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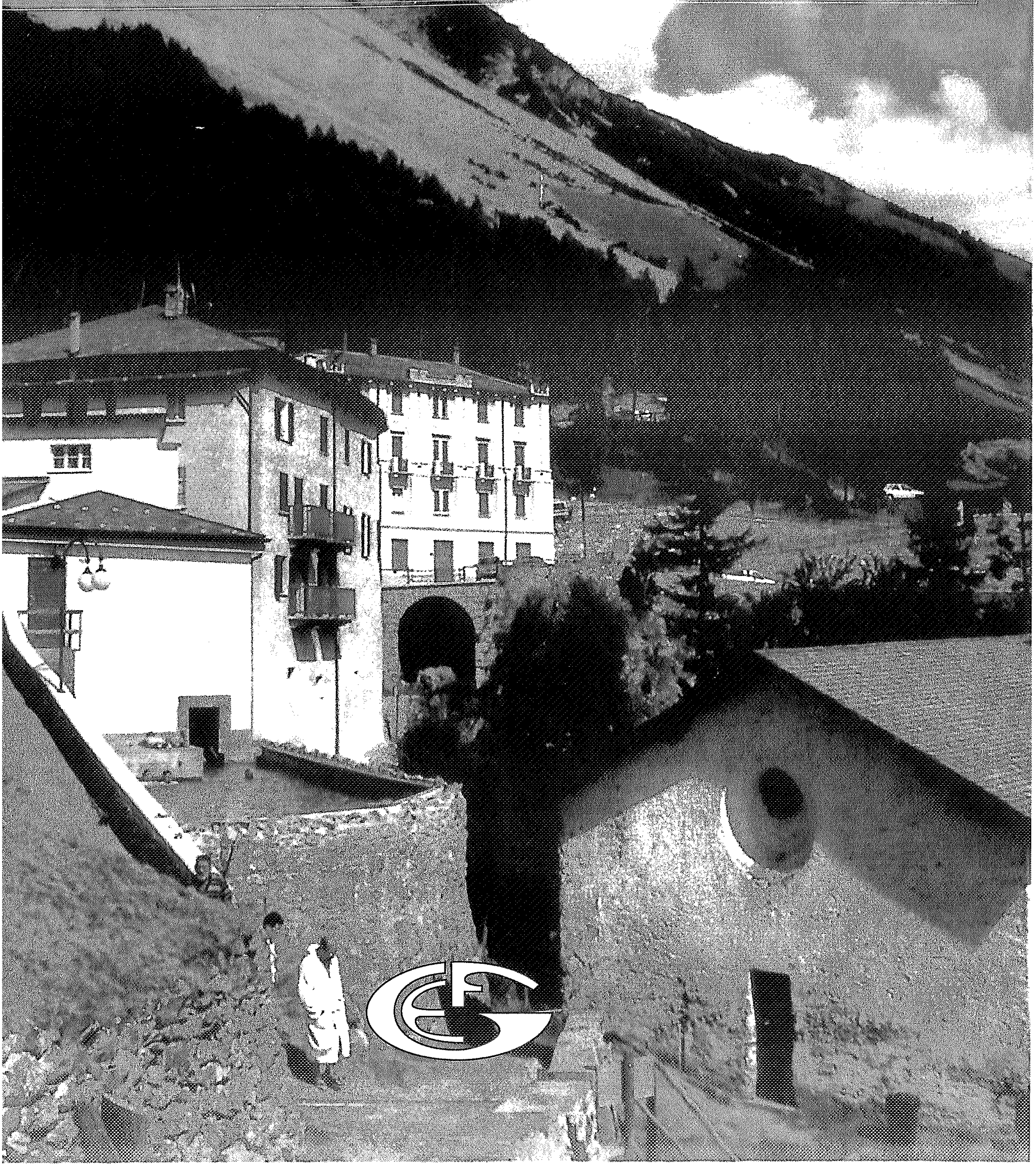

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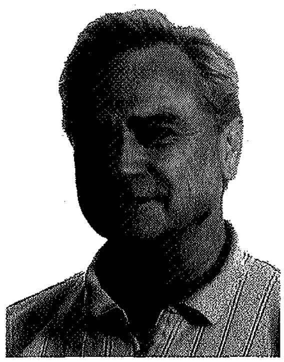
Foreword

Wonders and curses of e-mail communication

by Christer Åkerman, President

At the end of May this year I went to Mozambique to do bedrock mapping. I was armed with the web mail address of the Geological Survey of Sweden and the ambition to keep in touch with the world. In the beginning, I really tried to keep pace with incoming and outgoing e-mails, but it soon became clear that it was a hopeless undertaking. The computers and programmes of the Internet café in Tete, the main village of the province, worked so slowly that most of the time was waiting for searches or something to open. While struggling to respond to one e-mail, two new ones came in. And there was not always electricity.



Coming back to high-tech Sweden after more than three months of field work under primitive conditions, I had some 330 incoming e-mails on my PC waiting for me. A large portion of these e-mails were addressed by and to the EFG Board and Brussels office, and even more mails were related to the Federation. As president of EFG, I naturally felt a strong pressure to show my concern and respond in some way.

It took me more than a week to go through the mails and respond to the ones that still urged some kind of reaction. It was not always clear whether or not it was appropriate to respond one or two months after receiving the mail. Maybe it would be considered as an offence to answer so late! This is one of the acquired characters of e-mail – you feel a strong pressure to answer mails straight away, although they have replaced the old normal letters and should be considered as a normal mail delivered by the postman. On the very few occasions that I receive good old letters with stamps nowadays I experience a moment of happiness!

Electronic mail is a wonderful tool for fast communication, not least for groups of people with common interests, missions and goals. The EFG Board is also very much dependant on the use of e-mail for its current work considering the spread of board members all over Europe and the implications of travelling costs and time. This fact does not,however, eliminate the need for thorough board meetings face to face. In my opinion, decisions must sometimes be founded on concentrated discussions, including expressions, voices and smell. And we are social creatures that need to meet!

I hear more and more people expressing the opinion that taking care of e-mails now steal so much time, that there is not enough time for real work. E-mails have a remarkable talent for becoming self-generating. The common impression that e-mail is all about quick communication creates bad language and terrible spelling and generates questions – and comments. And, as if that was not enough, there are mad people spreading virus programmes, swindlers sending Nigeria letters, and rascals offering fantastic things. Apart from causing damage and costs, all this is time-consuming.

It sounds contradictory, but is it possible, that the need for and development of fast communication in modern society is hampering our development?!

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The thermal station of Bagni Vecchi and its panoramic pool
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43rd EFG Council Meeting Ljubljana, Slovenia June 2003

by EurGeol. Gareth Ll Jones

This year the Council met in formal session in the University in Ljubljana, the lovely capital city of Slovenia. This was preceded by a field trip which visited the dramatic underground gorge of the Skocjanske Jame show cave and the old mercury mine of Idrija where the lowest 7 levels have been flooded, but the upper 4 may be visited. We were impressed to see native mercury glistening on the rocks in places.

Here are just some of the highlights of the meeting. These do not adequately represent all of the hard work contributed by delegates. Council was convened in the magnificent Main Hall of the University with full audio-visual facilities. The weather was a bit warm at >30°C, but we managed well!

The death since the last meeting of the Polish delegate and our friend Zbigniew Wilk was marked by a minutes silence. President Christer Åkerman (SN) was working in Mozambique, whilst the Vice-President was involved with running the meeting so the assembly was chaired by Gareth Jones (IR). Fifteen member countries plus the Associate Member country attended, whilst observers were welcomed from the Italian CNG and from Serbia and Montenegro.

The President reported through the chair that the EFG had been accepted by the Australian Stock Exchange as a ROPO or Recognized Overseas Professional Organization, which is a further recognition of the high professional standard required to be a European Geologist. Important changes to the way that Council is run were introduced by the Board whose proposal of two year terms for officer positions was accepted by Council.

Vice President Uros Herlec (SL) presented to Council new EFG leaflets which had been produced for use in Brussels and for National and local governments whilst Secretary-General David Norbury (UK) spoke of the co-operation with the International Association of Engineering Geologists who have taken the EFG dossier as a starting point for further development along with ISRM and ISSMGE.

The function of the Commissaire aux comptes who audit the financial procedures was further improved this year as reported by Thomas Imbach (CH). This preceded Carlo Bravi (IT) Treasurer's report on the finances, who highlighted the need for delegates to source advertising for the magazine in their countries.

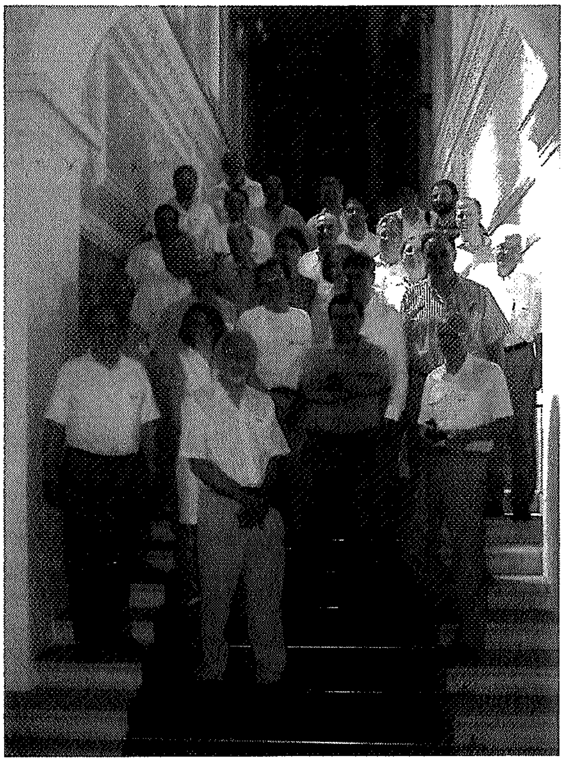
EU Advisor John Clifford (IR) highlighted the work done on the Draft Directive on recognition of qualifications. He also dealt with the ongoing problems of geologists not having the access to freedom of movement which the EU purports to champion - work continues. Agency Chief Isabel Fernandez dealt with the work of the Brussels office including contacts with other organizations and exploration of policy areas of interest to the EFG. In particular the participation in Green Week (this issue) was a successful role model for all members.

Members who are considering applying for Licensed Body status include Finland and Poland. Johannes van Stuivenberg (CH) was thanked as he handed over as international Licensed Body Chair to Antoine Bouvier (FR). The National Licensed Bodies UK and Ireland reported significant uptake of the EurGeol. title through the new system, whilst Spain reported that they were almost ready to start off their new title system. It is expected that the 500th title will be awarded before the end of the year. The incoming and regulation of the EFG's Continuing Professional Development (CPD) scheme was reported by Ruth Allington (UK) which is being developed on the UK model. Uros Herlec (SL) reported on the Life Long Learning ERASMUS network, whilst Detlev Doherr (DE) presented an on-line learning scheme. Herald Ligtenberg (NL) described the more efficient uses of EFG resources through panels of expertise, available through the National Associations for Civil Protection and Natural Hazards. John Clifford and Slavko Solar (SL) reported on the progress made at the meeting with the UN and the international Reserves and Reporting group before the Council meeting (see this issue). The EFG adopted the MILOS Statement - "Contribution of the Minerals Professional Community to Sustainable Development" which will be promoted within DG

Council members enjoy the sunshine on a trip to Idrija mercury mine

Enterprise. The Editor Maureen McCorry explained how the European Geologist magazine was continuing to develop and how savings could be made in some areas. She was still frustrated by the difficulty in getting advertising from the delegates and national associations.

The Strategic Plan was reviewed with acknowledgement of those targets likely to be met and those whose aspiration was not yet a reality. The plans for the second International Professional Geology Conference in London, UK in June next year were reviewed. Sponsorship would be necessary and Council thanked the generous offer of US delegate Kelvin Buchanan to initiate the sponsorship fund. The location of Prague for 2005 was confirmed. The meeting was ably organized by Uros Herlec, Slavko Solar and the Board of the Slovenian Geological Society, who were thanked by Council for the facilities and the hospitality. A number of delegates were able to visit the alpine Lake Bled on the Sunday afternoon.



Council members at the University of Lljubljana

Ljubljana Workshop June 12th 2003

by EurGeol. John A Clifford

A Workshop on Resources and Reserves organized by the Geological Society of Slovenia addressed the issue of the Similarity and Difference between the United Nations Framework Classification and the Code for Reporting Mineral Exploration Results, Mineral Resources and Mineral Reserves - The Reporting Code.

At the Workshop, Mr. Andrej Subelj, a member of the UN - ECE Task Force, spoke on the UN Framework Classification ("UNFC") and EurGeol. John A Clifford PGeo, FIMMM, FAusIMM, CEng(UK), from the European Federation of Geologists, spoke on The Reporting Code.

The main objective of the UNFC is to create an instrument that permits resources and reserves of solid fuels and mineral commodities to be classified on an internationally uniform system based on market economy criteria.

The Reporting Code, which follows the JORC template, in common with the SAMREC and CIM codes, sets out minimum standards, recommendations and guidelines for public reporting. Public reports in this context include any report prepared for the purpose of a) informing investors or potential investors and their advisors or b) satisfying regulatory requirements. This family of codes has been adopted by the major professional geological and mining associations in Australia, Canada, Europe and South Africa and have either been adopted or endorsed by the major financial and investment institutions in those areas.

A conclusion of the Workshop was that the classification system underpinning each is compatible.

Definitions in common include those for Proved and Probable Reserves and Measured, Indicated and Inferred Resources as used in The Reporting Code and compare with Codes 111, 121, 122, 331, 332 and 333 in the UNFC.

There are three additional categories in the UNFC that are not used in The Reporting Code. These categories refer to material that is either poorly defined or which has been shown by appropriate technical and economic studies to be currently not economic. They are of particular interest for government planning purposes, which would include future land use or strategic mineral inventories, but are not relevant for non-governmental investment and financing decisions.

The principal difference between The Reporting Code and the UNFC is the audience to which each are directed. The Reporting Code is designed to serve the international investment community, whereas the UNFC is designed to facilitate governmental and inter-governmental communication, in particular between market economies and economies in transition.

A further difference, at this time, is the Competent Person concept, which is a central feature of the implementation of The Reporting Code. This requires that all public reporting must be prepared by or under the direction of and signed by a Competent Person. By signing a report the Competent Person accepts full responsibility for its content. The application of this concept is now under review by the UN-ECE with a view to incorporating it into the UNFC.

Swedish Geology Day

by Emma Härdmark [1]

Once a year, all of Sweden is involved in geological activity. Not geological activity in terms of earthquakes, but in terms of Swedish Geology Day. Amateurs and professional geoscientists open up their doors to the public. This year, Geology Day had over 15,000 visitors.

Une fois par an, la Suède entière est concernée par les événements géologiques. Il ne s'agit pas d'événements en terme de tremblements de terre, mais sous forme du " Jour de la Géologie ". Amateurs et professionnels des Sciences de la Terre ouvrent leur porte au public. Cette année le " Jour de la Géologie " a rassemblé plus de 15 000 visiteurs.

Una vez al año, toda Suecia lleva a cabo una actividad geológica. No es una actividad geológica tipo terremoto, sino el Día Sueco de la Geología. Aficionados y científicos profesionales abren sus puertas al público. Este año el Día de la Geología tuvo más de 15000 visitantes.

The purpose of Swedish Geology Day is to spread information and knowledge about geology and other geoscientific areas to the public.

"*We are lucky to have the entire Swedish geoscientific sector supporting our efforts*", says Erik Huss, project manager for the third annual Geology Day. "*Geology is a hidden subject in society but we are doing our best to uncover the amazing facts of our planet*".

Members of the Royal Swedish Academy of Sciences founded Swedish Geology Day in 1999. A work group was appointed and a project manager was employed. The first Geology Day would be carried out in August 2001, following contact with geoscientists, both professionals and amateurs, all over the country. Prior to the Geology Day, a lot of work was put into securing the financing of the project. Early on, large companies and organizations were informed about the project and luckily believed in the venture and supported the project fully.

Geology Day is now transforming into a more permanent organization, *The Association of Geology Day*, run by the project manager and the board of the association. The board consists of representatives of geoscientific enterprises and industries, amateur associations, universities, museums and the Royal Swedish Academy of Sciences. The board meets once a month to discuss ideas and to plan upcoming activities. Project manager Erik Huss,

who has been in charge of the practical parts of the project this year, works part-time with Geology Day and part-time with a geological magazine and says he could easily fill more than a full-time job with Geology Day planning alone.

This year, Geology Day took place on Saturday September 13, a difficult time to get media attention because of the Swedish EMU referendum on September 14. Also because of the tragic murder of the Swedish Minister of Foreign Affairs, Anna Lindh, only two days prior to Geology Day.

"*The media focus was obviously not on geology that weekend*", says Erik Huss, who had spent a lot of time informing and inviting the media to the events on Geology Day.

Fortunately, Geology Day attracted many visitors anyway. Over 15,000 participants took part in at least one of the more than 300 different events in 100 locations all over the country. The participants could for example meet up with real scientists, have their own rock samples classified by mineralogical experts or listen to lectures by the most prominent geological research workers in Sweden. Many of the events were especially designed to attract children and young people. They could travel on the "back in time bus" and meet dinosaurs and learn about the early history of our planet. Or they could try indoor ice wall climbing, gold panning or watch a true-to-life minivolcano erupting. The official opening ceremony was held at the Swedish Museum of Natural History in Stockholm. The museum was very proud to be able to have a newly discovered meteorite, the largest meteorite ever found in Sweden, on display during Geology Day.

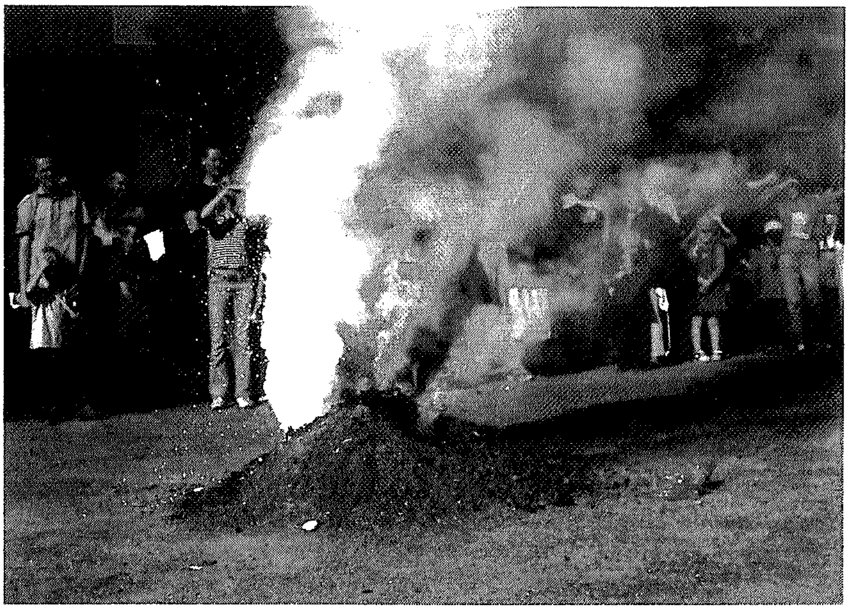
"*At the Museum of Natural History we had a geological quiz as one of our events during the day*", says Erik Huss. "*When we corrected the results, we found the grown-ups knew no more than the young ones about geology. A very typical example of how poor the geological knowledge is among the public*".

The poor knowledge about geology in society was one of the main reasons for the founding of Geology Day in Sweden.

"T*he sad story of the tunnel project in Hallandsåsen (see European Geologist No 14) could have been avoided if the constructers had consulted geological expertise before starting the drilling*", says Erik Huss. "*It is amazing that Civil Engineers, who are to carry out such large underground constructions, often have very little geological education.*"

Geology Day put more and more focus on reaching out to schools. One-day workshops, when a geologist comes to class to talk about basic geology with the pupils, were arranged. This was very successful and during the week prior to Geology Day many departments invited classes to come and visit them at university. It was much appreciated by both children and teachers.

[1] Student of Journalism, University of Uppsala, Sweden. Masters Earth Sciences



A mini volcano erupted twice during Geology day. The temperature rose to over 1500⁰ C and volcanic glass was produced. It was both horrifying and exciting for the many spectators.

Erik Huss adds that it is a problem that geology is not a subject in schools in Sweden, in contrast to many other countries. It is, therefore, harder to attract students to geoscientific courses at university level for the obvious reason that they are not familiar with the subject at all. Where there is geology in schools, it is taught by geography teachers, who often have a background in the social science field, not in natural science. It is up the individual teachers to introduce the pupils to geology.

Geology day is also valuable because the geological sector itself gets together and different business areas get to know each other.

"*That strengthens us all*", says Erik Huss. "*We notice that more and more event organizers during Geology Day get together to plan and perform their events together. I believe that is a very good side effect of Geology Day*".

Getting financial support for Geology Day has not been easy because of recent global economic difficulties. Geology Day has four main investors, the Swedish Geological Survey (SGU), Swedish Nuclear Fuel and Waste Management Company (SKB), Swedish Aggregates Producers Association (SBMI) and the Swedish Museum of Natural History, which also supplies an office for the project manager. Together with eight smaller sponsors, Geology Day has managed to secure 67,000 euros.

"*There are so many ways to develop Geology Day, I would very much appreciate a budget of a least 1,000,000 SEK (110,000 Euro)*", says Erik Huss. One of the reasons for transforming the project of Geology Day into a more stable organization is to attract future sponsors.

Erik Huss emphasizes the importance of long-term economic security. He says it takes time to change the general perception of geology in society. And he welcomes a European network for cooperation between national Geology Day / Geology Week organizations.

He is now about to sum up and evaluate his first year as project manager for Geology Day 2003. One of the lessons he has learned is that it does take time to establish an event day with participants ranging all they way from leading scientists to enthusiastic amateurs.

"*But I like it*", he adds, "*Our Swedish Geology Day will definitely grow even larger in the coming years and I am looking forward to evaluating the effect of our work in five years time*".

Read more about Swedish Geology Day at www.geologinsdag.nu.

Professor Alasdair Skelton from Stockholm University brought lots of children "back through time" in the Time-train. They learnt about different ages in Earth's history. A very popular event at the Swedish Museum of Natural History in Stockholm.

How forensic geology can help solve crimes

by EurGeol. Dr Laurance J Donnelly[1]

Over the past one hundred years or so, several crimes have been solved due to the expertise provided by geologists. However, due to the sensitive and confidential nature of police investigations, only occasionally are these reported in the scientific literature. The main objectives of this paper are therefore to raise international awareness and draw the attention of European Geologists to the growing interests in 'forensic geology' in the United Kingdom. This is demonstrated by one particular case study. A geological and geophysical investigation has been undertaken in Northern England, to help locate the grave of a murder victim who was last seen alive in June 1964. Some details of this investigation are provided to demonstrate the potential benefits of using geologists as forensic scientists.

Durant la dernière centaine d'années, plusieurs affaires criminelles ont été élucidées grâce à l'expertise apportée par les géologues. Cependant, en raison du caractère très sensible et confidentiel des recherches effectuées par la police, ce n'est que très occasionnellement que ces affaires apparaissent dans la littérature scientifique. L'objectif principal de cet article est donc de développer une prise de conscience au niveau international et d'attirer l'attention des Géologues Européens sur l'intérêt croissant de la géologie judiciaire dans le Royaume Uni. Cela est bien illustré par un cas d'étude particulier. Une étude géologique et géophysique a été réalisée au Nord de l'Angleterre pour aider à la localisation de la tombe d'une personne assassinée et que l'on a vu vivante pour la dernière fois, en Juin1964. Des détails de la recherche sont dispensés pour démontrer les avantages potentiels qu'il y a à utiliser des géologues comme scientifiques en affaires judiciaires.

En los últimos cien años, se han resuelto varios crímenes gracias a la experiencia de los geólogos. Sin embargo debido a la naturaleza muy sensible y confidencial de las investigaciones policiales, sólo en contadas ocasiones han sido publicados los casos en la literatura científica. Por lo tanto los principales objetivos de este artículo son despertar el interés internacional y atraer el de los Geólogos Europeos sobre el creciente interés que tiene la "geología forense" en el Reino Unido. Esto queda demostrado con un caso en particular. Se ha llevado a cabo una investigación geológica y geofísica en el Norte de Inglaterra para colaborar en la localización de la tumba de una persona asesinada que fue vista con vida por última vez en junio de 1964. Se incluyen detalles de la investigación para demostrar los posibles beneficios del empleo de los geólogos como científicos forenses.

Forensic Geology (also known as Geoforensics or Forensic Geoscience) is a rapidly growing branch of geology within the United Kingdom. It has no formal definition but for the purposes of this paper it may be defined as: "*A specialist branch of geology that is concerned with the applications of geoscience for assisting the police in helping to investigate and solve crimes*".

For more than a century some crimes have been brought to successful prosecution, due to the involvement of geologists. Two main approaches have been employed:

- The geochemical, mineralogical and petrological analysis of rock or soil fragments from a suspect's or victim's clothing, or body, compared to the geology at the scene of the crime.
- The applications of mineral exploration and site investigation techniques (such as geophysical surveys) to locate buried objects related to criminal activities, including weapons, jewellery, money, clothing, or disturbed ground such as murder victims' graves.

[1] Laurance J Donnelly BSc (Hons), PhD, FGS, CGeol
Research Fellow, British Geological Survey, Keyworth, Nottingham, NG12 5GG, UK.

Background and history

The origins of Forensic Geology can probably be traced to the publication of Sherlock Holmes in the late 19th century. For instance, Dr Watson observed how Holmes could recognize different soils on clothing, and from their colour and consistency could identify what part of London they came from (Doyle 1956). Other Victorian writers of fiction also made reference to the use of geology in solving crimes. For instance, Thorndyke (quoted in Sargeant, 1975) described red-brown loam containing chalk fragments and foraminifera (microfossils) on a suspect's clothing. This was identified as being characteristic of the Cretaceous Chalk at Gravesend in Kent. It was at this locality where a body was subsequently located in a dene hole (a prehistoric flint mine). Although fictitious, these demonstrated an understanding of how geology might be used to solve crimes.

It was Hans Gross, a criminal investigator and professor of criminology in the late

1800s, who was one of the first to advocate the use of microscopes in mineralogical studies analysing 'dust' and 'dirt' on shoes and 'spots' on cloth (Gross 1893). Gross considered that 'dirt' on shoes can often identify where the wearer of the shoes had last been, more effectively than verbal enquiries. This theory was subsequently used by George Popp in 1904, during a murder investigation (the Eva Disch case), in Frankfurt, Germany. In a subsequent murder (the Margaret Filbert case), near Rockenhausen, in Bavaria, Germany, Popp studied encrusted soil layers on the shoes of the main suspect.

The Federal Bureau of Investigation (FBI) have been using forensic geology since 1935, initially to help solve the Matson kidnapping case. Forensic geologists have also been used by the US Drug Enforcement Agency (USDEA). Professional forensic geology courses and guidance reports have now been produced in the USA for lawyers and police officers. In the UK, geologists have not been used to the same extent for criminal investigations, although forensic archaeologists have been applying geological principles to assist crime studies. The first publication on Forensic Geology was published in the 1970s (Murray and Tedrow, 1975).

Geologists techniques for crime scene investigations

Traditional police methods of finding graves often involve large-scale 'finger-tip searches' and 'trial-and-error' excavations. These may be inefficient, labour intensive, and may even destroy evidence and ignore subtle ground disturbances. These are often undertaken by non-specialists such as volunteers or army cadets. Geologists on the other hand are trained to 'read the ground'. For instance, during the exploration and investigation of the ground for mineral resources, mining-engineering, civil engineering site investigations and monitoring geological hazard. It is possible to determine whether ground disturbances may be due to natural processes of weathering and erosion or whether they have been induced by the activities of man (such as tipping, digging, burial, etc), possibly during a criminal act. The main geological techniques available to investigating police officers are as follows:

- Mineralogical and petrological analysis of fragments of rock and soil (compared to geology at the scene of a crime).
- Use of geological maps and other geological data.
- Geomorphology (observation, recording and interpretation of ground features and disturbances).
- Geophysics to locate buried objects (such as weapons, jewellery, money and murder victims' graves).
- Remote sensing (a new generation of high resolution satellites and instruments).

Mineralogy, petrology, palaeontology & geochemistry

A number of cases during the 20th Century describe how rocks, soils, minerals and fossils have been used as physical evidence in both criminal and civil matters. As with all forms of physical evidence, including fingerprints, the main use of scientific evidence is in helping to establish the guilt or innocence of an individual with respect to a criminal act (Locard 1930, Murray and Tedrow 1975). The analysis of rock and soil in forensic geology aims to establish the probability that a sample was, or was not, derived from a given place. Rocks and soils are complex mixtures of natural materials, brought together by (natural) geological processes. They therefore differ from manufactured products such as glass, paint and fibres. A major advantage of using rocks, minerals or fossils as physical evidence lies in this objectivity, enhancing the analysis and testimony of the expert. When a suspect is confronted with irrefutable scientific 'evidence,' this may be sufficient to encourage a confession.

Geological Maps

Geological maps are the principal means by which ground information is presented. These are archived nationally and are supported by substantial data repositories in Geological Surveys. In the UK, maps published by the British Geological Survey (BGS) have been used in police investigations to identify potential burial sites and topographic features mentioned in witness or suspect statements. Since search investigations were usually undertaken under a limited budget, geological maps can be used to eliminate areas of ground which are less likely to conceal buried objects, therefore enabling the more cost-effective use of resources and significantly reducing the time spent on unsuccessful searches. For example, geological maps were used in Kent to assist with a search of several hectares of open and wooded ground to locate buried human remains. The maps provided information on possible and unlikely burial sites. Where the Cretaceous Chalk bedrock was exposed, the use of a spade was considered unlikely. Large areas of the landscape could then be given a low search priority.

Geomorphological Observations

Police searches for murder victims' graves or buried artefacts traditionally rely on recognizing obvious signs of ground disturbance and discarded items such as clothing. Search teams may not necessarily have the experience to observe and interpret subtle natural ground disturbances arising from the particular crime. These might include vegetation changes, undulations, spring lines, breaks in slope, convex and concave slopes, disturbed ground, periglacial deposits, the occurrence of loose soil, drag marks, or the compaction of ground. These can be interpreted by a geologist in relation to physical processes (such as landsliding, rock falls, soil creep, glaciations, periglacial action, river deposition, wind erosion) or the activities of man (for example mining subsidence, waste disposal, tipping and digging). It may therefore be possible for a geologist to discriminate those features of a 'natural' origin from those which may be related to a particular crime.

Geophysics

Geophysical surveys provide an alternative, more cost-effective method for locating disturbed ground and buried objects. Geophysical surveys measure the vertical and lateral variation of physical properties of the ground. These include electrical conductivity, magnetic, electromagnetic and gravity, etc. If a buried object provides a property contrast this can then be used to detect its presence. The data can only be interpreted in the light of some knowledge of the likely natural ground conditions. In this respect there are two main approaches to carrying out a geophysical survey:

- Measure a physical property, such as electrical conductivity on a grid basis over the ground surface. Contouring of this data will locate anomalous zones.
- Measure a physical property along a detailed horizontal profile, such that details of the vertical variation of that property are determined.

The choice of instrument, methodology and interpretation need to take several inter-related factors into account. These include the physical properties of the target (human remains, buried ransom money, jewellery, weapons, zips and buckles on clothing), the geological profile, depth of burial, topography, ground conditions, age of the burial and the experience and the skill of the operators.

Ground Penetrating Radar (GPR) was used for the discovery of buried murder victims at Cromwell Street, Gloucestershire in the early 1990s. A hoard of bank notes, worth about £150,000, was similarly located in a field in Lincolnshire using GPR. This was handed over as the ransom for the safe return of an estate agent, Stephanie Slater, in 1992. There often appears to be a general tendency for the Police to use ground penetrating radar (GPR), purely because it may have worked in the past, without understanding whether it was applicable to the particular geological, geotechnical, hydrogeological and environmental conditions. However, backfilled graves and burial sites may also be detected by a range of other techniques such as magnetic, electrical and electromagnetic (EM). A resistivity survey was carried out in South Yorkshire, UK, in a field that showed no obvious topographic features. The survey successfully located the foundations of a documented church and associated burials.

Case study: The search for a murder victim's grave, Saddleworth Moor, Northern England (The Moors Murders)

Saddleworth Moor is a sparsely populated, remote part of Northern England, located on the Lancashire and West Yorkshire border. The ground rises to over 330 masl and is dominated by peat moorland. During the 1960s, Myra Hindley and Ian Brady were responsible for the abduction and murder of several young children. Their bodies were subsequently buried in unmarked graves on Saddleworth Moor. Three of the children were recovered during the initial police moorland search in the 1960s, and a fourth body was recovered when the case was reopened in the 1980s. In spite of several searches by the Police, the body of a fifth victim still remains undiscovered. This particular case has become known as the Moors Murders (Williams 1967, Wilson 1986, Harrison 1987, Topping 1989). The author has been carrying out a geological and geophysical search of the moorland for the missing grave (Donnelly, 2002a-e).

The Police search

The initial police searches for the unmarked grave-site included the following:

- Gathering of intelligence information (interviews with Hindley & Brady, etc).
- Use of volunteers to search the crime scene (non-specialists).
- Insertion of a wooden stick into peat to smell for decomposition.
- Horizontal stripping (digging) of the peat using spades (dig & search).
- Use of specially trained police 'sniffer' dogs.
- Statements and interviews with Hindley & Brady (1960s and 1980s).
- Visits to Saddleworth Moors by Hindley & Brady (1980s).
- Some archaeological support (guidance on methods of burial, excavation and recovery).

The geological and geophysical search

The methodology adopted by the author was that of a typical site investigation or mineral exploration survey, which consisted of the following phases:

Phase 1: Review of information and establish contact with key personnel:

- Part A: Desk study, literature search, intelligence gathering (review of published books and papers, present and historical topographic and geological maps, geomorphology studies, descriptive memoirs, aerial photographs, statements and police reports).
- Part 2: Reconnaissance walkover surveys and detailed field inspections and geomorphological observations
- Part 3: Development of a conceptual geological model of the moorland (stratigraphy, lithology, structure, mineralisation, geological hazards, engineering properties, types and distribution of superficial deposits, hydrogeology, hydrology and geomorphological processes).
- Part 4: Reconnaissance field investigations (geophysics, geochemistry and satellite imagery).
- Part 5: Design and implementation of detailed field investigations and data acquisition (geological mapping, sampling, hand-held drilling & trenching, site investigation).

Phase 2: Design of the exploration & search methodology:

- Part A: Geochemical studies of decomposing human remains and the influence on the geology and groundwater (such as the generation of any leachate plumes or other geochemical signatures).
- Part B: Observations of any ground disturbances (such as digging) and their influence on geomorphological processes.
- Part C: Design and testing of a range of geophysical surveys which included ground penetrating radar (GPR), microgravity, electrical resistivity, electromagnetic and magnetic.
- Part D: Acquisition of detailed stereoscopic aerial photographs, high resolution remote sensing and satellite imagery data.
- Part E: Design methodologies and strategy for geophysical survey, data acquisition, analysis and interpretation.
- Part F: Implementation of field investigations, invasive digging at selected geophysical anomalies.

Landscape photographs

In the 1960s, shortly after the arrest of the 'Moors Murderers', several incriminating photographs of Saddleworth Moor were found in their possession. Some of these were landscape scenes, whilst others were photographs of the ground. The precise locations of where these photographs were taken was determined by an examination of the geomorphological features of the landscape, and the recognition of physical features on the moorland landscape (Fig. 1). These included landslides, rock falls, rock outcrops, peat bogs and sandstone

Figure 1 a, b. (above and below) Typical moorland topography of the 'scene of crime', Saddleworth Moor, Northern England. The geomorphology and topography played an important role in the identification of burial

plateaux escarpments. This narrowed down the search area from a vast open moorland to a specific area of the moors which was subsequently identified as a characteristic outcrop of Carboniferous (Namurian) Millstone Grit (Kinder Scout Formation). A search of this area resulted in the discovery of the bodies of two children.

The search of the Moors

In the mid 1980s the Moors Murders case was reopened with the objective of locating the two other missing children. Again the interpretation of aerial and ground based landscape photographs, along with other evidence, played a key role in locating potential search sites. The systematic and time- consuming excavation of the peat in areas where the peat locally thickened, as shown on geological maps, was undertaken. This included the sides of gullies, edges of slopes and peat bogs. The body of a child was eventually found and recovered from a shallow grave in 1987 (Topping 1987).

Since the early 1990s, a geological and geophysical search for the last remaining body has continued on Saddleworth Moor by the author. This search has been based on the geological and geophysical exploration methodologies described above. The geological search has been designed to find and recover objects believed to be related to the murder (such as spades) as well as the grave site itself. Published and unpublished maps from BGS, at scales of 1:50,000 and 1:10,560, were particularly useful in identifying areas of thin or absent peat cover, thus significantly reducing the search area. The geological maps also provide information on conspicuous topographic features such as valley slopes, escarpments, waterfalls, shale and sandstone exposures that were considered significant in this particular case. These were regularly mentioned in information supplied by the murderers.

The two murderers occasionally referred to physical features of this landscape and the ground surface. These included, for example, shale slopes, a gully with a sandy bottom, a waterfall, a moonscape, and rock exposures weathered into specific shapes. When these descriptive terms were analysed from a geological perspective, they provided information on precise sites where the geophysical search could be focused. Physical features of the landscape enabled Brady and Hindley to quickly locate the grave sites at the time the crime was committed. This facilitated quick and efficient burial, and enabled re-visiting some time after burial had taken place, for psychological reasons. The types of topographic features and landmarks which may have been used include a sighting (or bearing) to one or more distant escarpments on the skyline, a particular exposure of rock, a waterfall, the confluence of streams, shale slopes, sandy filled gullies or peat bogs etc. The geological interpretation of police information enabled potential burial sites to be identified. This has provided the basis for the design and implementation of geophysical surveys in an attempt to locate the last remaining grave site. To date this search is currently ongoing, several spades have been found as well as other objects.

Figure 2 a and b. Typical police search of Saddleworth Moor, Northern England, for a murder victim's grave site. Using large numbers of non-specialist volunteers (above) and police 'sniffer' dogs (below) (after Wilson 1986 and Topping 1989).

Figure 3 a and b. Geological and geophysical search of Saddleworth Moor, Northern England for a murder victim's grave site, using site investigation (above) and mineral exploration techniques (below) (after Donnelly & Fenning,

How can Geologists more effectively assist Police searches?

The reasons why geologists are not conventionally used by the Police in comparison to other forensic scientists are complex and may be due to a combination of the following:

·Traditionally the Police have not known when to call upon the expertise of a geologist; and may not be completely familiar with their skills and capabilities. The Police may not know what questions to ask of whom.

·Criminal investigations, especially murder inquires, are extremely sensitive issues. Geologists therefore need to be familiar with the strict police protocols for their investigation and the presentation and integrity of evidence at murder scenes. This suggests the need for geologists training in police matters and forensic science.

·Search teams are inter-disciplinary and involve the integration of specialists such as ground search personnel, dog handlers, helicopter pilots, forensic scientists, pathologists, mountain rescue, photographers, divers, forensic anthropologists, forensic archaeologists and scene of crime examiners. All have different objectives, which are based on diverse knowledge and training. Geologists would need to serve on search teams, to understand the respective scientific roles and be able to operate in the judicial environment of the Police operation.

·The perceived need to consult a geologist would have to be Police driven. Each team member would have to understand the nature of the geological investigation.

·There is a need to provide clear guidance as to why, when, and where, the search would be enhanced by including a forensic geologist in the team.

·Geologists need to know the legal basis for deciding what scientific methods are admissible in court. This is a complex matter and any geologist must consult with lawyers prior to giving evidence. Geological evidence may have to be demonstrated, and experimental techniques justified. The diversity of geological evidence (the identification of rocks, minerals, soils, fossils; the use of maps, applications of instruments) may mean that geology is not always seen as being an option for investigating officers.

Investigations to locate buried murder victims often generate large amounts of attention from the media, and the general public. This is likely to cause some searches to be executed quickly by using man-intensive methods, such as digging. The forensic geology investigation must be executed in a comparable time frame, rather more quickly than a commercial geotechnical site investigation or exploration survey.

Conclusions

Attention has been drawn to the use of geology in criminal investigations. Cases from the early 20th Century onwards have demonstrated how soils, rocks, minerals and fossils can provide physical evidence to help solve criminal cases. The concept is based on the probability that identical samples would have originated from the same source and this indicates that the person deliberately or accidentally came into contact with the ground at the scene of a crime. Mineral exploration and site investigation techniques, notably geophysics, have improved over the past few decades to meet the needs of geologists working in the minerals, mining, and civil engineering industries, and with geohazards. These methodologies are adaptable to search for graves or other objects of a criminal nature. The use of geologists to assist with searches offers the potential to lower the cost of investigating a crime scene by reducing the numbers of persons required and the time taken to search a given area of ground. They can improve the likelihood of locating buried evidence and murder victims' graves.

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Competence and responsibility:

the roles of learned and professional institutions and their members

by EurGeol. Ruth Allington [1]

No recent cultural shift in the attitude of professionals generally has been greater than that over competence and responsibility. In public services from teaching to medicine, the drive is to set, measure and attain standards. In private practice (law, accountancy, consultants), public demand for professionals to be competent and responsible (and, ultimately, called to account) is strong.

Developing, maintaining and demonstrating capabilities and experience through lifelong learning, CPD and professional qualifications have always been enshrined in the cultures of all the best organizations, in all professions. However there has been a step change - from the need to demonstrate competence within professions (as judged by peer groups) to the imperative to communicate levels of competence, professional standing and standards to non-specialists - from the general public to the legal profession and insurers.

The Geological Society of London, in common with all other learned and professional institutions, recognizes the importance of the role it must play. That role includes providing a framework within which Fellows can work towards Chartered Geologist status, and to continue developing thereafter. Achieving wider recognition for the "aspirational" Fellowship grade of CGeol - within and beyond the geoscientific community - is also important.

The Professional Committee's drive to update and re-launch both the CPD scheme (and the guidance to those working towards it) is progressing, and the new scheme should be launched at the Society's AGM in 2003. The Society is also developing a range of training opportunities covering both 'technical and scientific' and 'professional' areas. Three of these CPD courses have been run this autumn, to be repeated around the country next year. More Society-endorsed courses will be added to the portfolio during 2003, including those run by (or with) university departments, commercial course providers and research institutions, and others run by the Society centrally, or through Regional and Specialist Groups.

Within the European Union, the Society - through membership of the European Federation of Geologists (EFG) - is seeking to promote the title of European Geologist (EurGeol.). More widely, we are in touch with the Canadian Council of Professional Geologists (CCPG) and the Institute of Geologists of Ireland (IGI) to establish mutual recognition of their professional qualifications. We are also concluding discussions with the Australian Joint Ore Reserves Commission (JORC) and the Canadian Securities Commission regarding recognition of Chartered Geologists as 'competent persons' able to sign off resource assessment and related reports.

Each of these initiatives seeks to establish CGeols on lists of professionals qualifying under particular codes or regulations as 'competent persons'. However, this is not the same as seeking to persuade the world at large that all CGeols are automatically 'competent persons'. JORC defines a 'competent person' as "A person who is a Member or Fellow of...with a minimum of five years' experience... *relevant to the style of mineralisation and type of deposit under consideration and to the activity which that person is undertaking"*. This is entirely consistent with the definition used in the UK Quarries Regulations (1999).

An individual's performance, competence and degree of responsibility for what they do as a professional are ultimately a matter for them personally, and their employer. What the Society can (and should) do, is provide its Fellows with opportunities for training and development and a framework within which they can develop at all stages of their careers.

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Layered basement and structural patterns of Montague County, north Texas

by EurGeol. Dr. Robert G. Font [1]

Seismic coverage of Montague County of north Texas, directly west of the Muenster Arch, reveals a fascinating scenario of structural patterns and tectonic evolution. A layered basement complex of truncated wedges reflects the possible existence of a late Precambrian to early/mid Cambrian basin filled with siliceous strata and mafic plutonic intrusions. Limited petrophysical data is supportive of these conclusions. The layered basement sequence may represent activity related to the early rifting of the Wichita (Southern Oklahoma) Aulacogen or reflect an even older (Grenville?) deformation episode

Les résultats de la couverture sismique du Comté de Montague au Nord du Texas, en plein ouest de Muenster Arch, révèlent un scénario fascinant de modèles structuraux et de tectonique évolutive. Un substratum complexe et stratifié avec coins tronqués rend compte de l'existence possible d'un bassin, daté de la fin du Précambrien au Cambrien inférieur et moyen, bassin comblé par des dépôts siliceux associés à des intrusions basiques. Des données pétrographiques partielles corroborent ces conclusions. La séquence des couches formant le substratum peut être rattachée à un mouvement initial de fracturation du Wichita Aulacogen (Sud de l'Oklahoma) ou refléter un épisode de déformation même plus ancien (Greenville).

La cobertura sísmica del Condado de Montague al norte de Texas, directamente al oeste de Muenster Arch, revela un fascinante escenario de modelos estructurales y evolución tectónica. Un complejo basal en capas con cuñas truncadas refleja la posible existencia de una cuenca del Pecámbrico Superior al Cámbrico inferior/medio rellena de estratos silíceos e intrusiones plutónicas máficas. Los escasos datos petrofísicos apoyan estas conclusiones. La secuencia estratificada del basamento podría representar una actividad relacionada al rifting temprano del Aulacógeno Wichita (Oklahoma del Sur) o incluso un episodio de deformación más antiguo (Grenville?).

The fault patterns mapped in Montague County appear reflective of the interpreted principal stress orientations expected during the genesis, deformation and eventual destruction of the Wichita (Southern Oklahoma) Aulacogen. After a late Precambrian and early Paleozoic rifting stage, subsequent tectonism relates to plate convergence. NW and ENE fault trends are dominant and explainable from a reconstruction of principal stress directions. Normal faults generated during the rifting stage appear to have been selectively reactivated as reverse faults during Carboniferous and Permian time.

[1] Robert G. Font is president and owner of Geoscience Data Management, Inc. former executive vice president of *Strategic Petroleum Inc.*, area geologist and project supervisor with *Conoco-Phillips Inc.*, and professor of geology at Baylor University. Font has a Ph.D. from Texas A&M University and 31 years of professional experience.

Tectonic setting and structural architecture

The study area is Montague County of north Texas, USA (Fig. 1). An intriguing layered basement complex of northwest-dipping and thickening truncated wedges (Figs 2-4) west of the Muenster Arch uplift is revealed by seismic data shot by Conoco-Phillips, Inc., in the early 1980s. The layered basement rocks of Montague County are, possibly, late Proterozoic to early Cambrian in age. These rocks are practically virgin, with nearly no significantly-deep penetrations by the drill bit. Based on seismic evidence, these wedges are visibly truncated by a sharp, angular unconformity at the base of the Paleozoic with considerable topographic relief (Figs 2-4). The intense reflectors that define these wedges and their corresponding sequence boundaries are also found to abruptly terminate against the Muenster Arch uplift (Figs 3 and 5).

Due to its geographic location, Montague County of north Texas lies in close proximity to the southern margin of the tectonic feature known as the Wichita or Southern Oklahoma Aulacogen (Fig. 1). Therefore, the Paleozoic tectonic history and structural patterns of the Montague County region are believed by the author to have been influenced by the genesis, deformation history and ultimate destruction of the aulacogen complex.

The aulacogen's importance as a tectonic entity is described by Hoffman et. al. (1974) where the aulacogen is defined as the failed arm of a rift triple junction; two of the rifts opening to form ocean basins, while the third (the aulacogen) extends at high angle to the newly rifted continental margin, far into the adjacent craton. The aulacogen is a deeply subsiding trough; its fill is contemporaneous, as thick as, and lithologically similar to the adjacent miogeosynclinal sedimentary wedge; and its early history is dominated by vertical tectonics (Hoffman et. al., 1974). Aulacogens are often characterized by intermittent mafic and felsic volcanism

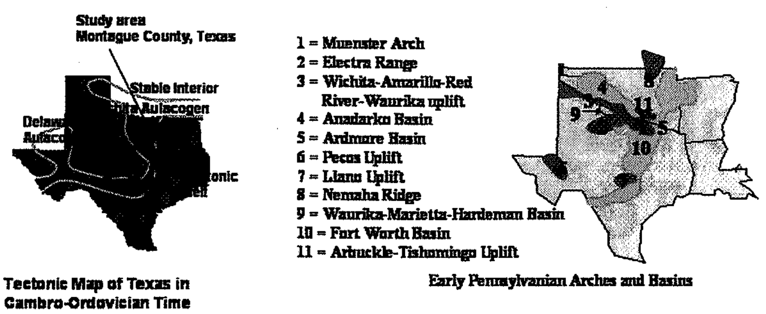


Fig. 1 – Location Map of the Montague County Area of North Texas, Illustrating Main Structural and Tectonic Features.

and plutonism, with the initial rifting being accomplished through thermal doming of the lithosphere produced by mantle plume-generated uplifts (Walper, 1976). The vertical tectonics, volcanism and plutonism characteristic of the early stages of an aulacogen's development are replaced by a later episode of compression and development of folds and faults (Walper, 1976).

The Wichita (or Southern Oklahoma) Aulacogen is thought to have formed starting in late Precambrian and early Paleozoic time (Burke and Dewey, 1973; Walper, 1976; Webster, 1980). Walper (1976) relates this time to the formation of four major aulacogens extending east to west from the Appalachian region to west Texas. The location of the Wichita aulacogen is believed by various authors to reflect a Precambrian system of sutures and fractures. Cebull et. al. (1976) discuss the location of discontinuities in the orogenic pattern of the southern United States and propose that such discontinuities express the separation of the North American continental plate during the Precambrian along NE-trending rifts and NW-trending zones of offset or transform faults. The Wichita Aulacogen appears to have developed along the trend of one of these ancient, NW-trending zones of weakness.

Ham et. al. (1964), Walper (1976) and Gatewood (1978) have described the tectonic setting and sedimentary fill of the Wichita (Southern Oklahoma) Aulacogen. The aulacogen experienced a rifting stage attributed to the split of a proto-Pangaea super continent (Walper, 1976). This stage is characterized in the area of the Wichita Uplift (Fig. 1) by the extrusion and intrusion of mafic and felsic igneous strata. A subsequent stage of sagging, subsidence and sedimentation occurred from late Cambrian through early Carboniferous time (Walper, 1976). The third and final stage in the aulacogen's history occurred from the Carboniferous through Permian time, as the Afro-South American plate converged with the North American plate (Walper, 1976). Plate collision and the thrusting of the Ouachita-Marathon deformation belt effectively terminated the aulacogen as a tectonic element (Walper, 1976).

Fault patterns mapped from seismic data in the Montague County area, at the level of the angular unconformity at the base of the Paleozoic, are shown in Fig. 3. A NW and an ENE fault trends predominate. The author herein proposes that NW-trending normal faults were generated during the rifting stage and that these were selectively reactivated as reverse faults due to the reorientation of the principal stresses (Fig. 6) during the convergence episode that resulted in the formation of Pangaea, the thrusting of the Ouachita-Marathon belt and the ultimate destruction of the aulacogen. The author also concludes that the observed ENE fault trend is linked to the principal stress directions that reflect the compressive stage (Fig. 6).

A discussion of the importance of the Wichita (Southern Oklahoma) Aulacogen in economic geology is beyond the scope of this paper, but it is recognized by, among others, Webster (1980), Gatewood (1978a), and Font (1994).

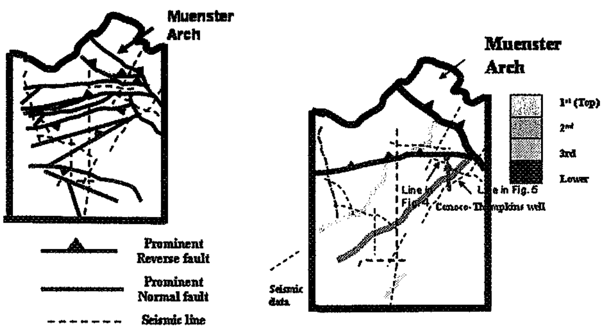


Fig. 3 - Approximate Sub Crop Pattern of Pre-Paleozoic Truncated Basement Wedges and Fault Pattern as Mapped at the Base of the Paleozoic.

Montague County, Texas.

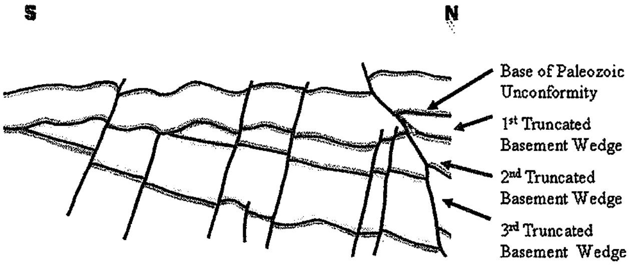


Fig. 2- Schematic N-S Cross Section Across Montague County, Texas, Illustrating the Truncated Pre-Paleozoic Basement Wedges.

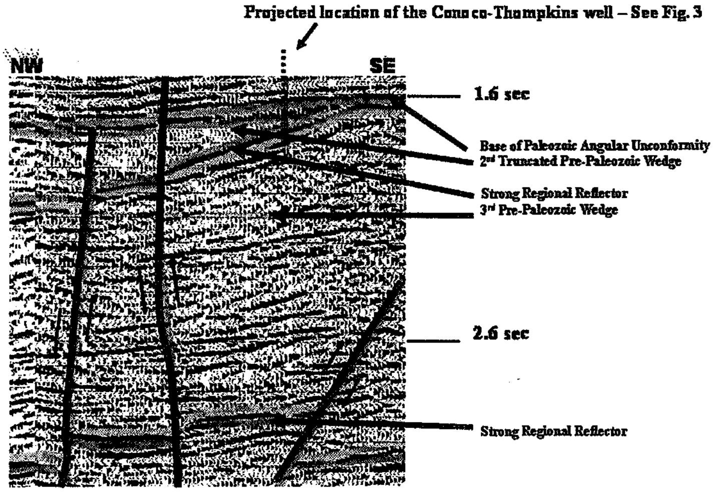


Fig. 4 – Pre-Paleozoic Wedges Dip and Thicken in a NW Direction. Here the 2nd Wedge (That Which Lies Below the 1st) is Visibly Truncated.
Courtesy of Conoco-Phillips, Inc.

Layered basement complex and truncated wedges - discussion

The layered basement pattern seen in the Montague County seismic lines (Figs. 2-5) appears to be quite similar to the layered basement sequence described by Brewer et. al. (1981) in the area of the Wichita-Amarillo Uplift (Fig. 1). According to Brewer et. al. (1981), COCORP seismic data along the southwest side of the Wichita-Amarillo Uplift reveals the location of a late Proterozoic basin that extends eastward from the Hardeman basin area of north Texas and southern Oklahoma toward the southeast (i.e., in the direction of Montague County of north Texas). Thus, they have recognized the existence of the late Proterozoic basin in the Oklahoma area. They also describe the basin's fill as composed of clastic sediments and mafic igneous rocks, consider the basin as developing in the late Proterozoic (1,200 to 1,400 million years old) and compare it to Irkutsk and Amadeus basins of the USSR and Australia.

Recently, other similar layered basement sequences are described by Rupp (2001), Drahovzal (2001), and Miller (2001) in different parts of the country. Rupp (2001) describes a Proterozoic layered basement sequence in the Illinois, Indiana, Ohio and Kentucky area. He also states that limited penetrations of this sequence have yielded the presence of lithic arenites interlayered with mafic volcanic rocks. Drahovzal (2001) describes the layered basement of central and western Kentucky and southern Indiana. Again, based on limited penetrations, a sequence of lithic arenites and felsic and mafic igneous rocks is revealed. Miller (2001) contrasts the layered basement of the Wichita Uplift-Hardeman Basin region to that seen in the Texas Panhandle and the New Mexico area and in the latter, describes volcanoclastic strata and mafic intrusions as the source of the reflectivity, substantiated by limited well data.

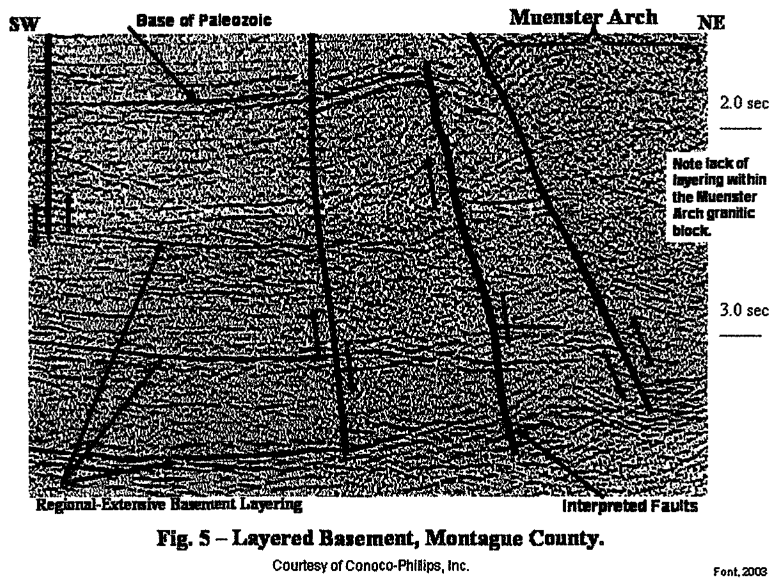


Fig. 5 – Layered Basement, Montague County.
Courtesy of Conoco-Phillips, Inc.

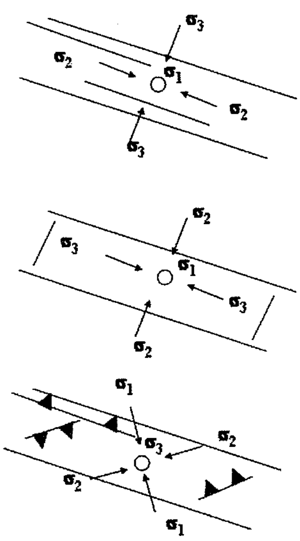
Font, 2003

Based on the above discussion, it is plain that the seismic data recorded in the Montague County area of north Texas reveals a layered basement pattern that appears similar to that described by Brewer et. al.(1981) along the southwest side of the Wichita-Amarillo Uplift. It is also apparent that basement layering is not uncommon, as confirmed by recent papers from Rupp (2001), Drahovzal (2001) and Miller (2001). In Montague County, the mapped pre-Paleozoic layered basement complex of truncated wedges is known to strike nearly perpendicular to the Muenster Arch and to dip and thicken in a northwesterly course (Figs. 2-4), in opposite direction of the Fort Worth Basin (Fig. 1). Also, within the study area, the basement features rise to the south (Fig. 2). Strong reflectors that define the wedges and their sequence boundaries visibly terminate against the Muenster Arch uplift (Figs. 3 and 5). From all of this, the author concludes that the Montague County pre-Paleozoic wedges are indicative of a regionally-extensive basement sequence of siliceous strata interlayered with sills and dykes of mafic composition. In addition, the author infers that this layered basement complex is reflective of the existence of a possible late Proterozoic to early/mid Cambrian basin that filled with siliciclastic strata intruded by diabasic dykes and sills. The absolute age of these basement rocks is unknown. It is not possible to ascertain if they are late Proterozoic or Cambrian in age, or if the mafic dykes and sills are significantly younger than the siliceous strata that they intrude. Furthermore, whether the layered basement features are related to the initial rifting stage of the aulacogen's development or to an even older (Grenville?) episode of Precambrian deformation cannot be determined.

Unfortunately, significantly-deep penetrations of the Pre-Paleozoic wedges of Montague County are meager at best. In the general absence of well data, velocity analyses of the seismic wedges indicate lithologies with velocities in excess of 17,500 feet per second and densities greater than 2.90 grams per cubic centimeter.

To the author's knowledge, only one well has penetrated deep enough to drill a significant distance (1,852 feet) into this fascinating pre-Paleozoic sequence of wedges. A deep (11,500-foot TD) well drilled by Conoco-Phillips, Inc., in 1983 (Conoco-Thompkins #1), penetrated the second wedge (Figs. 2-4) near its point of truncation below the angular unconformity at the base of the Paleozoic. Data for this well was never made public and has since been destroyed (Conoco-Phillips, personal communication, June 27, 2003). Thus, a description of the basement lithology encountered in this well is based on recollections by individuals and evidence from a non-annotated sonic log of the well kept at Geomap Company, Inc., in its Plano, Texas library. It is important to note that interlayered mafic (diabase) and siliceous (granitic) rocks were reportedly found in this critical well below the base of the Paleozoic (various Conoco-Phillips sources, personal communication)

A sketch of the gamma ray curve recorded in the Conoco-Thompkins #1 well from the base of the Paleozoic to the well's TD, as well as the author's interpretation of the interlayered mafic and siliceous Pre-Paleozoic lithology encountered by this well, are illustrated in Figure 7.



Initial rifting stage in late Pre Cambrian and early Paleozoic. Postulated stress directions as follows: Major principal stress σ_1 vertical oriented perpendicular to surface, minor principal stress σ_3 horizontal and perpendicular to the margins of the aulacogen, intermediate principal stress σ_2 horizontal and parallel to the strike of the aulacogen. High-angle normal faults would generate striking NW-SE, parallel to the strike of the aulacogen.

By late Devonian to mid Carboniferous time, a major stage of vertical tectonics occurs, giving rise to the uplift of the Wichita-Amarillo-Muenster positive elements. Postulated stress directions are as follows: σ_1 vertical oriented perpendicular to surface, σ_3 horizontal and parallel to the margins of the aulacogen, σ_2 horizontal and perpendicular to the margins of the aulacogen. High-angle normal faults would generate trending NE-SW, perpendicular to the strike of the aulacogen.

Final stage of compression in late Carboniferous and Permian time, during the plate conversion episode that forms Pangaea. Results in the destruction of the aulacogen. Postulated stresses are as follows: σ_1 horizontal oriented nearly NNW-SSE as a result of the compression, σ_3 vertical perpendicular to the surface and σ_2 horizontal and striking ENE-WSW. This stress system generates reverse faults striking ENE-WSW and reactivates earlier normal faults into reverse faults. Reactivated NW- trending faults may exhibit a right-lateral strike slip component, whereas NE trending faults would favor a left-lateral strike slip component.

Font, 2003

Fig. 6 - Postulated Stress History of the Wichita Aulacogen Area.

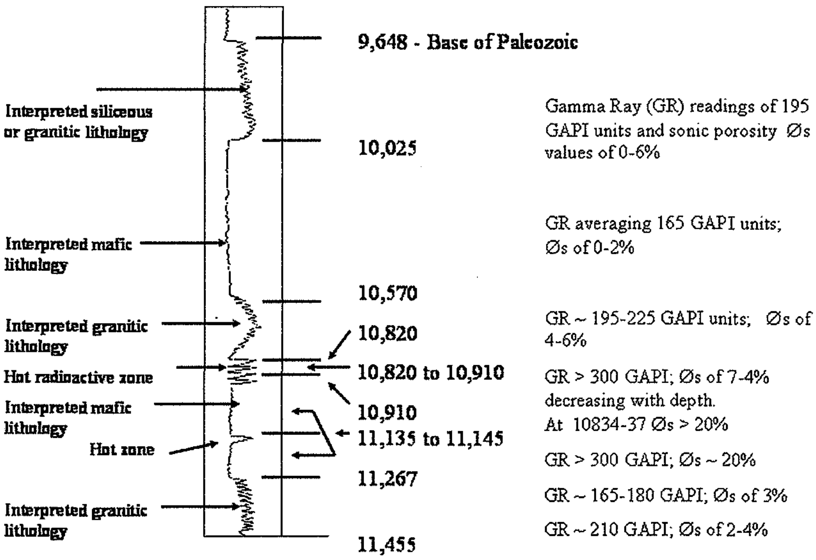


Fig. 7 – Schematic of Gamma Ray Curve Illustrating the Pre-Paleozoic Section Penetrated by the Conoco-Thompkins #1 in 1983.

Font, 2003

Conclusions

Seismic evidence in the north Texas area directly west of the Muenster Arch uplift reveals a layered basement sequence of at least three northwesterly-dipping wedges truncated by a sharp angular unconformity. The layered basement complex indicates the possible presence of a late Proterozoic to early/mid Cambrian basin filled with silicic strata and mafic intrusions. This idea is supported by limited petrologic and petrophysical data. These layered basement features may be related to the initial rifting stage of the Wichita Aulacogen, or to an older deformation episode to possible Grenville age.

Fault patterns in the area are dominated by a prominent NW and ENE trends. The observed patterns appear reflective of the interpreted principal stress orientations expected during the genesis, deformation and eventual destruction of the Wichita (Southern Oklahoma) Aulacogen.

Acknowledgements

I am appreciative to CONOCO-PHILLIPS, Inc., for allowing me to use as illustrations some of their proprietary seismic data which I purchased from them in the Montague County area. I am particularly thankful to Dr. Tim Denison of the University of Texas at Dallas for his expert commentary regarding basement lithology in the north Texas area and his thoughtful remarks pertinent to the log of the Conoco-Thompkins #1 well. I am appreciative of Ms. Lila Williams, a long-time petroleum explorer in the Montague County area for her valuable input. I also express my gratitude to my colleagues Cassini Nazir and Elaine Travers for reviewing the article. Finally, I am thankful to Rusty Goetz of Conoco-Phillips for her recollections regarding the basement lithologies encountered in the Conoco-Thompkins #1 well.

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Thermal springs of Bagni Nuovi and Bagni Vecchi, Bormio, Italy

by EurGeol. Dr. Luigi Gonsalvi and Dr. Francesvo Varni
Coordinator: EurGeol. Dr Carlo Enrico Bravi

The area where Bagni Nuovi and Bagni Vecchi are located geologically belongs to the Austroalpine domain, in detail, to the middle Austroalpine units of the "System Ortles-Quatervals-Languard". From the bottom to the top, this structural system basically consists of a lower unit (Cristallino dell'Ortles) of low to middle metamorphic grade, made up of philladic metapelites locally intercalated by quartzites, amphibolitic gneiss, marbles and prasinites; a middle unit, mainly represented by quartz-sericite bearing schists, quartzites, conglomerates; and a Noric-Liassic units of a thick dolomitic-calcareous sedimentary sequence (Sedimentario dell'Ortles).

The transition from the metamorphic units of the basement (Cristallino dell'Ortles) and the upper dolomitic-calcareous Mesozoic (Sedimetario dell'Ortles) is represented (Fig. 1) by an important shear zone called "Faglia dello Zebrù", which originated at the expense of the more plastic schists, quartzites and conglomerates of the middle unit. This tectonic element is east-west oriented, with a mean dip of 30° to the north and, as revealed by the recent excavation of the new penstock by Quadrio Curzio S.p.A. for the Premadio II electric plant enlargement, characterized by a thick band of faults, associated with decimetric to decametric thick slices of basement and sedimentary sequence with a heavy cataclastic texture, locally recemented by tight quartz and calcite veins.

Geomorphology

The area where Bagni Nuovi and bagni Vecchi are placed lies on the left orographic flank of the Valtellina Valley (Fig. 2), in the lower part of the slope coming down from the "Cresta di Reit" mountain. In the upper part, this slope consists of high and rocky walls of dolomites and dolomitic limestones of the "Dolomia del Cristallo" formation (Sedimentario dell'Ortles), black or grey and massively stratified, whose outcrops feed a large detritic deposit of scree slope and talus cone materials extending down to the village of Bormio, and basically made up of coarse, blocky elements up to 10 cm, with rare silty matrix. The Zebrù line runs right here, buried below this debris cover, and such a thick system of faults and diaclasis represents an important way for meteoric waters to circulate; as they seep down through the fractured rocks (1000/1100 m ca.), they get warmer with the geothermic gradient and lighter, rising up (Fig. 3) enriched in minerals and gases and feeding the large geothermal system of Bormio.

This system comprehends nine springs of hot water, located along a band 600 m wide and 200 m high in the slope mentioned above, with temperatures up to 43°C and a rate of flow up to 1000 litres/minute (Cinglaccia spring).

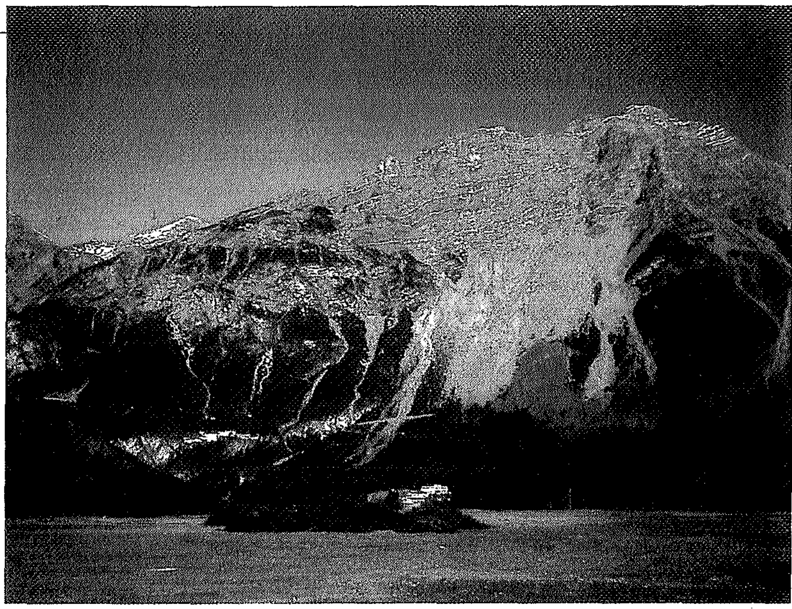


Figure 1. Panoramic view of the left orographic flank of the valley. In the background, the "Cima di Reit". Red line shows approximately where the Zebrù line passes. Note the position of Bagni Vecchi (blue circle) with respect to the tectonic line.

Figure 2. Detail of Bagni Nuovi and Bagni Vecchi with respect to the 1:100.000 geological map ("Foglio Bormio"). Zebrù Line in red.

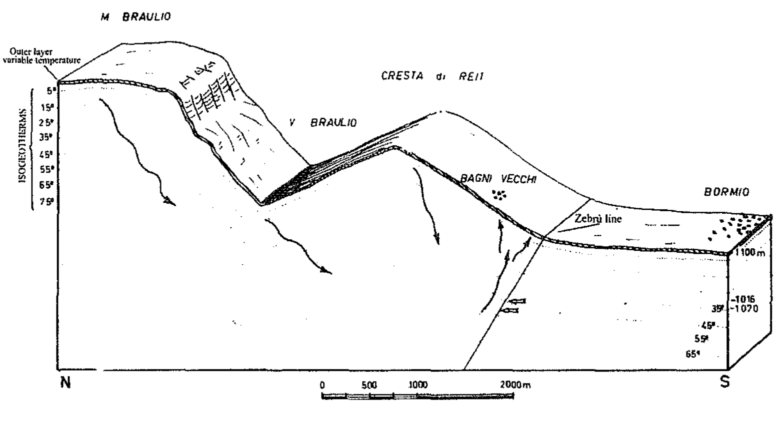
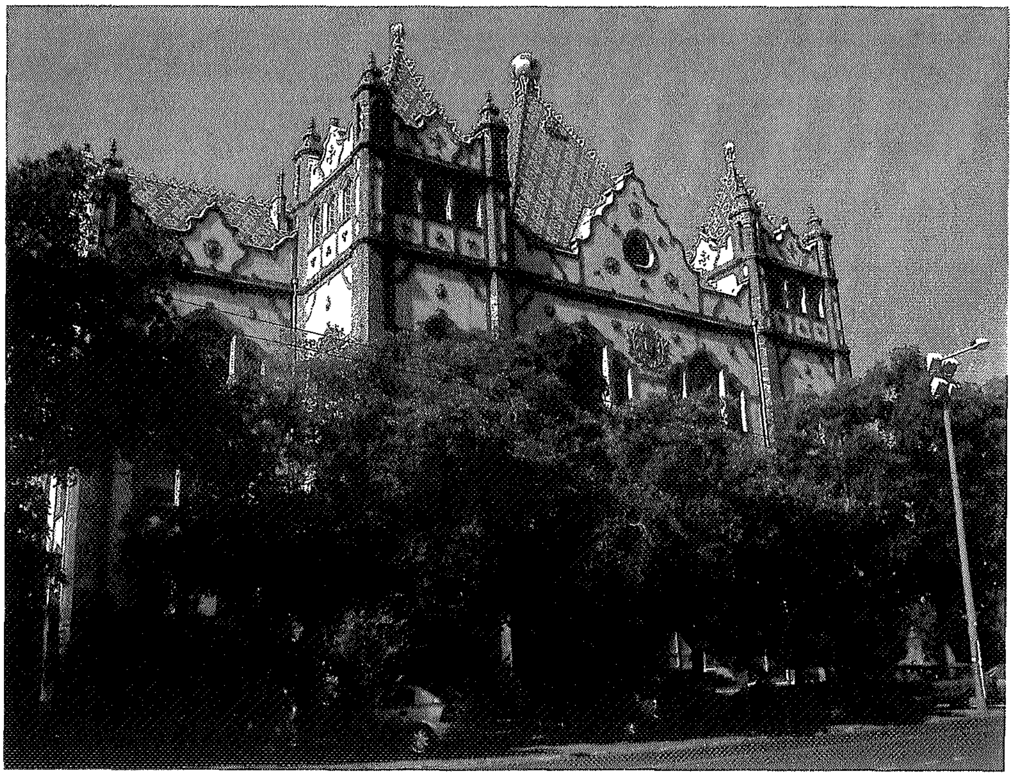


Figure 3. Schematic geological sketch of the geothermal system to which Bagni Nuovi and Bagni Vecchi belong.

Quadrio Curzio S.p.a. was set up in 1957 and is the continuation of Impresa Ing. Saverio Quadrio Curzio, which was founded at the beginning of the twentieth century. Ever since it began operating, the Company has been primarily engaged in the construction of underground infrastructures, and tunnelling still continues to be one of its main fields of operation. The construction of underground railway tunnels and stations, the tunnels housing penstocks in hydroelectric plants, and road tunnels, represents the main sector in which it operates. In more recent years, the Company has acquired the specific know-how of excavating tunnels with full-section mechanical-drive tunnel boring machines. Purchasing one of the most technologically advanced tunnel boring machines in existence and making use of a highly specialized team of technicians and operators of indubitable reliability, between 1997 and 2001 Quadrio Curzio brought to completion two important projects on behalf of Enel S.p.a., essentially consisting of excavating two hydraulic tunnels 750 and 1750 m in length with a gradient of up to 42°, and currently has work in progress on behalf of AEM of Milano, including the excavation of an approximately 870 m long hydraulic tunnel at a gradient of 45° degrees and a horizontal hydraulic tunnel approximately 3200 m in length.

The expertise acquired over the years by Quadrio Curzio also finds expression in the construction of various kinds of underground infrastructures and, in particular, in the construction of parking areas. Between 1999 and 2002, Quadrio Curzio, in cooperation with a number of professional structural designers and urbanologists, submitted a series of projects for the construction of underground parking areas in Milan, taking part in the public tenders called by the Municipality of Milan and being awarded contracts for 10 areas for the construction, precisely, of relevant underground parking areas in accordance with the Law no. 122/89 (Tognoli Law), for a total of 2,710 parking spaces.

In view of the recent developments in the regulations on the subject, aimed at encouraging the inflow of private capital in the execution of public works which, by their very nature are capable, through their management, of ensuring a return on investment, as of 2000 Quadrio Curzio has submitted a series of project financing proposals for the implementation of a number of important projects in the transport and hotel - spa bath sectors. In the latter sector, Quadrio Curzio cooperated with Bagni di Bormio S.p.a., the proprietor of a hotel - spa bath real-estate complex in Bormio, in the upper Valtellina area, which was recently redesigned and totally restructured by Quadrio Curzio S.p.a.. Within the framework of the project financing initiatives, Quadrio Curzio was appointed by the Municipality of Milan as Promotor for the construction of four underground public parking areas in rotation on a thirty-year concession, for an overall number of 1,538 parking spaces, and was identified as the Franchisee, in Temporary Business Asssociation with Bagni di Bormio S.p.A., for the restructuring and management on a thirty-year concession of the Spa Baths of Prè-Saint-Didier, on behalf of the Independent Region of the Valle d'Aosta.



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Modelling of subsurface geological structures on a future disposal site of low- and intermediate-level radioactive waste

by Gáspár Albert [1]

In Hungary, investigations have been conducted since 1978 into the deposition of low and medium level radioactive waste from the Paks Nuclear Power Plant. Research has shown that the granite complex, lying underground in the southern part of Hungary, is the most promising for establishing a waste deposit. Amongst other research projects, a 3D geological model was developed to designate the exact location of an underground depot. This model not only shows the geological structures in a graphic way, but gives an exact and understandable representation of the geological environment both in 2D (maps, sections) and 3D (surface and block models).

En Hongrie, des recherches ont été menées depuis 1978 sur le stockage des déchets nucléaires faiblement et moyennement actifs, générés par la Centrale nucléaire de Paks. Ces travaux ont étudié un complexe granitique souterrain, situé dans la partie sud de la Hongrie, et estimé comme étant le plus favorable pour recueillir les déchets. Parmi d'autres projets de recherche, un modèle géologique 3D a été développé pour permettre de sélectionner l'endroit exact, propice à l'enfouissement des déchets. Ce modèle représente non seulement les structures géologiques sous forme graphique mais fournit une image précise et claire de l'environnement géologique à la fois en 2D (cartes, sections) et 3D (blocs diagramme, en surface et profondeur)

Desde el año 1978 se vienen realizando investigaciones en Hungría sobre el almacenamiento de residuos radioactivos de baja y media intensidad de la Central Nuclear de Paks. Los investigadores han considerado el complejo granítico situado al sur de Hungría como el más prometedor para establecer un repositorio de residuos. Entre otros proyectos de investigación se ha desarrollado un modelo geológico en 3D para establecer la situación exacta de la instalación subterránea. Este modelo no sólo muestra las estructuras geológicas gráficamente sin que también proporciona una representación exacta y comprensible del ambiente geológico en 2D (mapas y cortes) y 3D (bloques diagrama con modelo del terreno).

The deposition of radioactive waste is a world-wide problem, requiring promt action and financial expenditure. Where nuclear power plants operate, the task of depositing the produced hazardous radioactive waste has to be faced. This waste can basically be divided into two groups, according to the level of hazard and the type of treatment it requires: the group of high level waste (spent fuel) and that of low and medium level waste. In Hungary, investigations have been conducted since 1978 into the deposition of nuclear waste from the Paks Nuclear Power Plant. This concerned primarily low and medium level radioactive waste, since the spent fuel was taken back for reprocessing by the former Soviet Union and then Russia until 1998.

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Research shows that the granite complex, lying under the Geresdi Hills to the east of Mecsek Mountain (Fig. 1), is the most promising among the places geographically suitable for establishing a waste deposit. This is where detailed investigations started in 1997 to designate the exact location of an underground depositing establishment (Balla et al. 1997, Turczi et al. 1997). Most of the geological research was conducted by scientists from the Geological Institute of Hungary overseen by the Public Agency for Radioactive Waste Management.

The purpose of the model

The purpose of a geological model is to give an exact and understandable representation of the geological environment, as well as an analysis of the unexplored areas. Using the surface and sporadic spatial data, the model aims at providing a tool to researchers, so that close estimations of the physical parameters of any surface or subsurface points around the proposed disposal site can be made.

The modelling methods were based primarily on mathematical estimation processes (e.g. linear interpolation, kriging, etc.). In data-free areas, such as certain parts of the sub-terrainian granite surface, traditional manual construction processes were used, analogous to those of thoroughly explored areas near the site, as well as on published data on the morphology of similar formations. Through these processes, new data were generated from the existing (measured) spatial datasets on those primarily subsurface areas, where direct research has not been conducted. It was noted during later calculations that these new datasets have the same punctuality as the original (measured) ones, but their hierarchy is secondary.

Historical review

The three-dimensional geological modelling of the area started in 2001. This

Figure 1. Location of the research area

Figure 2. Model of the fault zones and the granite complex (orange grid), on the proposed disposal site area. Green contour lines mark the boundary surface between the monsonite and monso-granite. In the columns of the boreholes: green is monsonite, purple is monso-granite, yellow is loess. Northwest is left. (Albert 2003)

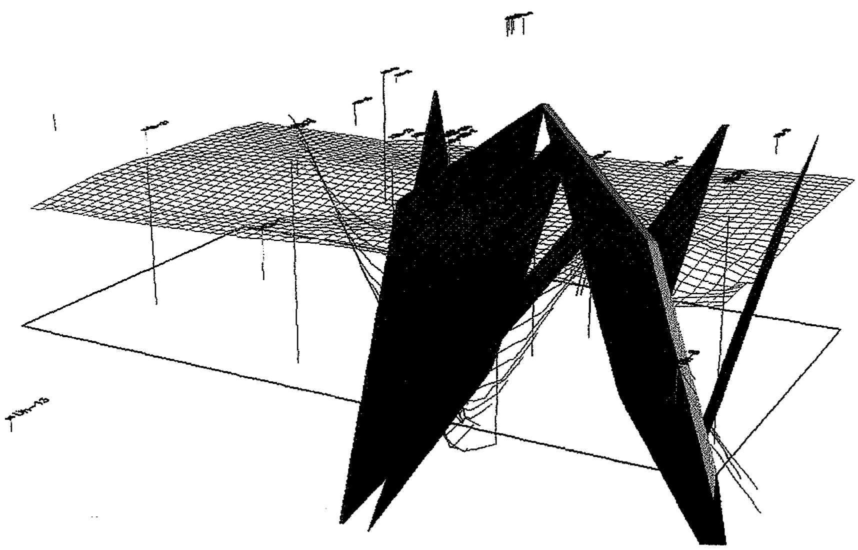
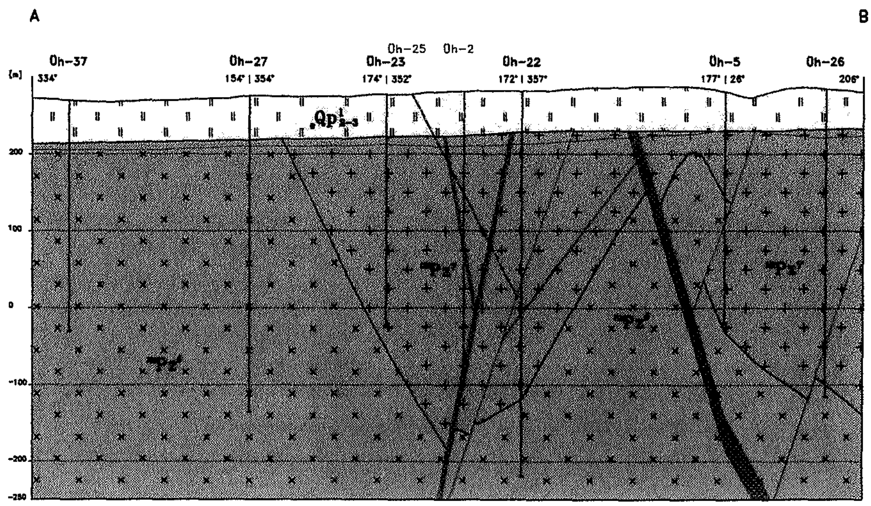


Figure 3. Vertical section of the model.
mPz? (pink) = monsogranite; mPzd (green) = monsonite; eQp2-3l (yellow) = loess; red = fault zones. North is left. (Albert G. in Balla et al. 2003a)



phase of the Project was focused on two main horizons. One is the digital terrain model and the other is a surface model of the granite complex, covered by relatively young continental deposits. The basic data of the terrain model are derived from digitized contour lines of the 1:10000 scale topographic state maps. Besides the contour lines, the xyz-values of the boreholes were also used as input data, to improve punctuality. Similar to the terrain model, the granite surface had also different types of source data. One of them was a bedrock surface map, with "isodepth" contour lines (Balla et al. 1998), but it had to be corrected, according to the outcrop boundaries (Chikán et al. 1997) and the surface topographic map. The other source was the database of the Geological Institute of Hungary (Gyalog et al. 2001). Surfer 7 was used to create the surfaces, and AutoCad 2000 to visualize them.

In 2002, subsurface geological research on the future disposal site started. Since the software above had limited capabilities, it was decided to look for a vast 3D modelling tool, to be able to follow the needs of other co-projects (e.g. hydrogeology, tectonics). A list of criteria was set in order to purchase a modelling tool. The software should:

- be able to import and export 3D (xyz) data in the easiest and most commonly used form;
- be able to build up surfaces easily, quickly and without the deformation of the original data;
- support the handling of a complex layer structure in a "user friendly" way (turn layers on and off, rename them, select objects on them, etc.);
- be able to construct, and reconstruct the entities of the model (including the surfaces) dynamically using the latest incoming data;
- have the possibility to rotate the model arbitrary, and perform geometric operations in the virtual space;
- support the modification of the entities in any view, the optional projection of the visualization, and the peeling off of generated surfaces.
- support the automatic creation of polylinear sections, including any surface that has been defined in the model;
- have the option to run executable scripts to avoid repeating the same orders;
- have the possibility to represent scenarios in a way that is close to reality (to produce rendered images of the 3D

model);

- have GIS options, in order to analyse the entities of the model and their attributes which are stored in different databases;

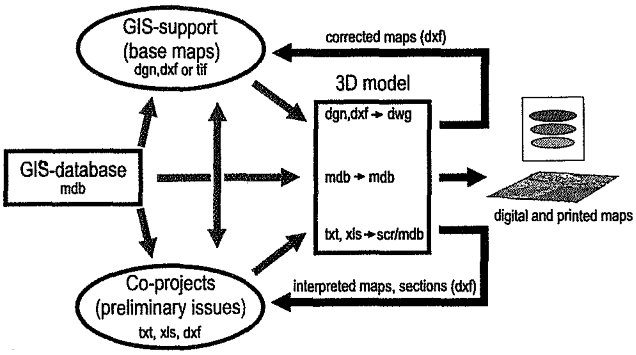
According to these criteria, Land Desktop 3 of Autodesk (LD3) was chosen which is an "intranet-friendly" integrated GIS and 3D modelling software. In the first half of the year 2002, the software was tested with the data from the earlier research project (see above).

Until the end of 2002, continuing exploration created a huge amount of data that had to be integrated into the model. These data consist mostly of the reduced lithology of core-samples from the new boreholes, but marker points and lithology of the explorational trenches and observation wells were also added to the database of the model. These data made it possible to create a higher resolution surface model of the granite complex, and newly measured geodesic features of the main valleys (Turger 2002) improved the terrain model as well. Two hypothetical fault-zones from earlier research (Balla et al. 1998) were also inserted into the model space to create a "starting point" of geodynamics. The virtual fault-zones were 3D blocks, intersected with horizontal plains by a 10 m interval. This produced a 3D wire frame, which made it possible to see other objects behind the faults in any view. In the model, the intersection lines of the faults and the terrain surface could be studied and followed to the supposed outcropping points in the valleys. A few geoelectric and seismologic sections (BALLA et al. 1998) were also inserted in the model space, to study the different interpretations of the lithological boundaries.

In the first quarter of 2003 the issues of different co-projects (hydrology, tectonics) (Balla et al. 2003a-b) provided enough data to construct a geodynamic model with many faults (Fig. 2.), and to create a groundwater surface model. From the results of the core-sample observations, three main lithological provinces of the granite complex could be differentiated; the mainly coarse to medium grained quartz-monsonite (monsogranite), the medium to fine grained monsonite and the feldspar-rich leucocratic seams (Balla et al. 2003a). The first two of these types of rocks are the most characteristic of the model's lithological categories.

Parallel to this, new contour line data (for 96 km2) were added to the terrain model to increase its resolution. The interval of the contours was 2.5 m and

Figure 4. The structure of data exchange.



the source of the data was a digital state topographic map bought from the Institute of Geodesy, Cartography and Remote Sensing.

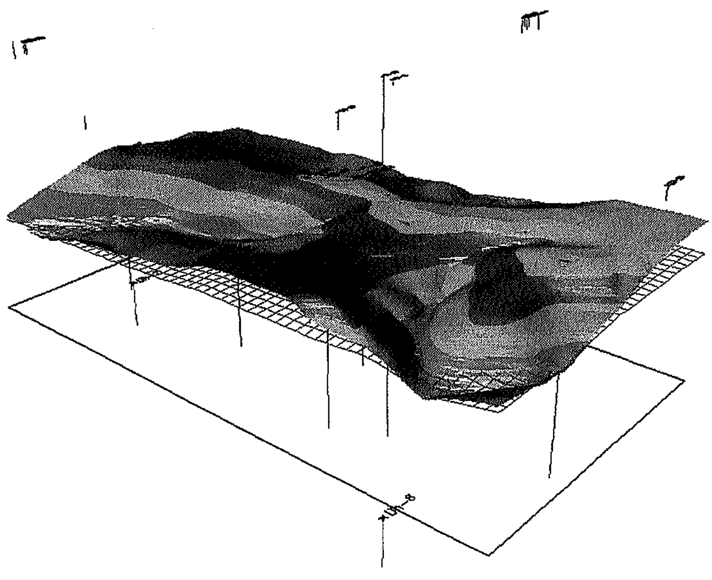
In the second quarter of the year, there was increasing need for sections, maps and digital block models. In most cases, researchers want 2D files or printed maps, showing a horizontal or vertical section of the faults, boundaries and surfaces (Fig. 3).

Exchanging data

The number of boreholes built in the model is 176, of which 130 originate from the Hungarian Geological Survey and 46 from the databases of the Geological Institute. In the model, the simplified borehole-sequences were used with undistorted parameters (including inclined boreholes). As a result of the simplification, three formation types appear in the model: monsogranitoid, monsonitoid and overlying formations. During modelling, ground and underground formations from 120,000 hectares were processed and 12 surface models, 14 fault zone models, 2 block sections, 5 linear sections and 18 horizontal sections were generated for external use. In a further four cases, complex vector databases were exchanged.

It is important that the data in the model be quickly available for users and in the proper form. For this to be achieved, a number of criteria had to be met. One of the most important conditions was the transparency of the data, as the set of potential users can greatly vary (hydrogeologists, geophysicists, tectonophysicists, etc.) and so the applied data-analysing methods can be very different. This means that the output data of the 3D model had to be available in the simplest form as well. The output data, in most cases, were sent to the users as AutoCAD exchange files (dxf) in ASCII form. The types of files and the

Figure 5. Perspective view of the proposed disposal site area. Hypsometric colours show the terrain model, orange grid marks the surface of the granite complex. In the columns of the boreholes; green is monsonite, purple is monsogranite, yellow is loess. Northwest is left. The boundary frame of the visualized model (black hairline) shows the sea level. (Albert 2003)



file transport directions are summarized in Figure 4.

The whole dataset of the model can be divided into two hierarchical groups: the primary data group, which contains the measurements; and the secondary data group, which is derived from the first one. The static part of the model consists of data from the outcrop and borehole observations and the GIS-database. The dynamic part has been estimated with mathematical processes. The calculated surface points can be overwritten by new values with higher priority (e.g. new borehole data).

Since the GIS-database, which supports data for the model, is developing continuously, the change of this source alters the model as well. Because of this, all entities of the model that had some relation to the new data, had to be modified, as well as processing the incoming data. The LD3 interactively supports the construction and modification of the generated surfaces, makes it possible for users to rotate arbitrarily the 3D models, modify the optional visualization and peeling off of surfaces and promotes the better understanding of the geology of the area by choosing freely the track of sections or the location of the block models. A metric perpendicular coordinate system, similar to the Hungarian Geodesic Grid Reference (EOV), was defined for the model. Its resolution is able to handle millimetres as well, which is the smallest possible unit of the incoming data.

Visualizing the model

The visualization of the model also had to be considered, which depends on the possibilities of the modelling software. Fortunately, the selected developing tool supports both the 3D (surface and block models) and 2D (maps, sections) representation (Fig. 3).

The LD3 was developed from AutoCAD 2000 engineering software, so its own file format is dwg (drawing) or the widespread dxf (drawing exchange), which can be imported to almost all CAD software. The LD3 also has GIS functions, so before starting to work with it, it was necessary to define a project library for the vector-graphics (dwg) and for the databases that contain attributes of the objects in the model. These databases are in MS Access format (mdb). Other databases (e.g. borehole data information systems) can be connected with a key-field to attributed graphic objects, providing lots of possibilities to run thematic SQL sequences. The source maps of the model were converted from the Microstation dgn (design) file format; other spatial data were imported from a simple txt, or xls file (Fig. 4). All of the data, depending on their style, were added to the model's own database (mdb), or were inserted right into the model space using a script-file (scr).

The continuous upload of the GIS-database and the construction of the geological model are parallel to each other. Furthermore, the preliminary analysis of the geological and geodynamic features is also a parallel process. This side-by-side construction could not exist without frequent consultations with the co-project researchers. This dialog was promoted by the arbitrarily set vertical sections, along which they could study the faults and the generated surfaces of the model. When the geometry of the surfaces had changed because of new incoming data, the sections followed the change automatically. These sections can be exported to a dxf-file, which is supported by most GIS and graphic software.

The software applied in this particular case, offers many functions to visualize the model in a way that is close to the user's cognitive reality. It is worthwhile emphasizing that the model can be observed not only in orthogonal (parallel) view, but also in a perspective projection (Fig. 5). We can attach colours and textures arbitrarily to surfaces, and the wide rendering and lighting options also help us to achieve a scenic view of the virtual reality.

Acknowledgement

I wish to express my thanks: to Mr. Zoltán Balla, and Mr. László Gyalog (leader and assistant leader of the exploration project) and to Mr. Péter Scharek for his co-operation in publishing this article.

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The EFG stand in Green Week:

Contribution of the Earth Sciences to the main political areas of the Environment

by EurGeol. Dr Isabel Fernández Fuentes and EurGeol. Dr Carlo Enrico Bravi

The European Federation of Geologists participated in Green Week (2 - 5 June 2003), Changing our behaviour, organized by the European Commission's Directorate-General for the Environment. EFG contributed with a stand and a presentation. Under the title "Contribution of the Earth Sciences to the main political areas of the Environment" EFG presented a Stand. In this Stand our association showed the importance of good geological information as a key to understanding environmental challenges as a whole. The presentation focused on Climate Change

La Fédération Européenne des Géologues a participé à la Semaine Verte (le 02 - le 05 juin 2003). Cette manifestation était organisée par la Direction Générale de l'Environnement de la Commission Européenne, avec pour objectif de modifier notre comportement. La FEG a participé au niveau d'un stand et d'une présentation. Sous le titre : Contribution des Sciences de la Terre aux aspects principaux de la politique environnementale, la FEG a mis l'accent sur l'importance d'une information géologique de qualité, clef pour comprendre les problèmes environnementaux dans leur ensemble. La présentation a concerné surtout les changements climatiques.

La Federación Europea de Geólogos participó en la Semana Verde 2 - 5 / 06 / 2003, organizada por la Dirección General de Medio Ambiente de la Comisión Europea. En dicho evento la FEG contribuyó con un Stand y una presentación. Bajo el titulo "Contribución de las Ciencias de la Tierra en las principales políticas del medioambientales", fue presentado el stand en el que nuestra asociación quiso poner de manifiesto la importancia de una buena información geológica como clave en la comprensión de los problemas medio ambientales en su conjunto.

Green Week 2003 was about bringing people together to debate, as a follow-up to the World Summit on Sustainable Development in Johannesburg, the key environmental issues of sustainable consumption and production, renewable energy and climate change and water. A number of high-level political meetings took place, as well as "traditional" Green Week conference sessions involving stakeholders, special workshops for young people and children and an exhibition featuring interesting projects that illustrated best practice in the field of the environment.

Green Week 2003 was aimed at local, regional and national decision-makers, as well as environmental stakeholders like companies, industry and non-governmental organizations.

The EFG Stand presented the contribution of the Earth Sciences to the main political areas of the Environment, Water, Natural Hazards and Climate Change. Each area was illustrated with examples to explain the geological impact. In the exhibition we presented four groups of panels:

1. Why Society Needs Geologists

Geologists collect and interpret data that map, monitor and predict the changing planet.

Geologists identify and define the natural resources which society needs for its survival.

Geologists are essential for the more effective administration of sustainable development, environmental quality and standards, land use planning, environmental management and resource utilization.

2. Geology and Water

Nothing works without water. It is critical therefore that our water resources are identified and protected. Knowledge of the local geology achieves this objective.

Issues where geology has particular relevance include:

Pollution: Seven million people are dying every year from diseases associated with the consumption of water.

Protection: By ensuring the presence of near-natural water in aquatic systems we provide a basis for the environment to develop in a successful and sustainable fashion.

Sustainable Use: Mapping and monitoring of available resources is an essential first step.

3. Geology and Natural Hazards

Geologists play a central role in identifying risks and proposing mitigation measures in regard to:

Volcanic Eruptions: The Vesuvio volcano in Italy is listed amongst the five most dangerous in the world.

Earthquakes: Approximately 40,000 people died as a result of earthquakes in Turkey(1999), El Salvador (2001) and India (2001).

Land subsidence: Damage due to land

subsidence is estimated to cost over 500 million Euro annually in the United Kingdom.

4. Geology and Climate Change

Understanding the past is a key to predicting the future. Our changing global climate is giving rise to increased risk from:

Flooding: The 2001 floods in central Europe are estimated to have cost at least 50 billion Euro.

Landslides: Between 1945 and 1990 almost 2,500 people died due to landslides in Italy

Coastal Erosion: Knowledge of the local geology identifies high risk areas

In the stand we also had the opportunity to present the EFG mission and objectives, magazine, leaflets, as well as information on the various national delegations.

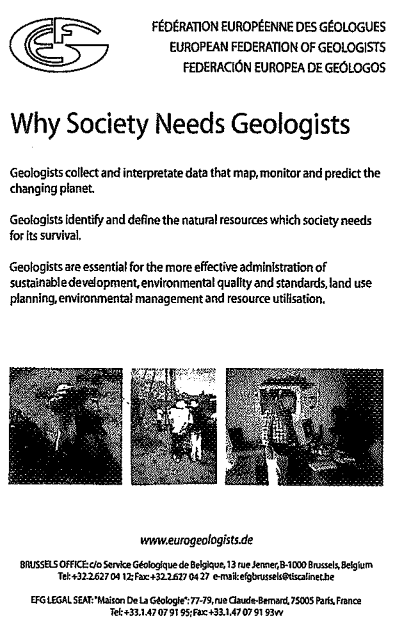
The EFG Presentation was made by Dr Oscar Abbink, from the Netherlands national association, KNGMG, about Climate Change, Geological Records and Geohazards: "How the Past is a Key to the Future"

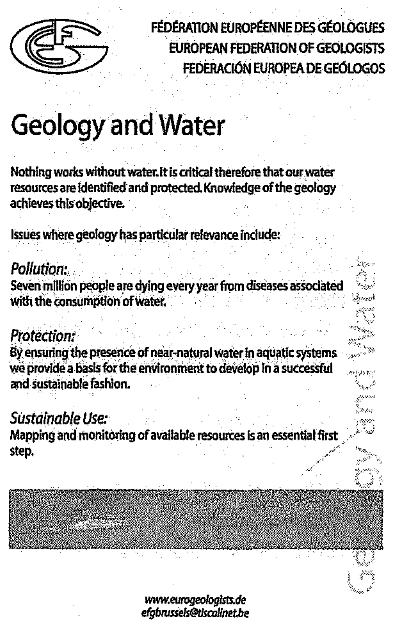
The aim of this presentation was to demonstrate how information on past climates and environments can be used to predict future changes in our natural environment and in society.

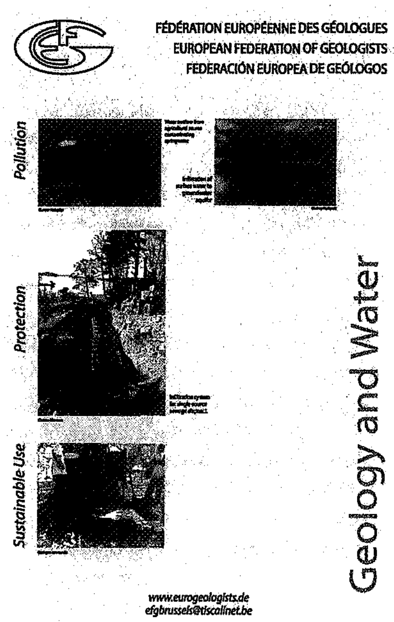
During the week the stand received extensive public interest. Among the distinguished visitors were the European Commissioner of the Environment, Margot Wallström, the Director of Quality of Life - Health, Nature & Biodiversity, DG Environment, Prudencio Perera Manzanedo plus several officials from European institutions and international associations active in the field of the environment.

The EFG stand was manned by Carlo Enrico Bravi, EFG Board member, Isabel Fernandez, EFG Agency Chief, and Ana Pazos, a geologist from Madrid. Valuable cooperation was given by the Belgium -Luxembourg association, UBLG: Dick de Costa, President, and André Chabot.

Ana Pazos and Isabel Fernandez during the Green Week exhibition.







Posters from the Green Week stand

On top of the World

by Steen Laursen [1] and Louise Hakjær

To claim or not to claim the North Pole, that is the question in the next ten years. Russia and Denmark are both trying to make claims on the top of the world, while USA has completely different ideas about how to share the Polar Sea. The scramble for the top of the world is made possible by the UN Sea Law Convention and a quite unusual geology in the North Pole Basin. The UN convention gives the natural resources of the seabed of the shelf to the bordering coastal nations, but under the North Pole there is a strip of shelf running for thousands of miles from one side of the Polar Basin to the other, and it is only attached to the continents at the ends.

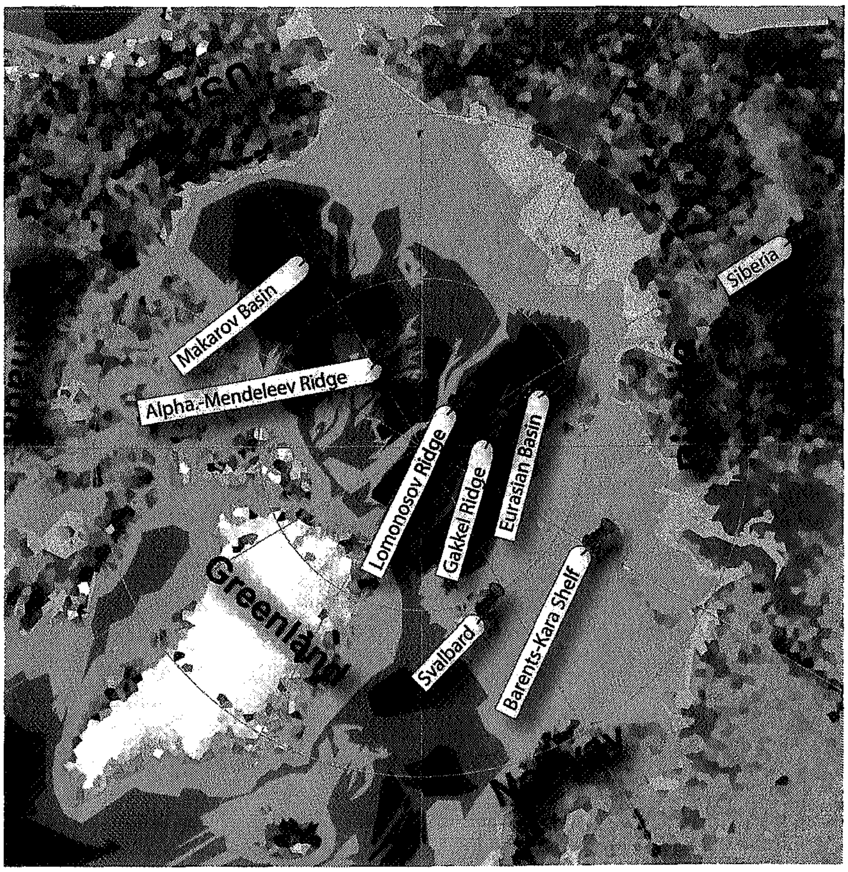
Revendiquer ou non le Pole Nord, voilà le dilemme posé pour les dix prochaines années. La Russie et le Danemark revendiquent tous deux ce point du globe tandis que les Etats-Unis ont une optique totalement différente sur le partage des eaux polaires. La dispute pour le Pole est rendue possible par l'application de la Loi sur la mer (Convention des Nations Unies) et par le caractère tout à fait inhabituel de la géologie propre au Bassin du Pole Nord. La Convention octroie les ressources naturelles de la plateforme de bordure aux pays riverains. Sous le Pole Nord, court une plateforme en bande étirée sur des milliers de kilomètres entre les deux extrémités du bassin polaire et elle se trouve rattachée aux continents à ses deux bouts, au niveau du Groenland et de la Russie.

Reclamar o no reclamar el Polo Norte, esa es la cuestión en los próximos diez años. Tanto Rusia como Dinamarca intentan reclamar el extremo superior del mundo, mientras los EEUU tienen una idea completamente diferente de cómo repartir el mar polar. El debate sobre este extremo del mundo es posible debido a la Convención del la ONU sobre la Ley del Mar y la inusual geología de la Cuenca del Mar del Polo Norte. La Convención de la ONU otorga los recursos naturales del lecho marino de la plataforma a las naciones que rodean el mar. Bajo el Polo Norte hay una banda de plataforma de miles de kilómetros desde un extremo de la cuenca Polar a la otra y sólo está unida a los continentes por los extremos a Groenlandia y a Rusia.

Russia tried and failed in the scramble for the North Pole when its claims on territory in the Arctic Ocean were turned down by the United Nations Commission on the Law of the Sea. Nevertheless the commission has suggested Russia try again.

In the meantime, Denmark is preparing its own claims on the Arctic Ocean, and the Danes are also aiming for the North Pole. Canada and Norway do not seem to have ambitions for the North Pole, but they are also preparing claims on parts of the Arctic Ocean.

The USA is also interested in the Arctic Ocean. It suggests using a principle that is much like the one used for sharing the Antarctic, sector lines from national borders to the North Pole. Sector lines following the lines of longitude give the largest areas of the Arctic Ocean to the countries farthest from the North Pole.



Features of the Arctic Ocean important for national claims. (Steen Laursen)

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[2]Louise Halkjær Geologist and journalist. halkjaer66@hotmail.com

Unique Lomonosov

According to the United Nations Convention on the Law of the Sea (UNCLS), it is only possible to make claims on the resources of the seabed of the shelf. Every coastal nation automatically gets the resources within 200 nautical miles of the coast (one nautical mile equals 1,850 kilometres). If the shelf is very wide, a nation can get more.

But the Lomonosov Ridge in the Polar Basin has an unusual geology, and it might make it possible for Denmark and Russia to claim the North Pole, though it is about 400 miles from their closest shore. About 55 million years ago the ridge was the slope of the north European and Asian shelf, the Barents-Kara shelf, but when the Atlantic Ocean opened, the slope was separated from the shelf by a mid-ocean ridge.

So today the Lomonosov Ridge is in fact a slice of shelf lying under the surface of the Arctic Ocean, and if a country can prove that this ridge is an extension of its shelf, then this country can claim the entire ridge. It appears that the ridge is connected to Greenland's shelf at one end and to Russia's shelf at the other.

Why a sea convention

Before the UN convention, the term "Freedom at Sea" was prevalent. No one could own the sea, a principle used and misused. Technologically developed countries used their technology to sweep fishing grounds on their own continental margins as well as those of other countries, and the mining industry developed techniques that made it possible to exploit the mineral resources of the sea floor. The inequality of the distribution of technological possibilities between countries made it necessary for Third World countries to protect their interests.

In 1958 The Geneva Convention stated that coastal nations only had rights to the resources of the shelf out to a water depth of 200 m - or as deep as it was possible to exploit the natural resources. But as coastal countries developed new techniques they were able to exploit an increasing part of the sea floor. The Geneva Convention was slowly undermined. Thus new negotiations began and in 1984 the UN created the Law of the Sea that included the new kind of area, the juridical shelf.

A shelf according to The United Nations Convention on the Law of the Sea

The juridical shelf is defined by the UN Convention on the Law of the Sea §76. This is not a shelf in a geological sense. A geological shelf is the continent's prolongation out into the ocean. The juridical shelf is the part of the sea, where a nation can claim all rights to the resources of the seafloor and below. This area is defined by law, but it is based on the concept of the geological shelf.

A juridical shelf accepted by the commission cannot be changed, but the commission does not decide who this shelf belongs to. It only decides that it can belong to someone. After the commission's decision, the countries making claims must negotiate among themselves and agree about their mutual border.

To draw the line

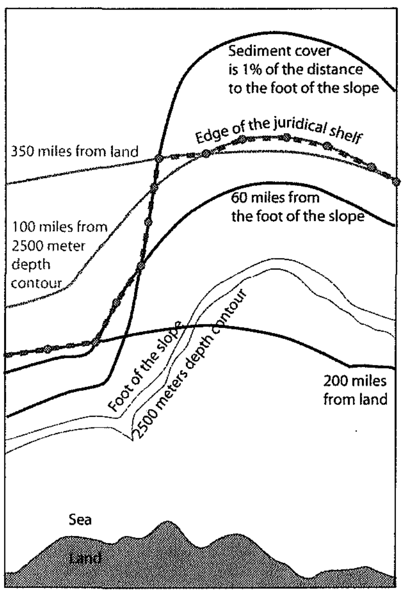
In the figure, there are three, wide black lines. They represent three definitions of the seaward border of the juridical shelf. The line which is farther out to sea is the one which defines the seaward border.

There are also two grey lines. They represent two different limitations of how far seaward the border of the juridical shelf can be. So if a grey line is farther seaward than the two black lines, then the more seaward grey line sets the border.

The final border is shown by the dotted line. In reality it must be defined by a number of points with straight lines between them. It is up to the country making the claim to define these points, but there must not be more than 60 nautical miles between them.

200 nautical miles

The first rule used is that any coastal nation has a juridical shelf 200 nautical miles wide along its shores. The conditions of the geological shelf do not matter for this rule. The 200 nautical miles are measured form the coast at low tide. This juridical shelf is coincident with the exclusive economic zone, a nation has the right to the resources of the sea itself, such as fish and waves.



Continuation of the geology

Before a nation can make claims on a juridical shelf wider than 200 nautical miles, it must prove that its geology continues farther at sea than this distance. This will usually be a wide shelf. Mid-ocean ridges cannot be used as a basis for claims on the sea.

Two rules

If the foot of the slope of the geological shelf is more than 140 nautical miles from land, the juridical shelf will be wider than 200 nautical miles because rule number two states that the juridical shelf continues for a further 60 miles. The foot of the shelf is defined as the place where the gradient of the slope has its maximum change.

But if there is a lot of sediment on the ocean floor farther out, the juridical shelf can be even wider. This is because the third rule states that if the sediment cover of the ocean floor at any place is thicker than one percent of the distance to the foot of the shelf, then this forms part of the juridical shelf.

Two rules set limitations

But there are limits to how wide the juridical shelf can be. The first of these rules says that the juridical shelf cannot be wider than 350 nautical miles. The second says that this shelf cannot go any farther seaward than 100 nautical miles from the 2,500 m depth contour. Because of the last rule, in some cases the juridical shelf can extend itself considerably beyond 350 miles from the coast.

Rights to the resources

Along with the juridical shelf come the exclusive rights to the resources on and below the sea floor. In the Arctic Ocean one expects to find oil, gas, gas hydrates and perhaps different ores.

The living resources on the sea floor such as mussels and sedentary algae are also included in the resources. Organisms could present the possibility of finding new raw materials for the pharmaceutical industry or maybe even DNA material for scientific and commercial use. The research on the shelf is to be administered by the nation which has the right to the resources.

With access to the resources, there also follows the right to establish environmental rules in the area. This is important in the vulnerable arctic environment, because if the prognoses for climate development is true, it might soon be possible to sail across the Arctic Ocean. The route from Europe to the Pacific is much shorter if it crosses the Arctic Ocean. So with this traffic and the expected exploitation of oil resources in the arctic, regulation of the environment will be important.

The Arctic Ocean is also an important area in a political sense, lying between the USA, Europe and Russia.

Rejection of the Russian application

Russia is the first country to claim a sea territory according to the rules of the UNCLS, so there is no precedent for the verdicts of the commission. Also, the Commission is not expected to give any reason for its decisions, so no one knows exactly why the Russian claim was turned down.

National comments on the Russian claims

Denmark and Canada said little when Russia made its claims. The two countries stated only that they needed to finish their own surveys in the Arctic Ocean, before they could make any comments. Norway said much the same, but mentioned that they have old disagreements with Russia about their mutual border, and the disputed border is used in the Russian claims.

The USA on the other hand had a great deal to say. In general, they stated that the interpretation of the geology in the Arctic Ocean is not a question of what the commission thinks. It is a question of what geological experts in general think.

The American answer to the Russian claims is that data are lacking. Russia only stated what area they wished to claim, not what data they used to arrive at these claims.

Second they stated that Russia cannot claim the ridge called the Alpha-Mendeleev Ridge, because it lies on a hotspot, and therefore cannot be a continuation of Russian bedrock geology. There are different theories for the formation of this ridge, some saying that it is in fact a mid-ocean ridge. But in any case, submerged volcanic ridges cannot be claimed, according to the UN convention.

Third, the USA considers The Lomonosov Ridge to be a "*freestanding feature in the deep, oceanic part of the Arctic Ocean Basin, and not as a natural prolongation of the continental margins of either Russia or any other state*". So, according to the USA, neither Russia nor Denmark can make any claims on it.

Data demanded by the commission
To find the rightful owner of the North Pole, the commission needs bathymetrical data, refraction and reflection seismic data, sediment cores and other data collected from the sea ice from ship, airoplane or satellite. This is the necessary backup for a convincing interpretation of the geology in the area. After these investigations a nation must work its way through a lot of calculations to find the maximum area this interpretation can give access to.

Denmark and Russia aiming for the North Pole. (Royal Arctic)

The results and interpretations are to be presented to the 21 experts on the commission. They put on their glasses, study the material and consider the arguments about the geology beneath the North Pole and its connection with one country or another.

Danish claims

In 2003 the Danish government earmarked almost 3 million euro for its national claims in the North Atlantic, based on the UNCLS. These claims are made on the behalf of Greenland and the Faeroe Islands, which are a part of the Danish Kingdom. Later, Denmark expects to use about ten times more money on the claims in the Arctic Ocean, including the North Pole.

Because of the costs of working in this area, Denmark is expecting to cooperate with Canada, which is also preparing claims in the Arctic Ocean. The two countries have not agreed where the mutual border will be, but Christian Marcussen from The Danish Geological Survey says that a median line might be suggested. This is how the other borders between the two countries have been decided. Germany also seems to be involved in the project. Although they have no claims in the region, they have a tradition of research in the Arctic Ocean.

Problems in the Arctic

"*The North Pole isn't an easy task*" says Christian Marcussen. "*The area is notorious for its weather and ice. It is impossible to move around up there without a polar icebreaker. We also have to consider the complexity of the geology of the artic basin*". The 14 million square kilometres of water surface covers several ridges, deep basins and extensive shelf areas.

"The bathymetric data from the area north of Greenland is limited, but we know that the USA and Russia have collected a great deal of data from submarines. So much data do exist" Christian Marcussen adds. Unfortunately most of these data are to some extent military secrets. Information on how it was collected is not released and for this reason the accuracy is unknown.

Geology of the Arctic Ocean

by Steen Laursen [1] and Louise Hakjœr [2]

The Lomonosov Ridge once made up the edge and slope of the north European and Asian shelf, but 55 million years ago it broke lose. Today it cuts through the deep part of the Polar Sea, but it is still attached to a shelf at both ends. For this reason this ridge may be the key to the resources of the central Polar Sea and the North Pole.

La chaîne de Lomonosof a représenté, pour un temps, la bordure en pente du bouclier nord-européen et asiatique mais, il y a 55 millions d'années, elle se mit à dériver. Aujourd'hui, elle traverse la mer polaire dans sa partie profonde, mais reste attachée au bouclier, à ses deux bouts. Pour cette raison, cette chaîne peut constituer la clef des ressources de la partie centrale de la mer polaire et du Pôle Nord.

La dorsal Lomonosov fue una vez el borde y talud de la plataforma Noreuropea y Asiática, pero hace 55 millones de años se desprendió. Hoy atraviesa la parte más profunda del mar polar, pero todavía está unida a la plataforma por ambos extremos. Por esta razón esta dorsal podría ser la clave para los recursos de mar polar central y el Polo Norte.

The Arctic Ocean is the least explored sea in the world, because of its extensive ice cover. There are no exact maps of the seabed of this ocean, and the geological models are built on limited data. Still we can get a reasonable picture of the structure and formation of this sea.

Basins and ridges

The ocean at the top of the world covers 14 million km^2, and covers the extensive north European and Asian shelf. The shelf of north of North America and Greenland on the other hand is narrower. The only direct connection from the deep parts of the polar basin to the rest of the World's oceans is a narrow strait between Greenland and the Norwegian island Svalbard. This strait also separates the shelf of North Europe and the shelf of Greenland and North America.

The deep part of the polar basin is divided into smaller basins by two or three ridges, of which the Lomonosov Ridge is the largest. This ridge crosses the basin from the border between Canada and Greenland, under the North Pole to the middle of the Siberian shelf. On the Canadian side of this ridge is the Amerasian Basin and on the European side is the Eurasian Basin.

The Eurasian Basin is itself divided in two by a mid-ocean ridge, the Gakkel Ridge, which is the northern termination of the Mid Atlantic Ridge. This ridge passes through the strait between Greenland and Svalbard. The Gakkel Ridge disappears under the sediments of the extensive Siberian shelf. This ridge was created when the European Basin opened 55 million years ago with the axis of opening lying between this shelf and its slope. The part involved was the shelves from Greenland to Europe and farther to Siberia. There is still seismic activity around this mid-ocean ridge.

The Amerasian Basin on the other side of the Lomonosov Ridge also seems to contain a mid-ocean ridge, The Alpha-Mendeleev Ridge. The exact shape of this ridge is uncertain and there is some uncertainty as to whether it is a ridge or the surface features of a hotspot. The magnetic structure in the ocean crust makes a rather complicated pattern, which is not common in the ocean floor near a mid-ocean ridge.

The formation and the age of the Amerasian Basin are uncertain. Christian Marcussen from the Geological Survey of Denmark suggests that it was formed between 90 and 130 million years ago.

The Lomonosov Ridge

When the Eurasian Basin opened 55 million years ago, its mid-ocean ridge formed at the edge of the North European and Asian shelf, the Barents-Kara Shelf. The shelf was then separated from its edge and slope, which now makes up the Lomonosov Ridge. During the next 55 million years the Eurasian Basin grew, and the geology of the Lomonosov Ridge was separated from most of the shelf it used to be part of. The sediments of the continents were replaced by oceanic sediments, which now cover the ridge with up to 500 m of deposits. Today the ridge is submerged under up to 2000 m of water.

But both ends of the Lomonosov Ridge seem to be attached to the shelf to which it once belonged. To some geologists it is fair to state, that the ridge is a continuation of the geology of Greenland and/or of Russia, though there is a narrow trough between the ridge and the shelf at either end. According to other geologists, these troughs are underlain by deep ocean floor and therefore not a continuation of any shelf.

Limited data

Unfortunately this picture of the Arctic Ocean is built on sparse data. The main problem is the extensive ice cover of the polar region, which can be many kilometres thick. Most of the existing data are collected by the naval services of the USA, Russia and the former Soviet Union, and the information, therefore, is partly or wholly classified. So although much data are available, the way they are collected is secret and therefore their accuracy is unknown.

For these reasons, many details are uncertain, such as the exact shape of the trough separating Greenland from the Lomonosov Ridge. But in the years to come many more details will be known, for precise maps of the Arctic Ocean and reliable geological models are a necessity for settling the rights to the resources of the Arctic Ocean.

A list of subjects of interest to the claims on the polar region can be found in the abstracts at the web-page of ICAM-IV meeting in Halifax, N.S., September 30 to October 3, 2003. www.icamiv.org/registration.html

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The Greek Ombudsman, environmental protection and enforcement of legislation:

the role of earth and environmental scientists.

by Constantine A. Antoniades[1] and Maria Apostolou[2]

Through its mediation work, the Quality of Life Department of the Greek Ombudsman, contributes to the administration's work to enforce environmental law and assure that the principle of "sustainable development" is applied. The GO has the right to recommend solutions for the resolution of specific problems and acts of maladministration. In a significant number of cases good knowledge of legal requirements in combination with technical experience in the earth and environmental sciences has proven to be a useful tool in detecting acts of maladministration. Particularly, scientists with expertise in earth and environmental sciences are vital when investigating environmental and technical problems. Otherwise, in-depth investigation is not possible. It is necessary that the administration adopts fundamental principles for environmental protection and applies, in every case, existing legislation

Par son intervention, le Département de la Qualité de la Vie - Service de la Protection en Grèce - participe aux efforts dispensés par l'Administration pour faire respecter les lois sur l'Environnement et pour s'assurer que le principe du *Développement durable* est appliqué. Le Service a le droit de proposer des solutions pour résoudre des problèmes spécifiques et cas de mauvaise administration. Dans un certain nombre de cas, une bonne connaissance de la loi combinée avec une expérience technique en Sciences de la terre et de l'Environnement a démontré son utilité en permettant la mise à jour d'actes de mauvaise administration. Les experts en Sciences de la Terre et de l'Environnement sont indispensables dans l'étude des problèmes techniques et environnementaux et garantissent une investigation en profondeur. Il est impératif que l'Administration adopte les principes fondamentaux qui régissent la protection de l'Environnement et applique, pour chaque cas, la législation existante.

A través de su trabajo de mediación, el Departamento de Calidad de Vida del Defensor del Pueblo Griego, contribuye al trabajo de la administración para aplicar la legislación ambiental y garantizar que se aplica el principio del "desarrollo sostenible". El DPG tiene el derecho de recomendar soluciones para resolver problemas específicos y actos de mala administración. En un número significativo de casos, un buen conocimiento de los requisitos legales en combinación con experiencia técnica en las ciencias de la Tierra y del Medio Ambiente ha demostrado ser una herramienta útil para detectar actos de mala administración. En especial los científicos con experiencia en las ciencias de la Tierra y del Medio Ambiente son vitales cuando se investigan problemas medioambientales y técnicos. De lo contrario no es posible realizar una investigación en profundidad. Es necesario que la administración adopte los principios fundamentales en la protección del medio ambiente y aplique en cada caso la legislación existente.

The Greek Ombudsman (GO) has responsibility for five departments: **1)** The Citizens' Rights Department, **2)** The Social Welfare Department, **3)** The State – Citizens' Relationship Department, **4)** The Quality of Life Department and 5) the Childrens Rights Department. The Quality of Life Department deals with complaints concerning the protection of natural and urban environment and, in general, investigates cases involving land use, urban planning, public works and construction of large-scale projects (highways, dams, etc.) and culture. In a significant number of cases good knowledge of legal requirements in combination with technical experience in the earth and environmental sciences has proven to be a useful tool in detecting acts of maladministration. These acts may occur during the decision-making process but in many cases are observed through the results they impose (e.g. impacts on wetlands caused by construction, illegal embankments, insufficient environmental protection measures, etc.). Over the last five years the Quality of Life Department has investigated several complaints pertaining to illegal acts and adverse environmental impact. The findings, which are periodically published by the Department, clearly indicate extensive and serious violations of environmental legislation, particularly in ecologically vulnerable areas such as those included in the NATURA 2000 Network or the RAMSA convention. Law 2477/97 that was revised witnh law 3094/2003 provides the GO with special authority and force when dealing with issues related to the protection of the environment, or when

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[2] Junior Investigator at the Quality of Life dpt. of the Greek Ombudsman, political scientist and public administration specialist.

illegal acts are evident. The recent revision of article 24 of the Greek Constitution establishes the right of the individual to the environment and the principle of sustainable development. These new additions to the Constitution significantly extend the Ombudsman's capacity to investigate and mediate environmental matters.

Through its mediation work the Quality of Life Department contributes to the administration's work in order to:

- Achieve the delicate but crucial balance between the right to the environment and the right to property (in particular in connection with land use) as required by law and the Constitution.
- Clearly specify essential concepts and rules contained in national and community (European Union) legislation on the environment.

It has been demonstrated that many citizens' complaints can be adequately addressed only if the decisions of the administration are seen to comply with legal and technical requirements. On-site inspections and verification of the technical information provided by the administration are important tools in the investigation of complaints. In many cases it is found that:

- Planning procedures are not "legally correct" and lead to technical solutions that have significant impact on the environment.
- Planning procedures are "legally correct" but lead to technical solutions that have significant impact on the environment.
- Planning procedures are "legally correct" and technical solutions proposed are generally acceptable but the administration has not taken the time, or does not have the ability, to effectively educate the concerned citizenry.

In addition to recommending solutions for the resolution of specific problems and acts of maladministration, the GO has the right to recommend legislation (for example the need for monitoring).

Case studies

While investigating complaints related to environmental problems a number of issues were revealed. For example, the absence of an environmental management programme that includes appropriate legal mechanisms and regulatory frameworks, the lack of application of nationwide and long-term planning, as well as the need for effective coordination and the effective participation of local authorities. In many cases the administration did not enforce legislation concerning environmental protection even though serious violations were reported and verified. Some typical violations are:

- Construction activities did not address environmental impact or took no measures to protect the public from potential accidents.
- Existing industrial units had no permits, environmental protection plans nor monitoring programme.
- New activities, such as the construction of an industrial unit, did not comply with proper procedures, were not located appropriately, and did not properly organize and apply an environmental protection program.
- No monitoring of environmental conditions was performed.
- In many cases Environmental Impact Studies (EIS) and related studies were falsified to indicate no impact from an activity or to support pre-determined decisions for the location of an activity.

During the last five years (1998-2002), the Quality of Life Department received 9,265 complaints accounting for approximately 22% of all complaints submitted to the Authority. Of these cases, approximately 20% referred to environmental issues.

Representative cases investigated by the Quality of Life Department

1. Pollution of the environment from liquid fuel tanks in Mytilini

This case deals with the adverse environmental effects of large liquid-fuel tanks on Mytilini, an island in the north-eastern Aegean Sea. In addition to pollution from tank leakage and inappropriate waste handling, it was confirmed that environmental pollution was increased by the burial of toxic waste from the facility. In 1997 and 2001 the Council of State (decisions 4633/1997 and 4141/2001) invalidated the two joint decisions of the responsible ministries concerning the approval of Environmental Conditions for the storage facility. As stated in the decisions "... installation and operation of tanks for the storage and transport of liquid fuel cannot be allowed within the area in question..."

When citizens filed a complaint at the beginning of 2000, the Ombudsman repeatedly requested the regional government and the Ministry of Environment, Land Planning and Public Works to immediately address these serious problems. The GO also expressed the opinion that apart from the removal of these facilities, a further examination of environmental conditions was necessary, including surface water, groundwater and soil sampling analysis.

After this request a study compiled by private individuals in the area where toxic waste was buried confirmed the existence of polluting substances in the subsoil below the facilities. However, when senior technical investigators from the office of the Ombusdman reviewed the submitted report and data it was discovered that samples were not collected from areas with significant indications of impact. In addition, only surface water and shallow underground water were sampled and analysis was not performed for the full list of contaminants. Therefore, further investigation was requested.

Facility officials stated that it would not be a good idea to seal them, since this would disrupt the island's fuel supply. Furthermore, they believed that there is no reason to investigate environmental conditions in the area in question since their estimate is that other sources may contribute to pollution in the area.

It took seven years since the publication of the first decision of the Council of State and almost three years from the Ombudsman's intervention, for the regional government to seal the facilities, in December 2002. The island's fuel supply has not been disrubted and state officials confirmed that the tanks would be relocated within the next six months. Based on the above facts and arguments, the Ombudsman referred the case to the district prosecutor. To date, the local governor has been charged and summoned to court for violating the environmental protection law and for not performing his duties adequately. The GO will continue its intervention until the facility is removed and the environment is remediated.

2. Illegal permit for the operation of a stable within a protected area

Citizens submitted a complaint claiming that local authorities (the prefect governor and the city mayor) issued a permit for the operation of a stable next to a lake within the region of a significant river delta, which is a protected area under the RAMSAR convention (Northern Greece). The permitting agencies did not consider the existence of the lake and issued an incorrect verification of the distance of the facility from city limits. In addition, no measures for the protection of the environment (waste handling, etc.) were taken.

Following the citizens' complaint, the GO requested local authorities to justify their acts. They denied the existence of the lake and claimed that no impact to the environment is expected. It was verified that the legal procedure for obtaining a permit for the operation was not followed. Senior investigators from the office of the GO collected existing data and performed an on-site visit, observing several problems.

The facility is next to the lake (approximately 100 meters), situated on lake-bottom or coastline, due to illegal artificial drainage of lake-water. An illegal dam was constructed to prevent lake-water from covering the surrounding area. Sandy sediments comprise the facility area and a shallow groundwater aquifer is present. This aquifer is connected to the regional aquifer as well as the lake and river water. Environmental impact is visible in the form of stressed vegetation, eutrophication (water bloom) of lake-waters, and visible pollutants on the lake water surface. It appears waste and chemicals used for agricultural purposes are directly disposed in the ground and lake water. From geomorphological indications and older maps it was verified that a few smaller lakes, within the same region, were illegally drained and used for agricultural purposes.

The investigation by the GO concluded that there were several illegal administrative acts and the facility must be removed. In spite of this, the local government did not comply with the recommendations of the GO. The Ombudsman's report was sent to the prosecutor while citizens petitioned the State Court to cancel the administration's decisions. To date the stable owners have been convicted twice for illegal operation of the facility and the prefect governor has been charged and summoned to court for violating the environmental protection law and for not performing his duties adequately. Senior technical investigators reports were utilized by the State Court and all relative administration decisions were recinded. The facility has still not been demolished although livestock is being moved to another location.

3. Creation of dangerous conditions along a country road due to illegal mining activities.

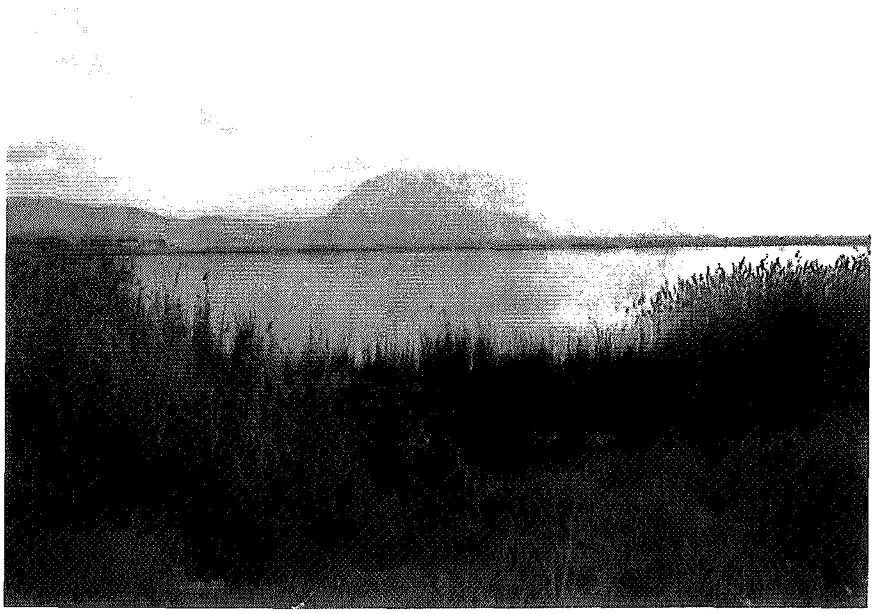
Citizens complained that due to illegal mining, a vertical slope was created adjacent and downgradient from the main road leading to their village. They claimed that the road was dangerous and could collapse at any time. The GO requested a geological and geotechnical study to investigate the claim. The administration denied that the road was dangerous and did not perform the requested studies. GO investigators performed an on-site visit, collected geotechnical information (bedding, joint and slope dip, and dip direction) and evaluated the slope stability. From on-site observations and data interpretation, it was estimated that there is a significant possibility of road subsidence. It was also estimated that at some locations along the road, rock fall and sliding are a strong possibility. It was requested that part of the road above the vertical slope be rerouted while protective measures for slope stability should be undertaken at other locations. The road was not rerouted, but protective measures were implemented.

4. Destruction of a protected wetland area (Fig. 1)

The area of interest is located in western Greece and is in the NATURA 2000 network and protected by the RAMSAR convention. Many of the issues referenced in the citizen's report could only be verified by an on-site visit and knowledge of the specific conditions of the area. GO investigators collected all available data and performed an on-site visit. The general problems observed include artificial drainage of the wetlands in the area, a decrease of material transported by rivers, and the intrusion of fresh water, via pumping stations, that has significantly altered the hydrological and geological conditions. In addition, disposal of sewage (municipal/industrial waste) and illegal embankments have destroyed and polluted extensive areas of the wetland. It was verified that:

1. National and European legislation was violated and not enforced on third parties by the administration.
2. Illegal embankments (backfilling of extensive areas) exist within the wetland and coastline areas. Some of these were used to house containers used to shelter a population of Roma (European gypsies) (Fig.2). The municipalities were granted a significant amount of money to shelter the Roma.
3. Responsible authorities considered the above-mentioned illegally created land as public! It was therefore registered by the public real estate agency as property of the state.
4. Municipal waste disposal is performed at many areas along the coastline and within the wetland with visible impact to the environment, ignoring procedures. Numerous buildings and constructions have been created along the coastline. The public electric company has already powered these illegal constructions.
5. Sewage is disposed directly in the wetland in many areas, with visible impact to the environment.

The protected wetland area



Roma encampment on the wetland site

The GO contacted all involved parties and has sent a total of 13 letters to date, requesting immediate protection and restoration of the affected areas and pointing out the urgent need to apply National and European environmental law for the protection of the area according to the RAMSAR convention and the NATURA 2000 92/43 directive. The prosecutor was also informed about the findings of the investigation.

To date, municipal waste is still disposed within the protected area and the new municipal landfill has not been constructed. The real estate agency claimed that the area was not a result of illegal embankment, but was created due to a fall in sea-level and the mayors requested that government exclude the area from NATURA 2000 and the RAMSAR convention!!

The problem has not been resolved and therefore the office of the Ombudsman will continue its mediation and investigations.

Findings – Recommendations

The collaboration of scientists within the GO has proved to be successful in the investigation of complaints. Particularly, scientists with expertise in earth and environmental sciences are vital when reviewing reports concerning environmental and technical problems. Otherwise, in-depth investigation is not possible. State and local authorities share the responsibility of applying the relative legislation. It is necessary that the administration adopt fundamental principles for environmental protection and apply existing legistlation. In many cases the GO had to intervene as a substitute for the responsible authorities, request the application of law, and provide technical support for a variety of issues. Wherever the letter of the law leaves room for interpretation, authorities should respect the spirit of recent constitutional revisions. Administrative authorities should not be allowed to claim the overused excuse that they lack the necessary resources for effectively monitoring environmental conditions. In addition to national action, remediation of impacted areas must become a priority of state and local government and the principle of "the polluter pays" to prevent and remediate must be utilized.

The main problems recorded from the complaint investigation are the following:

1. When evaluating and processing the data comprising EIS reports, many environmental problems are not considered, mainly due to the lack of multidisciplinary scientific collaboration.
2. Sometimes EISs are performed very slowly and therefore are completed only after the project has been concluded.
3. In large-scale projects the cumulative impacts are not accounted for, and failure to evaluate and present alternative development plans is a common phenomenon.
4. State and local authorities tend to simplify procedures and overlook legal requirements in order to fast-track development and investment initiatives.
5. Many problems occur because nationwide planning is not achieved and as a result, activity locations are "pre-approved" without a complete EIS. This means that even though the impact of the project is not assessed the project location is approved and the EIS "must" confirm that the location is suitable. Thus, alternatives are not evaluated and, in many cases, scientists performing EIS must "fit" data to approve the location and conclude the "Finding Of No Significant Impact". This is done so that the project is not cancelled and the investment money is not "lost".
6. Continuous monitoring of site conditions has not been performed in any of the cases investigated by investigators of the Greek Obudsman's office. Data (chemical analysis of soil, surface

and groundwater samples) indicating site conditions for existing plants or facilities are not available and are not presented in the EIS reports.

In order to contribute to the integrated protection of the environment, a number of recommendations are presented within GO reports:

1. Modify relative laws so that EISs are required for facilities located in industrial zones, mining areas and army activities-facilities.
2. Enforce legal requirements for continuous monitoring and collection of samples for chemical analysis. Describe the procedure and provide the technical information necessary to perform monitoring and remediation activities.
3. require sufficient EISs during the "pre-approval" procedure so that alternative locations are considered
4. EISs should conclude only after the thorough examination of all available and collected data (assuming that they are adequate), including "worst case scenarios". Scientists should be conservative in their estimates and interpret the relative laws towards the protection of the environment. Also, they should not be subject to interventions from other interested parties.
5. The main purpose of EISs is the achievement of *sustainable development* and therefore, it is important to evaluate the cumulative impacts of the project. Impacts of the various projects should not upset the balance between development and nature.
6. Perform EISs along coastlines for all activities. These require the collective efforts of chemical, hydraulics and civil engineers, hydrologists, biologists, geologists, agronomers, cartographers, and agricultural scientists.

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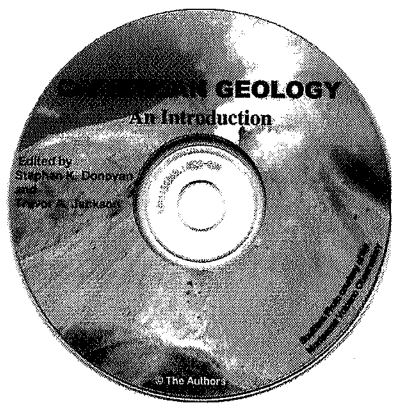
Caribbean Geology: an introduction

CD review by David Harper



Available from Professor Trevor Jackson, The University of the West Indies, Mona Campus, Kingston 7, Jamaica: at US$45 (including postage).

The geology of the Caribbean is diverse and fascinating. Here, the widely-differing disciplines of geophysics, palaeontology, petrology, sedimentology and tectonics meet to chart the evolution of one of the world's most active, interesting and intensively-studied basins. The printed version of 'Caribbean Geology: An Introduction' has served as a key reference source and the standard student textbook for the region for nearly ten years. Three general chapters on, respectively, geological provinces within the Caribbean, evolution of the Gulf of Mexico and the Caribbean, and the Caribbean seafloor, are followed by 12 regional chapters; here, the geology of the main Caribbean islands is described together with relevant parts of Central and South America. The detailed content of the book has already been reviewed elsewhere (Harper, 1996). It is an indispensable guide to the geology of the greater Caribbean region, well illustrated with a large variety of maps, sections and stratigraphical columns. Not surprisingly the book is now out of print. Rather than provide a reprint of a paper second edition, the editors have opted to go electronic.

The book has been scanned and the original edition is now available on CD. The book has been reconstructed as a single file and the CD includes Adobe Reader. The text and diagrams are clear and of course the facility is available to rapidly search the book for keywords. The editors intend the CD to act as the basis for an electronic second edition within the next 12 to 18 months. The current CD is nevertheless an excellent substitute for the hard copy, providing a perfect addition to any laptop.

Reference

Harper, D.A.T. 1996. Book Review: Caribbean Geology: An Introduction, edited by Stephen K. Donovan and Trevor A. Jackson. University of the West Indies Publishers Association. 289 pp. Geological Journal 31, 197-198.

H.R.H. Felipe de Borbón, Prince of Asturias appointed Honorary Geologist by the Ilustre Colegio Oficial de Geólogos.

The distinction of Honorary Geologist was conferred during an audience given by Prince Felipe to a significant representation of the ICOG, last 10th September 2003 which took place at the Zarzuela Palace in Madrid. The President of the ICOG, Mr Luis Suarez, in his speech thanked the Prince of Asturias for the audience and explained the reason for his nomination as Honorary Geologist. The Secretary of the ICOG, Mr Manuel Regueiro, read out the minutes of the General Assembly where the nomination was approved. The President also handed the Prince of Asturias a silver plate with an engraved remembrance of the act, and an extraordinary fossil fish in a wooden frame.

HRH Felipe de Borbón in his replying speech thanked the ICOG for his nomination and said that he felt part of the geological community and praised the great professional activity carried out by all geologists in Spain.

Prince Felipe, centre front, flanked by ICOG officials

Delda

"Best Practices," a dangerous term

by EurGeol. David M. Abbott, Jr., [1]

The term "best practices" increasingly appears in the geoscience literature. For example, the term caught my eye in the title of an abstract for the 2003 AAPG Annual Meeting in Salt Lake City. I dislike the term "best practices" for three reasons. First, the so-called "best practice" is not always the best in all cases. Second, evolving technology allows for improvements in practice so that what might be the "best practice" today will not be the best practice tomorrow. And third, in the litigious American society, failure to use a "best practice" because of reasons one or two can get you into legal hot water if the practice you used, which really was the best for the situation in question, wasn't a published "best practice." "Best practice" cannot be a substitute for professional judgment but that isn't the way litigating lawyers like to view things.

Not the best in all cases

The problem with "best practices" and prescriptive standards is their underlying assumption that all situations are the same. The earth is neither homogeneous nor isotropic. Furthermore, the answers sought may differ and therefore the "best practice" may not be applicable. Professional judgment is needed to determine the appropriate method for the job at hand.

For example, when I was a U.S. Securities and Exchange Commission geologist doing field examination on mining fraud cases I had neither the time nor budget to conduct conventional sampling programmes. The usual question I was trying to answer was whether there was any basis for claimed reserves. I would therefore identify and sample the richest portion of the deposit. I took a high-graded sample, which is definitely not acceptable practice when determining the average value of a deposit. However, when the "high-grade" samples thus collected were analyzed and were found to contain very modest amounts of the valuable material at best and had considerably lower values than touted, I answered the question I was asking.

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Consulting Geologist Denver, Colorado, USA

As another example, fire assaying is generally recognized as the preferred method of quantitatively determining the precious metal content in geologic materials. However, John H. Wells' Placer Examination: principles and practice (1973, US Bureau of Land Management Technical Bulletin 4) contains a section "Fire Assay of Placer Samples-Misleading Results" that correctly points out that fire assaying is inappropriate for determining the precious metal content of placer deposits because fire assays recovery and report quantities that cannot be recovered using conventional placer recovery methods. Actually, the problem exists for all deposits because 100% of the contained metal is never recovered and allowances for recovery losses must be incorporated.

"Best Practice" standards uncritically applied can produce rubbish. Herbert C. Hoover, one of the better mining engineers of the late 19th century, wrote, "No engineer can approach the prospective value of a mine [the value in addition to reserves or for properties with no reserves] with optimism, yet the mining industry would be non-existent to-day were it approached with pessimism. Any value assessed must be a matter of judgment, and this judgment based on geological evidence. Geology is not a mathematical science, and to attach a money equivalent to forecasts based on such evidence is the most difficult task set for the mining engineer. It is here that his view of geology must differ from that of his financially more irresponsible brother in science." (Principles of Mining, 1909, p. 21).

As an example of the point, consider the following example regarding foundation testing. The Denver metropolitan area has many areas where swelling clays have or can cause extensive foundation damage if the potential problem is not identified and appropriate ameliorating steps taken. The "standard practice" has been to drill vertical test holes within a new development to test the soils and shallow bedrock for swelling characteristics. Figure 1 illustrates the practice with a drill grid and various horizontal layers with differing engineering properties. This practice works well in most of the Denver metro area because the soils and rocks are subhorizontal in most places.

However, near the mountain front, the abrupt change from the Great Plains to the Rocky Mountains is marked by steeply dipping strata and application of the standard method of vertical test drilling to identify swelling soil problems fails miserably. Figure 2 provides a simple illustration of the problem. Here a relatively narrow but steeply dipping layer of swelling clay crosses the drill grid but drilling fails to penetrate the swelling clay and so its existence is undetected and unknown, at least within the relatively small area drilled. Examination of the regional geology would clearly reveal the steeply dipping nature of the strata in the area, and the occurrence of bentonites within various Cretaceous shales has provided marker beds for Rocky Mountain-area correlations for years. As shown in Figure 2, blind application of the "standard" vertical drill tests can produce meaningless results. (This example was included in "Professional Ethics & Practices" column 19, The Professional Geologist, June 1997)

Evolving technology

Another problem with "best practice" is that technology changes. Formerly, surveying with transits or plane tables was required to provide high accurate locations for points of interest, like lease and well locations. Today's high quality GPS systems have changed that. The techniques of chemical analysis continually improve in precision (although the accuracy of the precise result depends on the representativeness of the sample and its preparation). Statistical analysis of thousands of samples occurs almost instantaneously and modern spreadsheets compute with far greater precision than mainframe systems could a decade ago. Computer software now produces cross sections and 3D diagrams that formerly took days or weeks to draft. Seismic processing techniques continue to improve. Therefore what constitutes "best practice" changes with technological advances. Keeping the "best practice" standards up to date presents a continual challenge.

Related to evolving technology is the evolution of geological concepts. Many of us started our geologic training prior to the development of plate tectonic theory and its application to petroleum exploration. Remember Marshall Kay's 1951 GSA Memoir 48, North American Geosynclines (which GSA reprinted in 1971)? Concepts in stratigraphy have similarly evolved from the focus on vertical successions with most time lines being parallel to formation boundaries. The erroneous nature of this concept was demonstrated by such well-known papers as R.J. Weimer, 1960, Upper Cretaceous stratigraphy, Rocky Mountain area: AAPG Bull, v. 44, p. 1-20, and L.L. Sloss, 1963, Sequences in cratonic interior of North America: GSA Bull, v. 74, p. 93-114. We then focused on environments of deposition and facies mapping. Then came high-resolution stratigraphy. More recently, sequence stratigraphy was developed by R.M. Mitchum, P.R. Vail, and others. R.J. Weimer's 1992 Presidential Address, Developments in sequence stratigraphy: foreland and cratonic basins: AAPG Bull, v. 76, p. 965-982, reviews many of these developments and their related contributions and problems. Today, basin-centered gas is a big deal, but are these accumulations truly different, or are they simply old-fashioned structural and stratigraphic traps that happen to be located in basin centers?

Failure to use the "best practice" as a legal tar pit

The ultimate problem with "best practices" is that attorneys challenging your work for the opposing side like to consider a "best practice" as something set in concrete that must be rigidly adhered to. Failure to do so "obviously" constitutes incompetent practice. By calling a methodology a "best practice," we are inviting ourselves into a tar pit of legal problems that could be avoided by not adopting "best practices" terminology in the first place. This is particularly true when the description of a particular "best practice" fails to include statements about its limitations.

Failure to recognize and describe such limitations can be viewed as a form of scientific dishonesty. As C.P. Snow observed in The Search (1959), "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." How many practices are applicable in all situations without limitation? I'll acknowledge that a particular practice may be applicable 95% of the time. But it is important to recognize that in the other 5% of the cases, the "best practice" is not the best way of doing things; indeed it may be inappropriate. Those are the cases that may be the most tempting for lawsuits because they are unusual. Allowance for professional judgment must be allowed for the exceptions.

Conclusion: no substitutes for professional scientific judgment

Unfortunately, the term "best practice" is all too common and I'm afraid increasingly used by well-meaning folks who have not recognized the consequences discussed above. Whether the so-called "best practice" is really applicable to the job at hand must be decided on the basis of professional scientific judgment. AIPG issued a Policy on the Exercise of Professional Judgment on March 31, 1998, which is available on the AIPG web site and in the Membership Directory.

When you decide to deviate from a published "best practice" for sound scientific reasons, you should describe in detail in your report what the so-called "best practice" is and why it was inappropriate for what you were doing and why the method you used was better.

Following the foregoing suggestion requires that you know that some one or some group has promulgated an applicable "best practice." Part of competent professional practice is keeping up with what is going on in your field(s) of practice. If you become aware that a "best practice" is being proposed, actively urge those proposing it to call it something else or at least include in the description of the proposed "best practice" that there may be instances when it may be inapplicable and that future developments may supercede it. This is our best defense against finding ourselves in the "tar pit" during cross examination.

This is a reprint of an article that appeared in The Professional Geologist, November 2003, p. 14-16. An earlier and somewhat different version of this paper was published in the DPA Correlator, July 2003, p. 10. I want to thank Hugh Hay-Roe for suggesting that this paper deserved a wider audience.

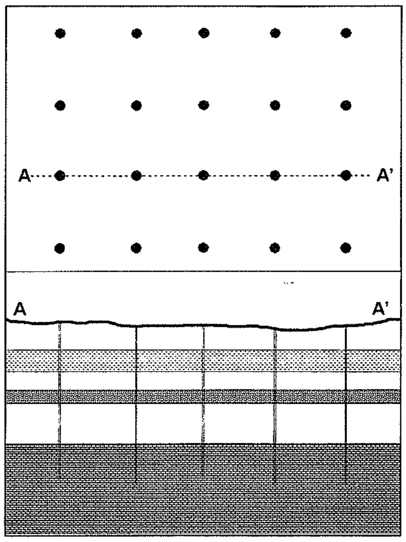
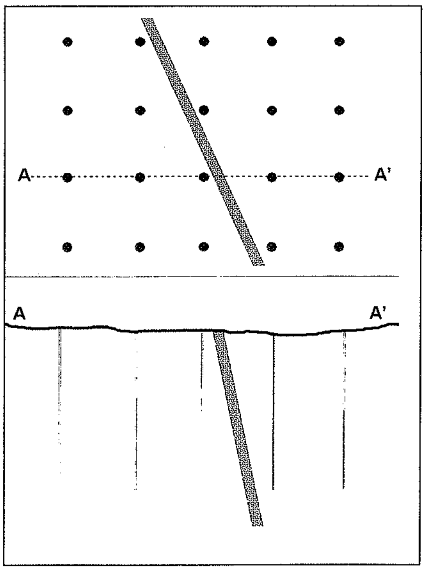


Figure 1. A diagramatic map of a drilling grid to test flat-lying layers with varying engineering properties and a related cross section. The grid shown is more regular than may be encountered in the field.

Figure 2. Diagramatic drilling grid identical to that in Figure 1. However, in this instance, a layer of steeply dipping swelling clay is undetected by the drilling, as illustrated on both the map and cross section.



Rejected? Only temporarily

by Stephen K. Donovan[1]

"He is despised and rejected of men; a man of sorrows, and acquainted with grief; and we hid as it were our faces from him; he was despised, and we esteemed him not." (Isaiah, 53: 2.)

Dear Contributor,

I am writing to inform you that, following peer review, your paper entitled "Plate tectonics and the away record of Leyton Orient F.C. 1947-1982" is not acceptable for publication in the *New Journal of Irrelevant Coincidences*. I realize that this will be a disappointment, and trust that any influence this decision may have on your present and future employment prospects will be manageable. However, I remind you that rejection of a research paper isn't necessarily an indication of its worth, but is at least in part a reflection of the ideas and prejudices of one or more peer reviewers and, ultimately, the editor. Their decision may be influenced by many factors, some of which may appear arbitrary to an observer. For example, a colleague once submitted a paper to a regional geographical journal, where it was rejected for being too geological; the same paper, submitted to the principal geological journal for the same region, wasn't accepted because it was too geographical.

Rejection of abstracts, essays, reviews, research papers, monographs and books is part of the culture of science, and happens at all levels. My own first rejection letter, which I wish I'd preserved, arrived about 40 years ago, when I was a schoolboy. My favourite boys' comic, *The Eagle*, had serialized Conan Doyle's *The Lost World*. Even in those days I felt that dinosaurs had too good a press and I wanted to redress the balance in a letter extolling my fascination with the most gargantuan of all mammals, the Oligocene *Paraceratherium*. The sentiment was real, the facts were accurate, but I suspect the style was poor, at best. The editor politely, but firmly, rejected my first 'paper.'

While nobody relishes having a paper rejected, there are many advantages to being the temporarily unsuccessful author of a paper in geology in 2004 rather than 1954. With so many journals in all fields within the Earth sciences, does rejection really matter when there is so much choice for resubmission? With the word processor it is all so easy. Examine the comments of reviewers, make those alterations you consider significant or at least worthy, change the format to that of a different journal and three copies can be in the post to the next editor on the same day. Fifty years ago, many of the journals which fill the library shelf – *Geology*, *Sedimentology*, *Tectonics*, *Terra Nova*, *Palaeontology*, *Marine Geology*, the list goes on and on – did not exist, so rejection was altogether more serious. There were fewer choices of journals, fewer potential reviewers in any given subject area and no easy way to turn a typescript around without having it retyped in the correct style. Now, with perseverance, even the dullest paper describing a minimal increase in our knowledge can look forward to publication somewhere. A struggling author can even buy from a range of 'how to' guides which demystify the publication process and give simple help on how to get into print (e.g., Luey, 2002); indeed, specialist volumes exist that deal solely with the problems of rejection (e.g., Baker, 1998).

Authors also need to recognize that rejection may be influenced by factors outside their control. For example, over the past few years, since citation indices, impact factors and their ilk became important to bureaucrats for the assessment of academic achievement, some of the leading journals have experienced a cumulative jump in annual submissions of up to 50 %. If the resources are not available to increase the number of pages published annually, then the only way that publication schedules can be maintained for any journal is by rejecting more papers. A paper good enough for acceptance in a given journal a few years ago may be rejected now for no other reason than there just isn't enough space.

As you will deduce from the above, I consider re-submission to a different journal to be a probable outcome of rejection. Few academic authors can afford the luxury of not publishing every paper that they write; an unpublished paper collecting dust in a filing cabinet is a wasteful extravagance. So, where should your rejected paper go next? Our perceptions of the scientific literature are maintained by details such as local and international reputation, publisher, impact factor, publication time and number of free offprints, among others. Should your paper go to a journal that you perceive to be of greater or lesser reputation than the one that has already rejected you? I'm sure many authors favour the latter, assuming that going to a presumed lower position in the hierarchy might ensure publication. I would like to suggest the reverse position – a rejected paper should more logically be resubmitted to a 'better' journal than the one that rejected it. This is not a whimsical suggestion. The paper has already been critically reviewed by one or more experts in the field. Revision of your paper in the light of their comments should strengthen it. After revision, critically read the paper again. Your own understanding of the problem and/or the data may have matured or changed in the months since submission. Almost invariably, a paper that has been rejected and resubmitted will have been improved by answering criticisms by reviewers and also the author. In my experience, aiming higher the second time around commonly leads to success. If not, aim higher still on the third submission, but only after the most critical re-evaluation. Maybe there truly is something wrong with your paper. Whatever, if your paper is rejected, don't shoot the reviewer, just look for the editor who is willing to give your paper the attention it deserves.

Yours sincerely,

A.N. Editor

[1]Curator of Mesozoic Macroinvertebrates, Nationaal Natuurhistorisch Museum, Postbus 9517, NL-2300 RA Leiden, The Netherlands

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News and events 2003-2004

Germany and USA

Landslide Course

An introduction (video taped and narrated) consisting of 10 Power Point slides.

* Chapter 1 - Weathering, sediment and soil formation. Consists of 69 PP slides without narration.
* Chapter 2 - Strength of earth materials. Consists of 27 PP slides without narration.
* Chapter 3 - Landslides and slope stability analysis. Consists of 60 PP slides without narration.
* Appendix A - Effective stress, pore pressure and liquefaction. Consists of 7 non-narrated PP slides.
* Appendix B - Derivation of strength equations and the Coulomb-Mohr fracture criterion. Consists of 17 non-narrated PP slides.
* Appendix C - Consists of 5 non-narrated PP slides and covers:
Stability of infinite slopes in sand
Stability of infinite slopes in clay and maximum height of clay slopes
Stability analysis of slab slides
Technique for predicting the most likely slip surface
* Self-assessment questions - Consists of 4 PP slides.
* Exam (to obtain course accreditation) Consists of 25 multiple choice questions and 8 PP slides.
* A "textbook" consisting of a 38-page Word document that will be available as a PDF file.

All in all, the course consists of 207 Power Point slides plus the 38-page Word document. The introduction is video taped and narrated.

Access to the course will be granted by Professor Dr. Detlev Doherr and Mr. Mike Schilli of the University of Offenburg in Germany. The current version is available through: http://london.rz.fh-offenburg.de

Ireland

Kieran Harrington PGeo has been awarded the 500th EurGeol. title. He is a graduate of University College Galway and has worked as an exploration Geologist for Glencar mining in Ireland and Ghana.

Serbia and Montenegro

Conference

April 2004: Mediterranean Conference on Earth Observation (remote sensing), in Belgrade.

Organizers: Faculty of Mining and Geology, Remote Sensing Center, University of Belgrade, and Faculty of Civil Engineering, Univ. of Belgrade.

Topics are:
1. Acquisition of remote sensing data,
2. Processing of remote sensing data,
3. Application of remote sensing data,
4. Cooperation and education of Earth observation.

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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 150 words should be included in English, French and Spanish. Articles should be sent via e-mail to the Editor at Harper-mccorry@mail.tele.dk or on disc to Kaplevej 7, 2830 Virum, Denmark. Photographs or graphics are very welcome and should be sent to the Editor as tif or jpg files.

Deadline for submission 30 March and 30 September.

Advertisements

Prices for advertisements

	One Insertion	Two Insertions
Full page (colour)	820 Euro	1320 Euro
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Preferential location	25% plus	
Price for special pages:		
Outside back cover (colour)	1200 Euro	1900 Euro
Second page (colour)	1000 Euro	1600 Euro
Second last page (colour)	1000 Euro	1600 Euro

Data for European Geologist Magazine	
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7000 issues of European Geologist are distributed among professional geologists all over Europe. They are sent to the European countries National Federations of Geologists, and these national organisations distribute them to their members. These include geologists working in companies as well as at universities.

Layout of the magazine is made in Adobe Indesign for PC.

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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.