of rehabilitation was clearly demonstrated by the presentations which discussed the reclamation of brown field sites. It was shown that it is a very important element of the site operation, and should be considered at the outset.

Information on land rehabilitation is dispersed among different science disciplines, expert data bases, policies and legislation frameworks and can therefore be difficult to obtain in order to achieve the optimum solutions. However, it is also to be recognized that the requirements of each site will differ, and there are no 'off the shelf' solutions. Instead, it is important to understand the processes leading to successful reclamation and tailor them to the specific requirements of a site.

Many examples of good practice in this field have been published. At the EU level, work is being done to prepare a reference document on Best Available Techniques (BAT) for the management of tailings and waste rock from the extractive industries. This will assist all stakeholders involved (incl. national administrations and industry) in developing and implementing rehabilitation schemes. However, there is a continuous need to improve our knowledge, through research and development and the dissemination of results. There are already many projects ongoing and others being planned (e.g. Tailsafe, Promiss etc.).

A related issue is how to deal with the legacy of the past (abandoned mines) which requires focused effort and financial resources but again also the necessary technical know-how. Some countries have already made (partial) inventories of abandoned sites. At EU-level, the Pecomines project is looking at cost-effective means of identifying the potentially most polluted abandoned sites. It will be for policymakers to evaluate which measures should be taken. As to the technical solutions, we have to learn from experience drawn from the field (e.g. the uranium mine in Slovenia and the mercury mine in Asturias) and from the diverse R&D projects which deal with this matter.

Gathered knowledge and expertise combined with adequate policy and legislation framework, which would respond to the societal values and objectives and industry interests, should serve to accomplish a higher degree of cleaning up past malpractices and to create firm guidelines for future land rehabilitation practices at national and EU level. If the workshop made a step to this end then its primary goal was accomplished.

Water supply problems in Central America and Africa

News from NGO World Geologists (Geólogos del Mundo)

by Carlo E. Bravi, Luis Dichtl, Vicente Fabregat and Juan Luis García

Since the NGO was founded in 1999, WG has mainly dealt with projects related to risk prevention and risk management. Since 2001, the problem of water supply has been taken into consideration. At present some interesting and important projects have already been completed (El Salvador -- Burkina Faso) and others are on-going (El Salvador -- Mali) or planned to start in the near future (Honduras). A very close cooperation with local partners is most essential for good results and future sustainability.

Depuis sa création en 1999, l'ONG Geologos del Mundo s'est en priorité consacrée aux problèmes de prévention et de gestion des risques. A partir de l'année 2001, les problèmes d'alimentation en eau potable des populations ont été pris en considération. Aujourd'hui, quelques projets importants et de grand intérêt ont déjà été réalisés au Salvador et au Burkina Faso; d'autres sont en cours au Mali et au Salvador tandis qu'un autre Projet doit démarrer prochainement au Honduras.Une étroite coopération avec des Partenaires locaux est essentielle pour garantir des résultats alliant qualité et pérennité.

Desde la fundación de la ONG en 1999, Geólogos del Mundo ha llevado a cabo proyectos de prevención y gestión de riesgosgeológicosfundamentalmente. Los proyectos de abastecimiento con aguas subterráneas se empezaron a realizar en el año 2001. Hasta ahora se han completado varios proyectos de aguas de gran interés e importancia (El Salvador, Burkina Faso) y, en la actualidad, se están haciendo proyectos en El Salvador y Mali y se empezará otro pronto en Honduras. Es esencial para obtener buenos resultados y asegurar la sostenibilidad de los proyectos una estrecha colaboración con las contrapartes locales.

Since the year of its foundation, (February 1999) the NGO World Geologists (Geólogos del Mundo) has been carrying out Projects in the field of Hazard Classification and Risk Prevention and Management, together with planning for correct land use. Most of the projects were carried out in El Salvador C.A., where WG was very active during the 2000 earthquakes and where a permanent delegation was established right from the beginning.

It was in October 2001 that WG became involved with the huge water supply problem in most of the countries that have a medium or low Human Development Index. At present some interesting and important projects are on-going in El Salvador and Mali and others will start in the near future in Honduras.

Water supply projects in La Union, El Salvador

Because the NGO was already present in El Salvador C.A., another NGO (Medicos Mundi) operating in the area brought our attention to a very critical situation in the very far eastern area of this Country (Fonseca Gulf, Dep. La Union- Pasaquina Municipality) at the border with Honduras, which was due to the lack of water .The Villages of La Rompiciòn and Barrancones, together with other dwellings spread over a 30 km^2 area, totalling about 2,500 inhabitants, had no other water resource than the highly polluted water that could be collected from the Goascoran River, marking the border with Honduras. A lot of illness and desease was recorded among the inhabitants, with the deaths of several young children.

A feasibility study and project preproposal were quickly prepared and addressed for financing to the Nando Peretti Foundation in Rome. The Project was accepted and financed. Detailed hydrogeological studies and drilling tests were carried out in the period March - November 2002. The very positive result was the location of a water well in a fault system, which resulted in the planning and construction of a "rural aqueduct", with a 25 m^3 water deposit and a 6,500 m long water pipeline with 21 water fountains along its length.

The cooperation and partnership with local organizations (Ministry of Environment and Natural Resources, Pasaquina Municipality, etc.) was of great importance. The sustainability of the project is guaranteed by the local Water Committee, which is in charge of running and maintaining the Aqueduct.

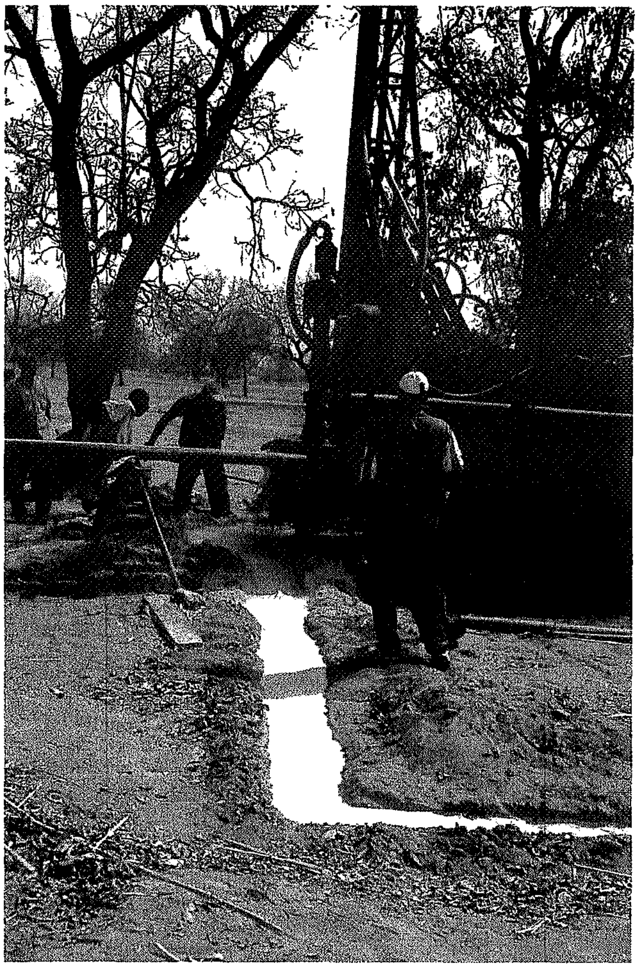
The "La Rompiciòn-Barrancones Rural Aqueduct" was officially inaugurated on the 1st May 2004 (Fig. 1) by the Italian Ambassador in El Salvador, Dr. Roberto Falaschi, with the presence of several local dignitaries and most of the inhabitants.

This first positive result has led to a number of requests made to WG by other villages, both belonging to the Pasaquina Municipality and the Municipality of Conchagua (southwest of the town La Union), all of which suffer from a great lack of water.

Two more project preproposals were therefore prepared and addressed to the Nando Peretti Foundation in Rome. The Foundation Board has authorized the complete financing of both projects.

Detailed hydrogeological studies were carried out in December 2003 and February/March 2004, followed by drilling tests. The location of the well drillings

Figure 1. Inauguration of La Rompicion-Barrancones rural aqueduct



has always been influenced by structural interpretation.

Four water wells have been drilled in the Pasaquina area (villages: Agua Agria, El Cortezal, San Felipe, Piedras Blancas) and one well in the Conchagua area. All water wells gave a water yield beyond all expectations.

During the period May/July 2004, a small and localized rural aqueduct (water well with pumping system, water deposit and pipelines) was planned and constructed in the village of Agua Agria. People who used to walk 2-3 km to collect small quantities of water from poor water springs, have now water at home or very close to it. As many as 85 families, who have joined the newly formed local Water Committee, have tap water in their houses. A total of 1,000 people benefit from this aqueduct. Its official inauguration is planned before the end of the year, when both projects are due to be completed. At the end of the works a total population of 12,000 will have benefitted from these projects.

Furthermore, a final project preposal has already been addressed to the Nando Peretti Foundation and is now awaiting a financing decision. WG has already taken some steps to offer technical assistance to the Italian Cooperation in El Salvador and to AERCI, the Spanish Cooperation Agency in the country.

Water supply to rural villages in the San-Tominian region (Republic of Mali)

Responding to a request of the Salesian Order, World Geologists initiated a rural water supply project in December 2002, in the zone of the Touba parish, southeastern Mali, West Africa.

A preliminary Identification Mission, with the financial support of the private company TICO S.A., visited the three communities involved (Beo, Madoulo and Ealo, together amounting to 1,000 inhabitants), confirmed the water supply problems, identified the water needs and the type of wells required, with the help of the communities involved, and carried out a preliminary groundwater survey, including the main regional and local geologic/hydrogeologic features, as well as the most significant wells and springs.

The fact that most of the inhabitants, particularly the children, suffer health problems is due to the lack of permanent water supply facilities. Moreover, due to the scattered habitat, the heavy burden of walking considerable distances every day in search of water falls mainly on the women, who are in charge of water supplies.

Accordingly, a project proposal was formulated including social components (community reinforcement, social communication, sensibility to hygiene), hydrogeological investigations (geophysical prospecting and borehole drilling), followed by the construction of a permanent large diameter well for each one of the three localities. The technical management and the groundwater studies are the responsibility of World Geologists, the social components are carried out by the social workers of the San Bishopric (Touba Parish) and the construction of boreholes and large diameter wells are executed by local contractors.

The surveys carried out show a sparse population density (10-30 inhabitants per km^2). The bwa is the main ethnic group, of Christian and animist religious groups, practising subsistence agriculture and raising livestock. Annual rains, averaging 600-800 mm, ensure the recharge of the aquifer. The principal aquifer exists on the widely outcropping, flat, fairly thick and fissured Koutiala and Bandiagara Sandstones, of Precambrian age. Ground water flows to the North to the Bani river – a tributary of the Niger- through an underground drainage system controlled by faults and fractures. More than 100 deep wells are known to make use of the Precambrian aquifer in the San-Tominian region. The aquifer is covered locally by recent, thin and discontinuous layers of lateritic type rock, whose unreliable groundwater is used by existing traditional water wells.

As a result of the investigation borehole (depth 40 m) made in Beo on the sandstone aquifer, a sufficient water yield (2,000 l/h) was found, suitable for permanently supplying the Beo water needs and less subject to seasonal variations than the shallow traditional wells. The large diameter well is already under construction.

Although the drilling of hand pump equipped boreholes gives the advantage of better sanitary protection of the well water, the lack of a regional hand pump maintenance system in this case was an important reason to prefer the construction of large diameter wells instead.

The participation in the project of Manos Unidas and of the Madrid Polytechnic University ensure the financial resources needed. Manos Unidas, an important Spanish NGO attached to the Catholic Church, is financing the construction of a large diameter well in Beo. The Madrid Polytechnic University is financing the Ealo subproject. Manos Unidas is also considering financing the third large diameter well in Madoulo.

In the near future, World Geologists and the Bishopric of San envisage new water supply developments in conjuction with a social and economic development programme promoted by the diocese. As a first step, World Geologists has proposed identification and feasibility studies as well as project proposals concerning 60 new villages with water supply problems.

Future water supply projects in Honduras

WG has recently moved to Honduras, where the first hydrogeological project has already been financed by the Asturian Principality (Spain). The local partner ASIDE is very well organized and efficient on its national territory.

Furthermore, two pilot project preproposals have been prepared and addressed to the Nando Peretti Foundation in Rome. One project in the north of Honduras, El Progreso area (Guayamitas), and a second project in the south of the country, Danli area (Sartenejas). A joint mission with WG technicians and the Project Coordinator of the Nando Peretti Foundation was carried out in September. Both projects are awaiting a financing decision. If these projects are accomplished, a total population of 8-9,000 people will benefit.

Thus, WG continues to help developing populations to obtain a better quality of life, made possible by solving the basic problem of water supply.

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Recent excavations in the Würmian sediments (upper Pleistocene) of Milan, Italy

by Dr. Geol. Luigi Gonsalvi[1], Dr. EurGeol. Carlo Enrico Bravi[2] and Dr. Geol. Mattia Dugnani[3]

The city of Milan is situated between the foothills of the Alps and the Po river's alluvial plain: this transition area reflects its peculiar deposits, made up of a thick series of gravel, sands and clays deposited during the glacial periods of the Pleistocene. In particular, Milan and its surrounding area overlie the geological unit of *Fluvioglaciale Würm,* which is represented by about 70 m of gravels and sands in a silty matrix, locally including clay lenses.

This unit represents the so-called "*livello fondamentale della pianura*" because it is so widespread, and it is characterized by decreasing grain size from the north to the south, thus reflecting the decrease of transport and depositional energy.

Bedrock here is represented by pre-pliocene sedimentary units, which, however, outcrop only rarely in the northern part of the province. Between bedrock and the *Fluvioglaciale Würm* unit, the following geological unit can be found (from the bottom to the top):

Unità Villafranchiana: silty and clay sediments typical of a marine transitional environment.

Unità del ceppo: sandstone and conglomerates, hard cemented, turning to gravels and reflecting continental alluvial fan deposits

Morenico Mindel: silts with pebbles, sands and clay weathered superficially, characteristic of morain deposits. These sediments represent the older glacial period in this area.

Fluvioglaciale Mindel: well rounded pebbles in a yellow-red silty-clay matrix, representing the interglacial deposits

Morenico Riss: unsorted sediments with gravels and sands with a clay-rich matrix, including some blocks deriving from the alpine arc

Fluvioglaciale Riss: rounded pebbles in a sandy matrix

Morenico Würm: gravels, pebbles and silts with chaotic structures, often including blocks

More recent post-Würmian deposits can be found locally and consist mainly of lacustrian and alluvial sediments derived from river flooding.

[1] Consultant geologist.
[2] Coordinator.
[3] Quadrio Curzio geologist

Hydrogeology

The groundwater in the Milan area is characterized by three main aquifers (Tab. 1) the first significant only to the civil engineers. This aquifer (60-120 m thick) is free and single in the northern part of the city, while a second half-confined acquifer appears, starting from the centre to the south of the city. The upper aquifer dips southward, at a variable depth of 6-22 m.

Therefore, any underground civil construction, depending on the depth of its foundations, must take steps to prevent flooding during excavation.

Technical aspects of a current case: underground carparks in Milan

Quadrio Curzio S.p.A., who were awarded the tender for 10 underground carparks in Milan with a capacity of about 200-400 spaces each, spanning three or four underground levels, is working intensively at present on these civic buildings, with five sites opened simultaneously (Bacchiglione, Caterina da Forlì, Costa-Loreto, Murani, Populonia).

The working areas lie in highly urbanized sites, and present the typical problems associated with big cities: presence of underground services (electric power, public water, gas, telephone cables, etc.); traffic jams during working hours; streets too narrow for the site vehicles.

On top of these logistical problems, are the technical difficulties of underground water with high pore pressure values, vertical front borings developed over several meters and a large volume of quarried material.

The main steps in this type of building may be briefly summarized as follows:

Site investigation of underground services and their displacement in case of interference with the structures

Diaphragm walls execution, as an earth retaining system, with hydro-cutter up to depths variable from 15 to 30 m (Fig. 1)

HYDROSTRATIGRAPHIC UNITS (according to Francani V. and Pozzi R.)	HIDROGEOLOGICAL UNITS	AGE
FLUVIOGLACIALE WURM AUCT.	SUPERFICIAL AQUIFER	UPPER PLEISTOCENE
FLUVIOGLACIALE RISS-MINDEL AUCT.	1st AQUIFER	MIDDLE PLEISTOCENE
CEPPO AUCT.		LOWER PLEISTOCENE
VILLAFRANCHIANO	2nd AQUIFER	
	3nd AQUIFER	CALABRIAN

Table 1. Hydrogeology of Milan

First step excavation and tie strands execution (1st or up to 2nd order, according to the project depth) (Figs 2-3)

Figure 1. Quadrio Curzio's hydro-cutter, site of Bacchiglione

Figure 2. Diaphragm walls and tie rods, site of Bacchiglione

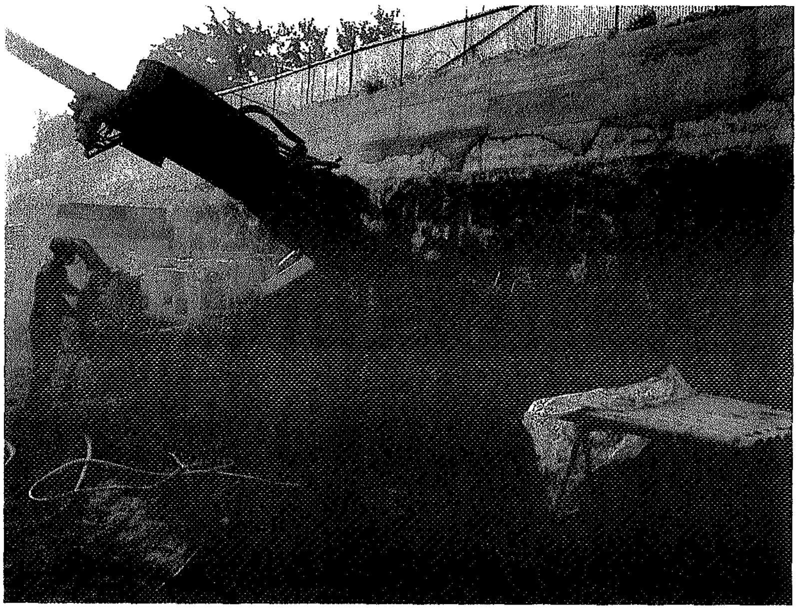
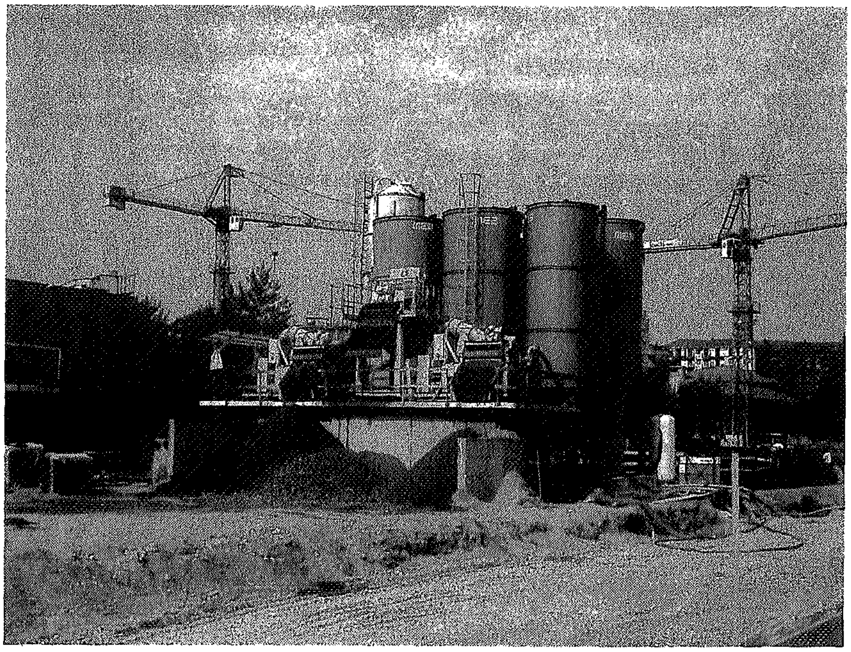


Figure 3. Tie rods execution, site of Caterina da Forlì



Excavation to water table (if present) and ground consolidation treatment with specifically designed chemical solution

Further excavation to the bottom and realization of basement

Structures building: 3-4 underground levels

Surface arrangements and urban furnishings: streets, pavements, trees and gardens, etc...

For the diaphragm walls execution, unlike conventional systems requiring rope or Kelly clamshells, Quadrio Curzio S.p.A. is employing, for the first time, in Milan, a Bauer BG 25 BC 32 hydro-cutter which works with the so-called "reverse circulation" method. A cutter frame, mounting two counter-rotating wheels and moved by a 365 kW tracked dozer with an operative weight of about 115 t, mills and sucks up the ground, mixing it with bentonitic mud: the quarried material reaches a plant (Fig. 4) where mud is extracted and re-employed in milling, while the ground fractions -sand and gravel- are separated.

This method offers a continuous progress of grounding, as the cutter works always at the bottom of the trench. Then, after the material extracted from the trench is chemically and geotechnically tested according to the UNI-EN standards in force, it is used in a mobile concrete plant and laid directly to form the diaphragm walls.

The remaining material quarried from the center of the park is brought to a site in the Milan suburbs, where Quadrio Curzio S.p.A. has a large crushing and concrete plant with a modern lab for aggregates and concrete testing, and which supplies all concrete necessary for the structures.

Conclusions

Although working activities take place in a highly urbanized context, the complete geological, geotechnical and hydro-geological characterization of grounds allows Quadrio Curzio staff to employ the most suitable technology in achieving the best results in such kinds of buildings, maintaining safety standards, and, last but not least, a short building schedule with lower costs.

Figure 4. Hydro-cutter mud treatment plant, site of Caterina da Forlì

Geological and climatic controls on vineyard terrain: part 1. Geology

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 object of this article and its successor is to restore the balance, and discuss in turn the importance of geology and climate on viticulture. Vineyards thrive on rocks of all ages and types. Superficially this might suggest that geology is unimportant. In fact the interplay of geology and climate determines the landscape in which a vineyard stands, and the soil in which it grows. The second article will discuss the role of climate in general, and climate change in particular.

La qualité et le *caractère* d'un vin est fonction de la géologie, du climat, des variétés de cep et du savoir faire du vigneron. S'il existe un grand nombre d'ouvrages traitant des deux derniers paramètres, il y a moins de littérature sur l'influence de la géologie et du climat. Le but de cet article et du suivant est de combler ce retard en discutant tour à tour de l'impact de la géologie et du climat sur le produit *vin*. Les vignes poussent sur les sols de tout âge et de toute nature. A première vue, cela pourrait faire croire au peu d'influence qu'a le contexte géologique. En réalité, 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. Le second article traite du climat en général et du changement de climat en particulier.

La calidad y el carácter de vinos está controlada por la geología, el clima, la variedad de la uva y la receta. Hay mucha literatura sobre las dos última variables, pero bastante menos sobre geología y clima. El objeto de este trabajo y el sucesivo, es restaurar el equilibrio y discutir además sobre la importancia de la geología y el clima en la viticultura. Los viñedos proliferan sobre rocas de todas las edades y tipos. A primera vista eso podría sugerir que la geología no tiene importancia. Sin embargo, el juego entre geología y clima determina el paisaje sobre el que se encuentra un viñedo, y el suelo sobre el que crece. El segundo artículo debate sobre el papel del clima en general y el cambio climático en particular.

Geologists have studied the relationship between geology and viticulture for many years, with all the collateral conviviality that such research demands. The birth of this discipline was the opening address given by Maurice Lugeon, eminent French Professor of Geology, at the International Congress of Wine Producers at Lausanne in 1935. For Anglophones, however, Peigi Wallace's paper at the International Geological Congress in Montreal in 1972 was the wake up call. Subsequently many books and papers have been published on the geology of wine, most notably in France, naturally (Pomerol, 1989; Wilson, 1998), but also Slovakia (Bezak, et al. 2002) and even the UK (Selley, 2004). In England, geologists such as Dr Jeremy Leggett and the late Sir John Knill planted vineyards at Melton Lodge, Suffolk, and Shaw-cum-Donnington, Wiltshire, respectively; while Denbies, England's largest vineyard at over 100 hectares, was planted on the recommendation of a notorious local geologist.

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Figure 1 shows that across Europe vines grow on rocks of all types and of all ages, from the Precambrian granites of Portugal to the modern terrace gravels of the River Thames. Superficially this suggests that geology has nothing to do with viticulture. Though vines grow on all rock types, geology exerts an important though indirect control on vine growth. The controls are principally related to topography and soil. These will now be considered in turn.

Topographic controls on viticulture

Temperature decreases at a rate of 0.6°C per 100 m. Thus in hot climates vines flourish in the mountains, whereas towards the polar limits of viticulture they are cultivated at progressively lower altitudes. This point is demonstrated by comparing the elevation of the vineyards grown on the chalk in the Champagne of France, and of the English Downs, discussed later. In warm climates, vines will thrive on horizontal land. Sunshine is adequate to ripen grapes. Moving towards the poles, however, the angle of the sun gradually decreases, temperature decreases, and the amount of solar radiation received by the vines correspondingly declines. There are therefore advantages to planting vineyards on north-facing slopes in the southern hemisphere, and south-facing slopes in the northern hemisphere. This is illustrated in Figure 2 and may be expressed mathematically as:

$$I = k \text{ sine } (a + b)$$

Where I = the intensity of radiation received on the slope
k is a constant
a = the angular elevation of the sun
b = the angle of inclination of the slope to the horizontal along a meridian, i.e. to the south, in the northern hemisphere, to the north in the southern hemisphere.

In southern England, where the angle of the sun is 62° at noon on mid-summer's day a vineyard on a 30° slope will receive 8% more sunlight than a vineyard on level ground. This does not sound too significant. By October, however, during the final days of ripening before harvest, the difference is 30%.

It is further held that the optimum ori-

GEOLOGICAL PERIOD		ROCK FORMATION	VINEYARDS BRITISH	VINEYARDS MAINLAND
RECENT		Glacial, periglacial & alluvial superficial deposits	Morville Hall Thorncroft	
TERTIARY		Clays & sands	St Andrews Painshill Hale	Bordeaux
CRETACEOUS		Chalk	Adgestone Godstone Denbies Breaky Bottom Hambledon	Champagne
		Upper Greensand Gault Clay Lower Greensand Weald Clay Hastings Sands	Deepdene Purbeck Lamberthurst	
JURASSIC		Purbeck & Portland L-stns Kimmeridge Clay		
		M Jurassic L-stns		Burgundy
		Lias Clays		
TRIASSIC	NEW RED S-STN	Mercia mudstone Sherwood S-stn.		
PERMIAN		Sands Dolomites & shales		
CARBONIFEROUS		Coal Measures Main L-stn.	Wootton Pilton Eglantine	
DEVONIAN	OLD RED S-STN	S-stns & Shales	Three Choirs Sharpham Beenleigh Manor	Beaujolais Rhine & Moselle
SILURIAN ORDOVIAN CAMBRIAN PRECAMBRIAN		Assorted horrible igneous and metamorphic rocks	La Mare Grace Dieu	Muscadet Port

Figure 1. Diagrammatic stratigraphic charts of the United Kingdom and Euroland showing that vineyards are planted on rocks of many ages

entation of a slope is to the east of south, since the vines then benefit from the early morning sun when the diurnal temperature is at its lowest. Easterly slopes may also be sheltered from prevailing westerly winds. For the southern hemisphere, needless to say, it is northerly slopes that are preferred to southerly ones. Vineyards planted on slopes benefit from good soil drainage in regions of high rainfall. Vineyards are best planted halfway up a slope in what is referred to as the 'thermal zone'. If too near the hillcrest the vines may be damaged by cold winds, if too close to the bottom of the slope the vines may suffer from cold air trapped at the bottom. Frost hollows are particularly dangerous, where cold air is trapped at the bottom of valleys. Late spring frosts are especially hazardous at the time of budburst, since they may not only destroy the buds, but also even large numbers of vines. Prominent headlands may provide shelter from prevailing winds. Thus, as the cross-section in Figure 3 shows, vineyards ancient and modern, have been planted in southern England to take advantage of geology and the resultant landscape.

Water at the foot of a slope is particularly advantageous for vineyards for several reasons. First, they may reflect sunshine up the slope, thus increasing solar radiation. This effect has been noted in the Mosel and Rhine river valleys of Germany and the Neusiedler See in Austria benefits from this situation, each having water at the foot of their southerly slopes.

This brief account shows that there is no simple correlation between rock type and viticultural success, and as Figure 1 showed, UK and Euroland vineyards have been planted on rocks of many different ages and types. As demonstrated above, however, rock type has a strong though indirect influence on viticulture. It controls topography, and hence microclimate. It also controls the chemical and physical properties of the soil in which the vines grow. Reference has already been made to the Cretaceous Chalk limestone. This rock type is particularly suited to viticulture, and provides a good example of how rock type determines topography and soil character, and thus affects viticulture.

Chalk: the midwife of Champagne and other fine white sparkling wines

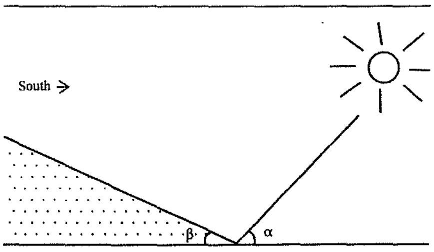
Many limestones are hard, tight, splintery rocks, which though extensively fractured, and thus well drained, seldom have much porosity in which to store moisture. Chalk is a limestone with particular petrophysical properties in terms of its porosity and permeability. It is lighter and softer than most limestones. This is because it is highly porous, with up to 40% void space. These pores have the ability to store large quantities of water. Chalk, however, is also commonly extensively fractured (Fig. 4).

These fractures give the rock a high permeability, allowing good drainage. Chalk slopes are thus particularly good sites for viticulture because they are always well drained, but can store large amounts of moisture that the vines may tap during dry hot summers (Hancock, & Price, 1990). Chalk differs from other limestones, and is chalky, because it is composed of the microscopic fossil plates of a particular group of calcareous 'algae', the Coccolithophoridae. These are composed of calcite, the variety of lime that is stable at the temperatures and pressures that are found in the subsurface. Most lime sediment, however, is composed of aragonite. This has the same composition as calcite, but a different crystal structure. On burial, aragonite quickly recrystallizes to calcite, resulting in hard,tight limestone.

Because of these special physical properties, the chalk is particularly favoured for viticulture, both in France, and England. In France the Chalk, or *Craie*, crops out in two main areas, around the rim of the Paris basin, and along the northeastern rim of the Aquitainian basin. Both areas are, confusingly, termed 'champagne'. The word was derived from the Campania region, north of Naples, which in turn took its origin from the Latin *Campus*, meaning an open field. The Chalk gives rise to open rolling countryside.

The north-eastern flank of the Paris Basin is the home of the only sparkling white wines that may legally be termed

Figure 2. Diagram to illustrate the relationship between slope and solar radiation (after Hancock, 1999)



Champagne. In this region the chalk escarpments reach heights of some 300 m. Vines are grown on the mid – lower slopes at altitudes of less than 200 m. Figure 5 illustrates the topography of the chalk escarpments of Champagne, and contrasts them with those of England. In England the Downs seldom reach such elevations and chalk vineyards, such as those at Adgestone, Hambledon, Godstone, Oxted and Denbies, are generally less than 150 m above sea level.

The answer lies in the soil

The soil on which vines grow is of great importance. Indeed soil has been poetically described as 'the soul of the vine'. Soil results from the interplay of climate and rock type. Soil may be defined as the disaggregated detritus formed by the weathering of bedrock and/or superficial deposits. It is the insoluble residue of the underlying parent material. Soil contains organic matter of various types, ranging from rotted tree roots to bacteria, which together constitute humus. Soil contains organic matter in varying amounts, ranging from the waterlogged peat soils of cool temperate climates, to the inorganic soils of deserts. There is general agreement on the physical properties of soil that are beneficial to viticulture, but less agreement on the chemical composition of the soil that is favourable. Vines like a steady, but moderate, supply of moisture. They do not thrive in waterlogged soils. This is one reason why vineyards are often planted on hillsides since they allow good drainage. In dry conditions vines develop taproots that may penetrate down through fractures for many metres to reach the water table.

One last physical attribute of soil to note is colour. Soils come in a wide range of colours that depend on the bedrock and climate. Dark soils reflect less sunlight than pale ones, but absorb more heat and thus warm up during the daytime and can radiate heat back into cold night air to the benefit of ripening grapes. In many German vineyards, which are planted near the northern climatic limit of viticulture, the indigenous black slate around the roots is favourable, and, sometimes, black rocks, such as basalt, are scattered around the roots of the vines.

Turning from the physical properties of soil that favour viticulture to the chemical composition, there is less consensus. The only parameter on which all agree is that high nitrogen content in the

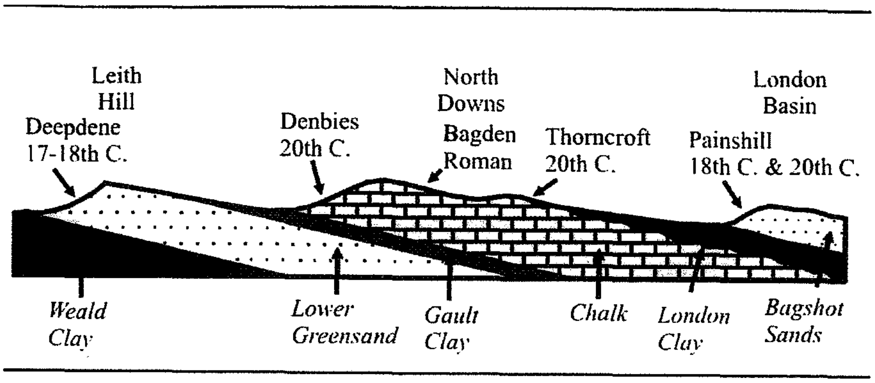
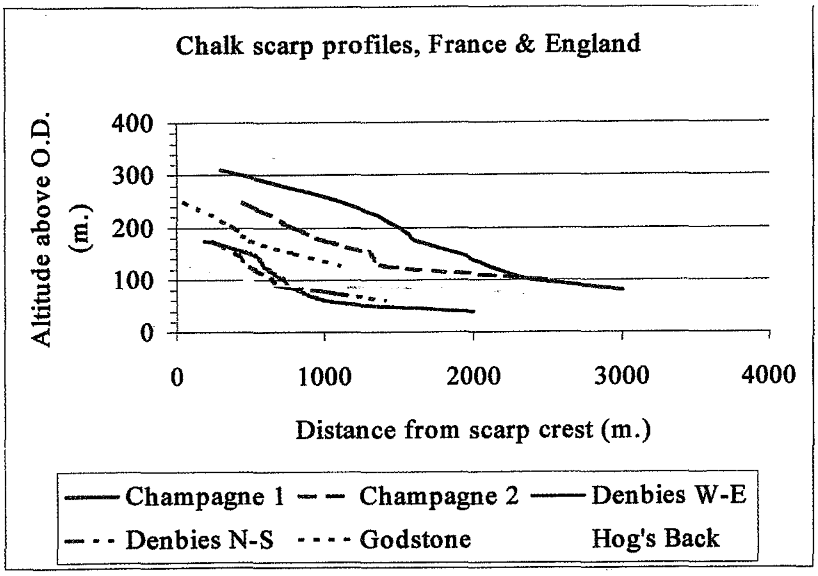


Figure 3. South – north cross-section from the Weald and into the London Basin to show how vineyards through the ages, though located on various rock formations, have been planted on southerly slopes to optimize the amount of sunshine that the vines receive. From Selley (2002) © Petravin Press.

Figure 4. Outcrop of Cretaceous Chalk, Denbies, England, showing the extensive fracture system that permits good drainage. From Selley (2004) © Petravin Press.

Figure 5. Profiles of the chalk escarpments of Champagne, France, and of southern England. Note that the English escarpments, and thus the vineyards on their slopes, are lower than those of France. From Selley (2004) © Petravin Press.



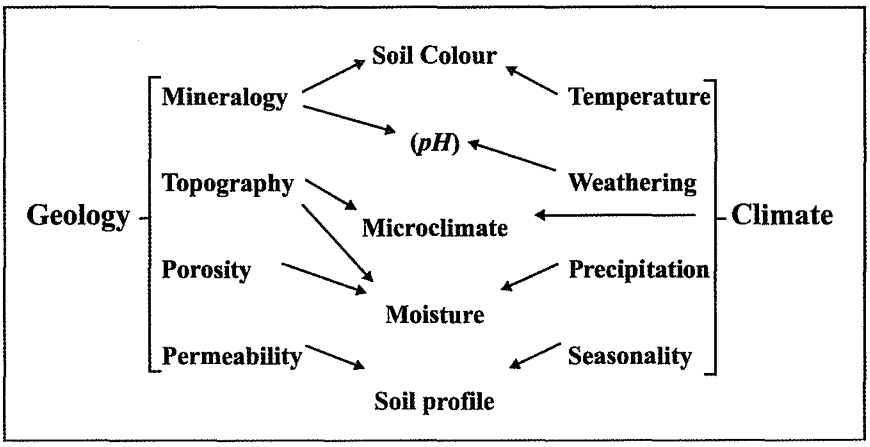


Figure 6. Soil, the "soul of the vine" (Wilson, 1998), results from the complex interplay of geology and climate. Note that in many vineyards it is the superficial deposits, such as alluvium, wind blown sand or glacial boulder clay, that determine the character of the soil, as much as the solid bed rock beneath. From Selley (2004) © Petravin Press.

soil is bad, thus manuring is not a good idea. Soils vary from acid to alkaline (for non-chemists: acididity/alkalinity is measured in terms of pH from 0 – 14, where 7 is neutral, anything less is acidic, anything more is alkaline).

Vines do not thrive in extremely acid soils with a pH less than 5. Such soils are usually to be found in regions of high rainfall. Alkaline soils, with a pH above 8.5, usually have free lime or salt. The latter is obviously to be avoided. Alkaline soils occur on limestone, naturally. Though some lime is good for plant growth, excessive lime can inhibit the uptake of nutrients essential for plant growth. This may cause the leaves to turn yellow due to a lack of chlorophyll, a condition known as chlorosis. Chlorosis is due to deficiencies of several important trace elements, but especially iron. It can be cured with the addition of iron. Iron occurs naturally in many rocks, in pyrites (iron sulphide), in chalk, or in glauconite (a complex potassium ferromagnesian silicate) found in greensand, and some chalk. Where iron is absent in the bedrock it may be applied in the form of chelated iron. Chlorosis may be avoided by planting lime-tolerant vines. The optimum amount of potassium for viticulture varies with climate and rainfall. Figure 6 shows how the interplay of climate and geology controls soil: 'the soul of the vine'.

Terroir and terroiristes

The French have subsumed the concatenation of soil, topography and climate into a quasi-mystical concept that they term 'terroir'. 'Terroir' is a key parameter in the Appellation Contrôlée scheme of classifying French wines.

The relationship between terroir and wine has been expressed in a simple mathematical formula by Jefford (2003) as:

Wine = grape variety + terroir + vintage + winemaking

Jefford (ibid.) writes poetically that '*Fermentation seems to draw out the grape's memory of the stone in which it once buried its roots, of the view across the valley that it had as it ripened, and the ever-changing weather pattern it enjoyed or endured as the season unfolded.*' Geologists will concur, though mentally replace 'stone', which is something worn on a ring around the finger, with 'rock'. 'Terroir' has attracted as much argument between terroiristes and non-believers, as the medieval theological debates on the number of angels who could pirouette on a pinhead. No Anglo-Saxon, however, could possibly understand such a quintessentially French concept as 'terroir', and it would be presumptuous to attempt to do so. Curious readers will find 'terroir' discussed in most wine books. Enthusiasts are referred to Hancock (1999a).

In the next article the role of climate, and particularly changing climate, on viticulture will be discussed. Meanwhile more will be found on www.winelandsofbritain.co.uk

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Sustainable mining in the European Union: pressures, impacts and responses

by Gyozo Jordan[1]

This article reviews the rationale for the new Mine Waste Directive (MWD) in terms of (1) environmental pressures and impacts posed by large amounts of material and waste, (2) catastrophic pollution accidents and (3) problems of abandoned mines. Responses by the professional community to challenges by EU policy-making are also presented. Some of the most important national and international efforts are introduced together with examples for decision support tools that have been successfully used for mining impact assessment. The objective of the article is to provide the geoscience expert with background of the MWD and to offer useful information for his/her work in the field of sustainable development of mining in the EU

L'article passe en revue le pourquoi de la nouvelle Directive sur les déchets miniers (MWD) en termes de : (1) contrainte environnementale et d'impact créé par une grande quantité de déchets et d'eaux résiduaires, (2) pollutions accidentelles et catastrophiques et (3) problèmes liées aux mines abandonnées. Les réponses données par l'ensemble des professionnels au défi lancé par la politique européenne, sont également présentées. Les actions les plus significatives au niveau national et international sont examinées ainsi que les cas de mise en place d'outils d'aide à la décision pour évaluer l'impact environnemental créé par les mines. Le but de l'article est de fournir au spécialiste en Géosciences, les grandes lignes de la MWD en lui offrant une information utile professionnellement, dans le domaine du développement durable du secteur minier européen.

Este artículo repasa la lógica de la Nueva Directiva de Residuos Mineros (MWD en su acrónimo inglés) en cuanto a (1) las presiones medioambientales y los impactos que representan grandes cantidades de materiales y de flujos de estériles. (2) accidentes con resultado de contaminación catastrófica y (3) los problemas de las minas abandonadas. También se presentan las respuestas de la comunidad profesional para los retos de la política de la UE. Se indican también algunos de los principales iniciativas técnicas nacionales e internacionales, junto con ejemplos de herramientas para la toma de decisiones que han tenido éxito en la evaluación del impacto de la minería. El objetivo del artículo es proporcionar al experto en Ciencias de la Tierra suficiente información de base de la Directiva de Residuos Mineros y ofrecer una información útil para su trabajo en el desarrollo sostenible de la minería en Europa.

The 'Proposal for a Directive of the European Parliament and of the Council on the Management of Waste from the Extractive Industries' identifies three main reasons that justify harmonized legislation and the need for a separate EU Directive for mining waste management: (1) the large amount of waste produced, (2) the catastrophic impact of tailings dam accidents, and (3) the widespread problems caused by abandoned mines. The discussion below follows the European Environmental Agency DPSIR (Driving force, Pressure, State, Impact and Response) environmental reporting scheme (Fig. 1) and presents these problems based on the results of geo-scientific research.

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Pressures and impacts: the scale of mining-related environmental problems

The world mining industry is not large in real terms (around 93 bn Euro of raw metal production), but mineral raw material extraction is the first and most fundamental step in the life cycle of many products. The extraction of non-renewable mineral resources feeds a wide range of minerals and metals into the world's economies, and mineral resources represent about 30% of the global world trade. The European mining and extractive industry contributes about 7% of the EU GDP and feeds essential raw materials to all other EU industries at local, regional and EU-wide scales. At the same time the extractive industry produces extremely large amounts of waste (Fig. 2). These include materials that must be removed to gain access to the mineral resource, such as topsoil, overburden and waste rock, as well as tailings remaining after minerals have been largely extracted from the ore. Mining creates the largest amount of waste in the European Union and it ranks first in the relative contribution of waste in many Central and Eastern European countries. For example, the annual EU waste production from the mineral extraction industry is estimated to be 400 Mt. It is estimated that such waste amounts to about 29% of total waste generated in the EU each year.

Global effects of mining are best approached by considering global biogeochemical cycles. For example, the major pool of sulphur in the global cycle is found in crustal minerals and many metals are mined from sulphide minerals. Large amounts of SO_2 are emitted during the smelting of copper ores. Lead mining and smelting activities by the ancient Greeks and Romans, for example, led to measurable increases in the lead concentrations of ice cores in Greenland. Sulphur is also an important constituent of coal and petroleum. Coal and petroleum extraction alone mobilizes 149 x 10^6 t/y sulphur, more than double that of 100 years ago.

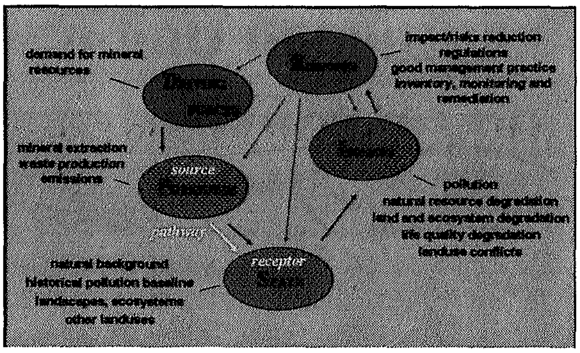


Figure 1. Schematic EEA DPSIR framework for mining waste. Traditional pollution source-pathway-receptor relationship is also shown. Red and green-coloured areas are related to socio-economic and environmental systems, respectively.

Regional scale mineral deposits can be very large and trans-boundary in nature. For example, large ore deposits are situated along the border zone of Archaean and Proterozoic terrains, SE-NW through central Finland into Sweden, including the Outokumpu region, where the total amount of Cu metal, extracted and reserves, is about 1 Mt. Another example of a regional trans-boundary deposit is the Erzgebirge, which is a major polymetallic mineral province in Europe, on the border between the Czech Republic and Germany. Regional-scale deposits often determine regional natural background concentrations of elements and compounds that can lead to regional trans-boundary pollution.

Although a mine site is essentially a point feature at the regional scale, the number of mines in a region can be significant. For example, there are 7,836 registered mineral deposits in Poland and, in Slovakia, 17,260 mine sites including shafts, adits, tailings ponds and waste rock piles have been inventoried. Another national project in Hungary has registered 15,008 quarries. The aggregated area affected by mining can also be significant. Mining areas cover 271,000 ha or 2.4% of the total area of Bulgaria. 487 aggregates quarries affect about 9,800 ha of utilized land, and total mining waste is estimated to damage about 40,000 ha of agricultural land in the country. At least 25% of the population of the Czech Republic lives in areas classified as highly degraded by mining.

A well-known example for regional impact is the historic mining area of Silesia in Poland. Negative effects of mining activity are especially recognizable at the Upper Silesia Coal Basin, as hard coal has been intensively exploited there for about 160 years. In the 1980s, all of 62 hard coal mines using an area of about 1,600 km^2, produced 190-200 Mt/y hard coal in a region of 6,650 km^2 (about 3% of the total area of Poland) where about 4 million people live. Another example of regional impact comes from data in the UK. Some 400 km of watercourse are currently degraded by abandoned coal mine discharges, with a further 200 km or so similarly contaminated by abandoned metal mine discharges in the UK. By rough extrapolation from these findings, it is likely that the total length of watercourses polluted by mine drainage in the EU 15 may well prove to exceed 5,000 km.

Pressures and impacts: accidents - triggering new EU legislation on mining waste

The greatest single concern about mines and mine waste is the failure of tailings storage facilities. Since 1975, tailings storage facility failures have accounted for around three-quarters of all major mining-related environmental incidents worldwide. An inert coal mine waste heap in Aberfan, Wales in 1966 caused the death of 144 people. In 1985 in Stava, Italy, a fluorite tailings dam failure released 200,000 m^3 of inert tailings resulting in 268 deaths. In 1998 in Aznalcollar, Spain, with the rupture of the dam wall, approximately 2 Mm^3 of pyrite sludge and another 4 Mm^3 of acid water containing high concentrations of heavy metals flowed into the Guadiamar River contaminating a 62 km long river section and a total area of 4,634 ha of land. The Baia Mare accident in Romania in January, 2000 released over 100,000 m^3 of process wastewater with cyanide compounds and heavy metals into the Tisza River. There have been many accidents that received less international attention but they still had serious regional or local environmental impacts. A typical 'unknown case' is the Gyongyosoroszi basemetal mines in Hungary where successive flotation waste bursts released more than 100,000 tons of mud with 5% sulphide mineral content into the valley and stream (Figs 3A and B). In July 1999 the dam of the water reservoir at the Recsk Copper Mines in Hungary was broken by a flood event (Fig. 3C) and the organic-rich sediment containing significant amounts of historic heavy metal pollution was re-suspended by the turbulent 200,000 m^3 of flood water and deposited downstream on the agricultural floodplain. Hundreds of similar 'small cases' have occurred in Europe that went unnoticed, except by the local authorities and people.

Following the Aznalcollar and Baia Mare accidents, the EU has identified three legislative activities:

- the inclusion of mining in the Council Directive 96/82/EC on the control of major-accident hazards involving dangerous substances (Seveso II Directive);
- the development of a separate Mine Waste Directive on the management of waste resulting from prospecting, extraction, treatment, and storage of mineral resources; and
- the development of Mine Waste Best Available Techniques Reference Document describing the best available techniques for waste management.

The main focus of the 'Proposal for the EU Mine Waste Directive' is on the prevention of mine waste facility accidents by engineering, monitoring and legal means. According to a recent study of the JRC

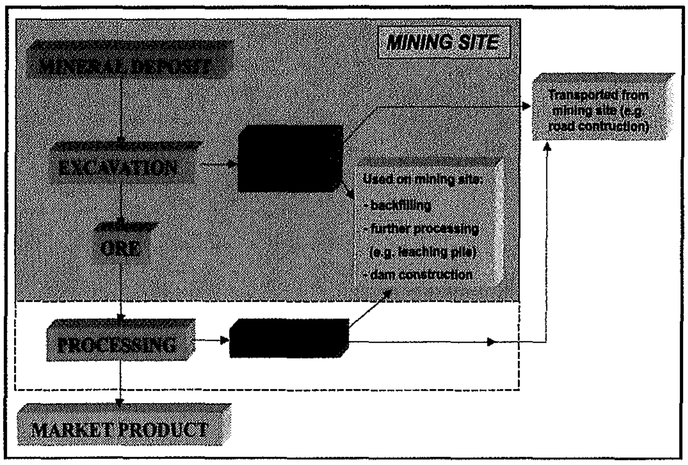


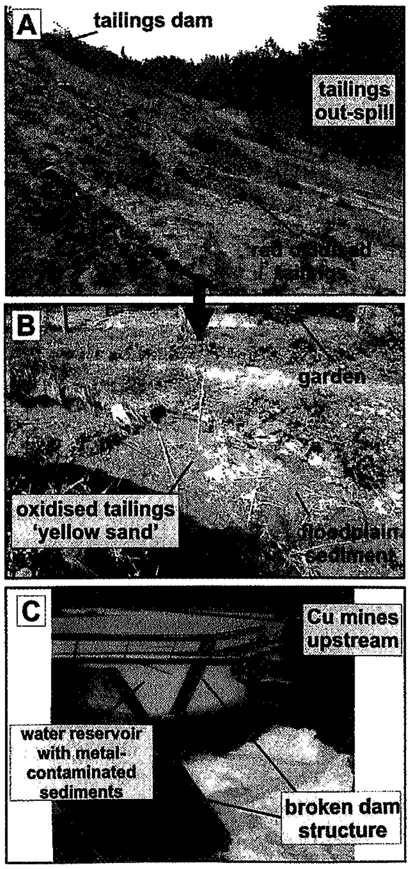
Figure 2. Mine waste streams in the extractive industries. Dashed line indicates that processing can also take place inside or outside of the excavation site (e.g. for bauxite mining). Red colour indicates mining waste (waste rock and tailings).

PECOMINES project, regulations on mining waste and accident prevention are very different among European countries and planning, prevention, impact mitigation, remediation and monitoring have to be analysed and managed in compliance with a number of European legislative requirements such as the Mine Waste Directive, Impact Assessment Directive, Seveso II Directive, Landfill Directive, Water Framework Directive, the Habitats Directive, the Waste Framework Directive and the Environmental Liability Diretive.

Pressures and impacts: abandoned mines - a Pan-European problem

An inventory of old mining sites registered in total 17,260 locations in Slovakia and a Hungarian national inventory has shown 15,008 quarries that are mostly abandoned. Abandoned mines are more of a problem in areas with a long history of mining, like Europe, because mine closure practices have changed with time

Figure 3. Accidents. A. Typical tailings dam burst showing heavy metal-loaded sediment release next to the dam at the Gyongyosoroszi Pb-Zn mines, Hungary (photo: S. Sommer). B. Contaminated tailings deposited on floodplains downstream (photo: U. Fugedi). C. Mine water reservoir dam broken by flooding at the Recsk Copper Mines, Hungary (photo: A. Somody).



and environmental protection has not been considered for closed mines, until recently. For abandoned mines there is a lack of clearly defined responsibility and remediation often has high cost. The major differences between abandoned and active mines are the following:

- engineering facilities such as dams, pumps, etc. are not maintained, leading to a lack of control of emissions and to accidents;
- in the absence of industrial management, there is a lack of information and knowledge about abandoned mines that leads to great uncertainty about their stability, potential hazards, and potential and existing environmental impact;
- in the case of any emerging environmental problem, implementation of environmental regulations is difficult. in the lack of a legal owner.

The major problems with abandoned mines are therefore uncertainty and lack of control. Experts classify abandoned mines among the most dangerous to the environment from a regulatory point of view. From an industrial point of view, if a new mining activity is proposed in an area of historic mining with abandoned mines, then there must be a recognition that the previous mining operation might have had an environmental impact. This requires the mapping of baseline pollution conditions that calls for detailed inventory and assessment of abandoned mine sites in the area.

Mining and mining waste: responses

In this section some of the main international and national efforts and methodologies for environmental assessment of mining are briefly described to illustrate the main lines of geo-scientific research and some of their results.

Responses: research efforts and results

Acidic drainage is recognized as the largest environmental liability facing the mining industry and, to a lesser extent, the public through abandoned mines. The MEND (Mine Environment Neutral Drainage) Program in Canada was implemented to develop and apply new technologies to prevent and control acidic drainage. The MEND Manual summarizes methods and results completed by MEND and provides comprehensive working references for the sampling, analyses, prediction, prevention, control, treatment and monitoring of acidic drainage. MEND concluded that while the developed toolbox of technologies and knowledge-base is adequate, there is a need for further research to improve understanding of processes, confirm performance of technologies through large-scale applications and long-term data, and a search for efficient technologies. The INAP (International Network for Acid Prevention) is an industry-based initiative that aims to globally coordinate research and development into the management of sulfide mine wastes. An INAP report concludes that risk assessment of AMD has focused mainly on hazard potential of mine waste and much less work has been carried out for the assessment of the environmental consequences of acid drainage and for integration of these results into formal decision-making process. This study also suggests that the great variety of site settings requires a case-by-case approach. A further example for research development by the industry is given by ANSTO's (Australian Nuclear Science and Technology Organisation) Managing Mine Wastes Project (MMW) and the Sulfide Solutions Research Project (SSRP). The main objectives of these projects are to develop and apply various measurement and computational tools that can be used in the management of mine wastes. The goal of the MiMi (Swedish Mitigation of the Environmental Impact from Mining Waste) is divided into five areas: (1) field studies and characterization, (2) laboratory studies of key processes, (3) prevention and control, (4) predictive modelling and (5) communication and commercialization. The project has developed state-of-the-art reports and case studies. The PIRAMID project (Passive In-situ Remediation (PIR) of Acidic Mine/Industrial Drainage, FP5 project), was concluded in the 'Final Report' and the 'Engineering guidelines for the passive remediation of acidic and/or metalliferous mine drainage and similar wastewaters' documents. Because of ground and surface water AMD pollution can persist for a long time after the cessation of industrial activity, PIRAMID suggest PIR as cheap and sustainable remedial methods. The MINEO project (Assessing and Monitoring the Environmental Impact of Mining Activities in Europe Using Advanced Earth Observation Techniques, FP5 project) used hyperspectral remote sensing techniques for impact assessment of mining. MINEO compiled the General Guidelines for image-processing procedures and algorithms for contamination and impacts mapping from airborne imaging spectroscopy. The ERMITE project (Environmental Regulation of Mine Waters in the Euro-

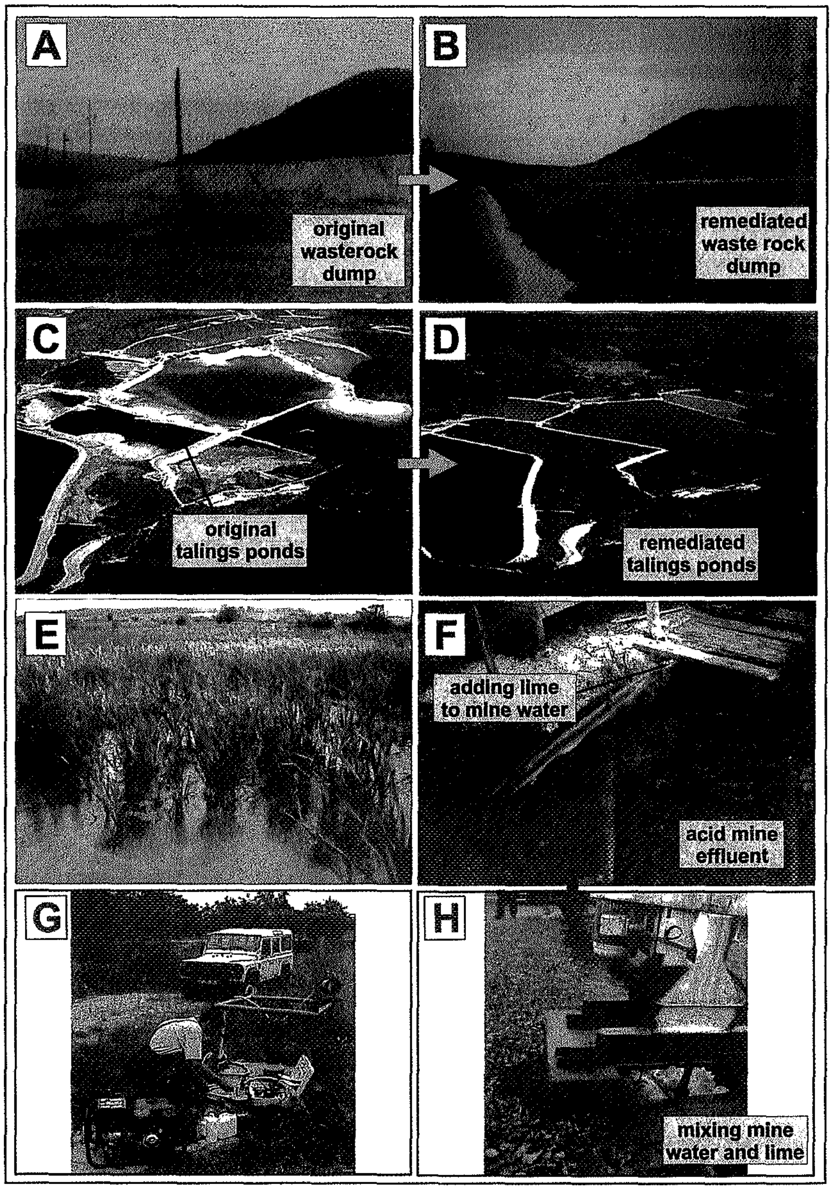


Figure 4. Remediation and long-term treatment. A and B. Waste rock dump at the Recsk Copper Mines in Hungary before and after remediation (photo: A. Somody). C and D. Tailings before and after passive treatment with water cover. E. Passive in-situ treatment. Aerobic reed-bed treating ferruginous overflow from abandoned underground coal workings at St Helen Auckland. F and H. Active treatment of acid mine drainage by neutralization with lime at the Gyongyosoroszi Pb-Zn mines, Hungary (photo: S. Sommer). G. Post-closure monitoring. Monitoring network at the Mecsek Uranium Mines, Hungary (photo: courtesy of the Mecsekerc Rt.).

pean Union, FP5 project) delivered the 'Economic analysis of mine water pollution abatement on a catchment scale' and the 'Mine waters pollution control: the legal situation at BIH and the EU levels' reports concluding that mine water pollution abatement is commonly not quantified in a catchment perspective and mine waters are part of the water cycle but are rarely treated as such.

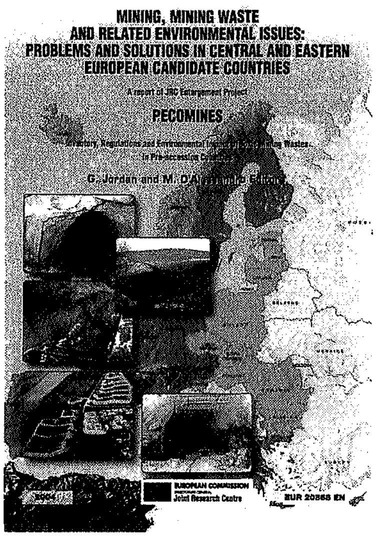
Responses: development of decision and policy support tools

The assessment of mining impacts requires methods that are (1) holistic, i.e. address the problem in its integrated complexity, and are (2) direct decision support tools, i.e. environmental decisions can be directly based on their results. Environmental management systems (EMS), environmental accounting, environmental audit, environmental reports, technology assessment (TA), and other specific decision support and evaluation schemes such as benefit-cost analysis (BCA) and multicriteria analysis (MCA) are methods for data gathering and evaluation to support and control decisions within the industry and thus these are not dealt with in this article.

Landscape Ecology (LE) provides complex decision-support landscape modelling and mapping techniques. LE was used, for example, in combination with landscape geochemistry, geochemical modelling and GIS methods to study spatial aspects of AMD impact in small catchments and in wetlands. Industrial Ecology (IE) limits its scope to industrial activities in relation to ecosystem sustainability. IE has two underlying principles. First, the recognition of the similarity of industrial systems and ecosystems. This enables the study of industrial development towards 'self-sustainability', control and regulations. Second, analysis of the 'ecological footprint', i.e. the area and resources necessary to support the industrial system in its complete functionality. An industrial system is more 'eco-efficient' if its ecological footprint is lower than those of others. Some studies suggested ways for the use of IE for bio-remediation of mine waste sites and abandoned mine sites. Similar to LE, Landscape Geochemistry (LG) has developed a complex tool box for modelling and mapping geochemical systems such as soils in a catchment. For example, LG has been used to study and map secondary accumulation of heavy metals in sediments deposited down-slope from mineralizations. Also, LG has been used to distinguish between natural background and mine pollution. Others used LG and GIS for the spatial analysis of heavy metal distribution in stream water and sediments impacted by metal mining. The USGS has developed the Geo-environmental Model (GEM) concept in order to analyse and predict the environmental impact of mineral deposits and extraction. The principle is that enough knowledge on the economic characterization of mineral deposits has accumulated including geological, mineralogical and geochemical information that enables the environmental classification of deposit types. An example for GEM application is provided by the joint USGS-MAFI project results on the Lahoca/Recsk and Gyongyosoroszi ore deposits in Hungary where GEM predictions of AMD generation and neutralization were confirmed by detailed geochemical studies.

Environmental Impact Assessment (EIA) is a project management tool and it used as an aid to public decision-making on larger projects. EIA consists of the screening, scoping, report writing, report review, decision-making and monitoring steps, according to the EU EIA Directive. Mining EIA has to consider (1) site-specific features, (2) the whole mining life cycle under the principle of 'design for closure', (3) differences between mining and processing methods, and their specific impacts, (4) thorough baseline surveys, (5) alternatives for methods and management practices, (6) special spatial and temporal scales of mining, and (7) residual impacts for impact mitigation. Risk assessment (RA) deals with the probability of any adverse effects. Various types of risk to be considered at the mine project life cycle include regulatory risk, engineering risk, facility risk, financial risk, human health risk and ecological risk. For efficient AMD treatment, practice should move from pure RA to complex risk management. Material Flow Analysis (MFA) (or Substance Flow Analysis - SFA) limits its scope to industrial activities in relation to matter transport and transition processes between socio-economic systems and the environment. Physical input-output analysis and materials balance methods form a set of related tools for analysis in which flows and accumulations of a substance are studied both within the economic and the environmental systems of mines. Product life cycle assessment (LCA) focuses on the product itself rather than the production site or process. LCA involves the analysis of all impacts created by a product "from cradle to grave". LCA enables a comparison of the impacts of similar products, or an estimation of the total impact of a given product. "Traditional" LCA, i.e. dealing with a specific product seems unsuitable for use in a mining context because mining is only the first stage of product life cycle and thus it is only a part of the complete cycle. Asset life cycle analysis of mining includes exploration (discovering natural resources), appraisal (assessing natural resources), development (design and construction of production facilities), production, closure (decommissioning of production and waste facilities) and after-care (sustainable remediation). Today, mining waste management is an integrated part of the life cycle of a mine. This means that various closure options are considered and evaluated in depth even before the mining activity starts, also called "design for closure". Clearly there is a need for a systematic and integrated approach in assessing impacts throughout the asset life cycle of mining operations.

Gyozo Jordan was seconded from the *Geological Institute of Hungary (MÁFI)* to the Joint Research Centre of the European Commission (JRC) for three years to contribute professional expertise to the preparation of the new EU Mine Waste Directive. Dr Jordan has recently returned to MÁFI where he continues to be involved in mining-related environmental assesessment, including joint projects with JRC. His book on the topic: ***'G. Jordan and M. D'Alessandro (eds). 2004. Mining and Mining Waste and Related Environmetal Issues: Pressures and Impacts in the Central and Eastern European Candidate Countries, Joint Research Centre, Ispra'*** is available at: http://viso.ei.jrc.it/pecomines_ext/index.html
e-mail: jordan@mafi.hu



Related Sources and Useful Links

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ANSTO
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Passive In-situ Remediation of Acidic Mine/Industrial Drainage (PIRAMID)
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Assessing and Monitoring the Environmental Impact of Mining Activities in Europe Using Advanced Earth Observation Techniques' (MINEO)
http://www.brgm.fr/mineo/

Environmental Regulation of Mine Waters in the European Union (ERMITE)
http://www.minewater.net/ermite/

Medal of Merit Award

During the EFG's June 2004 Council meeting in London, the third Medal Of Merit was awarded to Richard Fox. Previous recipients of the Medal were Eric Groessens (Belgium) and John Shanklin (UK)--see European Geologist 15. Richard first represented the United Kingdom in 1984, when he supported John Shanklin, then the immediate Past President. In 1986 he was elected to the position of Vice-President under President Gerald Clement and in 1990 himself became EFG President serving for three years until 1993.

During his time, the profile of the EFG was raised across Europe and countries which joined were Ireland, Sweden and Finland, with Denmark and the Netherlands in process. He was particularly involved with connecting to the European Parliament and the European Community. In 1992 he organized the presentation of the EFG Groundwater Dossier to the European Parliament where many of the MEPs involved with the Groundwater Directive attended.

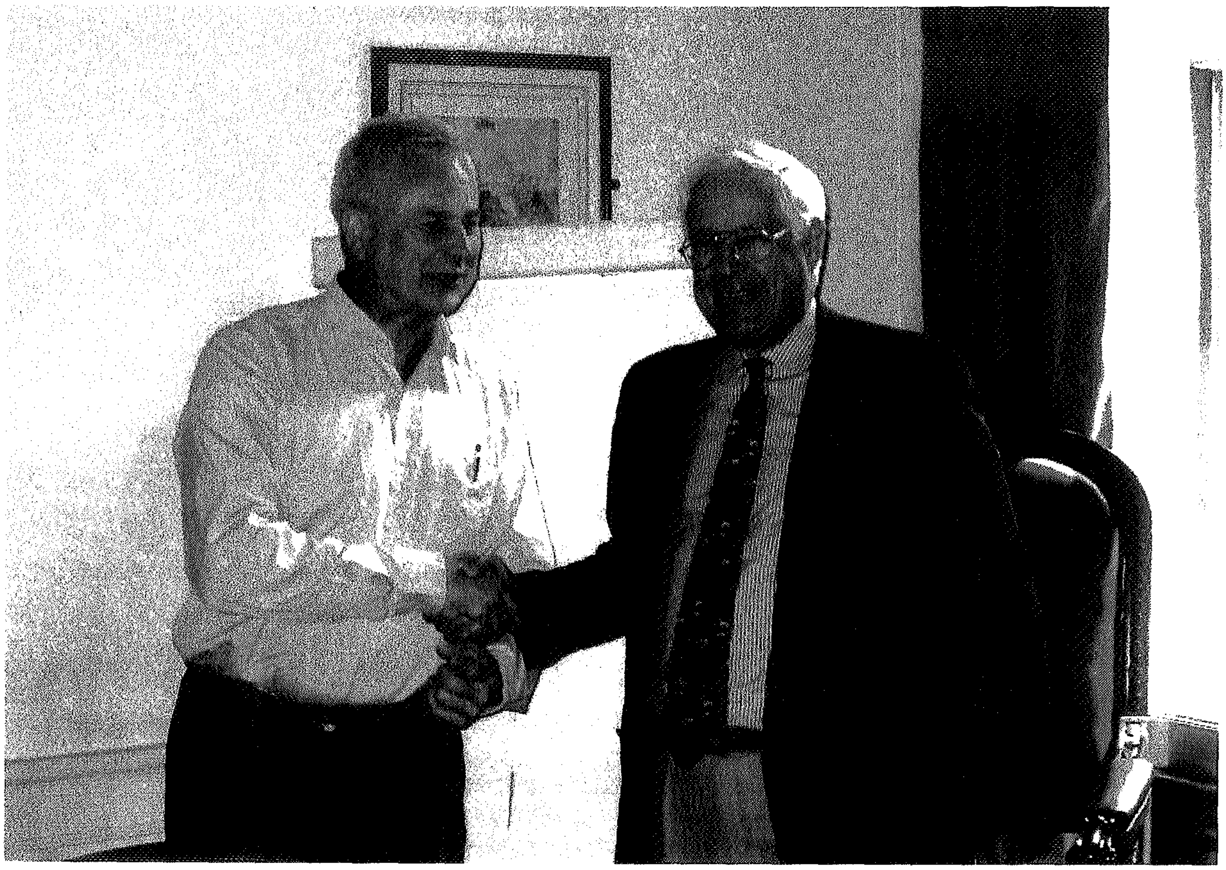
It was under his direction that contact was made with professional Engineers, Chemists and Biologists who were drawing up Codes of Conduct, and European Titles. This led to the Title of European Geologist being passed by the EFG Council, with the first EurGeols being awarded in 1993. Following the World Geological Congress in 1989, he and John Shanklin set up links with the American Institute of Professional Geologists through Bill Knight, Executive Director of the AIPG. This eventually led to the reciprocal Associate Membership between the EFG and AIPG.

Although he retired from representation in 1996, he was still heavily involved in important auxiliary roles including Chair of the Registration Committee and then the Registration Authority, which he concluded with distinction in London in June 2004.

Above all, Richard was a fine representative of the Federation and we all remember his consummate skill when in 1992 he addressed first the Regional Assembly of Castilla Y León in Salamanca, Spain and later a special meeting of the European Parliament in Brussels.

Richard was Director of Land Search for ReadyMixConcrete until he retired recently and now operates his consultancy Richard Fox & Associates in Winkfield near Windsor.

Richard's acceptance speech at the Council meeting is reproduced on the following page.



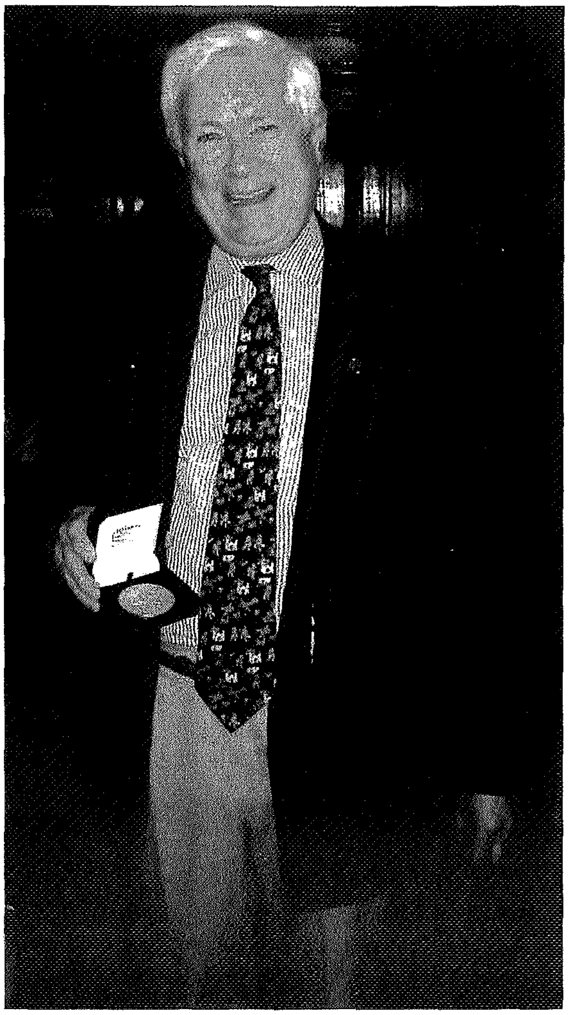
Richard Fox (right) receives his EFG Medal of Merit from Christer Åkerman, EFG President, at the EFG Council Meeting at the Geological Society of London, June 2004. (Photo: Gareth Jones)

This really is a great honour for me and I thank you all with much sincerity. It seems a long time since 1983 when I first had the privilege to represent the UK on the EFG Council (it was the Institute of Geologists in those days, because the Geological Society, we thought, could not provide the professional support). But in geological time, it is merely the blink of an eye.

Of course there are many memories of those 20+ years, and particularly the early days when the member countries, Belgium, France, Italy, Portugal, Spain, UK, and Germany as observer, were meeting every six months, spending much of the time putting together the framework for the "Code of Ethics" and the title of European Geologist. And they are good memories.

With John Shanklin as the first EFG President and the likes of Gerald Clement's Presidency driving us all, my baptism (or apprenticeship) into the Federation was a good one.

Certainly, my Vice-Presidency, under Gerald emphasized the need to think 'European' and to avoid the nationalist trap. It was during this time that we were encouraged to go to the World Geological Congress in Washington in 1989 and there we met Bill Knight and many of the other AIPG celebrities. We learnt so much from that meeting and the many other occasions thereafter.



Of course, there have been differences of opinion, but it was always encouraging to know that there was a common theme that prevailed, to promote professional geology throughout Europe, and overseas, as much as possible. There were good contacts with geologists in South America, Africa and Australia and, of course, there is always the Hong Kong Group of the Geological Society to provide the stepping stone to China! Links with other European professionals, like the Engineers, Chemists, Biologists and even the Lawyers, were fruitful, and at least we discovered that it would be too lengthy and costly to achieve a 'Special Directive' for geology to be recognized in the EU. The EFG is now on a strong footing and all credit to you, Mr. President, and all the past Presidents, their Boards and Councils.

It was, and is, hard work, and we gave up so many Sundays to deal with such a wide range of matters. I now have time to go fishing, play tennis and Lesley and I enjoy the theatre, museums, and the freedom to go to Portugal to see her parents. But it was fun and I am so glad that I have been able to play my small part in promoting professional geology on such a wide remit.

My wife Lesley could not be with us today because we have guests arriving for the Royal Ascot week ahead. She sends her best wishes and 'grand embras' to those who remember her.

As ever, it is thanks to the Geological Society for their support and hospitality and I hope to continue my association with the profession through this wonderful building here in Piccadilly, where geology had its beginnings, and to maintain contact with the so many friends that I have made through the EFG.

I have taken too much of your time but allow me a few minutes to read an e-mail I received this week from my God-daughter in Australia.

A philosophy professor stood before his class with some items on the table in front of him. When the class began, wordlessly he picked up a very large and empty mayonnaise jar and proceeded to fill it up with rocks, about 25mm in diameter. He then asked the students if the jar was full. They all agreed that it was.

So the professor then picked up a box of small pebbles and poured them into the jar. He shook the jar lightly. The pebbles, of course, rolled into the open spaces between the rocks. He then asked the students if the jar was full. Again, they agreed that it was.

The professor picked up a box of sand and poured it into the jar. Of course, the sand filled up everything else. He then asked once more if the jar was full. The students responded with a unanimous 'Yes'.

The professor then produced two cans of beer and proceeded to pour their entire contents into the jar, effectively filling the empty spaces between the sand. The students laughed. 'Now', said the professor, as the laughter subsided, 'I want you to recognize that this jar represents your life. The rocks are the important things – your family, your partner, your health, your children – things that, if everything else was lost and only they remained, your life would still be full. The pebbles are the other things that matter – like your job, your house, your car. The sand is everything else. "The small stuff". If you put the sand into the jar first', he continued, 'there is no room for the pebbles or the rocks. The same goes for your life. If you spend all your time and energy on the small stuff, you will never have room for the things that are important to you. Pay attention to the things that are critical to your happiness. Play with your children. Take time to get medical checkups. Take your partner out dancing. There will always be time to go to work, clean the house, give a dinner party and fix the disposal. Take care of the rocks first, the things that really matter. Set your priorities. The rest is just sand'

One of the students raised her hand and inquired what the beer represented. The professor smiled. 'I'm glad you asked. It just goes to show you that, no matter how full your life may seem, there's always room for a couple of beers'.

My thanks again. And now for a couple of beers.

Hero of yesteryear, villian of today: asbestos

by EurGeol. Anwar H. Khan[1]

During the last century Asbestos was extensively used in building and industrial products across the world. Asbestos, meaning 'indestructible' in Greek, has high tensile strength and durability with distinct insulation properties. There is a serious downside to this so-called 'wonder' mineral. Asbestos exposure is fatal and has already caused millions of deaths due to incurable lung diseases called Asbestosis and Mesothelioma.The use of asbestos continues unabated in several products particularly in developing or underdeveloped countries. This article is an attempt to provide some basic information on asbestos and its environmental and health hazards. Due importance has been given to the test methods for the analysis of asbestos-containing materials.

Au cours du siècle dernier, l'asbeste a largement été utilisé dans le monde entier comme produit de construction et industriel. Le terme *asbeste* qui signifie indestructible en grec possède un fort degré d'élasticité et de résistance et des propriétés particulières d'isolation. Cette soi-disant *merveille minérale* offre cependant un inconvénient majeur. Une exposition prolongée à l'asbeste est mortelle et a déjà causé la mort de millions de personnes par maladie incurable des poumons appelée asbestose et mesothéliome. L'utilisation de l'asbeste pour la fabrication de plusieurs produits, continue sans répit dans les pays sous-développés ou en voie de développement. Cet article a pour but de fournir une information de base sur l'asbeste et les risques pour l'environnement et la santé. Une importance justifiée a été donnée aux méthodes de test de détection de l'asbeste dans les matériaux.

Durante el último siglo el asbesto se ha utilizado ampliamente en la construcción y en prôductos industriales en todo el mundo. El asbesto que significa "indestructible" en griego, tiene una elevada resistencia mecánica y durabilidad y buenas propiedades aislantes. Este mineral llamado mineral "maravilla" tiene un serio inconveniente, la exposición al asbesto resulta fatal y ha causado ya millones de muertes debido a una enfermedad incurable denominada asbestosis e mesotelioma. El uso del asbesto continua sin disminuir en diversos productos en especial en países subdesarrollados. Este artículo pretende proporcionar la información básica sobre el asbesto y sus riesgos medioambientales y para la salud. Se ha dado la importancia adecuada a los métodos de ensayo apra el análisis de materiales que contienen asbestos.

The word ASBESTOS comes from the Greek meaning "inexhaustible" or "indestructible". Asbestos fibres are durable and have high tensile strength. They are resistant to heat, fire, chemicals and biological degradation. Because of these physical properties, asbestos was used extensively in construction and many other manufacturing and insulation industries, during the last century. Asbestos is commonly found in a variety of man-made products including ceiling and floor tiles, roof shingles, cement, water and sewerage pipes, automotive brakes and clutches, insulation products and heat-resistant fabrics. Since asbestos is an inorganic mineral, it does not burn. When mixed with other materials, it often adds strength, or imparts other desirable qualities.

From a geological or technical point of view, asbestos is defined as the common name for a group of naturally occurring fibrous silicate minerals of the amphibole or serpentine group. Chrysotile (white asbestos), known as fibrous serpentine, comprises the majority of commercial asbestos. Other commonly occurring forms are amosite (brown asbestos), crocidolite (blue). All varieties are found in metamorphic rocks. Amosite is generally considered more lethal than chrysotile.

Health Concerns

Asbestos is a potential health hazard because long term inhalation exposure to high levels of asbestos can cause lung diseases such as asbestosis, mesothelioma, and / or lung cancer. Asbestosis is the scarring of the lungs due to the lodging of asbestos fibers in the small air pathways. This scar-like tissue does not expand and contract like normal lung tissue and so breathing becomes difficult. Blood flow to the lung may also be decreased, and this may cause enlargement of the heart. Asbestosis is a serious disease and can eventually lead to disability and death. According to one estimate, within the next ten years, over 550,000 people may be affected by asbestos-related diseases.

Environmental Effects

Because asbestos is a mineral, asbestos fibres are relatively stable in the environment. Asbestos fibres do not evaporate into the air or dissolve in water. However, pieces of fibre can end up in air and water from the weathering of natural deposits and the wearing down of manufactured asbes-

[1]DGM, Al Hoty Stanger Ltd.

tos products. Asbestos-containing material that can be crushed into a powder is termed "friable asbestos." When asbestos-containing materials become friable, there is a chance that asbestos fibres can become suspended in air. It is under these conditions that airborne asbestos fibres represent the most significant risk to human health. For the inhabitant of a building or for workers in a work place, the primary hazard from asbestos-containing materials (ACM) comes from airborne particles.

Common asbestos-containing materials
Asbestos has been commercially added to more than 3,000 products. Whist the list is long, the following are some of the most common ACM which are found in houses and other routine places: flooring and floor tiles; ceiling and suspended tiles; corrugated or plain roofing sheets; gypsum dry walls; mastic and joint compounds; hard glue adhesives and coatings; beam spray; piping asbestos cement pipe and insulation system; boiler furnace and cloth iron wires and electric wire insulation; paper tape; automobile brake clutch linings and gaskets.

Asbestos regulations
The International Labour Organization (ILO) expressed its views seeking all 177 member countries to ban asbestos. Over thirty countries have already issued bans on all forms of asbestos In 1989, the Environmental Protection Agency (EPA) in the USA established a ban on new uses of asbestos. The EPA regulates the release of asbestos from factories and during building demolition or renovation to prevent asbestos from getting into the environment.

Professional and public awareness
All efforts should be made to eliminate, or at least minimize, the use of asbestos- containing material in any new construction or product. Substitute materials for asbestos are available for almost all uses. Such alternate materials include foamed plastic, fibrous glass, polyfoam, polystyrene, vermiculite, wood fiber, rock wool, perlite, alumina and gypum.

For existing dwellings, any renovation or repair work should be done only after ensuring that no asbestos-containing material shall be disturbed.

International regulations recommend that a professional asbestos survey is performed along with required analysis of SACM (suspected asbestos containing materials) for existing dwellings.

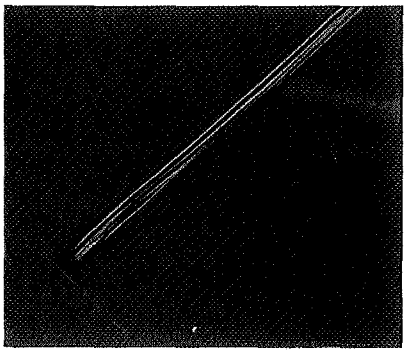


Figure 1. Amosite fiber under polarized light

Figure 2. Chrysotile Asbestos fibers under microscope

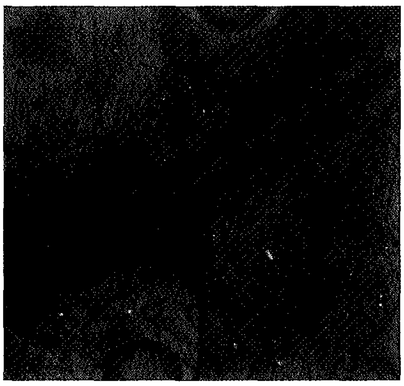
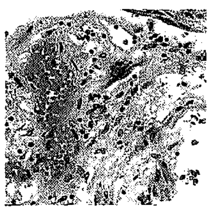


Figure 3. Crocidolite (amphibole group)

Figure 4. Photomicrograph showing Asbestos fibers lodged in the Lungs.



Recommended methods for asbestos survey and remedial measures
Initially a walk-way survey of the structure, or dwelling, should be performed by an asbestos specialist. Subsequently bulk material sampling should be conducted for any SACM. The samples should be analyzed in a specialist asbestos laboratory by means of Polarized Light Microscopy (PLM). Recommended method for PLM is EPA/600/R-93/116. While sampling, all the representative phases and layers of the material should be sampled and, wherever possible, each different phase/layer of the material should be treated as a separate sample for analysis.

A preliminary stereomicroscopic examination is mandatory for all samples. No sample preparation is necessary before this examination. If the sample is too large then representative subsamples can be made. Stereomicroscopic analysis is undertaken primarily to determine homogeneity, texture, friability, colour and extent of fibrous contents and fibre identification.

PLM technique utilizes the unique features of polarized light to differentiate various types of asbestos form non-asbestos fibres and classify the asbestos. The method is used for both qualitative as well as quantitative analysis of the bulk samples.

It should be noted that chrysotile and amosite are the most common types of asbestos in ACBM with some crocidolite. Other forms are rare. Furthermore, basic properties such as angle of extinction, sign of elongation and dispersion staining provide sufficient data for asbestos identification.

The aim of sample preparation for quantitative analysis is to provide the analyst a true, representative grain mount of the sample in which a clear distinction can be made between the asbestos and the surrounding non-asbestos matrix. Samples are mounted in refractive index (RI) liquids that allow distinction between asbestos and non-asbestos components. Various techniques are available for homogenization of sample materials that include blending, milling, grinding, etc., depending upon the type of sample, blinder, matrix, etc

The results will indicate whether the material is positive, containing more than 1% of asbestos, or negative with less than or a maximum of 1% asbestos.

For any location where airborne asbestos particles are suspected, the air should be sampled using a purpose built vacuum pump. NIOSH 7400 is a recommended method for the analysis of the collected sample using Phase-Contrast-Microscopy. There are limits to the amount of asbestos dust a person should breathe over an eight hour period. The limits are 0.3 fibres per millilitre of air for blue & brown asbestos. However, for white asbestos (chrysotile) this limit is extended up to 0.6 fibres.

It is stressed that removal and disposal of asbestos is a complex procedure, which should be handled by qualified and trained professionals only. Improper removal induces release of fibres and inhalation. Asbestos-containing materials should not be broken up for ease of disposal. When asbestos fibres remain tightly bound in a matrix, the risk of release is naturally reduced.

Finally, it is urged that all precautions should be taken to avoid asbestos exposure. Precaution is better than cure, particularly in this case, since there may be no cure for asbestosis!

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Hero or Villain? A reply

A review of the above article by Manuel Regueiro expressed doubts about the real dangers of some asbestos types; whether the dangers are inherent or are the result of poor education and failure to implement proper safety regulations. The author of the review points out that:

Asbestosis (clogging of the lungs due to breathing fibres, similar to silicosis with silica) and Mesothelioma (lung cancer, whose only known origin is asbestos inhalation; although 1% of the cases are "naturally" occurring) are two different diseases. All epidemiological studies carried out prove that there is a relation between amosite and mesothelioma, but this is not the case with chrysotile.

Asbestosis is comparable to silicosis or any other disease resulting from working in a polluted environment with any pollutant; it is not the mineral in particular that matters. Any material you inhale in quantities will be generally hazardous. Adequate ventilation lowers the risk and this is why most governments imposed rules on asbestos-handling before the final ban. Everybody understands that breathing a mineral-full environment (mines, quarries, shipyards) is hazardous, but what really scares people is that a very small quantity of one particular mineral can cause a cancer. This is not true for chrysotile, but is very true for amosite or crocidolite. And by including all of these minerals under the same umbrella, we are where we are today: banning all, just in case, no matter the cost.

There are uses of asbestos which are authorized by the EU Commission, as there are no alternatives (electrolitic processes and chlorine plants). Although, the Environmental Protection Agency (EPA) in the USA in 1989 established a ban on new uses of asbestos, the ban was lifted in 1991.

The main problem with this detailed procedure described in the text is that we might end up spending millions on asbestos-abating (such was the case in the USA) for a very small number of potential health problem cases, instead of using that money in measures to avoid car accidents or in cancer or any other disease research.

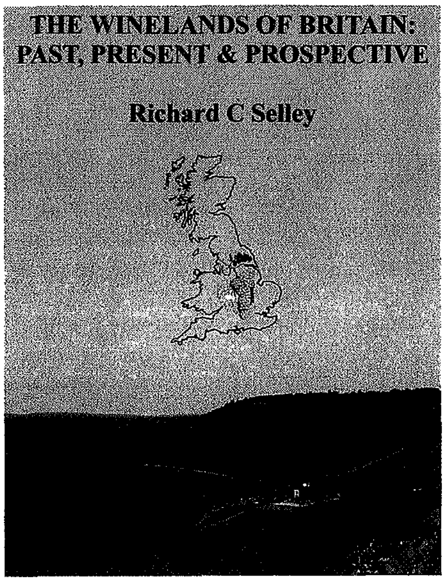
The Table below shows a comparison between hazards in the USA (Source: Citizen's Guide for Geological Hazards. AIPG).

My point is that sometimes there is a social turn against something that nobody knows very well. It is the fight against ignorance that matters. In general, most geological hazards, and this is one, are solved with information and prevention. Fear should not be the guideline.

Cause	Annual deaths (per million)
Asbestos exposition in a school	0.005 - 0.093
Plane accidents	6
Rugby	10
Drowning (5 - 14 yrs)	22
Car accidents (5 - 14yrs)	32
Home accidents (1 - 14yrs)	60
Tobacco smoke	1200

Wine On the rocks

Book review by David Harper[1]



The winelands of Britain: Past, present & prospective *by* Richard C. Selley.

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The late Derek Ager once famously remarked that his three main loves were 'Wine, women and geology', while one of Jake Hancock's obituarists noted that the great Cretaceous palaeontologist and stratigrapher 'suffered neither fools nor bad wine gladly'. It is thus not surprising that many learned and popular articles on the geology of wine are available, written by both geologists and winemakers alike. One might be curious about the origin of champagne, the relative merits of a good Burgundy or Claret, but British wine? Surely at best just a novelty, at worst barely drinkable. Not so! In the last 10 years huge improvements in the flavour and quality of British wines could potentially bring much more variety to the dining tables of Europe and beyond.

Richard Selley has, in this unashamedly home-produced book, uncorked the rich history of wine-making in Britain, revealed in some detail the relationship of British wine to the diverse geology of this island and has speculated on the future of the industry against a background of global warming. After an introduction, emphasizing that, apart from the grapes themselves, the main influences on wine quality are the effects of changing climate on a changeless landscape, follow the three main parts of the book: British winelands: Past; British winelands: Present; British winelands: Prospect. British vineyards have probably been with us for at least two millennia. Clearly the north-south gradient from the beer-dominated drinking bouts of the higher latitudes to the more relaxed wine cultures of the shores of the Mediterranean may have been a relatively recent phenonemon. Selley whisks us from the possibilities of a Neolithic wine industry through the vineyards of Roman Britain to the collapse of Roman rule and the 'Saxon Sag' or the 'Dark Age Drop' in wine production. Although wine returned with the arrival of the Normans, imports from Bordeaux may have inhibited the consumption of home produce. The decline was heightened during the Little Ice Age when cheap imports combined with a cooling climate, the Black Death and the dissolution of the monasteries to ravage the British wine industry. In later times wine production was very much the hobby of the rich eccentric.

A review of the current status of British wines brings into sharp focus the relative importance of geology, climate, recipe and the grapes themselves in wine production. Clearly bedrock geology has a profound control on the topography of the landscape and quality of the soil. The Chalk is of course an ideal substrate for the growth of vines, offering good drainage but also the possibility to retain water throughout intervals of drought. But when did the modern phase of British wine production start? Well, probably with Lord Bute in Wales during 1875, making good use of a substrate of New Red Sandstone and Carboniferous Limestone. But as Selley reports, [the satirical magazine] 'Punch' stated that it would take four men to drink it: the victim, two men to hold him down and a fourth to pour it down his throat'. Nevertheless, against a background of a warming climate (Industrial Revolution Warm Phase), better adapted vines and the means to avoid late frosts, British wine has prospered: Denbies vineyard, for example, produces some 200,000 bottles per year.

The prospects for the British wine industry are bright, particularly if global warming continues. Selley directs us to the very diverse geology of Britain and causes and mechanics of shorter-term climate changes, as the two critical ingredients in wineland development. There are now many vineyards (past, present or future) classified by Selley as 'abandoned, renaissance, virginal or prospective' developed or could be potentially developed on a variety of bedrock types ranging from Precambrian metamorphics of the Great Glen to the Pleistocene and Recent alluvium of the Thames valley. Particularly exciting is the notion of a Côtes d'Ecossaise replete with wine tours down the Caledonian canal. But wine should be seen as a complement not a challenge to the great Scottish malts.

Vine plants have been indigenous in Britain for some 50 million years and vines grown domestically for nearly 5,000 years. The British wine industry is clearly here to stay.

This is an enjoyable, well-researched book, combining anecdotal fun with factual detail. The more serious side of the book is represented by a sequence of maps of probable and actual vineyards through time providing an important database of vineyard distribution in relation to time and temperature. The quality of reproduction is good with very few typographic errors. There is a useful glossary and a good index. This is essential reading for all of us who combine geology and wine in the various strands of our lives.

Read also Richard Selley's article on Geological and climatic controls on vineyards, page 19, this issue.

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Are scientific honesty and "best practices" in conflict?

by EurGeol. David M. Abbott, Jr., CPG, FGS (CGeol)[1]

Honesty is the most frequently cited ethical principle for scientists. The growing use of "best practices" frequently conflicts with the honesty by failing to recognize when the "best" practice is inappropriate due to changed conditions or technology. These changes require the use of professional judgment. But professional judgment is harder for non-professionals to assess, hence the appeal of recipe-type "best" practice standards. Recipes assume standardized input ingredients; something geology fails to provide. Honesty demands this recognition, even if it eliminates the easy answer. These difficulties must be recognized if the use of "best" practices is to be scientifically honest.

La qualité et le caractère d'un vin est fonction de la géologie, du climat, des variétés de cep et du savoir faire du vigneron. S'il existe un grand nombre d'ouvrages traitant des deux derniers paramètres, il y a moins de littérature sur l'influence de la géologie et du climat. Le but de cet article et du suivant est de combler ce retard en discutant tour à tour de l'impact de la géologie et du climat sur le produit vin. Les vignes poussent sur les sols de tout âge et de toute nature. A première vue, cela pourrait faire croire au peu d'influence qu'a le contexte géologique. En réalité, 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. Le second article traite du climat en général et du changement de climat en particulier.

La calidad y el carácter de vinos está controlada por la geología, el clima, la variedad de la uva y la receta. Hay mucha literatura sobre las dos última variables, pero bastante menos sobre geología y clima. El objeto de este trabajo y el sucesivo, es restaurar el equilibrio y discutir además sobre la importancia de la geología y el clima en la viticultura. Los viñedos proliferan sobre rocas de todas las edades y tipos. A primera vista eso podría sugerir que la geología no tiene importancia. Sin embargo, el juego entre geología y clima determina el paisaje sobre el que se encuentra un viñedo, y el suelo sobre el que crece. El segundo artículo debate sobre el papel del clima en general y el cambio climático en particular.

"The only ethical principle which has made science possible is that the truth shall be told all the time. If we do not penalize the false statements made in error, we open up the way, don't you see, for false statements by intention. And of course a false statement of fact, made deliberately, is the most serious crime a scientist can commit." C.P. Snow, The Search (1959)

Snow's statement, which serves as the epigraph for this paper, concisely summarizes the importance of honesty in science.

Honesty: the fundamental scientific ethical principle

The Search is a novel in which the protagonist, a young physicist, publishes results that are based on an assistant's work that was not checked. When others attempt to repeat the results, errors in the original work are discovered. The young physicist's previously promising career is ended because he has violated the honesty rule as quoted above.

Further support for the contention that honesty is the fundamental scientific ethical principle can be found in professional ethics' codes and statements. For example, the European Federation of Geologist's Code of Professional Conduct includes the following statements:

> "5. The rules of ... honesty should control the actions of the geologist ...
>
> "6. The geologist must not put his name to anything that is untrue, ...
>
> "9. The geologist must not alter, or deny the existence of, facts or accepted technical or scientific truths which could thereby favour a client or mislead the public."

And the Geological Society of London's Code of Conduct states:

> 1. In pursuing and applying the science, the practice of geology requires the highest standards of integrity, responsibility and professional knowledge. This Code of Conduct applies to all Fellows of the Geological Society and is consistent with the code of professional conduct of the European Federation of Geologists.
>
> 3. A Fellow shall treat his colleagues with honesty and integrity...
>
> 7. A Fellow shall avoid any form of negligence in the practice of geology

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and shall at all times take all reasonable precaution to avoid any act or omission which might either (i) endanger life or adversely affect the health and safety of any person or (it) needlessly endanger or damage property or the environment.

8. A Fellow must express opinions on the basis of knowledge and honest conviction and must not alter or deny the existence of technical or scientific truths in order to enhance his arguments. He should never yield to pressure to make knowingly false statements and must always inform a client or employer of the true limitations of practical results.

The opposite of honesty is deception. Deception covers more than lying, *i.e.* saying something you know to be untrue. Avoiding deception requires communicating the whole of the relevant truth. Misleading statements are a form of deception. They are statements that, while true, fail to state the whole truth with the result that those hearing or reading the misleading statement are led to believe something that is not true. For example, if a geologist is asked whether a property located in the general vicinity of a gold mine contains gold, a truthful but misleading answer would be "yes." It is probable that detectable gold exists on the property. But the real question being asked is not whether there is detectable gold on the property but is there economically recoverable gold on the property.

Misleading statements are often supported or accompanied by material omissions, which are the failure to include statements needed in order to make the whole truth clear. Material omissions are frequently at the heart of deception and fraud. For example, a purported valuation for a quarry contained the following statements about the potential value of the tiles that might be produced.

The property contains 13 million cubic feet (US measurement units) of in-situ marble measured vertically from the property boundary.

Approximately 50% of the insitu marble can be used for producing tiles.

Thus there are approximately 6.5 million cubic feet of recoverable marble that can be cut into tiles.

If the tiles are 12 × 12 × ½ in dimensions, there are 12 ÷ ½ = 24 tiles per cubic foot; thus there are approximately 156 million saleable tiles.

If the 156 million tiles can be sold at retail for $13 per tile, the gross value of the tiles that can be produced from the property is over $2 billion.

The owner of the property who requested the report containing the foregoing statements attempted to use the report to obtain loans using the $2 billion value of the tiles as collateral.

However, the foregoing statements contain several material omissions:

The calculated 24 tiles per cubic foot allow no space for cutting and polishing each tile. A yield of 12 or 13 tiles per cubic foot is more realistic.

The retail price per tile is more than the value of a tile at the quarry, due to shipping costs, retailer's costs and profit margin. Further, the value of a tile at the quarry assumes it is cut, polished, and ready to ship, which is greater than in-situ value of the marble to the property owner.

No operating set-back is allowed for the quarry. This is not a reasonable extraction plan from either technical or regulatory perspectives and would not receive the required operating permits if proposed.

The foregoing was an example of intentional deception. Much more difficult to avoid are the unrecognized biases and resulting deceptions that we humans inherently have. As De Freitas (2000) pointed out, "scientists frequently do not properly acknowledge the limits of what they really know and uncertainties involved." Richard Feynman (1974, 1999) forcefully makes the point in his famous "Cargo cult Science" lecture at Cal Tech. Feynman urges us to avoid our biases, stating, "...you should report everything that you think might make it invalid—not only what you think is right about it: other causes that could possibly explain your results; and things you thought of that you've eliminated by some other experiment, and how they worked—to make sure the other fellow can tell they have been eliminated."

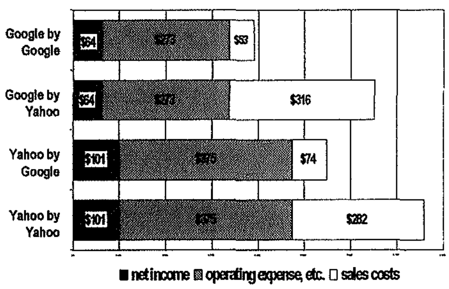


Figure 1. The first quarter 2004 results for Google and Yahoo using their respective accounting methods. Wall Street Journal, 10 May 2004, p.C1.

Best practices and standards: their appeal and their problems

The appeal of best practices and standards is that they provide a measuring tool, a meter stick against which a professional's practice can be measured. Those professionals failing to follow the specified best practice or standard can be judged incompetent for their failure. Failure to follow the best practices and standards expose the professional legal actions based on incompetent practice regardless of the applicability of the best practice or standard to the problem under consideration. The problem with the growing use of best practices and standards is that they fail to recognize the inapplicability of the best practice or standard to a particular case due to changed conditions or changed technology (Abbott, 2003). If best practices and standards are to comply with the honesty requirements of our professional codes of ethics and conduct, they must recognize their limitations and permit the use of professional judgment in their application. The following examples illustrate problems encountered with best practices and standards. *Accounting principles and standards.* Generally accepted accounting principles (GAAP) and generally accepted auditing standards (GAAS) are the *sine qua non* example of standardized practice. Their goal is to ensure that every entity using these principles and standards will generate comparable results. The *Wall Street Journal* (2004) reported an interesting example of the application of accounting practice comparing the results for the first quarter of 2004 for Google and Yahoo, the two biggest internet search engines. Yahoo was a public company and Google had announced its intention to become a public company. Given the similarities of their business, one would assume that their financial results would be similar. This wasn't the case as illustrated in Figure 1. Using the accounting methods employed by Google, Google's sales costs were $53 million for the quarter, but if Yahoo's accounting methods were employed, Google's sales costs would be $316 million. Yahoo's first quarter sales costs would be $74 million using Google's accounting methods, but Yahoo reported them as $282 million. The differences in results are dramatic. Reportedly, both Google and Yahoo were using accepted accounting methods; nothing suggested that either was engaged in improper or incompetent accounting. The reported reason for the differences was revealed deep in the footnotes to the financial statements. Google reported only the net revenue from hits received by those advertizing on Google while Yahoo reported the gross revenue from such hits. Because the costs associated from using Yahoo's accounting method must be shown somewhere, the result is the higher sales cost figures. Nevertheless, the results of the differing accounting methods exceeded an order of magnitude. In accounting, a change of greater than 10% is considered material. Those lacking accounting expertise would have difficulty detecting and understanding the differences when comparing the summarized results. *Fire assays for placer deposits.* Fire assays are the *sine qua non* method of accurately determining the quantities of precious metals in geologic samples. This has been true since ancient times; the Old Testament contains a number of references to trying by fire or purifying by fire. From time to time alternative methods of quantitative analysis of precious metals are put forward but none have proven more accurate than fire assaying. Most have proven to be either fraudulent or lacking fire assaying's precision. Why then does a heading in a well-known book on placer examination read, "Fire Assay of Placer Samples—Misleading Results" (Wells, 1973, p. 91). The short answer to the question is that fire assays, because of their procedures, report the total precious metal content in the sample assayed. The reported quantity frequently is materially higher than the quantity of precious metal that can be recovered using the gravity concentration techniques employed in placer mining. This is an example of the misleading statement I discussed earlier. The value of a precious metal deposit does not depend on the total quantity of precious metal within a specified volume of rock but rather on the quantity of precious metal that can be recovered and sold. Placer examination values report the amount of precious metal recovered by particular concentration techniques. In hard rock mines where fire assaying is the accepted methodology, the average assay values must be reduced by various mining and processing losses to determine the recoverable quantity of precious metal.

High-grade sampling. Deliberately taking high-grade samples is not a normally accepted practice. Normally, sampling programs are designed to obtain representative samples of the material in question. However, when I was examining cases of fraudulently hyped precious and base metal mining properties for the US Securities and Exchange Commission, I deliberately sampled the areas identified by the promoters as containing the highest grade material, including sampling only the high-grade part of a vein or similar concentration. I did this because I had neither the budget nor time to conduct a thorough sampling program. Invariably, the analyses of these high-graded samples reported undetectable or only trace amounts of precious and base metals. I could then argue that if the highest grade material on the property as identified by the promoter had no economically recoverable values, the lower grade portions of the property would not either. Given the purpose for which I was collecting the samples, high-grade sampling was the quickest and cheapest method for determining the fraudulent character of the claims being made by the promoters even though high-grade sampling is a non-standard and generally unacceptable practice.

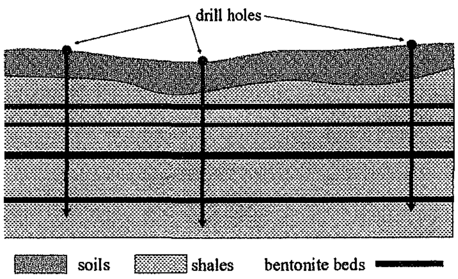
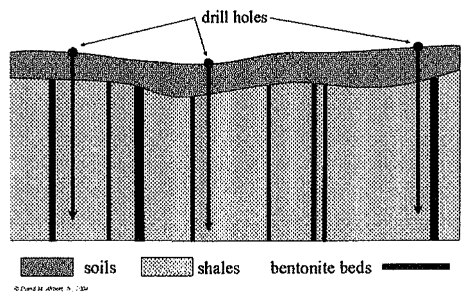


Figure 2. The standard method of testing for swelling soils by drilling vertical holes to intersect subhorizontal beds.

Figure 3. The failure of the standard method of testing for swelling soils when the beds are steeply dipping. The probability of intersecting a bentonite bed with vertical holes is very low.



Improper application of a standard practice due to changed conditions.
Swelling soils (bentonites) present foundation problems in many parts of the Denver, Colorado metropolitan area. Most of the Denver metro area is built over essentially flat-lying Upper Cretaceous and Tertiary rocks and the standard method of testing for swelling soils is illustrated in Figure 2. A number of drill holes are bored to depths below the level at which swelling soils might present a problem and any swelling soils found are tested to determine appropriate mitigation of the problem.

However, on the west side of the Denver metro area on the flanks of the Rocky Mountain front, the bedrock is steeply dipping rather than flat-lying and the standard method of drilling vertical holes to test for swelling soils problems is unlikely to intersect the swelling soils that are present (Fig. 3). Even though geologists have known about the change in dip for years, something that is clearly evident in the hogbacks flanking the mountains and problem areas, soil testing firms continued to use the standard practice despite the changed conditions (Noe, 1997, Noe and Dodson, 1997).

The two photos in Figure 4 illustrate the consequences for two of the many homes affected by the failure of the standard practice to properly test for swelling soils in areas where the bedrock and contained bentonite layers are steeply dipping. The "bat wings," which are particularly noticeable in Figure 4a, result from the upward heaving of the garage and driveway concrete slabs, which are poured directly on the underlying soils. Both houses in Figure 4 display non-parallel lines, one drawn along the line of the garage and one drawn along the line of a porch. These non-parallel lines, which are parallel in unaffected homes, result from the shifting foundations for these homes and indicate the potential amounts of resulting structural damage.

Honesty: avoiding misuse of models

Computer modelling has become a commonly used tool for the evaluation of a variety of geologic processes. However, as pointed out by both Rahn (2000) and Oreskes (2000), the limitations of computer models are frequently insufficiently discussed in the presentation of modelling results. Among the major reasons limiting computer modelling are the following points:

Geology is heterogeneous and non-

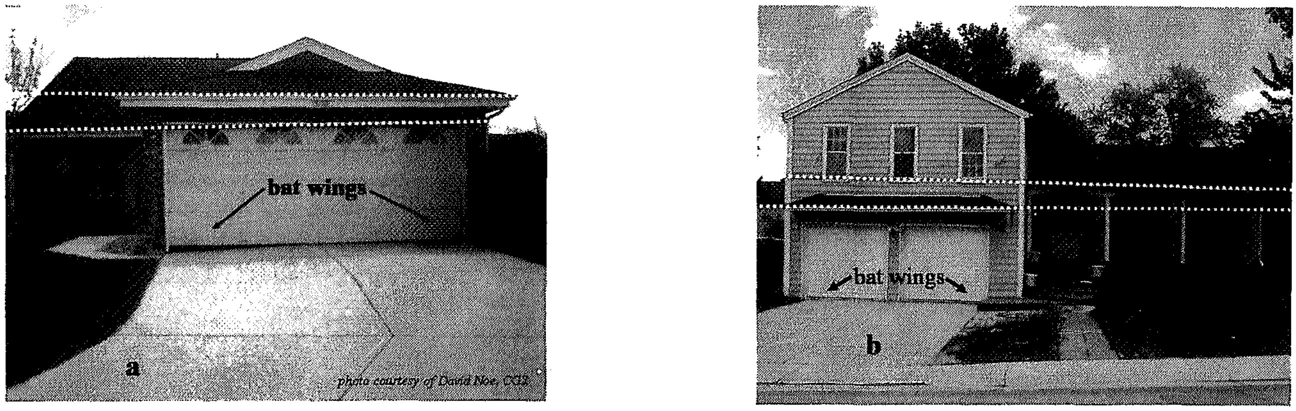


Figure 4. Two homes affected by swelling soils. The non-parallel, dotted white lines illustrate the shifting between the garages and the homes while the "bat wings" illustrate heaving of the garage and driveway slabs.

linear—if the mathematics conflict with geology, suspect the math.

Models can never be validated; they can only be invalidated by comparison with actual data (Rahn, 2000).

Models can be tweaked to fit the actual data—does the tweaking hide a bad model or improve a good model? (Oreskes, 2000).

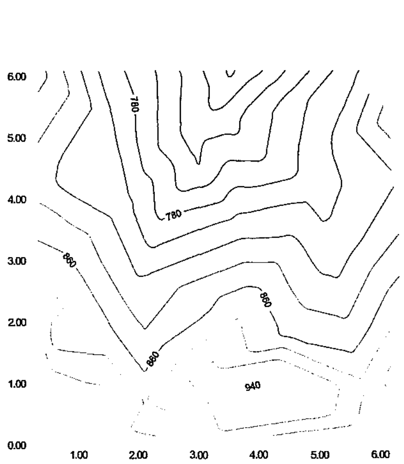
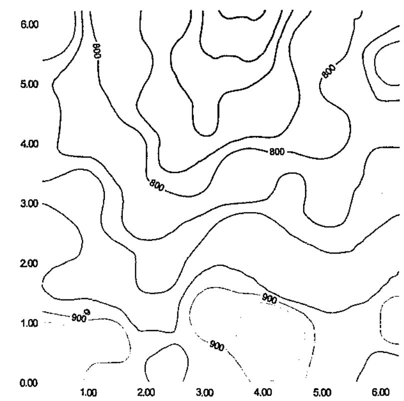


Figure 5. Gridded data contoured using a triangulation algorithm.

Figure 6. Gridded data contoured using an



3D models are interpretations, not necessarily the "truth."

A couple of examples will help illustrate these points.

Contouring programs. Drawing contour or isoline maps of topography, structural layers, sediment thickness (isopach), and many other quantities is widely applied geoscience practice. Formerly done manually, contouring now is most frequently done by computer, using gridded data. The problem is that different contouring algorithms generate different results and personal preference tends to be the basis for choosing between algorithms. Figures 5 and 6 illustrate this point. Both contour diagrams in Figures 5 and 6 were generated from the same gridded data set using the Surfer™ program but Figure 5 used a triangulation algorithm while Figure 6 used an inverse distance to the 4th power algorithm. Both diagrams show the major isoline features, the trough running from the top centre slanting down to the left and a high along the bottom just to the right of the centre. However, if these isolines are to be used to derive data for various points across their extent, then their differences rapidly become apparent as each method yields differing results for the same point.

Mathematical proof of exponential decline. When the production of hydrocarbons from a well is plotted on semi log paper over time, the production trend, particularly after about 6 months, frequently falls along a straight line. Straight-line plots on semi log paper reflect the applicability of the exponential function or change by a constant percentage amount per unit of time.

I once attended an oil reserve estimation short course during which a petroleum engineer mathematically proved that exponential decline should occur if one assumed that the reservoir was (1) isotropic, (2) homogeneous, (3) had a uniform thickness, and (4) had infinite horizontal dimensions. The problem is that these assumptions are never valid.

Figure 7 illustrates the reality of fluid flow in an oil reservoir rock. The rock is a Lower Cretaceous Dakota Group sand, which is a common reservoir rock in the Denver Basin. This outcrop, in a road cut southwest of Denver, is saturated with a fossil oil deposit. During the erosion and uplift of this unit, uranium and other metal-bearing waters entered and flowed down gradient. When the oxidizing, uranium and other metal-bearing water encountered the reducing environment of the fossil oil reservoir, a roll front uranium deposit formed along with related trace element features, one of which is the ilsemannite (a blue molybdenum oxide) tongue (Fig. 6). The ilsemannite tongue represents 2-dimensional cut through a geochemical cell resulting from ground water flow into and through the sandstone. The irregular shape

Figure 7. A tongue of ilsemannite ("moly blue") associated with a roll-front uranium deposit precipitated by a "fossil" oil pool in Dakota Group sandstone. This tongue illustrates how fluids really move through rock.

of the tongue illustrates the reality of fluid flow, which is very difficult, if not impossible, to accurately and precisely model.

Professional judgment is required

Geologic conclusions are, in the final analysis, expressions of judgement predicated upon knowledge and experience. A geologic conclusion, however, purports to be more than an arbitrary determination—it is reached as a consequence of method. No specific method is required, but the method used must be an orthodox method, in accordance with orthodox definition of terms, and the one best adapted to dealing with the questions asked about the property in question. This is the only basis for judging the validity of geologic work. Although different professionals will arrive at different conclusions, they should be able to honestly determine whether another professional arrived at his differing conclusions in a scientifically sound matter.

Ultimately, we must recognize that achieving the degree of honesty required of us as geoscientists is difficult to achieve but must be pursued with diligence. It is not enough to avoid conscious lies or deception; we must strive to avoid the subtle deceptions. We must describe what we don't know as much as what we know. We must ensure that the limitations of "best practices" and "standards" are understood by all!

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The Geological Society, London, 15 June 2004

News and events 2005

News from Portugal

The IV International Symposium ProGEO on the Conservation of Geological Heritage will be held at the University of Minho, Braga, Portugal on 13 - 16 September 2005.

Following the three previous events in France (1991), Italy (1996) and Spain (1999), the IV International Symposium will be the most important international scientific meeting with regard to Geoconservation and Geological heritage. It will bring together speacialists from many countries.

The main objectives are:

To discuss recent developments and methodologies in geoconservation strategies that can be cloned in other countries

To discuss legal frameworks to support geoconservation at European and International levels

To establish links between European and non-European Geoconservation specialists.

The symposium will comprise scientific sessions with invited plenary lectures, oral presentations and posters, as well as post-congress field trips. A meeting, and a cultural excursion are also planned.

All contributions should be integrated into one of the following themes:

Methodologies applied to the characterization of Geological Heritage

Management of Geological Heritage at risk

Integrating Geoconservation in Nature Conservation policies

Role of Geoconservation in the United Nation's Decade of Education for Sustainable Development (2005 - 2014)

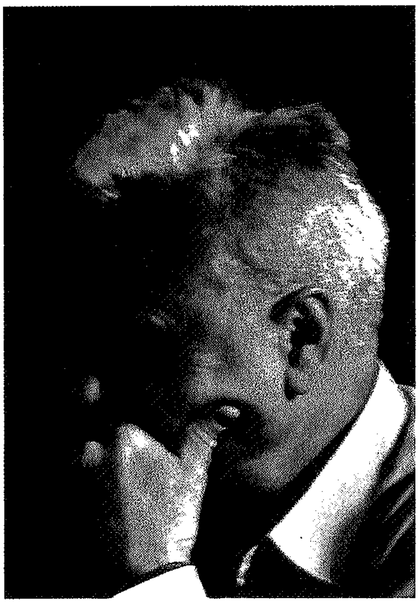
Experiences in the implementation of the Recommendation Rec (2004)3 of the Council of Europe

The Portuguese frameworks with International relevance

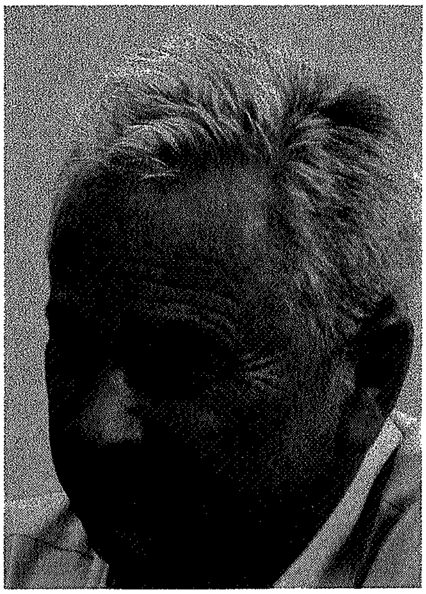
For further information, please log on to: http://www.dct.uminho.pt/cct/progeo2005/

Caption competition

Readers are invited to suggest a caption for one or both of the photos of our President, taken during the Council meeting in Burlington House, London, in June. Exciting prize for the best caption.
Send all submissions to the Editor at:
Harper-mccorry@tele2adsl.dk
before 1st April 2005
Winner will be annouced in European Geologist 19



Some examples:
Shine your light on me
You light up my life
Green with envy
A blue rinse?



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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.

Deadline for submission 30 March and 30 September.

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European Federation of Geologists (EFG)

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

The Council of the EFG is composed of the representatives of the national associations of geologists of Belgium-Luxembourg (UBLG), Czech Republic (CAEG), Finland (YKL), France (UFG), Germany (BDG), Hungary (MFT), Iceland (GSI), Ireland (IGI), Italy (ANGI), Netherlands (KNGMG), Poland (PTG), Portugal (APG), Slovakia (SGS), Slovenia (SGD), Spain (ICOG/AGE), Sweden (SN), Switzerland (CHGEOL), United Kingdom (GS), whilst the American institute is an Associate Member. There are observer associations from Austria, Bulgaria, Greece, Norway, Romania, Turkey and Canada. The EFG currently represents about 75,000 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 recognising 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 organise 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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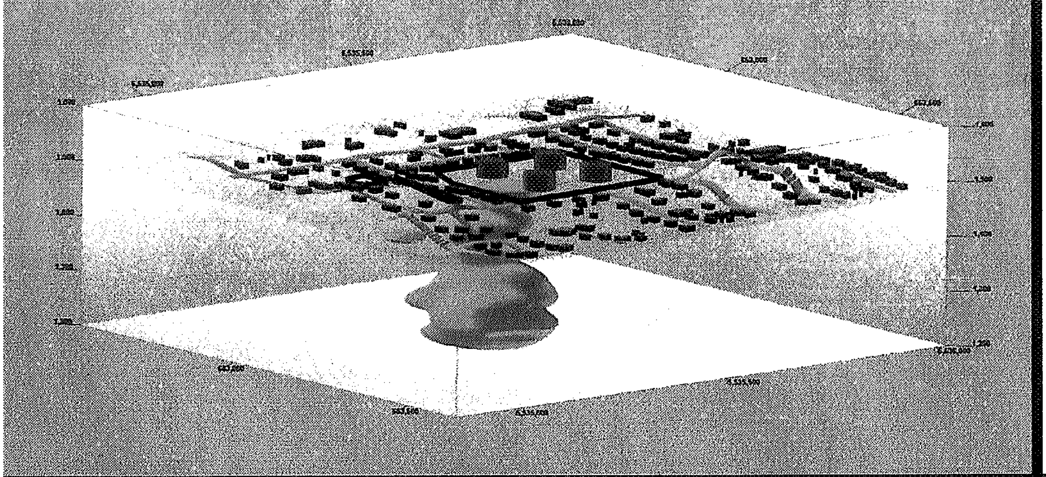

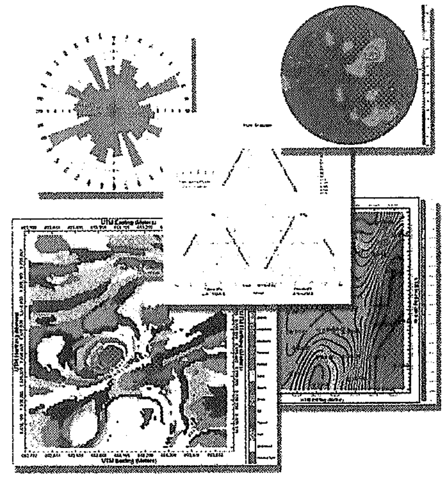

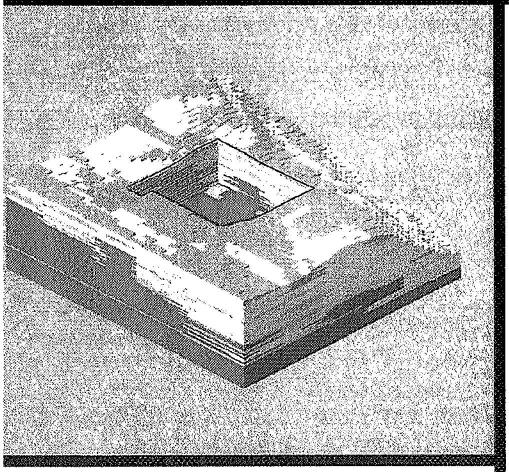

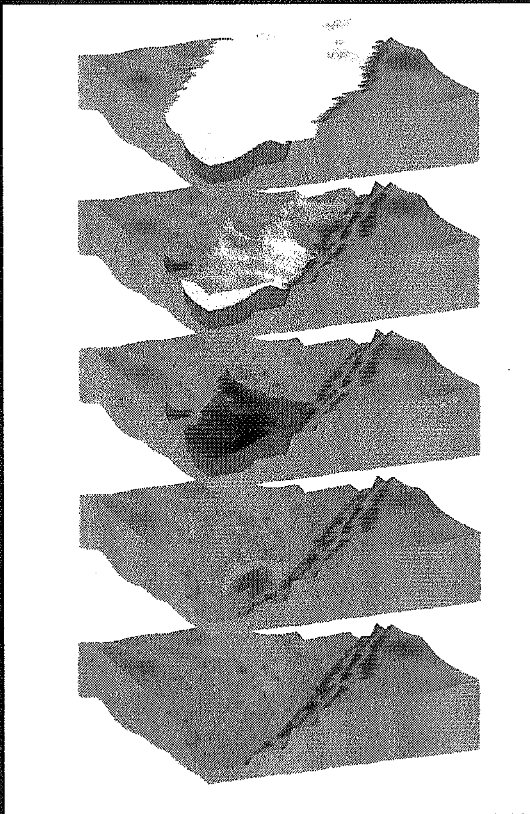

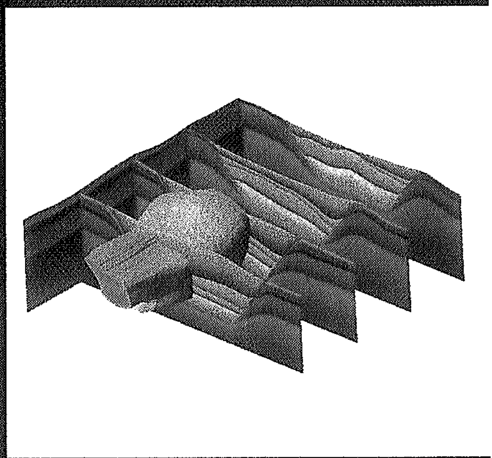

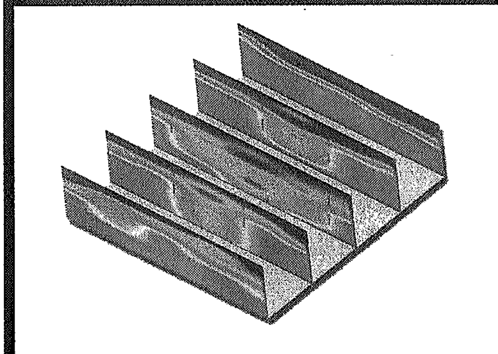

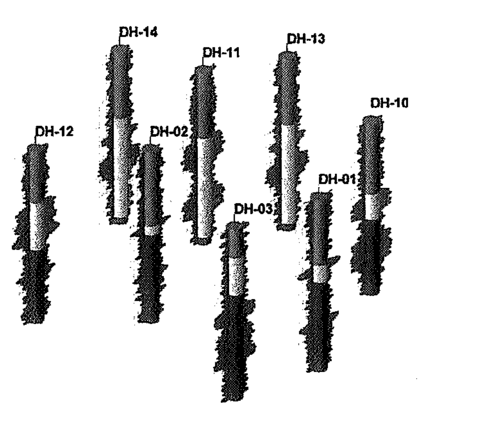

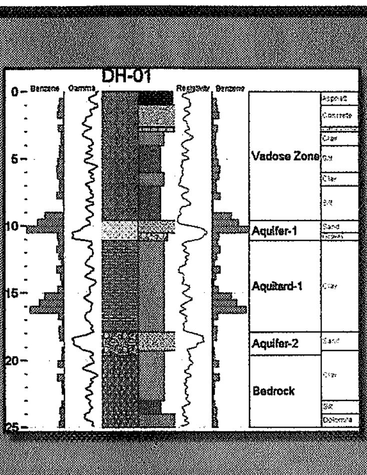

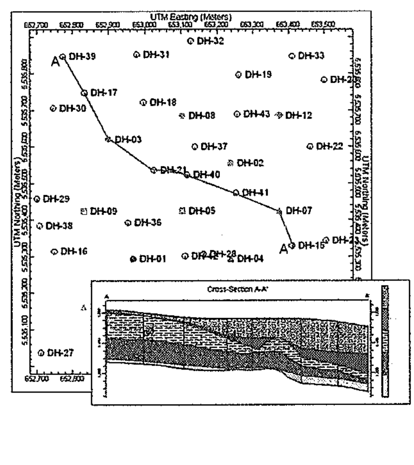

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