1998-1999

European Geologist

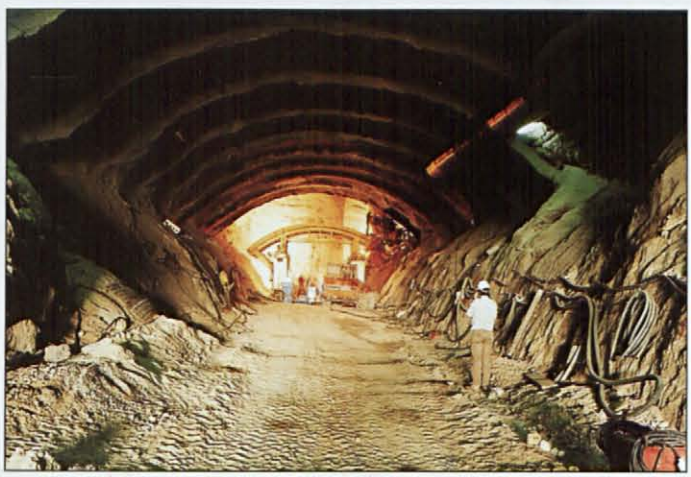
Revue de la Fédération Européenne des Géologues
Journal of the European Federation of Geologists
Revista de la Federación Europea de Geólogos

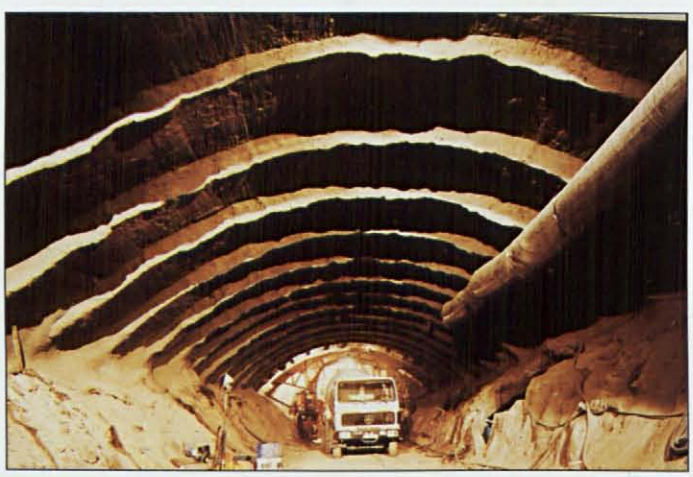
ARDITO DESIO'S 100 YEARS AND HIS LAST BIG PROJECT

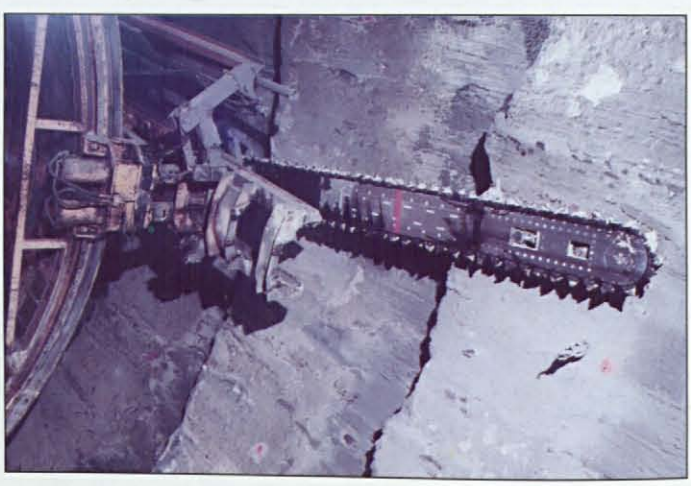
MIDGARDIA

THE APPLICATION OF GEOPHYSICAL LOGGING TECHNIQUES TO TUNNELING INVESTIGATIONS

TUNELES BAJO EL MONTE DE EL PARDO
EJECUCION DE LA PREBOVEDA (METODO PREMILL)







PRECORTE MECANICO

Pº de la Castellana, 130 - 6º
28046 MADRID
Tel.: 915 624 610 - 915 903 821
Fax.: 915 641 440 - 915 613 013

PREMESA
obras subterráneas

EUROPEAN GEOLOGIST

is published by the
European Federation of Geologists
«Maison de la Géologie»
77-79 Rue Claude-Bernard
75005 PARIS (France)
Tel: 33 (1) 47079195. Fax: 33 (1) 47079193
E-mail: efgparis@wanadoo.fr Web: http://efg.gsf.fi/
Eurogeopages: http://www.ykl.fi/eurog.htm

Officers
PRESIDENT
Prof. Manuel Regueiro y González-Barros
Instituto Tecnológico Geominero de España
Dirección de Recursos Minerales
Ríos Rosas, 23. Planta Baja
28003 Madrid (Spain)
Tel: 34 91 3495778. Fax: 34 91 4426216
E-mail: m.regueiro@itge.mma.es

VICE PRESIDENT
EurGeol Gareth Jones
Conodate International Ltd
7. Dundrum Business Park
Windy Arbour. Dublin 14. Dublin (Ireland)
Tel: 353 12965151 Fax: 353 12965152
E-mail: conodate@iol.ie

SECRETARY-TREASURER
Jukka Marmo
Geological Survey of Finland
P.O. Box 96
FIN-02151 Espoo (Finland)
Tel: 358 2055011. Fax: 358 2055012
E-mail: jukka.marmo@gsf.fi

PRESIDENT CGUE WG
Marianne Vasard Nielsen
Dansk Geologisk Forening
Elstedvaenge, 27
8520 Lystrup
Tel: 45 86222433 Fax: 45 86742433
E-mail: mvn.pka@po.ia.dk

EDITORS
Manuel Regueiro
Gareth Jones

ASSISTANT EDITORS
Laura Céspedes
& Natalia García

EDITORIAL BOARD
EurGeol Dr. Antoine Bouvier
CGG
1 Rue Léon Migaux
F-91341 Massy cedex (France)
Tel: 33 1 64473672. Fax: 33 1 64473986
E-mail: abouvier@cgg.com

Edmund Nickless
Geological Society
Burlington House, Piccadilly
LondonW1V OJU
Tel: 44 171 4349944 Fax: 44 171 4398975
E-mail: nicklesse@geolsoc.org.uk

Advertising & Subscriptions
M. Regueiro
Ilustre Colegio Oficial de Geólogos
Reina Victoria 8. 28003 Madrid. Spain
Tel.: 34915532403 Fax: 34915330343
e-mail: icog@icog.es http://www.icog.es

Printed by
Gráficas Summa, S. A.
Polígono Ind. de Silvota
Llanera. Asturias. Spain
Tels: 91 326 48 56 y 98 526 10 00

Depósito Legal: AS. 1.184-1995
ISSN: 1028-267X

Cover Pictures:
by Floriano Villa and Carlo Enrico Bravi
EGS SA

When one looks at the current situation in Central America after Hurricane Mitch, one can only shiver and maybe also consider the way to express solidarity to help relieve the population from part of its miseries. But one should also start thinking on a way to help to prevent the disastrous effects of these natural events which happened this time in Central America, but tomorrow, as we know, may affect any other part of the third world.

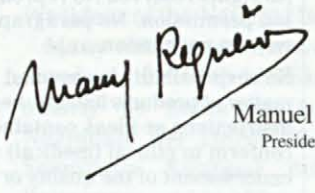
From our comfortable observation points, and with the help of our vast culture, we are often prone to make-believe that it is a matter of time and money, that the third world will upgrade to our level of welfare, but this is utterly impossible, as in fact those countries will never ever reach the development and standing of living that we possess. The reason for this statement is that the so-called developed countries have reached such a state after a specific history and a wealth of cultural heritage amalgamated in a mixture of races and countries. There was not a «developed» world then, we were in fact creating it. Now we are the developed world and the rest are not underdeveloped countries, they are wrongly-developed countries, and that makes a big difference. Seeing the objective through the media makes it desirable and creates corruption and higher differences between social levels in a particular country.

One of these wrong developments is precisely the lack of land-use planning. That same non-planning that has taken the lives of 10,000 in Central America, and has destroyed most of the infrastructure built with enormous effort. Many people were living in the wrong place and were unaware of the risks involved or of what to do in case of a strong hurricane.

It is also a matter of money of course, but in many cases planning is just a matter of education. A short visit to a site by an earth scientist – and a subsequent speech to the inhabitants to advise them and to change their dwelling habits might mean the difference between living and dying.

So, what can the European Federation of Geologist do about all this? I believe it is time to consider using our knowledge to help our fellow mankind in all those countries exposed to the «cholera of Nature», that is to say to Earth's natural behaviour. Maybe it is time to plant the seed for a new organisation «World Geologists» with volunteers from all around the world, to provide scientific advice, to search for water resources, to provide materials for local use, etc., etc., in those countries that need that expert advice and cannot pay for it. Such an organisation could be financed, like any other NGO, by a fund provided by international organisations and national governments, to carry out specific aid programs in the third world. If you are a geoscientist ready to help in this issue, contact the EFG and we can talk.

I wrote the above text last December. The NGO World Geologists was formally created by the Spanish Association of Geologists (ICOG) under the patronage of the EFG last february. Readers can find details inside this issue of the magazine.



Manuel Regueiro
President of the EFG

CONTENTS

Págs.

■ **Professional Geologists**
- Ardito Desio's 100 years and his last big project 3

■ **Interview**
- The last assignment 5

■ **Engineering Geology**
- Slopes and cellars – National Programmes in Hungary 7

■ **Geology**
- The Mono lake tufas & ikaite columns of Ikka Fjord 11
- Midgardia – A new name for the Mesoproterozoic supercontinent 15

■ **Geophysics**
- The application of Geophysical logging techniques to tunelling investigations..... 19

■ **Hydrogeology**
- The C.I.B.E. water supplier to the European capital, Brussels 27

■ **Petroleoum Geology**
- Technical data capture in geological and geophysical data management 31

■ **Environmental Geology**
- Extraction of mineral and the aquatic environment. Fields and size of the conflict in Poland..... 35

■ **Fiction Geology**
- Homeland..... 41

■ **EFG News** 47

■ **EFG**
- Member Associations 51

■ **Books Review** 58

■ **List of Advertisers** 60

■ **Geocalendar** 63

ARDITO DESIO'S ONE HUNDRED YEARS AND HIS LAST BIG PROJECT

LOS 100 AÑOS DE ARDITO DESIO Y SU ÚLTIMO GRAN PROYECTO

LES CENT ANS D'ARDITO DESIO ET SON DERNIER GRAND PROJET

by Floriano Villa and Carlo Enrico Bravi
ANGI. Via Cesare Battisti, 4. I - 20122 Milano. Italy

The geologist Ardito Desio has reached honorable age of 100 on April 18, 1997. He was born at Palmanova del Friuli on 18th April 1897 and very young he took part in World War One. He graduated in 1920 in Natural Sciences at the University of Firenze with a thesis on "Glaciale della Valle di Resia nelle Alpi Giulie" (Glacial Era of Resia Valley in the Giulian Alps).He became University Lecturer in Geology in 1927 and won the competition as Full Professor in 1931.

He held the chair of Geology at the University of Milan from 1931 to 1967; Professor out of the permanent staff from 1967 to 1972, he has been since then Professor emeritus at Università degli Studi in Milan. For years he lectured on Applied Geology at Milan Polytecnic for the students in Civil Engineering. Two generations of naturalists, geologists and engineers have studied on his book of Geology Applied to Engineering.

Besides more than 400 scientific publications, he wrote about 200 articles on newspapers and magazines. He promoted the Course for a Degree in Geological Sciences which he founded at Milan University in 1942.

Professor Ardito Desio is well-known in Italy and abroad especially as Geologist Explorer and particularly as the organizer and leader of the Italian Expedition for the escalade to the second world top, K2 (Karakorum Group) reached on July 31, 1954 by the two famous mountain-climbers Compagnoni and Lacedelli. Yet he had already reached exceptional results in his previous expeditions in Asia and Africa. In 1929 he took part in Aimone of Savoy's expedition to Himalaya, in high Baltoro, crossing in six months Shagsgam Valley and reaching the Mustagh Pass at 6000 metres. Immediately afterwards he started to explore Lybia and in 1931 he crossed Libyan Sahara with a big camel caravan; he then explored Cyrenaica, Syrtica, Fezzan and Tibesti, discovering first the existence of hydrocarbon in the Libyan subsoil and carried out the first geological map of the whole Libyan territory. Many were his expeditions to Karakorum, with the first geological maps on regional scale of that area and of Afghan Hindu Kush.

Professor Desio has always devoted great attention to Antarctic, with numerous programs created already in 1954, which were increased in the period he was President of the Italian Glacial Committee from 1967 to 1975, when he became Honorary President.

He invented and contributed to the realization of the Pyramid in Mount Everest for scientific and technological research.

It has also to be remembered his untiring work for the acknowledgment of the profession of Geologist and the foundation in 1948 of the Geologist National Association (ANGI) of which he is at present Honorary President.

Professor Ardito Desio.

Thanks to him in 1963 was enacted the institutive law of the Geologist Professional College (ORDINE NAZIONALE GEOLOGI ITALIANI - ONGI) and in 1969 he was the first President of the National Board.

Many manifestations were organized on his 100th birthday, particularly in Rome at Accademia Nazionale dei Lincei (important Scientist's National Board), in Palmanova and in Milan.

Everest's Pyramid. Detail.

EVEREST PYRAMID : history, structure and use

Prof. Ardito Desio founded the Ev-K2 CNR Project in 1987 when he was already 90 years old! The project was primarily adressed to studies connected with geology and geodesy.

In 1989 the Prof. Ardito Desio founded the Ev-K2 CNR Project in 1987 when he was already 90. The Italian National Research Council (CNR) and some italian private Companies gave the opportunity to support and enrich the Project with an alluminium and glass laboratory called "PYRAMID", due to its very peculiar shape.

The structure was initially to be installed on the Northern Slope of Mount Everest (TIBET). Political difficulties connected with the events of Tien An Men Square, suggested to shift the construction to the Southern Slope. Desio's diplomatic work was of most importance at this stage of the Project, including the agreement with Nepal Government.

Every part of the structure was man carried in a ten days long and difficult walk!

The PYRAMID measures 13,22 m (43,37 ft) at the base and 8,40 m (27,5 ft) in heigh - it is located in Mount Everest Khumbu Valley, at 5050 m (16,568 ft) above sea level.

The geometrical shape provides stability and resistance to natural elements, while the outer cover, with its reflecting glass, makes the structure perfectly integrated in the environment.

The PYRAMID is divided in three floors: ground and first floor for laboratories, third floor for the communication systems. Sleeping quarters are separate and take place in the southern part. They follow the Nepalese lodge style and can host up to 30 persons.

The PYRAMID is self sufficient, only uses renewable power sources (water, sun and wind) and has a waste disposal system.

Prof. Ardito Desio inaugurated it on 23rd October 1990....at the age of 93!!

The PYRAMID offers precious and unique opportunity for the studies of climatic and environmental changes, physiology and human medicine in extreme conditions, geology, geophysics and seismic phenomena.

Great importance has also beengiven to researches and innovations in Civil engineering, power production, electromedical instruments and technological communications.

Since the beginning of its history the Ev-K2 CNR Project had the patronage of the Italian Ministry of University and Scientific and Technological Research (MURST) and the Ministry of Foreign Affairs (MAE). It has developped with the contribution of NATIONAL RESEARCH COUNCIL (CNR) and the EUROPE COMMUNITY COMMISSION (CEE). The Project cooperates with many Institutes, Universities and Research Centres of the whole world. For any further information you can adress to:

LA PIRAMIDE SUL TETTO DEL MONDO - Bergamo - via Martiri di Cefalonia n. 4 - tel. 003935/247411 - fax 003935/240697.

THE LAST ASSIGNMENT

EL ÚLTIMO ENCARGO

LE DERNIER DEVOIR

by Ted Niels

The Geological Society. Burlington House. Picadilly. London. UK.

Gavrielle Groves-Gidney, 41, grew up in New York City and studied English and Linguistics at Fre-donia College before switching to Geology – in which she holds an MSc from the University of West Virginia.

She came to the UK in 1982, and has worked widely in the oil business, including Candecca Resources, Arco British, Union Texas Petroleum and DNO. She works as an independent geophysical consultant and technical editor as well as staff geophysicist for Exploration Geosciences.

Her work has taken her all over the world - a fact put to good use in her novel The Last Assignment (Angela Royal Publishers) which was published last year. Keeping one foot in the Graben

Gavrielle Groves-Gidney talks to Ted Nield about juggling her life as an exploration geophysicist with that of a successful novelist.

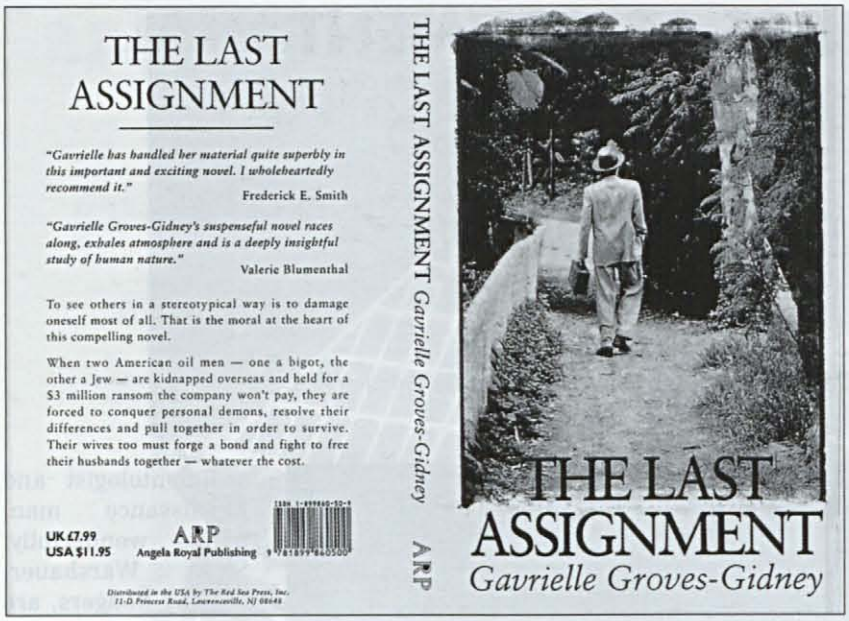
Ted Niels: *Gavrielle - There are not many geologist-novelists in the world. I know of three who have convinced someone to pay them for publishing their fantasies - and 66% of them are in this room. One thinks of novelists like C.P. Snow, who made something of a trade out of being a scientist, but most people would probably say that science and novel writing are poles apart. What's your view?*

Gavrielle Groves-Gidney: I don't think it's as bad as all that! There are quite a few scientist/novelists. Consider Isaac Asimov and Arthur C. Clarke. I think if you scratch under the surface you will see a great many artistic minds residing within the scientific community whether they are writers, musicians, poets, photographers, or painters. All great scientific minds encompass the artistic side as well, because inspiration whether it be 'breakthrough science' or 'art' comes from the same place. Have a look at Richard Feynman or Van Gogh's lives. This question of course raises another and that is whether Geology is really a science or an art - or encompasses both.

It is not unusual to find 'geologists' who have retired taking up places in creative writing courses or returning to their music, painting, or whatever. Robin Bathurst for instance, a marvellous Carbonate sedimentologist and Renaissance man, paints wonderfully. Steve Warshauer, Murray Rodgers, are oil company managers and fine musicians. The list goes on. To answer your question about geologist/novelists: no, I suppose there aren't that many - though geologists are renowned for their creative imaginations. Think about what geologists do: they observe, describe things in minute details, analyse their findings then take great leaps in faith and come up with their conclusions. This is totally compatible with creative writing, since the same process is necessary: except, perhaps, one turns left instead of right to do it.

TN: *You have written a novel about the dangers of closed thinking and stereotypical ideas. You are obviously concerned about racism and sexism as pernicious examples of such thinking. Scientists, too, are often the victims of stereotypical thinking. How do you think the novel can help the image of geoscientists with the wider public?*

GG: The Last Assignment is primarily about two American-born geologists who come into conflict with each other and then their environment. Under extreme pressure, they are forced to overcome their particular demons. In the book



I portray geoscientists as human beings trying to work with issues that trouble all of us, not as stereotypical mad scientists or logic machines. One must remember that when it comes to the geoscience community (particularly in the energy sector) the public thinks of us as part of the "corporate sector". If they have a negative image of that then they correspondingly have a negative view of us.

TN: *There are probably about as many female novelists as there are female geologists, even in the 1990s. Novel-writing has always been an accepted female pursuit. Your book has plenty of positive female characters, but no female scientists; why not? Or is this perhaps a question for the next book?*

GG: One of the women characters in The Last Assignment is a sociologist. Does that count? The book is partially about resolving conflict between men and dealing with their belief systems. If I had put a woman geoscientist in the same situation with a man, the story would have been completely different.

TN: *The males in your book are emotionally stunted to the point of stereotypes themselves. But you give an accurate picture of the blokish world that geology can be. Do you think that women have more trouble in geoscience as a career than they do in life in general? Are there extra obstacles, do you think, because of the machismo of the geological world?*

GG: Here is where I disagree. I do not feel that my male characters are stunted emotionally. I think they have come to a critical juncture where their survival depends upon them figuring out what stops them from being open and loving human beings. We should all do that. Unfortunately it usually only happens in life-threatening situations.

As for geology being blokish... I guess because I've always worked in so-called male dominated industries... it doesn't strike me as more or less blokish than any other field. In fact, my experiences offshore have been remarkable in the sense that I always felt that people believed I was there to do my job, and no-one interfered or created problems.

Surprisingly enough, if I was having a hard time it was always my male colleagues who would become distressed and inform me that I was experiencing sexism! My own view was that the person causing the difficulties did so for either professional reasons or ones of personality conflict. I suppose that had I not opted out of the career path in big industry I would, perhaps, be more aware of limitations. But perhaps not. You never can tell in this life.

TN: *In portraying life on an exploration rig, and in discussing the work of the geologists in your book, you have had to simplify quite a lot. There are those in the business who may scoff at what you have written for that reason. This is a neat parallel to the abuse that science popularizers sometimes get from scientists. How would you answer those who might accuse you of portraying the oil business in too simple a way?*

GG: If you're writing fiction you have to sacrifice a certain amount of the technical detail. There is no doubt about that. Remember always who the audience is. However I was on the well-site in Bangladesh referred to in the book, and I have been in the oil industry for over fifteen years working as a geologist then an interpretation geophysicist: so I would hope that whatever details I've put in are spot-on. But the book is not about the oil industry itself – it's a backdrop against which the crisis can be acted out. However, I was still making points about how the industry behaved in the 1980's.

On social and environmental issues, their record was not good. Companies were laying people off willy-nilly, and because of the lack of employment opportunities elsewhere, if you were stuck with a manager who had it in for you, no one above was going to help. I know - I was there myself. Perhaps things have changed now, perhaps not. Anyway, many geoscientists have now read The Last Assignment and they seem quite happy with my portrayal of the business.

TN: *What are your plans - is there another oil novel in the pipeline (sorry)?*

GG: I'm currently spending about 60% of my time doing technical work in different parts of the world. The other 40% is spent writing. I've just finished a novel, but that doesn't take place in the oil industry. However, the following one - which I'm a third of the way into - is about a woman geologist who gets into trouble on a gas condensate well in the Central Graben.

TN: *Well, it's good to know you can write as much as you do, and still keep one foot in the Graben.*

SLOPES AND CELLARS - NATIONAL PROGRAMMES IN HUNGARY

LOS PROGRAMAS NACIONALES HUNGAROS SOBRE TALUDES Y BODEGAS

LES PROGRAMMES NATIONAUX EN HONGRIE CONCERNANT LES GLISSEMENTS DE TERRAIN ET LES EFFONDREMENTS

by Tamás OSZVALD and Tamás HÁMOR
Hungarian Geological Survey, 1440 Hungary, Budapest P.O.B. 17

Summary

Hungary faces severe geotechnical problems caused by natural and human erosion of the landforms of the Neogene sediments which constitute a great deal of its surface. Notably slopes constructed in loess of rhyolitic tuffs and the wine cellars excavated in these materials, have produced failures that threaten the safety and wealth of 350 000 inhabitants in ca. 200 settlements and public railways and roads. The authors review the first results obtained from the slopes and cellars failure prevention programmes in which the Hungarian Government has invested 2,3 and 3,2 mUS$ respectively.

Resumen

Hungría afronta graves problemas geotécnicos causados por la erosión natural y antrópica de las formas del relieve de los sedimentos neógenos que constituyen una gran parte de su superficie. En especial los taludes realizados en loess de tobas riolíticas y las bodegas excavadas en estos materiales, han producido colapsos que amenazan a 350.000 habitantes en casi 200 poblaciones y a los ferrocarriles y carreteras públicas. Los autores repasan los primeros resultados obtenidos de los programas de prevención de fallos en taludes y bodegas en los que el Gobierno Húngaro ha invertido 2,3 y 3,2 M$USA respectivamente.

Résumé

La Hongrie fait face à de graves problèmes géotechniques causés par l'érosion naturelle et anthropique des reliefs constitués par les sédiments du Néogène qui occupent une grande partie du pays.

En particulier, les pentes constituées de loess à base de tufs ryolitiques et les caves à vin creusées dans ces matériaux sont à l'origine des effondrements qui menacent la sécurité et les biens de 350.000 habitants touchant, à peu près, 200 communes ainsi que le réseau de voies ferrées et de routes.

Les auteurs exposent les premiers résultats à mettre au compte des programmes de prévention des glissements de terrain et effondrements pour lesquels le Gouvernement hongrois a investi respectivement 2,3 et 3,2 millions de USD.

The area of Hungary covers the central part of the Pannonian Basin, a deep Neogene basin filled with loose, unamalgamated Miocene, Pliocene and Quaternary clastic sequence. This general geological setting is reflected in the geomorphological facies of the country, huge plains cut by rivers and interrupted by gentle hills. Despite this overall depocenter-type class of the basin, Hungary has to face severe egineering geological problems caused by natural and human erosion of the landforms of Neogene sediments. These loose sediments, sensible of erosion, build up the high, right bank of the Danube river and the 10-50 m high unstable slopes along the northern shoreline of Lake Balaton.

In many regions of Hungary slopes of lower height developed along gradually deepening, incised roads or in villages settled in narrow valleys. Besides unfavourable geology these slopes are affected by human activities like road cutting, artificial terraces, sanitary tanks, wine cellars, etc. Even in the last decade one could find cavern and cellar homes mined in Miocene rhyolitic tuff or Pleistocene loess. The outer front

Reprinted from: Geoscientist Vol 8. N° 1. January 1998.

Fig. 1. Typical incised road in loess and a way of slope stabilization, Pécs, Baranya county, Hegyhát balk.

of these homes generally collapsed from time to time but after moving the debris away inhabitants mined deeper into the cliff. Nowadays these underground homes are left and in front of them bigger, new houses stand. However the unfilled, occasionally 25 m long old tunnels underlie streets, and even worse, other block of new houses.

The rate of public potable water supply of homes in Hungary is 99 % while wastewater drainage system introduced to only 50 % of homes. Thus natural erosion effects are backed up by migrating wastewaters from the individual septic tanks of unreliable isolation. The public stormwater and groundwater collectors running under and along the streets are sometimes in bad conditions and the dynamic load of heavy traffic accelerates the unfavourable process.

These slopes consisting of loess or rhyolitic tuff are progressively being eroded by natural surface processes and human activities which lead to slumping, creeping, toppling, falling of sections or whole slopes. According to the 55 km of landslide sections recorded precisely and registered by the Hungarian Geological Survey the slope failures threaten the safety and wealth of 350 000 inhabitants in ca. 200 settlements and public railways and roads of different classes. Another 100 km of potentially hazardous slope sections are waiting for engineering geological mapping.

The resultant damages were occasionally compensated by the Hungarian Government from a «vis maior» fund. The «Slope Failure Committee», established on 1st of January 1997 and furnished with an annual budget, is able to handle this complex problem in an organized manner and even preventive actions have been considered to be accomplish in the next five years. The villages and cities are encouraged to apply for funding through open tenders twice a year.

Since 1975 the «Cellars Committee» has been working in a similar system which is responsible for the distribution of 500 million HUF (2.5 millionUS$) annually for compensations of cellars collapsed under public areas (e.g. streets, public buildings, etc.). The number of known settlements of this kind reached one hundred representing such big and touristic cities like Budapest, Pécs, Eger, Szentendre and the villages of well-known wine regions like Tokaj, Mád, Villány.

These two problems are often found together in many places, where the cellars are mined into slopes unstable by nature. However, the elimination and prevention of cellar collapse and slope failure hazards require different geotechnical methods and technologies, with rather different costs. Because of the long-standing tradition of the cellar programme and the numerous cases of both hazards, the Hungarian Government decided to run the administration and finan-

Fig. 2. An active cellar home in loess and the attached new house. Above a new level of houses and street, Ozora, Tolna county.

Fig. 3. Wine cellars mined in loess slope. Bátaszék-Lajvérpuszta, Tolna county.

Fig. 4. A strongly deformed cellar tunnel in loess under road No. 56. Dunaszekcsõ, Baranya county.

cing of the two programmes separately and allocated an annual budget of 460 million HUF (2.3 mUS$) for the slope failure programme and 650 million HUF (3.2 mUS$) for the cellar programme in the year 1998.

The experiences of the first round this year made the organization of a conference necessary to set the common base for local governments, engineering geologists, architects and technical companies to change ideas and practices. The declared task of the conference was to initiate the collaboration and cooperation of the parties in order to prevent or decrease the risk of slope failures and to effectively handle the damage caused by the accidents. The main topics were:

1. Slopes as geological, geomorphological phenomena.
2. Slopes - an engineering geological problem
3. Slope failure - a challenge for engineers
3. The role of slopes in land-use planning

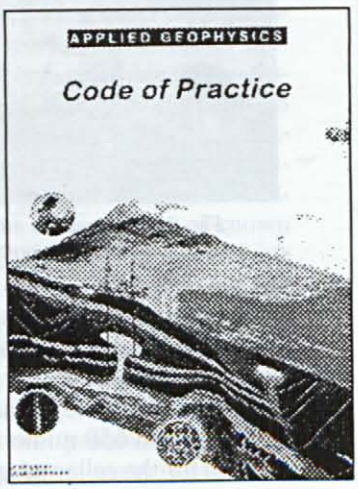
The conference was organised jointly by the Geological Society of Hungary and the Hungarian Geological Survey. This latter is to delegate a geologist (the first author) to both committees. It was held between 4-6th June 1997 in Paks, a city known for its high (50 m) loess slopes and the only domestic nuclear power plant. 40 people from municipalities, 35 participants of different professions, 20 colleagues from companies and the representatives of the central government, all evaluated the conference as a fully successful, pilot meeting and asked the organizers to repeat this event two years later, in 1999, on an international level, in order to know the practices of other nations fighting against the same natural and anthropogenic hazards.

Do you order services in geophysics

Do you provide services in geophysics

You need

this Code of Practice



APPLIED GEOPHYSICS
Code of Practice

Published by AGAP Qualité
an association for quality in applied geophysics

Part 1 - Quality systems. Recommendations for the quality assurance of services in geophysics.
Part 2 - A guide to the appropriateness of geophysical methods and techniques in applications related to the surface and the subsurface.
Part 3 - Collection of geophysics charts

20 pages of recommendations
9 tables
75 geophysics charts

"*Code of Practice for Applied Geophysics*" English version published in 1995
"*Code de Bonne Pratique en Géophysique Appliquée*" Version française publiée en 1992

PRICE : 1 145.70 French Francs (including VAT)

SEND YOUR ORDER TO

UNION FRANCAISE DES GEOLOGUES
Maison de la Géologie 77 rue Claude Bernard 75005 Paris France
Tel:33 1 47 07 91 95 Fax : 33 1 47 07 91 93 e-mail : ufg@hol.fr

THE MONO LAKE TUFAS (CALIFORNIA) AND IKAITE COLUMNS OF IKKA FJORD, (GREENLAND)

LAS TOBAS DEL LAGO MONO (CALIFORNIA) Y LAS COLUMNAS DE IKAITA DEL FIORDO IKKA (GROENLANDIA)

LES TUFS DU LAC MONO (CALIFORNIE) ET LES COLONNES DU FJORD IKKA (GROENLAND)

by Douglas Shearman

Former Chair of Geology at Imperial College. London. Wollaston medal of the Geological Society in 1997. Honorary Fellow of the Society.

Underwater view of an ikaite column. Ika Fjord. Greenland.

Abstract

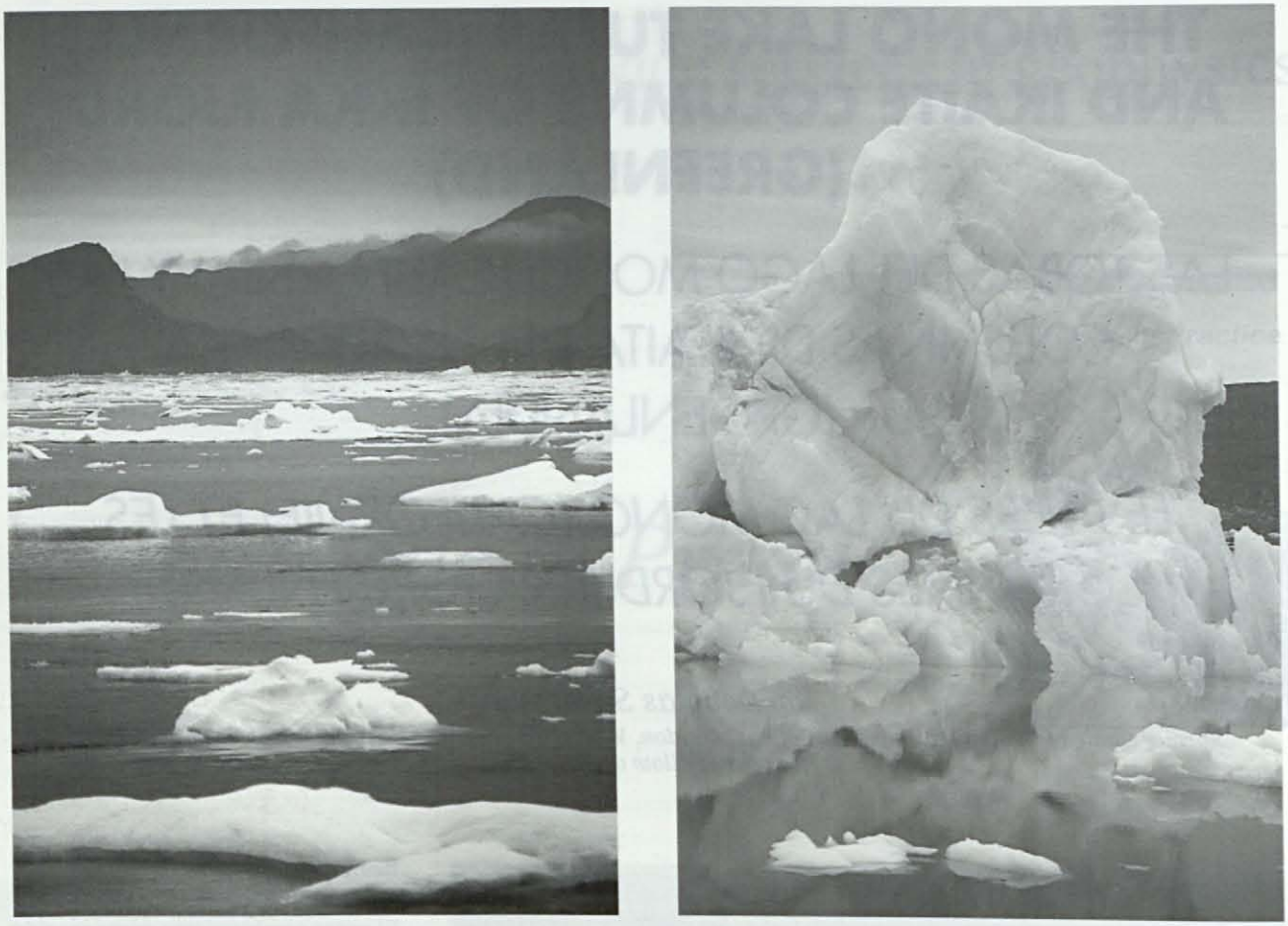
The author establishes a comparison between the morphology, composition and genetic environment of the tufa columns found in Mono Lake (California) and ikaite columns investigated by an expedition of British students in Ika fjord in Greenland. The former were formed in an alkaline water environment, whereas the latter were formed in marine waters. The work includes a complete set of spectacular photographs of the columns found in the sea floor of the fjord.

Resumen

El autor establece una comparación entre la morfología, composición y ambiente genético de las columnas tobaceas encontradas en el lago Mono en California y las columnas de ikaita investigadas por una expedición de estudiantes británicos al fiordo Ika en Groenlandia. Las primeras se han formado en un ambiente de aguas alcalinas, mientras que las segundas se han formado en un ambiente marino. El trabajo se completa con unas espectaculares fotografías de las columnas en los fondos marinos del fiordo.

Résumé

L'auteur compare, du point de vue morphologique, composition et origine, les tufs en colonnes que l'on rencontre au niveau du lac Mono (Californie) et du fjord Ikka au Groenland, ces derniers ayant fait l'objet d'études lors d'une mission effectuée par des étudiants britanniques. Les tufs du lac Mono se sont formés en présence d'eaux alcali-



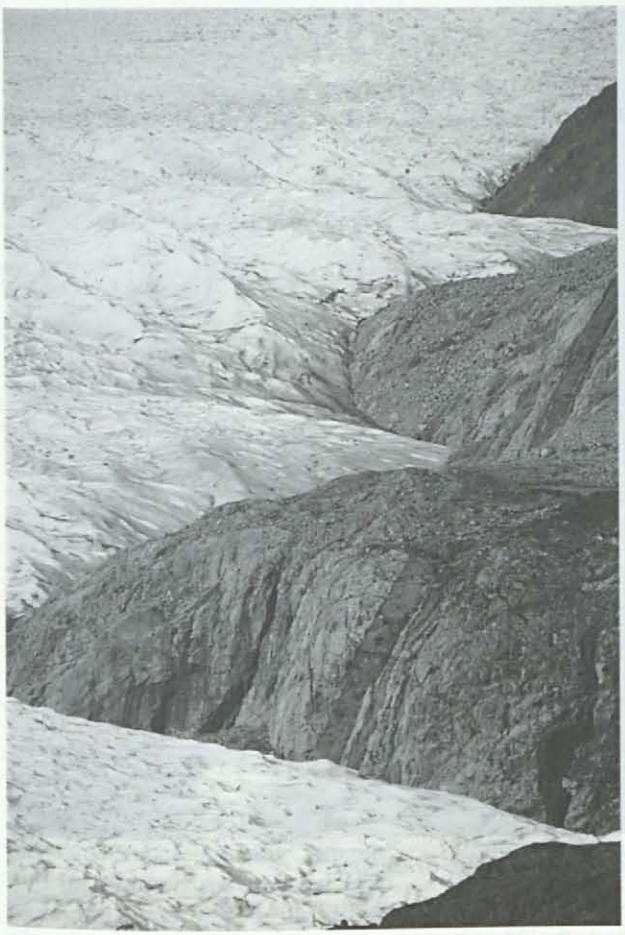
A view across the still, early morning waters of Ikka Fjord, south-west Greenland, up towards the surrounding highland plateau areas towards the Inland ice.

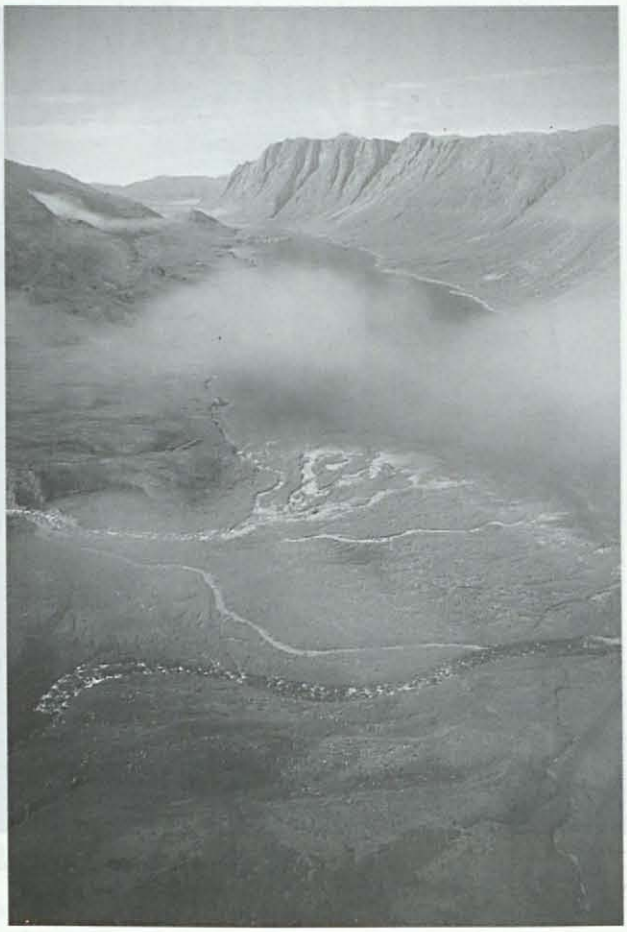
nes, ceux d'Ikka en conditions marines (eau salée).Les travaux présentés comportent toute une série de photographies spectaculaires des colonnes découvertes sur les fonds marins au niveau du fjord;

The morphologies of the tufa columns seen on the south shore of Mono Lake, California, are, in all essential respects, reminiscent of those of the columns of ikaite found in the waters of Ika Fjord, south-west Greenland. Indeed, recent research by Bischoff et al (1993) and Council and Bennett (1993) forcefully suggests that the tufa columns at Mono Lake were deposited as ikaite which subsequently changed to calcite. Readers may therefore be interested in seeing underwater photographs of ikaite columns taken in 1995 by a British student geological diving expedition to Ika Fjord. With this in mind, members of the expedition have produced a CD-ROM comprising approximately 200 photographs of the ikaite columns, mainly underwater, condensed from four and a half hours of video film taken in the course of the expedition.

Hans Pauly (1963), who first discovered the mineral ikaite, reported that it occurred as tufaceous columns which appear to have grown over bicarbonate springs which issue from the floor of Ika Fjord. The diving expedition found that the columns occur throughout a 1.5 kilometre reach at the head of the fjord. Individual structures, of which there must be several thousand, range from finger size up to 20 metres tall and roughly a metre in diameter, but none reaches above low tide level. They commonly have grotesque shapes, and pinch and swell in an unpredictable fashion along their length. The columns may occur singly or in clusters and the impression is gained, swimming amongst them, that the taller ones are in danger of toppling if disturbed; yet few of them appear to have done so. This may be due in part to their low submerged densities. The specific gravity of the mineral ikaite is 1.77 so that its submerged density in the marine derived waters of the fjord should be quite low, approximately 0.6. Conduits and other water filled voids within the ikaite columns would serve to lower the submerged density of the columns even further. The columns occur near the head of Ika Fjord in quiet water where they are additionally sheltered by a sill which protects them from small icebergs which might otherwise drift in and wreak havoc amongst them.

The fjord is iced over during the winter months, and throughout the





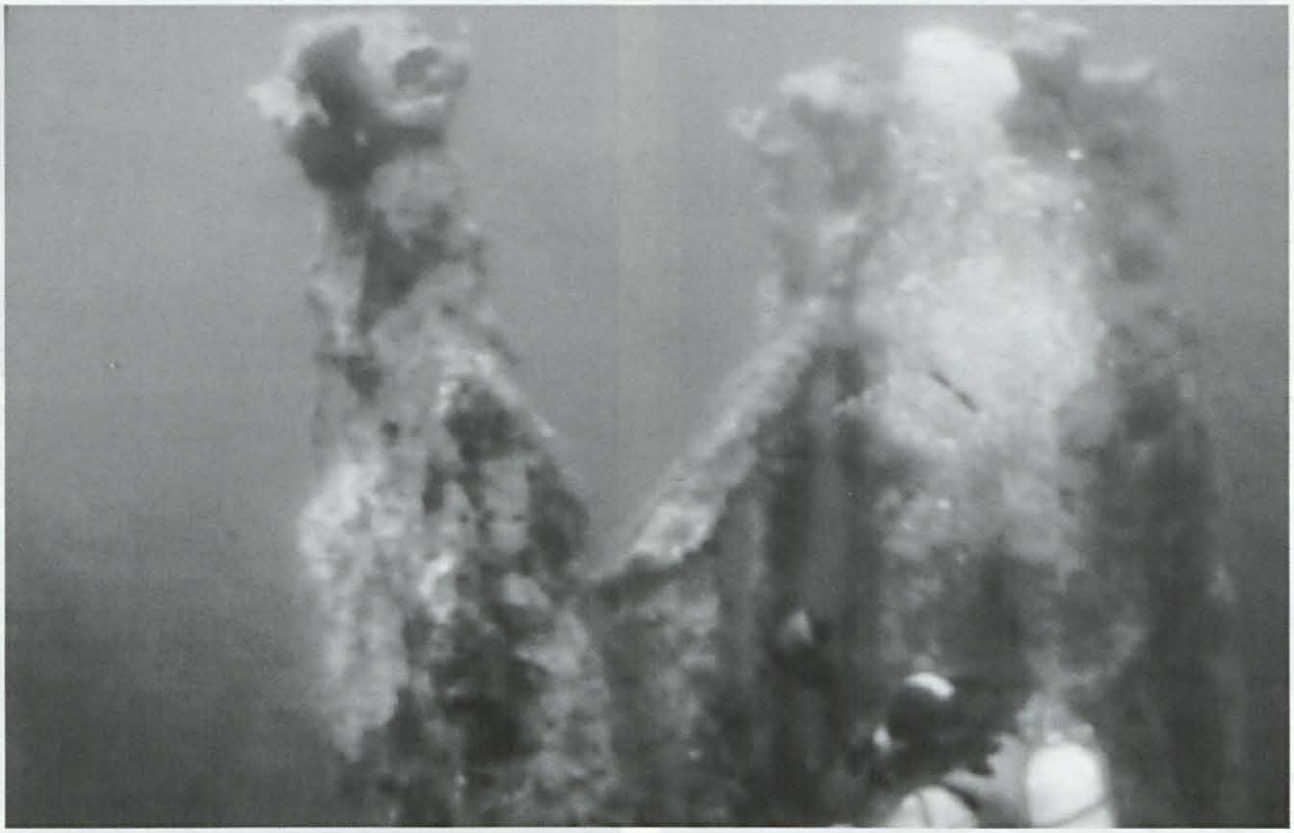
summer water temperature around the columns is consistently about 2 degrees C. Although apparently stable whilst in the ice-cold water of the fjord, pieces of the ikaite rapidly change to anhydrous calcium carbonate, mostly calcite, when removed and exposed to the warmth of summer sunshine, but they retain their overall shapes more or less intact.

Environmental conditions in Ika Fjord are more or less in accord with the known stability relationships of ikaite. Ikaite (calcium carbonate hexahydrate), $CaCO_3 \cdot 6H_2O$, is a high pressure mineral, stable only above 3 to 6 kilobars at normal Earth surface temperatures, but it can be crystallised from solution as a metastable mineral phase at normal pressures at 3 degrees Celsius if an inhibitor is present in the system which blocks precipitation of stable calcite. Ikaite can be preserved unaltered if put into refrigeration, but it rapidly decomposes to anhydrous calcium carbonate and water at normal temperatures. Phosphate can be used as the inhibitor in laboratory synthesis of ikaite. Unlike the anhydrous calcium carbonate minerals calcite, aragonite and vaterite, whose solubilities decrease with increase in temperature, the solubility of ikaite decreases with decrease in temperature, so that low temperatures favour precipitation of ikaite over the anhydrous calcium carbonate minerals. Thus, ikaite can be thought of as the ice-cold water calcium carbonate mineral.

The tufa columns seen along the south shore of Mono Lake now consist of calcite. They evidently grew under water, but they are exposed as the result of recent fall in lake level. Some are 3 to 4 metres tall and small springs issue from the bases of many of them.

The Mono Lake area, California, is comfortably hot in the summer, but the winter months are bitterly cold and ikaite precipitates in abundance as a white cloud about shoreline springs in the vicinity of the Tufa Park where spring water mingles with ice-cold lake water, temperature about 4 degrees Celsius. Some of the ikaite settles on or nucleates on low sublacustrine tufa mounds which become coated with a veneer of ikaite. This ikaite disappears or changes to calcite when the marginal lake waters warm up the following summer. Bischoff et al (1993) and Council and Bennett (1993) concluded that the tufa columns now exposed, may have grown seasonally, originating as ikaite which precipitated during the cold winter months.

Environmentally Mono Lake and Ika Fjord are markedly different from one another. The water of Mono Lake, a sodium, chloride, sulphate,



Underwater view of several ikaite columns. Ika Fjord. Greenland.

bicarbonate brine, is strongly alkaline, while that of Ika Fjord is essentially marine. Ikaite cannot be precipitated from either of them by lowering temperature alone: Mono Lake water requires the addition of calcium, whereas sea water requires the addition of carbonate ions. Those ions were evidently introduced by the springs over which the tufas grew. The springs on the southern shore of Mono Lake arise from a fan of volcanic debris which extends down from the Holocene volcanic crater which lies barely 2 kilometres to the south, and as Bischoff et al and Council and Bennett have argued, these springs provided the additional calcium which was no doubt derived from the volcanics. In Ika Fjord, the situation is reversed. There is sufficient calcium in sea water to account for the ikaite, and it is assumed that the carbonate was supplied by the springs; but the problem is that of the source of the carbonate. The ikaite columns occur along that part of the fjord which crosses the outcrop of the Gronnedai-ika carbonatite and syenite alkaline complex, which suggests some sort of relationship. The complex is Precambrian in age and that rules out a direct genetic relationship. Whether or not groundwater related to weathering of the carbonatite plays a role remains to be seen.

A consequence of the marked difference between the two environments is that in Ika Fjord which is essentially marine, the ikaite columns act as substrates which are extensively colonised by the encrusting calcareous alga Lithothamnion; by grazing sea cucumbers and echinoids together with sedentary sea anemonies. In Mono Lake, by contrast, the tufa columns are virtually devoid of an obvious flora and fauna.

The diving team comprised: John Bradley, formerly at Imperial College; Miss Kirsty Brown, Royal Holloway College; Chris Jenner, Oxford Brookes University; James Passmore, formerly Imperial College; Paul Seaman, Imperial College; and Anthony Taylor, a company secretary.

The diving team's visit to Ika Fjord coincided with that of a Danish expedition of geologists and marine biologists and some of the results of their work are currently in press; Buchardt (1997).

Photo: © The Imperial College Diving Expedition.

References:

BISCHOFF, J. L., Stine, S., Rosenbauer, R. J., Fitzpatrick, J. A., & Stafford Jr, T. W., (1993). Ikaite pecipitation by mixing shoreline springs and lake water, Mono Lake, California, USA. Geochimica et Cosmochimica Acta, Vol. 57, 3855-3865.

BUCHARDT, B., et al., (1997). Submarine columns of Ikaite tufa. Nature, Vol. 390, p 129.

COUNCIL, T. C. & Bennett, P. C. (1993). Geochemistry of ikaite formation at Mono Lake, California: Implications for the origin of tufa mounds. Geology, Vol. 21, 971-974.

PAULY, H., (1963). 'Ikaite', a new mineral from Greenland. Arctic, Vol. 16, 263-264.

MIDGARDIA - A NEW NAME FOR THE MESOPROTEROZOIC SUPERCONTINENT

MIDGARDIA, UN NUEVO NOMBRE PARA EL SUPERCONTINENTE MESOPROTEROZOICO

MIDGARDIA, UN NOUVEAU NOM POUR DÉSIGNER LE SUPERCONTINENT MÉSOPROTÉROZOÏQUE

by Ake Johansson

Laboratoire des Isotopes Appliqués à la Géologie, Museum d'Histoire Naturelle de Suède

Abstract

The all-encompassing late Paleozoic to Mesozoic supercontinent, Pangaea, and its southern part, Gondwana, have long-established names. In more recent times, the name Rodinia has become widely used for the Neoproterozoic predecessor of Pangaea, and the name Kanatia has been proposed for a slightly earlier but still Neoproterozoic supercontinent configuration. Extending the naming of supercontinents further back in geologic time, the name *Midgardia* is here proposed for the Mesoproterozoic supercontinent that is believed to have existed between c. 1.8 and 1.2 Ga ago. The name is derived from the old Nordic mythology of the Vikings, in which 'Midgard' denoted the part of the Earth inhabited by humans, and can be translated to 'Middle Earth', a name considered suitable for a supercontinent existing during the middle eon of Earth history.

Resumen

El supercontinente Pangea que englobaba a todos y que existió de finales del Paleozoico al Mesozoico así como su parte meridional, Godwana, tienen nombres bien establecidos desde hace mucho tiempo. Recientemente el nombre Rodinia se ha utilizado ampliamente para designar al predecesor Neoproterozoico de Pangea y el nombre Kanatia se ha propuesto para una configuración de supercontinente algo anterior pero todavía perteneciente al Neoproterozoico. Extendiendo la nomenclatura de supercontinentes algo más en el pasado geológico, se propone en este trabajo el nombre de *Midgardia* para el supercontinente Mesoproterozoico que se cree existió hace 1,8-1,2 Ga. El nombre deriva de la antigua mitología nórdica de los Vikingos en la que "Midgard" designaba la parte de la Tierra habitada por los hombre, y se podría traducir como "Tierra Media", un nombre considerado adecuado para un supercontinente que existió durante el eón intermedio de la historia de la Tierra.

Résumé

Le supercontinent PANGAEA qui intéresse tout ce qui a existé, entre la fin du Paléozoïque et le Mésozoïque ainsi que sa partie méridionale, GONDWANA, sont des noms établis de longue date. Plus récemment, le nom RODINIA est devenu d'usage courant pour désigner le prédécesseur néoprotérozoïque de PANGAEA et le nom KANATIA a été proposé pour désigner un ensemble légèrement plus ancien mais appartenant encore au supercontinent Néoprotérozoïque.

Remontant l'échelle des temps géologiques encore plus loin et poursuivant la nomenclature des supercontinents, le terme MIDGARDIA est proposé ici pour désigner le supercontinent mésoprotérozoïque que l'on suppose avoir existé entre c. 1,8 et 1.2 Ga. Le nom vient de l'ancienne mythologie nordique des Vikings, dans laquelle, le mot Midgard désigne la partie de la terre habitée par les hommes et qui peut se traduire par la "Terre du Milieu", un terme tout à fait convenable pour un supercontinent dont l'existence recoupe l'éon du milieu de l'histoire de la Terre.

In geology, as in most other sciences, many terms have Greek or Latin roots. This includes names of geological time periods, orogenic episodes and belts, and past oceans and continents: the eons and eras of earth history, starting with the

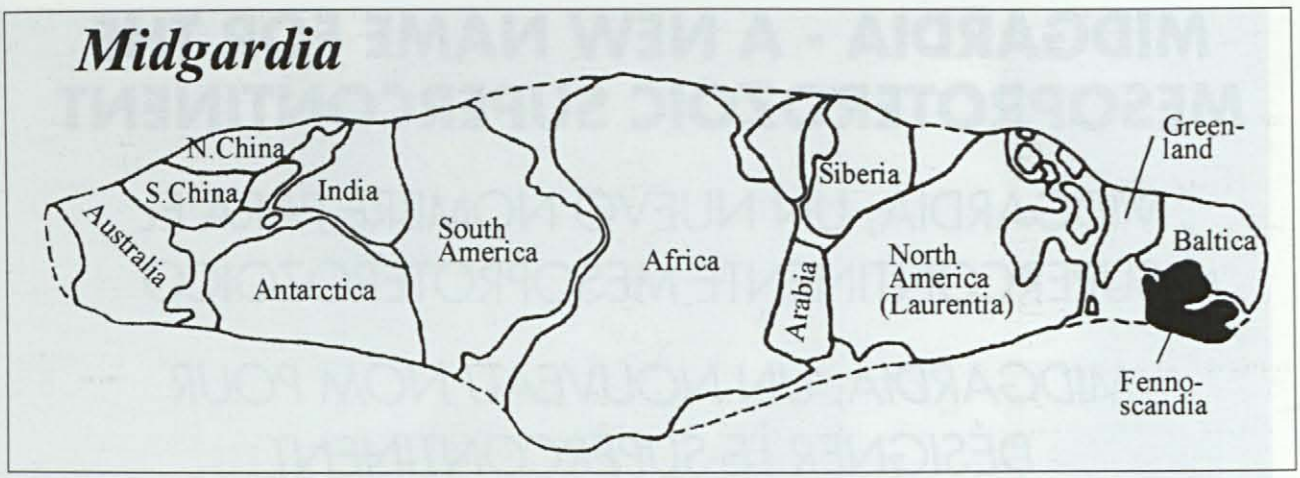


Fig. 1: The Mesoproterozoic Midgardian supercontinent, according to the paleomagnetic reconstruction of Piper (1982, 1983).

Archean, all have names of Greek origin; the Cambrian period derives its name from the Roman name for Wales and the Caledonian orogeny from the Roman name for Scotland; the Tethys Sea from the name of the Greek sea goddess and the Iapetus Ocean from the god Iapetus, father of Atlas in Greek mythology; the name of the late Paleozoic to Mesozoic supercontinent, Pangaea, simply means 'All Earth' in Greek.

However, there are also exceptions to this rule: the southern supercontinent of Gondwana ultimately derives its name from the Gonds, a tribal people in southern India. Rodinia, the Neoproterozoic supercontinental predecessor of Pangaea, derives its name from the Russian verb *rodit*, meaning 'to grow' or 'to beget', according to McMenamin and McMenamin (1990) who proposed the name, although it was reinterpreted to be derived from the word *rodina*, meaning 'motherland' in Russian, by Rogers (1996). A slightly earlier, but still Neoproterozoic, supercontinent configuration was given the name Kanatia from the Huron-Iroquois word *kanata*, meaning 'collection of huts', a word from which the name of Canada is also derived, by Young (1995).

On the occasion of Sweden organizing the program of the 10:th EUG meeting in Strasbourg in 1999, it was thought fair that our Nordic ancestors and their mythology also should be given a place in Earth history, and to that end the Mesoproterozoic supercontinent was selected. Piper (1982, 1983) depicted this supercontinent as an elongated landmass encompassing Baltica (NE Europe), Laurentia (North America), Africa, South America, India, Antarctica and Australia, as well as several smaller continental blocks, and on paleomagnetic grounds considered it to have existed more or less intact all the time from c. 2600 Ma to 570 Ma before present. More likely, it was assembled during the widespread Paleoproterozoic orogenic activity (e.g. the Svecofennian orogeny of Baltica) ending at around 1.8 Ga (Hoffman 1989), and dispersed at around 1.2 Ga in activity preceeding the Grenville orogeny (e.g. Park 1992). Throughout much of the intervening period it was characterized by widespread bimodal anorogenic magmatism (Hoffman 1989, Windley 1993, 1995).

This supercontinent has generally been referred to simply as the 'Mid-Proterozoic supercontinent' in the literature, a name which however is a bit too long for everyday use. Gower et al. (1990), pioneers in Transatlantic correlation, coined the term 'Nena', an acronym for 'Northern Europe - North America', for the Laurentia-Baltica part of the supercontinent. This name was also used in a somewhat extended sense by Rogers (1996) for one of three middle Proterozoic landmasses he considered had joined to form Rodinia at around 1.0 Ga. However, as with many acronyms, Nena is a bit too short and anonymous to become widely popular, and furthermore only refers to a part of the whole proposed supercontinent, albeit a part that has been the focus of much recent Transatlantic correlation work through the COPENA project (c.f. Brewer 1996).

However, the true pioneers of Transatlantic correlation were the Nordic Vikings. Norwegian Vikings did not only settle the Faroe Islands and Iceland, irrelevant from a Proterozoic point of view, but made extensive field trips to the Lewisian gneisses of northwest Scotland and the Archean and Proterozoic areas of southwest Greenland, settled the north tip of Newfoundland (a Proterozoic inlier within the Newfoundland Caledonides) and may even have reached mainland North America (Wineland, as they called it) as well as Svalbard in the far north. Swedish Vikings mainly travelled east along the Russian rivers, trying to establish correlations between the Ukrainian Shield and their native Fennoscandian Shield, activities later pursued by Gorbatschev & Bogdanova (1993) and the EUROBRIDGE project (Bogdanova et al. 1996), the latter using geophysical means not generally available to the Vikings (when aggravated, they could stomp the ground quite forcefully, but did not have the equipment to record any deep seismic echoes). Danish

Vikings, coming from a country largely made up of Mesozoic and Tertiary sediments and thus not used to the harsh living conditions of a Precambrian shield area, mainly went to western and southern Europe where the living was easy, climate favourable and food and drinking plentiful, although the possibilities of doing Precambrian bedrock correlations were meagre. However, in later times Danish geologists have made up for that by exhaustive geological studies on Greenland.

According to the ancient Nordic mythology of the Vikings, as outlined in the Icelandic Edda scriptures (Anonymous 13:th century, Sturlasson 13:th century), the Earth is (or was) divided in three (continental-sized ?) landmasses: Midgard ('Middle Earth' in free translation) where the humans lived, Utgard ('Outer Earth') where the giants lived, and Asgard where the Asa-gods lived. Midgard was surrounded by sea on all sides, in which the gigantic Midgard snake dwelled. It is not clear what time period this division refers to; clearly, in the middle Proterozoic there were neither humans, nor giants, gods or gigantic snakes around anywhere, life only consisting of uni-cellular microorganisms. However, since most land areas that once were part of the Mesoproterozoic supercontinent are now inhabited by humans, Midgard seems the most appropriate name for it. Furthermore, it seems highly appropriate that a supercontinent that existed during the middle part of the middle eon of Earth history should be given a name which can be translated to 'Middle Earth'. Latinizing (or Anglicizing) it slightly, the name *Midgardia* (or the *Midgardian supercontinent*) is hereby proposed for the Mesoproterozoic supercontinent that is believed to have existed between c. 1.8 and 1.2 Ga ago.

If future research would disprove the idea of one single Mesoproterozoic supercontinent and favour the existence of several continental landmasses, such as proposed by Rogers (1996), it is suggested that the name Midgardia is retained for the landmass encompassing Laurentia and Baltica, that is the areas settled and explored by the Nordic Vikings one thousand years ago.

References:

Anonymous (13:th century): Den poetiska Eddan (The Poetic Edda). In Swedish translation by Björn Collinder, 3:rd edition. Forum, Stockholm, 1972, 350 pp.

Bogdanova, S. and Eurobridge colleagues (1996): EUROBRIDGE, Palaeoproterozoic Accretion of Sarmatia and Fennoscandia. P. 80-89 in: Gee, D.G. & Zeyen, H.J. (eds.): EUROPROBE 1996 - Lithosphere Dynamics: Origin and Evolution of Continents. EUROPROBE Secretariate, Uppsala University, 138 pp.

Brewer, T.S. (ed.) (1996): Precambrian Crustal Evolution in the North Atlantic Region. Geological Society Special Publication No. 112. The Geological Society, London, 386 pp.

Gorbatschev, R. & Bogdanova, S. (1993): Frontiers in the Baltic Shield. Precambrian Research 64, 3-21.

Gower, C.F., Ryan, A.B. & Rivers, T. (1990): Mid-Proterozoic Laurentia-Baltica: an overview of its geological evolution and a summary of the contributions made by this volume. P. 1-20 in: Gower, C.F., Ryan, A.B. & Rivers, T. (eds.): Mid-Proterozoic Laurentia-Baltica. Geological Assocation of Canada Special Paper 38, 581 pp.

Hoffman, P. (1989): Speculations on Laurentia´s first gigayear (2.0 to 1.0 Ga). Geology 17, 135-138.

McMenamin, M.A.S. & McMenamin, D.L.S. (1990): The Emergence of Animals: The Cambrian Breakthrough. Columbia University Press, New York, 217 pp.

Park, R.G. (1992): Plate kinematic history of Baltica during the middle to late Proterozoic: a model. Geology 20, 725-728.

Piper, J.D.A. (1982): The Precambrian palaeomagnetic record: the case for the Proterozoic Supercontinent. Earth and Planetary Science Letters 59, 61-89.

Piper, J.D.A. (1983): Dynamics of the continental crust in Proterozoic times. P. 11-34 in: Medaris, Jr., L.G., Byers, C.W., Mickelson, D.M. & Shanks, W.C. (eds.): Proterozoic Geology: Selected Papers from an International Proterozoic Symposium. Geological Society of America Memoir 161, 315 pp.

Rogers, J.J.W. (1996): A history of continents in the past three billion years. Journal of Geology 104, 91-107.

Sturlasson, S. (13:th century): Snorres Edda. In Swedish translation by Björn Collinder. Forum, Stockholm, 1970, 151 pp.

Windley, B.F. (1993): Proterozoic anorogenic magmatism and its orogenic connections. Journal of the Geological Society of London 150, 39-50.

Windley, B. F. (1995): The Evolving Continents, 3:rd edition. John Wiley & Sons, Chichester - New York - Brisbane - Toronto - Singapore, 526 pp.

Young, G.M. (1995): Are Neoproterozoic glacial deposits preserved on the margins of Laurentia related to the fragmentation of two supercontinents? Geology 23, 153-156.

Instituto Tecnológico Geominero de España

1849 ITGE 1999 150 ANNIVERSARY

GENERAL PROGRAMME OF ACTIVITIES OF THE GEOLOGICAL SURVEY OF SPAIN

1999 PLANNING

EXHIBITIONS

- ★ Commemorative stamp and philatelic exhibition. 12th July 1999. ITGE. Madrid.
- ★ Mapping and historic documentation exhibition. Oct-Nov 1999. ITGE. Madrid.

CONFERENCES

- ★ Geographic information systems in natural hazards and environment. 29-30 April 1999. CSIC. Madrid.
- ★ Current advances in geophysical techniques applied to hydrogeology. 10-12 May 1999. Exhibition and Conferences Palace. Granada.

MEETINGS AND WORKSHOPS

- ★ EuroGeosurvey and Association of Ibero-American Geological and Mining Surveys meeting. 31 May- 4 June 1999. ITGE. Madrid.
- ★ ITGE's mapping. Nov-Dec 1999. ITGE.

PUBLICATIONS

- ★ Geological Heritage along the way of St. James. May 1999.
- ★ Measure and evaluation of underground water abstraction. March 1999.
- ★ Underground water pollution: a pending problem. April 1999.
- ★ Mineral and thermal waters in Spain. April 1999.
- ★ Karst in Andalusia. May 1999.
- ★ Underground water nitrate content in Spain. June 1999.
- ★ Hydrogeological map of Spain 1:1 000 000, including hydrogeological units delimitation. Memory, map and CD-ROM. June 1999.
- ★ Aquifers in Spain. July 1999.
- ★ Environmental education related to underground waters. July-October 1999.
- ★ 150 years of Spanish geology. October 1999.
- ★ Dictionary of hydrogeological terms. October 1999.
- ★ The ITGE and underground waters: current perspective to 150 years of hydrogeological activity. October 1999.

ACTIVITIES IN COLABORATION WITH OTHER INSTITUTIONS

- ★ IV Conference on Contaminated Soils.
- ★ International Conference on Water and Environment in Mining on the XXI Century.
- ★ II Conference on Mineral and Minero-medical Waters
- ★ XV Palaeontological Conference.
- ★ III International ProGeo Symposium on Geological Heritage Preservation.

Further information available in ITGE's web page:
http://www.itge.mma.es

Instituto Tecnológico GeoMinero de España
Ministerio de Medio Ambiente

RIOS ROSAS, 23. 28003 MADRID. SPAIN
TEL: +34 91 3495700 FAX: +34 914426216

THE APPLICATION OF GEOPHYSICAL LOGGING TECHNIQUES TO TUNNELLING INVESTIGATIONS

LA APLICACIÓN DE TÉCNICAS DE TESTIFICACIÓN GEOFÍSICA A LA INVESTIGACIÓN DE TÚNELES

L'UTILISATION DES DIAGRAPHIES DANS LA RECONNAISSANCE DES PROJETS DE TUNNEL

European Geophysical Services sa. 50, rue de Prés L7333 Steinsel. Grand-Duche de Luxembourg. http://www.egs.lu

Abstract

The increasing development of techniques and technology of data acquisition is today giving a more and more important role to geophysical logging during the phases of geological, geophysical and geotechnical research. The logging techniques object of this note are those used during the phase of research in tunnelling projects. They allow to distinguish the lithological assemblages, to develop a detailed structural analysis, to define the state of consolidation of the ground and to detect potential problematic zones. Since diagraphies provide a very complete fan of measures, only the measures of natural radioactivity, density, P and S waves speed and acoustic imagery will be dealt with.

Resumen

El creciente desarrollo de las técnicas y tecnologías de adquisición de datos está proporcionando hoy en día un papel cada vez más importante a la testificación geofísica durante las fases de investigación geológica, geofísica y geotécnica. Las técnicas de testificación objeto de esta nota son aquellas utilizadas durante la fase de investigación de los proyectos de túneles. Permiten distinguir los conjuntos litológicos, desarrollar un análisis estructural detallado, definir el estado de consolidación del terreno y detectar potenciales zonas problemáticas. Dado que las diagrafías proporcionan un amplio abanico de medidas, en este texto sólo se tratarán las medidas de radioactividad natural, densidad, velocidad de propagación de ondas P y S e imágenes acústicas.

Rèsumè

Le développement croissant des techniques et technologie de l'acquisition des données confère aujourd'hui un rôle de plus en plus important aux diagraphies, pendant les phases d'études géologiques, géographiques et géotechniques. Les techniques de diagraphies présentées ici concernent celles qui sont utilisées pendant la phase d'études de faisabilité de projets de tunnel. Elles permettent de distinguer les relations lithologiques entre les formations, de développer une analyse structurale détaillée, de définir la compacité des terrains et de déceler les zones à problèmes, potentielles. Les diagraphies fournissant toute une panoplie de mesures, seules, les mesures de la radioactivité naturelle, de la densité, des vitesses des ondes sismiques P et S et de d'imagerie acoustique seront abordées.

1. Introduction

Although certainly almost the whole spectrum of geophysical logging techniques will find an application in the field of tunnelling investigations, for the purposes of this document it is the intention to concentrate on the three which we would consider to be the most relevant; namely the formation density, full waveform sonic and borehole televiewer logs.

The in-situ formation mechanical properties data obtained by the synthesis of density and full waveform sonic log data will permit reliable calculations to be made in respect of ground stability and diggability, as well as identifying anomalous or potentially problematic strata in time to allow the proposed route or tunnelling method to be modified.

The fullwave sonic tool can also provide useful hydrogeological information: reflected Stoneley waves, when seen on the full waveform sonic data, are a useful indicator of the presence of open, permeable fractures.

When this data is taken in conjunction with the wealth of geological structure information provided by borehole televiewer data, a much wider and more profound understanding of the subsurface will be the result.

In conclusion, some of the other

geophysical logging techniques also applicable to this type of investigation will be mentioned.

2. Formation mechanical properties from full waveform sonic and density logs

2.1. Theory

Geophysical log data can be used directly to derive in-situ values of a rock's mechanical properties by means of the calculation of the principal elastic moduli. These processes rely on the input of three geophysical log data parameters; the formation bulk density and the formation compressional and shear wave interval travel times. The relationships used to derive the various moduli are the following:

$$\sigma = \frac{{}^1/_2\,(\Delta t_s/\Delta t_c)^2 - 1}{(\Delta t_s/\Delta t_c)^2 - 1}$$

$$G = (\rho_b/\Delta t_s^2)$$

$$K = (\rho_b/\Delta t_c^2) - \frac{4G}{3}$$

$$E = 2G(1 + \sigma)$$

where

σ	= Poisson's ratio
G	= Shear Modulus
K	= Bulk Modulus
E	= Young's Modulus
Δt_c	= Compressional interval travel time
Δt_s	= Shear interval travel time
ρb	= Formation bulk density

σ, being a dimensionless parameter, has no units. Δt_c and Δt_s are normally expressed in µs/m, ρb in gr/cc. For convenience the elastic moduli are normally expressed in MPa units.

Values for σ range from 0.05 for very hard, rigid rocks to about 0.45 for soft, poorly consolidated materials. For most rocks, G, K and E lie in the range 20 000 to 120 000 MPa, E generally being the largest and G the smallest.

2.2. Practical aspects

The geophysical logging parameters required for the derivation of the formation mechanical properties are the bulk formation density and both the compressional and shear wave acoustic travel times. At this scale of investigation, this generally requires that two separate sondes be run in the borehole. The sondes currently employed by EGS are known as the FDS (*F*ormation *D*ensity *S*onde) and the FWS (*F*ull *W*aveform *S*onic sonde).

The parameters measured by these tools are the following:

FDS
- natural gamma radioactivity
- borehole diameter
- bulk density (long/medium/short spacings)

FWS
- digitised sonic waveforms, at multiple transmiter - recevier spacings if required

Both of these tools require that the borehole be fluid-filled and are run at logging speeds of around 6 m/min.

In view of the large quantities of data recorded, the analysis of the fullwave sonic data generally takes place, subsequent to acquisition, at the local base or data processing center. At this time, the log analyst, aided by a range of computer-based Interpretation tools, will proceed to determine the first arrival times of the different waves as they appear on the recorded wavetrain.

2.3. Example logs

The composite log example shown in Figure 2-1 was recorded in a series of alternating quartzites and mica-schists. In track one are the natural gamma and density logs, in track two the compressional and shear sonic velocities and the derived Poisson's ratio log. Track three shows the calculated elastic moduli (Shear, Bulk and Young's) whilst in track four are presented the fullwave sonic data and travel time curves.

The quartzites are distinguished by their low natural gamma activity and in places, somewhat surprisingly, by significantly reduced sonic velocities. In terms of their mechanical behaviour they could represent a potentially problematic zone which, in the absence of the geophysical log data, may otherwise have gone unidentified.

As a contrast with the first example, the second composite log example (Figure 2-2) was recorded in a much more monotonous granitic terrain.

Only relatively minor changes are present in any of the elastic moduli, demonstrating the homogeneity and sound mechanical comportment of the formations.

2.4. Advanced processing possibilities

In addition to the derivation of the dynamic elastic moduli by the methods described above, mechanical properties data can be used to calculate other formation parameters such as tensile strength, pore, fracture and overburden pressures.

3. Fracture detection from reflected Stoneley waves

3.1. Theory

Stoneley waves propagate more slowly in the formations than either compressional or shear waves and therefore arrive at a later time along the received wavetrain. When a Stoneley wave passes a fracture that intersects the borehole, it applies a pressure to the fluid present in the crack. In an open, permeable fracture the result of this pressure is a fluid movement that causes a re-

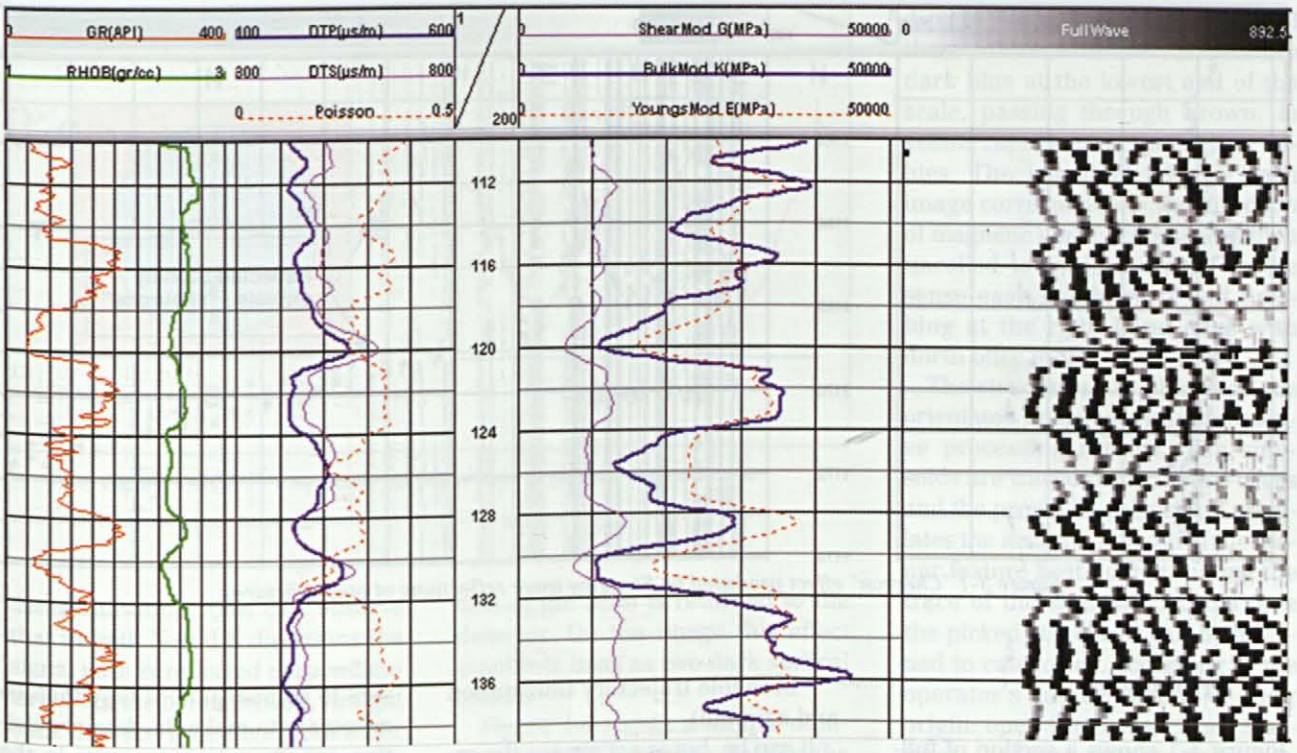


Figure 2-1 Composite mechanical properties log: variable mechanical compartment

duction in the amplitude of the direct Stoneley wave and the generation of a reflected Stoneley wave. These reflected Stoneley waves are visible on the full waveform log in the form of a chevron opening outwards that is centred at the location of the permeable fracture. The higher the amplitude of these reflected Stoneley waves, the larger and more permeable can be considered the fracture.

Extended mode fullwave sonic recordings of up to 8 ms are used to detect these reflected Stoneley waves.

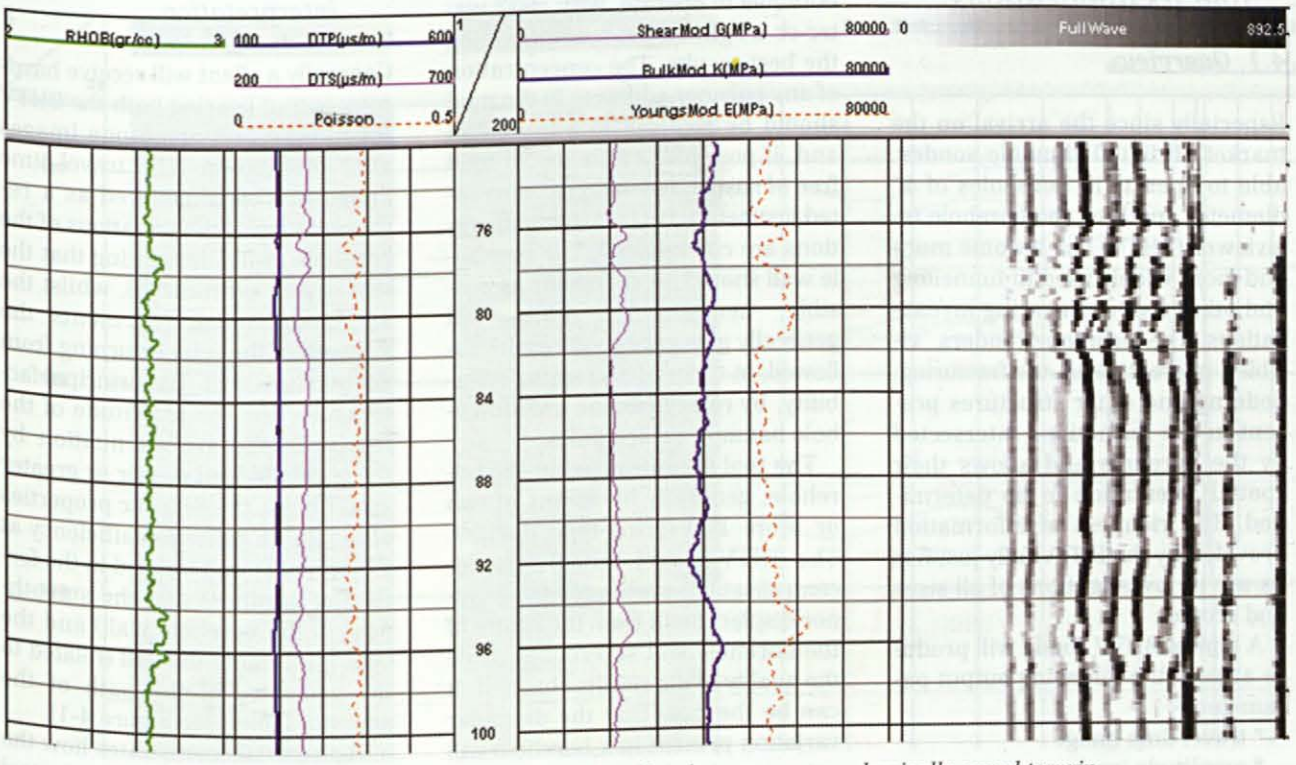


Figure 2-2 Composite mechanical properties log: homogenous, mechanically sound terrain

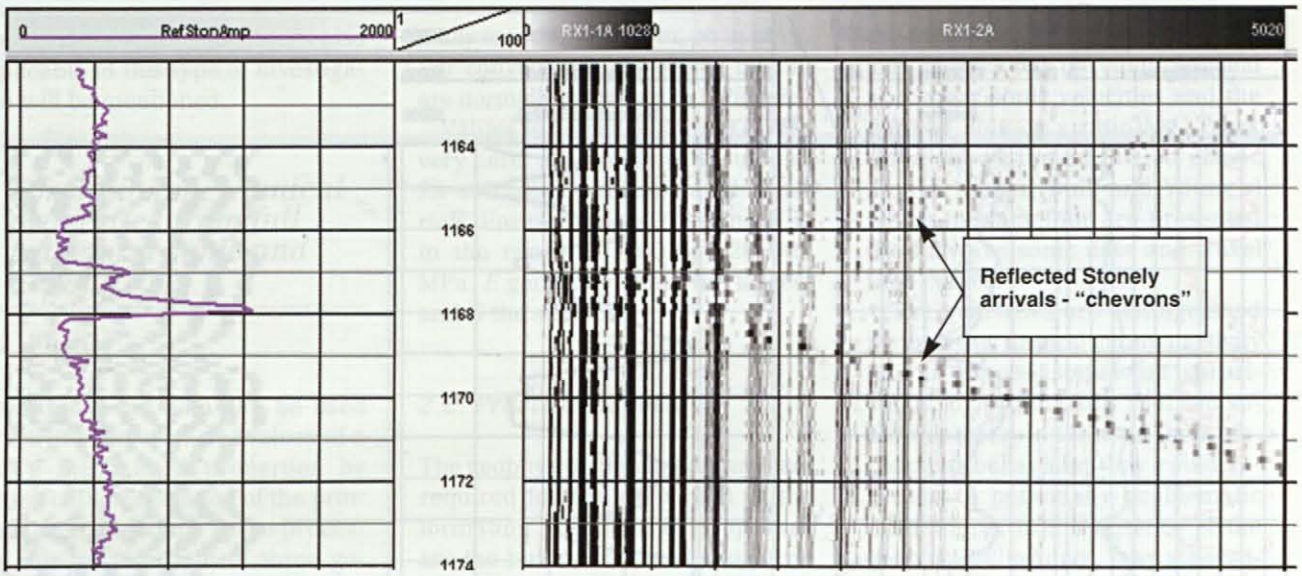


Figure 3-1 "Chevron" effect produced by Stoneley wave reflections at open fractures

3.2. Example log

Figure 3-1 shows a section of full-wave sonic log displaying several full and half "chevron" patterns. The strongest reflected Stoneley amplitudes are generated by a fracture situated at about 228.5 m.

4. The borehole televiewer and its applications

4.1. Overview

Especially since the arrival on the market of digital slimhole sondes, able to operate in boreholes of 4" diameter and less, the borehole televiewer (BHTV) has become more and more widely used in tunnelling and other civil engineering investigations. The technique renders "visible", in great detail, the fracturing, bedding and other structures present in the formations intersected by the borehole and allows their spatial orientation to be determined. The richness of information provided by the BHTV fully justifies its use in investigations of all sizes and scopes.

A typical BHTV sonde will produce at least the following output parameters:

* travel time image
* amplitude image
* borehole trajectory (inclination and azimuth).

It can be, but is not always the case, that during data acquisition the images are orientated in real-time for instantaneous display in the logging unit. Otherwise they will be displayed in non-orientated form and the orientation process carried out subsequent to acquisition.

The BHTV requires a fluid-filled borehole to operate, with clear water or a lightweight mud providing the best results. The concentration of any polymer additives in the mud should be reduced to a minimum and, if possible, a new, clean mud free of suspended sand etc. circulated just before BHTV logging operations are commenced. The borehole wall should be as regular as possible, hence cored holes will generally give very good results, followed, in order of decreasing suitability, by rotary tricone and down-hole hammer drilled holes.

The tool is centralised in the borehole, generally by means of two or more bowspring-type devices. The BHTV is very sensitive to decentralisation; even a relatively minor displacement from the centre of the borehole will severely degrade the quality of the results obtained. It can be the case that the diameter variation present in a borehole will overcome the ability of the centralisers to compensate; it may then be necessary to make the data acquisition over two or more runs in the hole with the centralisers adjusted or changed as necessary.

A normal logging speed for the BHTV is of the order of 2 m/min.

4.2. The orientated acoustic imagery and its interpretation

Generally a client will receive hard-copy output bearing both the BHTV travel time and amplitude images after orientation. The travel time image can be considered as a representation of the variations of the borehole radius (assuming that the tool is well-centralised), whilst the amplitude image represents the strength of the echo returning from the borehole wall. The principal factors affecting the amplitude of the received echo are attenuation by the borehole fluid (lesser or greater according to the acoustic properties of the fluid), reflection efficiency at the borehole wall (related to the formation hardness and the smoothness of the borehole wall) and the centralisation of the tool (related to the geometry of the path of the acoustic signal, see Figure 4-1).

Figure 4-1 demonstrates how the received amplitude is affected by tool

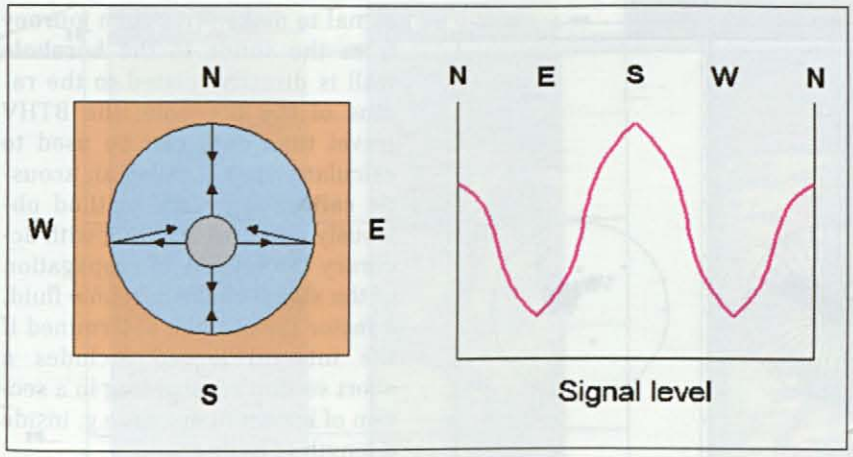


Figure 4-1 BHTV amplitude variation due to tool decentralisation

decentralisation. One can observe that in both N and S directions the signal path is reflected perpendicularly from the borehole wall, straight back into the transducer. All other things being equal, the S direction signal will be slightly stronger owing to its reduced path length in the borehole fluid.

In the case of the E and W directions, however, the signal is reflected obliquely from the borehole wall and only a reduced dispersed portion of the echo is returned to the detector. On the image this effect manifests itself as two dark vertical bands.

Figure 4-2 shows a sample of interpreted BHTV image data in the normal 2-d "unrolled" format.

The colours seen on the imagery bear no relation, except by accident, to the actual colours of the formations. They are calculated according to the magnitude of the travel time or amplitude value according to the scale seen at the top of these columns. In this case, we see dark blue at the lowest end of the scale, passing through brown, to yellow representing the highest values. The left hand edge of each image corresponds to the direction of magnetic north; the image is then unrolled towards the right in the sense east, south, west and finishing at the right hand edge with north once more.

The structures are picked off the orientated image using an interactive processing routine. The sinusoids are traced using mouse-clicks and the processing algorithm calculates the azimuth and dip of the planar feature best approximating the trace of the sinusoid. At this time the picked structures can be assigned to categories, according to the operator's interpretation of their origin: open fractures, closed fractures, bedding planes, veins etc. This information is added digitally to the processed data file as the picking progresses.

Should the inclination of the borehole depart more than a few degrees from the vertical, a further processing stage is required. This

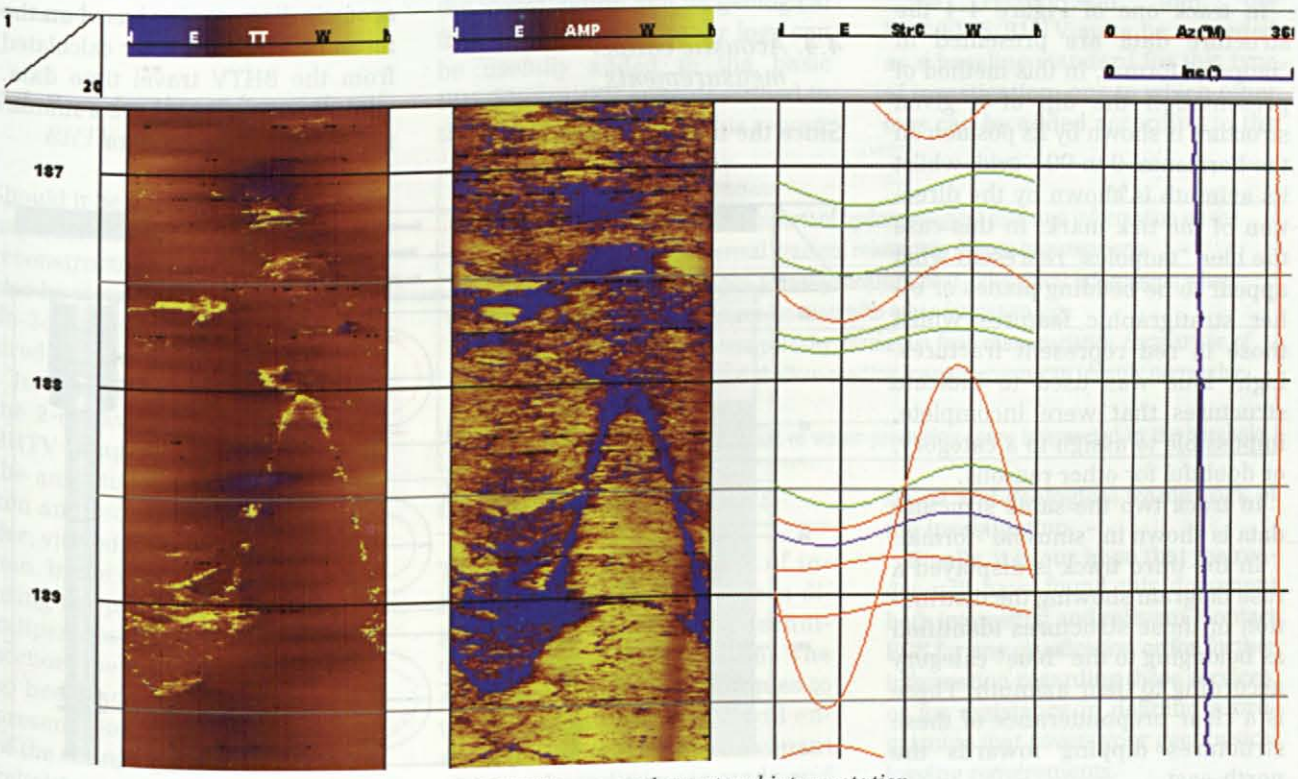


Figure 4-2 BHTV image and structural interpretation

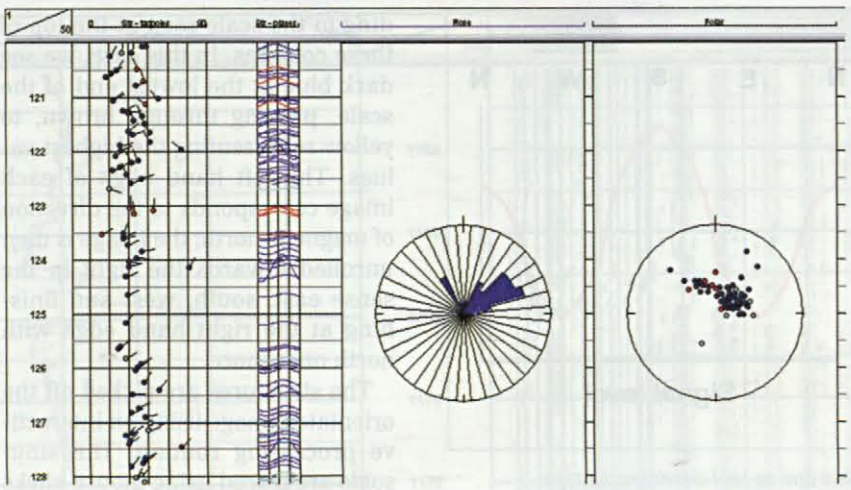


Figure 4-3 Example showing several presentations of BHTV derived structure data

takes the apparent dips and azimuths of the structures traced on the BHTV imagery and, taking into account the trajectory of the borehole, converts them into real geographical orientations.

4.3. Structural logs

The structural information obtained from the BHTV image can be processed and displayed in a number of ways.

In track one of Figure 4-4 the structure data are presented in "tadpole" format. In this method of presentation the dip of a given structure is shown by its position on the horizontal 0 to 90∞ grid, whilst its azimuth is shown by the direction of the tick mark. In this case the blue "tadpoles" represent what appear to be bedding planes or other stratigraphic features whilst those in red represent fractures. Light blue was used to indicate structures that were incomplete, impossible to assign to a category, or doubtful for other reasons.

In track two the same structure data is shown in "sinusoid" format.

In the third track is displayed a rose diagram showing the distribution of those structures identified as belonging to the "blue" category according to their azimuth. There is a clear preponderance of these structures dipping towards the north-east.

To demonstrate another alternative, the fourth track contains a polar diagram representation of the structure data.

These statistical representations of the structure data have been shown to be extremely useful in geological studies on core samples. Comparison of the BHTV-derived structure data with the data measured directly off the core samples renders possible the correct orientation of the latter when it might otherwise be difficult or impossible to achieve.

4.4. Acoustic caliper measurements

Since the time taken for the BHTV signal to make the return journey from the sonde to the borehole wall is directly related to the radius of the borehole, the BTHV travel time data can be used to calculate what is called an acoustic caliper log. This method obviously relies on knowing with accuracy the velocity of propagation of the signal in the borehole fluid, a factor that can be determined if the interval logged includes a short section of recording in a section of known diameter, e.g. inside a length of casing.

Figure 4-5 shows on the left, in track one, a section of BHTV travel time data in the normal "unrolled" 2-d presentation. In track two the travel time data is shown reconstituted into a 3-d representation of the borehole. Of note are the diameter change at 26.8 m and the cavity in the borehole wall at 29.5 m. In track three are shown three "bird's-eye view" cross-sections of the borehole, orientated such that north is uppermost, followed clockwise by east, south and west. The borehole enlargement in the SW quadrant at 29.5 m is clearly evident.

The log shown in track four is an acoustic diameter log based on the mean borehole diameter calculated from the BHTV travel time data, whilst in track five we see a simulated 3-d log using this data.

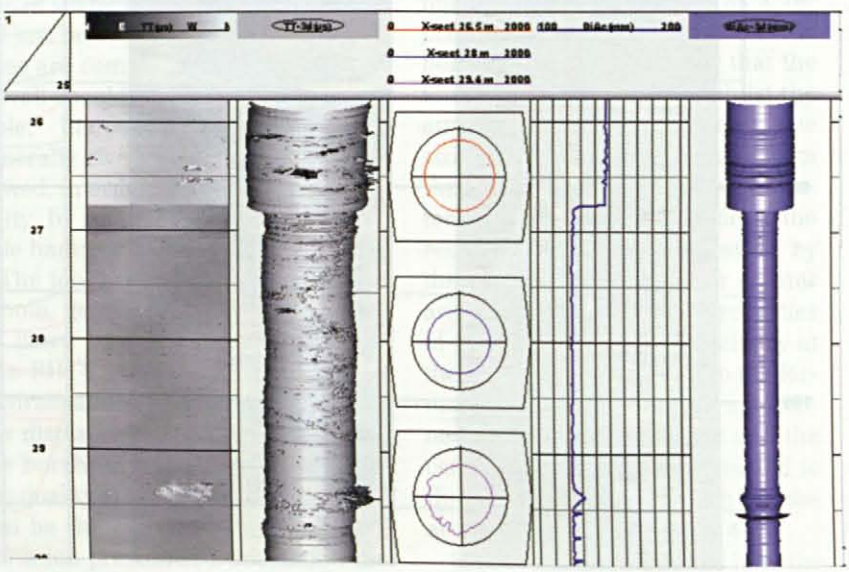


Figure 4-4 Derivation of the acoustic caliper log from BHTV travel time values

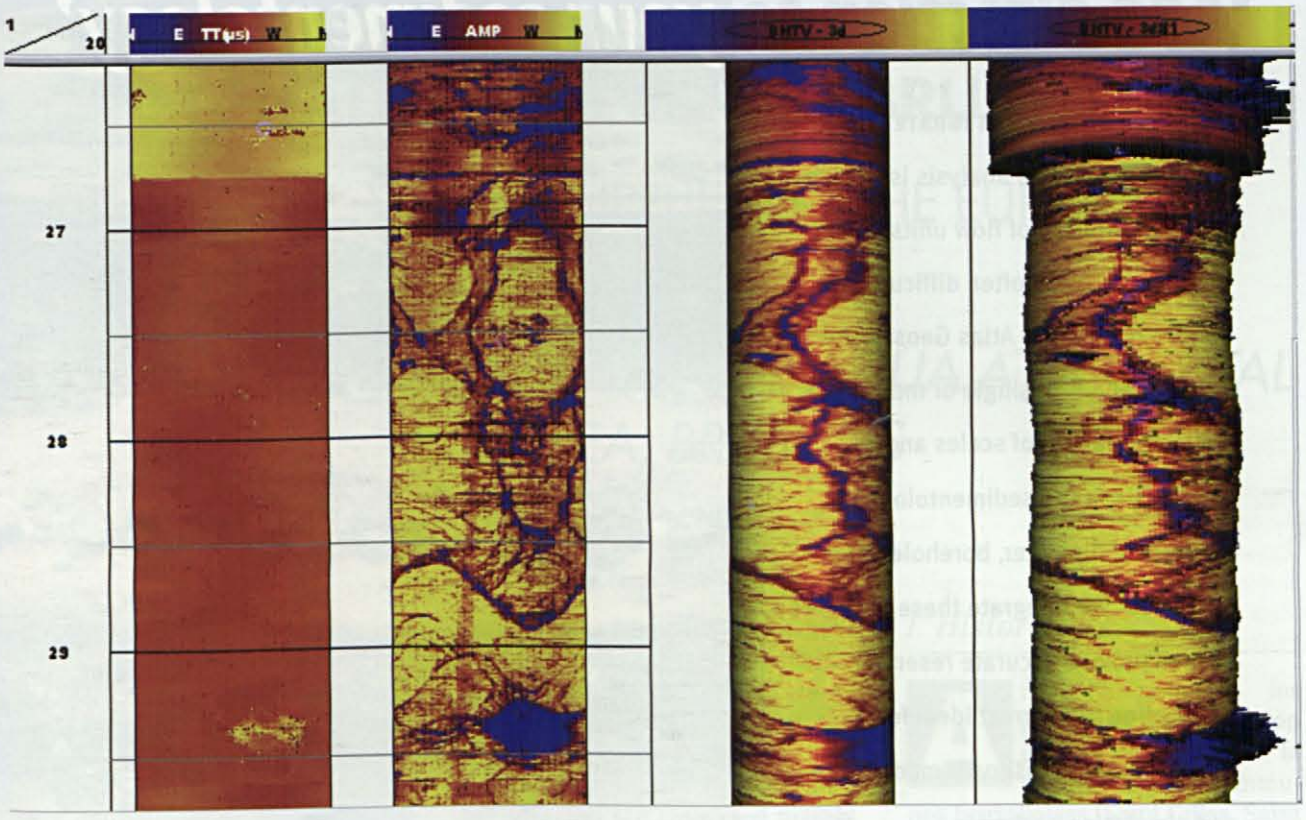


Figure 4-5 Pseudo-3d BHTV data presentation simulating a core sample

A principal application of this technique is in establishing downhole stress directions where borehole ovalisation or break-outs have occurred.

4.5. Pseudo three-dimensional BHTV presentation

Should it be considered useful; perhaps, for example, as an aid to core reconstruction, the BHTV data can also be viewed or printed in a pseudo-3d representation from any desired angle of view.

In the left-hand two tracks are the 2-d travel time and amplitude BHTV images. In the third track the amplitude image has been taken and reconstituted into a cylinder, viewed from a southerly direction. In the case of the fourth track, using the principle of the acoustic caliper described in the previous section, the travel time data has also been incorporated into the 3-d presentation to give an impression of the changing diameter of the borehole.

5. Customising the logging suite

Depending on the type and scope of the investigation and its geological framework, several other logs can be usefully added to the basic FDS/FWS/BHTV suite described in the previous sections of this report:

Log parameters	*Applications*
Fluid temperature/ conductivity:	provides important hydrogeological data and information on the geothermal gradient relevant in deeper investigations
Neutron porosity:	formation porosity measurement, lithological information when used in conjunction with other formation logs
Formation resistivity:	formation porosity, formation fluid characteristics, comparison of deep and shallow-reading measurements can identify permeable zones
Flowmeter:	identification of water-producing zones intersected by the borehole

6. Concluding remarks

The quantity and richness of information provided by modern digital geophysical logging techniques continues to increase. The application of these techniques to tunnelling investigations will ensure that an accurate assessment of ground conditions is made and allow potentially problematic zones to be identified in time for appropriate preventative measures to be taken.

We recommend that the FDS/FWS/BHTV suite be regarded as a baseline standard for this type of investigation; one to which other logs can be added according to the scope and geological framework of the investigation.

Finally, it is our hope that the reader will have found this document both interesting and relevant. Contact EGS for any clarification or for further information regarding these services, or for assistance in defining a programme that covers your geophysical logging requirements.

'Add direction to your sedimentology'

ORIENTATION DATA INTEGRATED WITH sedimentary facies analysis is vital to the identification of flow units within reservoirs. This is often difficult from cores alone. Baker Atlas Geoscience offers analysis of single or multiple wells at a variety of scales and are specialists in the sedimentological analysis of dipmeter, borehole images and cores. We integrate these borehole data to provide accurate reservoir description in a format ideal for direct input into reservoir modelling and simulation packages.

Permo-Triassic Fluvial Sediments, Burghead, Moray, Scotland.
Photograph courtesy of Andy Duncan.

Micro-scale

- Petrographic analysis, diagenesis, reservoir quality investigations
- Permeability characterisation using probe permeameter measurements

Reservoir-scale

- Facies interpretation of cores, dipmeters and borehole images
- Core goniometry of oriented or unoriented cores, whole or two-thirds slabbed
- Palaeotransport analysis, palaeoslope recognition and sandbody orientation
- Digital core imaging

Regional-scale

- Depositional modelling, environmental reconstruction and palaeoclimate forecasting
- Reservoir characterisation including provision of facies zonation and reservoir properties layering
- Application of sequence stratigraphic concepts for the identification of genetic sediment units and field-wide correlations.

BAKER HUGHES

Baker Atlas
GEOScience
INCORPORATING Z&S GEOSCIENCE

RECALL
eXpress®
Horizon®
Optima®
Seislink®
PETROS
INCLINE
SPATIAL

"The reservoir characterisation specialists"

For further information contact your regional Baker Atlas Geoscience office:

EUROPE, & AFRICA	(44) 1224 822555
NORTH AMERICA & LATIN AMERICA:	(1) 281 445 0767
MIDDLE EAST:	(973) 212234
ASIA & PACIFIC:	(61) 8 9322 4244

or for further information on our local offices, visit our web site at: http://www.zands.com/

LA C.I.B.E., FOURNISSEUR D'EAU DE LA CAPITALE EUROPEENNE, BRUXELLES

THE C.I.B.E. WATER SUPPLIER TO THE EUROPEAN CAPITAL, BRUSSELLS

LA C.I.B.E. SUMINISTRADORA DE AGUA A LA CAPITAL EUROPEA, BRUSELAS

Par V. Generet

Résumé

La CIBE (Compagnie Intercommunale Bruxelloise des Eaux) a été créée en 1891.En tant que Compagnie industrielle de service public, la CIBE assure deux fonctions principales:la production d'eau potable (qui est distribuée à 38 villages et districts urbains qui dépendent de la CIBE) et la fourniture d'une assistance (services) aux communes et associations communales qui auraient confié l'exploitation de leur réseau de distribution et la gestion du service aux consommateurs eux-mêmes.

Ses activités (à la fois techniques et commerciales) sont limitées principalement au domaine de l'eau. La CIBE fait les études préalables puis installe et utilise les installations de pompage, d'épuration, de traitement, de transport, de stockage et de distribution de l'eau (figure 1).

Abstract

The C.I.B.E. (Compagnie Intercommunales Bruxelloise des Eaux) was created in 1891. As a public servie and an industrial company, the CIBE assumes two main functions: production of drinking water (which is provided to 38 villages and communities which belong to CIBE) and providing services to those communities or association of communities which might have entrusted the exploitation of their ditribution network as well as the management of the service to consumers.

Its activities (both technical and commercial) are restricted mainly to the water business. The CIBE studies, installs and exploits installations of pumping, purification, treatment, transport, storage and distribution of water (Fig.1).

Resumen

La CIBE (Compagnie Intercommunale Bruselloise del Eaux) fue creada en 1891. Como sercicio público y empresa industrial, la CIBE asume dos funciones principales: la producción de agua potable (que suministra esencialmente a las 38 poblaciones y comunidades que la constituyen) y la prestación de servicios a aquellas comunidades y asociaciones de comunidades que le hayan confiado la explotación de su servicio de distribución así como la gestión de servicios a los abonados. Sus actividades (tanto técnicas como comerciales) se refieren fundamentalmente al negocio del agua. La CIBE estudia, establece explota y desarrolla instalaciones de captación, depuración, tratamiento, transporte, almacenaje y distribución del agua (Figura 1).

I. Historique

Afin de résoudre les problèmes d'alimentation en eau de qualité de la capitale, quatre communes bruxelloises (Saint Gilles, Saint Josse, Ixelles et Schaerbeek) décident de s'associer sans financement extérieur. Et le 12 décembre 1891 a lieu la création officielle de la CIE (Compagnie intercommunale des Eaux de l'agglomération bruxelloise). Les premières sources (du Crupet et du Bocq) et rivière (le Hoyoux), situées dans le Condroz, sont rapidement sélectionnées. Un travail titanesque commence alors en ce début de 20e siècle afin de rallier les sources à la capitale sur près de 100 km.

En 1908, le Roi accorde enfin une reconnaissance officielle à la CIE qui devient alors la CIBE (Compagnie Intercommunale Bruxelloise des Eaux).

Après la seconde guerre mondiale, la CIBE doit absolument trouver de nouveaux captages pour pallier à l'augmentation continue de la consommation en eau et notamment dans une ancienne mine de pyrite (à Vedrin) où elle apprend à éliminer le fer de l'eau et dans trois carrières (à Ecaussines) où elle doit maîtriser l'eutrophisation.

De tout temps, la CIBE a cherché à se moderniser et à soigner son image de marque. Parallèlement,

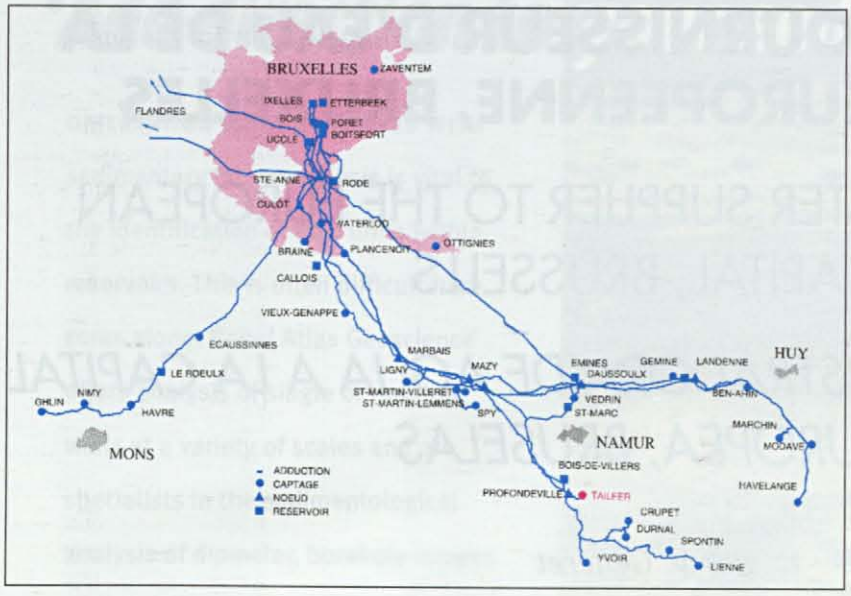


Fig. 1: Réseau de captages et d'adduction d'eau de la C.I.B.E.

elle vit au rythme d'une capitale en constante mutation, la suivant dans ses grands travaux de voirie et de construction.

Mais elle doit une fois de plus réagir à l'augmentation des consommations en étendant, cette fois, ses ressources à l'eau de surface (la Meuse, à Tailfer). A la fin des années 60, elle décide donc de se construire un important complexe de captage et de purification (opérationnel dès 1973 et complètement terminé en 76). Les années 70 ne sont cependant guère réjouissantes: crises pétrolières, inflation et pressions fiscales des provinces wallonnes freinent la CIBE dans son élan et augmentent ses dépenses alors que les volumes fournis se stabilisent. On ne pourra parler de véritable relance qu'à partir de 1985. L'amélioration se poursuit durant les années 90: la consommation ne cesse de progresser et la CIBE prévoit de nouveaux investissements.

Ces dernières années, la CIBE s'est consacrée au développement de son infrastructure et à la création, en 1995, d'un Département Environnement. Cette même année, elle se voit décerner la certification ISO 9002.

II. Aspects hydrogeologiques des captages

Une position géographique et géologique défavorable, des besoins en eau sans cesse croissants, ont progressivement amené la CIBE à rechercher, parfois à plus de 100 km, de nouveaux sites. Actuellement, les ouvrages de captage occupent 28 sites (dont un de surface) répartis dans 6 aquifères.

Un tel contexte offre une diversité géologique qu'il faut pouvoir gérer: captages d'eau de source par galeries dans des calcaires (aquifère dinantien, Modave et Bassin du Bocq), par puits dans des graviers (alluvions quaternaires, région de Huy) et des sables à faible profondeur (aquifère bruxellien, Brabant wallon), par forages dans la craie à grande profondeur (aquifère crétacé, région de Mons); captages d'eau de mine (calcaires frasniens et dinantiens, Vedrin), d'eau de carrières (calcaires frasniens à Saint-Martin, dinantiens à Ecaussines et Ligny) ou d'eau de surface (Meuse, Tailfer).

Fig. 2: Vue sur une partie de la zone de protection du captage de Modove.

Fig. 3: Evolution de la production journalière moyenne en fonction du temps.

Il va de soit que tous les captages subissent une surveillance stricte. Ainsi, la CIBE poursuit une politique de protection de ses zones de captage sur base de l'hydrogéologie, par conservation minutieuse des biens et achats de terrains avoisinants, et ceci depuis plus de 30 ans. La CIBE gère ainsi plusieurs domaines dont celui de Modave avec 450 hectares en pleine propriété (fig. 2).

Ces captages ne sont pas tous sollicités de la même manière. Le dispositif de production de la CIBE distingue en effet deux types de captages: les captages dits «de base» qui fonctionnent en permanence et les captages «à réserve» utilisés de manière plus irrégulière (captages en carrière, par exemple).

III. De la technique...

Réseau d'adduction

La CIBE fournit chaque jour près de 400.000 t d'eau à 2,1 millions d'habitants. En d'autres termes, 10 communes, 13 distributeurs d'eau et 2 organismes font appel à ses services.

Les principales lignes d'adduction convergent toutes vers le principal centre de consommation ou de répartition de la CIBE, la capitale et sa grande périphérie.

Le territoire desservi (42 communes), très variable, passe d'agglomérations urbaines à un aéroport et à des localités rurales. Cette vaste zone d'activité a été répartie en 6 secteurs locaux disposant chacun d'un siège technique et d'un service de garde.

Pour acheminer chaque année 140 millions de m3, la CIBE a déjà posé 496 km de canalisations d'adduction, 224 km de conduites de répartition, 4135 km de réseau de distribution. La CIBE, c'est encore 3 stations de pompage sur adduction, 2 tours d'équilibre, 7 réservoirs en amont et 5 réservoirs en aval des adductions. Ce système est parfaitement intégré et coordonné de manière à adapter la fourniture aux fluctuations de consommation.

Système de qualité

Le point fort de la CIBE est ce souci de la qualité du produit qui se manifeste tout au long du processus de production et de distribution. La CIBE se montre en effet plus exigeante que la législation actuellement en vigueur et la qualité de l'eau distribuée est sévèrement contrôlée. Afin de garantir cette qualité à tout moment, la CIBE dispose d'un laboratoire central (implanté dans la capitale) et de trois laboratoires de site.

Le produit de chaque captage subit d'innombrables analyses, se voit imposer des traitements personnalisés et est contrôlé jusqu'au point de fourniture aux consommateurs. Des échantillons sont quotidiennement prélevés à tous les stades du circuit de production ou de distribution pour les faire parvenir au laboratoire central.

IV. Developpement de la C.I.B.E.

En 1996, le volume d'eau produit par la CIBE atteint 137,5 millions de m^3 (58,8 % d'eau souterraine et 41,2 % de surface). Il s'agit d'un léger recul (3,2 millions de m^3), après une augmentation continue depuis 1993.

Depuis 1900, la production journalière moyenne est passée de 22.000 m3/jour à 380.000 m3/jour, ce qui représente une progression totale de 1.727 %, progression qui semble se montrer exponentielle du reste (fig. 3) !

Au cours de la dernière décennie, la production totale est ainsi passée de 125,8 à 137,5 millions de m^3 (fig. 4), ce qui représente une progression totale de 9,3 % et traduit donc une croissance moyenne annuelle de quelque 0,9 %.

En un an, le volume capté dans les eaux de surface a augmenté au détriment des eaux souterraines, faisant ainsi passer la proportion de 67,8/32,2 % à 58,8/41,2 % (fig.3). C'est en fait la richesse des nappes souterraines qui détermine le recours fait aux eaux de surface. Elle influence en effet à la fois la qualité intrinsèque des eaux fournies et le prix de revient moyen du mètre cube d'eau produit.

De l'économie...

En 1996, la CIBE a réalisé un chiffre d'affaires de 5,6 milliards de FB, soit 71,1 millions de mieux qu'en 1995. Le produit de la vente de l'eau portait quant à lui sur un montant de 3,65 milliards de FB. La valeur totale des activités de distribution, en constante progression

depuis 1990, atteint 1,4 milliards de FB en 1996 (+ 28 %).

La CIBE investit annuellement d'importants montants. Aujourd'hui encore, ces derniers s'inscrivent dans un vaste programme échelonné sur plusieurs années. Ce programme, entrepris en 1993 vise essentiellement le développement de l'infrastructure existante.

En 1995, le montant total des investissements avoisinait les 176,3 millions de FB. Un an plus tard, ce montant a atteint 328,9 millions, ce montant global étant alloué aux captages, adductions, conduites et réservoirs de répartition ainsi qu'aux immeubles d'exploitation.

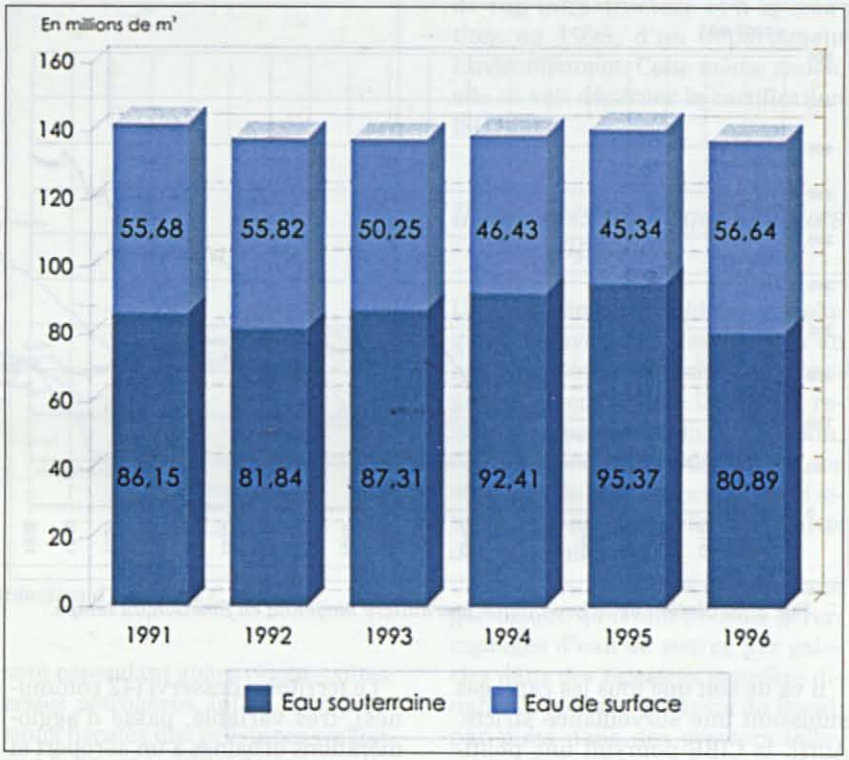


Fig. 4: Histogramme du rapport eau de surface /eau de captage en fonction du temps.

Des ressources humaines...

La CIBE emploie actuellement 1424 agents. Ce personnel hautement compétent compte 823 ouvriers, 529 agents administratifs et techniques et 92 cadres.

Le chiffre d'affaire généré par chaque agent peut être comptabilisé en milliers de FB, et n'a cessé d'augmenter depuis 1990. En effet, de 3.000,- BEF à l'époque, il atteint, six ans plus tard, 3.931,-BEF.

TECHNICAL DATA CAPTURE IN GEOLOGICAL AND GEOPHYSICAL DATA MANAGEMENT

TOMA DE DATOS TÉCNICOS EN LA GESTIÓN DE DATOS GEOLÓGICOS Y GEOFÍSICOS

SAISIE DES DONNÉES TECHNIQUES POUR LA GESTION DES DONNÉES GÉOLOGIQUES ET GÉOPHYSIQUES

by Eur.Geol. Robert G. Font and Elaine M. Travers
Geoscience Data Management, Dallas, Texas (USA)

Abstract

When most of us think of geological data management, we often envision the end product: images of all documents related to a specific geographic region or geological area magically appearing on our computer screens. In real life, any system that provides this service is only as good as the information that has been put into it. Often it takes an enormous effort to capture the data and enter it into a system that is efficient and easy to use. Identification and classification of scientific data are best performed by experienced technical personnel who understand the data fully. Choosing a format that will provide maximum benefit to the user is an important consideration. Adherence to uniform data entry standards is vital in establishing a coherent data base. Finally, an ongoing quality control program is needed to ensure consistency of internal standards throughout the system. Specific procedures and recommendations are presented.

Resumen

Cuando la mayoría de nosotros pensamos en la gestión de información geológica, solemos pensar en el producto final: las imágenes de todos los documentos relacionados con una región geográfica específica o área geológica, apareciendo por arte de magia en las pantallas de nuestros ordenadores. En la vida real, cualquier sistema que proporcione dicho servicio será tan fiable como la información que se le haya suministrado. A menudo es necesario un gran esfuerzo para adquirir los datos e introducirlos en un sistema que sea eficiente y fácil de utilizar. La identificación y clasificación de los datos científicos se realizan con mayor eficacia por personal técnico experimentado que entienda completamente los datos. La elección de un formato que proporcione el máximo beneficio al usuario es un asunto de importancia capital. La adopción a un sistema de entrada de datos uniforme es vital en el establecimiento de una base de datos coherente. Finalmente es necesario un sistema de control de calidad para asegurar la consistencia de las normas internas en todo el sistema. En el presente trabajo se presentan procedimientos y recomendaciones específicas para la gestión de este tipo de información.

Résumé

Quand la majorité d'entre nous évoque le problème de l'information géologique, nous ne pensons qu'au produit final : la représentation de l'ensemble des documents relatifs à une région géographique donnée ou zone géologique, qui apparaissent comme par magie sur les écrans des ordinateurs. En réalité, n'importe quel système qui fournit ce service aura le même niveau de fiabilité que celui de l'information entrée. Parfois, des efforts importants sont nécessaires pour acquérir les données et les entrer dans un système qui soit efficace et d'utilisation facile. L'identification et la classification des données scientifiques s'effectuent avec la meilleure efficacité lorsqu'un personnel technique expérimenté est à même de comprendre totalement la nature des données. Le choix d'un format qui donne le maximum de satisfaction à l'utilisateur est un sujet d'importance capitale. La sélection d'un système d'entrée des données, uniforme, est crucial dans l'établissement d'une base cohérente de données. Finalement, l'on a besoin d'un système de contrôle de la qualité pour assurer l'homogénéité des règles régissant l'ensemble du système. Dans le ca-

dre du travail effectué, l'auteur présente les procédés et les recommandations spécifiques pour la gestion de ce type d'information.

Introduction

Geoscience professionals in the oil and gas industry use vast quantities of technical information. Many of us dream of the day when we can see all of our data on the computer screen and retrieve it at a moment's notice in a format that will be of optimum benefit to us in our daily tasks. Thus, when we think of «data management» we tend to contemplate the end product: the world map on the computer screen, the point-and-shoot technique, and all of the files and documents we need «magically» appearing along with all of the detailed information we seek.

What may not be apparent to us as end-users is the enormous effort it takes to capture this material. Data capture involves the proper identification and classification of the documents, the indexing, coding and cataloguing process, data entry into a searchable data base, preparing the physical files and storing them so that they may be easily retrieved. A well-planned data management strategy is vital to deriving the maximum benefit from the data and preserving its value.

Experience has shown us that optimum data capture depends on four basic ingredients. Thus, the «formula for success» consists of the following components:

(a) the «right personnel» to manage the data

(b) the «proper format» for data capture

(c) the «internal standards» to ensure uniformity

(d) the «quality control program» to ensure accuracy

The right personnel

Quality people perform quality work. Geological data management personnel is no exception.

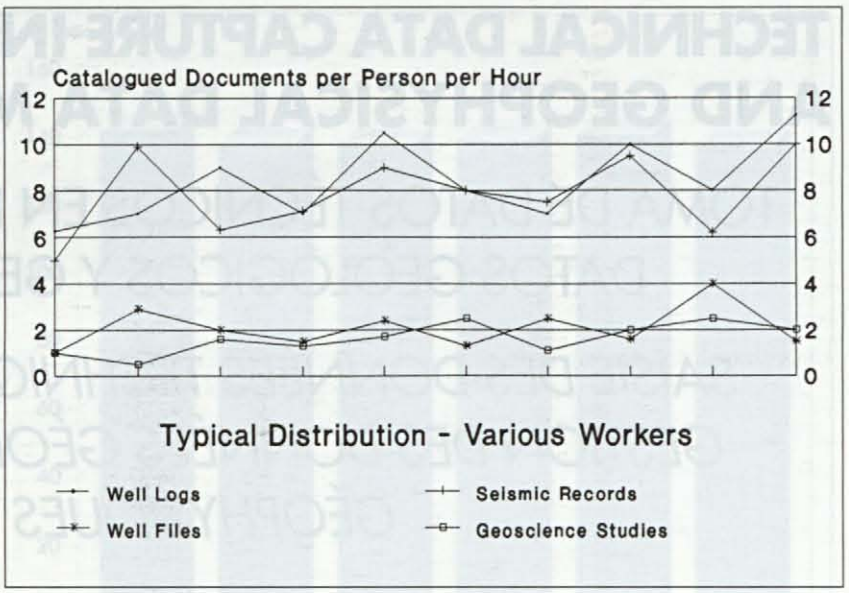


Figura 1. Technical Data Capture. Cataloging rates - Detailed inventories well and seismic data, technical studies.

Individuals who manage technical data must understand the different data types, their value to the interpreter and how they are used. Furthermore, they must know how to record this valuable information so that it is most beneficial to the end-user. The ideal data management staff is a blend of well-trained industry professionals, technicians and clerks, each performing tasks according to his level of expertise. Table 1 and Figure 1 summarize the personnel best suited for cataloguing various data types and illustrates typical productivity rates. Every member of the staff must be made aware of his contribution to the overall success of the company and encouraged to take pride in his accomplishments.

The proper format

The proper format for capturing technical data is a key component of successful data management. A major element of this phase involves the selection of the appropriate data base. A variety of excellent data bases are available for commercial purchase, or are the product of in-house development in some companies. Regardless of the origin, the data base must be simple, user-friendly, flexible and have sufficient storage capacity. It should also be easy to learn for both the end user and the data entry personnel. It must also be expandable, to allow for increased volumes of data to be added as the company's needs change. Finally, it should be flexible enough to permit sophisticated searches on multiple attributes in a variety of combinations.

Exactly how user-friendly does the data base need to be? Often the more powerful systems require a significant learning time in order to be used effectively. The key to answering this question correctly depends on the answer to another question: «Who is really going to use it?» Given the staff availability, some companies may find it more practical to delegate data base searches to the data management staff. Other end users will prefer to search the data base themselves, leaving the physical data retrieval for their data management or support personnel. Some factors in these decisions are the amount of time the end user has available for learning the system and the time he/she has available for actually performing the search. Frequency of use is also an important consideration, since it may be necessary to «re-learn» the system every time if searches are not performed daily. The

advantage to end user searching is the reduction of support staff. Alternatively, the advantage to relying on data management personnel for complete service is that the mechanics of the search and retrieval process are transparent to the end user. In the latter case, the «user-friendliness» of the data base becomes less critical. If used on a daily basis, workers can master «less-than-friendly» systems and operate them very effectively. Therefore, the question of «who is *really* going to use it?» becomes a critical factor in the selection.

Best Suited Personnel	Data Type Examples	Cataloguing Rate/Hour
Professionals (scientists and engineers)	Complex data often needing "judgement calls".	Highly variable, but average (in our experience) 1.5 files/hr
Technicians (Trained/Experienced)	Complex data, not involving "judgement calls". Also, searches for data "hidden" in the files.	Variable, but average 2.0 files/hr
Clerks (Trained/Experienced)	Intermediate to simple files.	Variable, but average 7.5 files/hr

Tabla 1. «The right personnel». For detailed technical data capture.

«The internal standards»

To ensure that key attributes of the data will be captured consistently, uniform internal standards are required. Without adherence to these standards, the integrity of the data base is compromised, and the information becomes less meaningful to the end user and less valuable to the company. Training is vital. Well-documented procedures manuals can also be a good source for ensuring uniformity. It is useful to develop a set of «coding forms» on which key information is handwritten before data entry. These forms allow the cataloguing personnel to have a ready guide listing all of the key parameters to be captured and other procedures that must be followed. The advantage of the coding forms is that they act as a quick reference and are apt to be used more often than a lengthy manual. They are also essential if cataloguing and data entry are done separately by more than one person. A partial listing of the most significant categories (maps and technical contents) to be captured from well files and geoscience studies, as well as selected log types and seismic attributes typically coded from log files and seismic records are presented in Table 2 (a and b).

As an example, a map is submitted to the data management staff for data capture. It lies within an area of high priority to the company, but has no title block or author's name. The map is a contour map joining points of equal thickness. It illustrates a sand with porosity of 15% or greater and true resistivity values of at least 10 ohm-metre^2/metre (i.e. the values defining the productive intervals). The map may be classified by the cataloguer as an isopach, a porosity map, an isolith or a net effective pay map. Which is correct? Although it may fit all these categories, the last (net effective pay map) defines it best. These rules should be established at the onset and should be well documented. The end result is consistency in coding and classification and a uniform and reliable data base. Table 3 shows an example illustrating the criteria for proper classification of selected map types typically found in technical studies.

MAP TYPES	TECHNICAL STUDY CONTENTS
• Structure	• Cross Sections
• Time-Structure	• Interpreted Maps
• Isopach	• Montages
• Isochron	• Production Data/Tests/Plots
• Velocity Gradient	• Formation Tests
• Porosity	• Pressure Buildup Data
• Production/Shows	• Interpreted Seismic
• Facies/Pinchout	• Paleontology
• Isolith	• Geochemistry
• Net Effective Pay	• Core Analysis
• Subcrop	• Rock Mechanics
• Fault/Fault Plane	• Log Data
• Tectonic/Lineaments	• Log Analysis Data
• Gravity/Magnetics	• Petrography
• Surface Geology	• Gravity/Mag Data
• Source Rock Data	• Daily Drilling Reports
• Surface Geochemistry	• Fluid/Gas Analysis
• Reservoir Properties	• Mineralogical Data
• Hydrodynamics	• Well Completion Reports
• Permeability	• Well Treatment Reports
• Acreage	• Environmental Impact Statements
• Index	• Geohazards Reports
• Others	• Driller's Logs
	• Surveyor Data
	• Engineering Tests
	• Others

Tabla 2a. Map types and technical contents typically catalogued from studies and well files.

SELECTED LOG TYPES AND SEISMIC ATTRIBUTES	
• Measurement While Drilling	• Polarity
• Dipmeter	• Fold
• Directional Surveys	• Scale
• Electric	• Shot Point Range
• Gamma Ray	• Stack vs. Migration
• Computer Processed	• AVO Analysis
• (i.e. VOLAN, etc.)	• 3D Data and Displays
• Porosity	• APF Display
• Neutron/Density	• Depth Display
• Sonic	• Synthetics
• Sample	• Refraction Statics
• Mud	• RAP Stack, RAP-MIG
• Production	• Pre-Stack Migration
• Cement Bond	• Etc., etc., etc.
• Tracer Surveys	
• Temperature Surveys	
• Etc.	
• True Vertical Depth	
• Etc., etc., etc.	

Tabla 2b. Log types and seismic parameters selected contents catalogued from logs and seismic.

MAP TYPE	DEFINITIONS
Isopach	Map of thickness values between two separate horizons. Contour lines join points of equal thickness. Determined from well data or from depth-converted seismic.
Isolith	Lithology isopachs. Examples include maps of net sand greater than a set percentage of porosity; map of percentage of lithology within a total isopach interval; ratio maps of % dolomite over % limestone depicting the desirable reservoir rock.
Isochron	Mapped on values between two separate seismic reflectors and contoured in time (seconds or milliseconds).
Net Effective Pay	Generally isopach maps designated as net pay or net effective pay. Typically defined by specific attributes, such as resistivity/ porosity cutoffs, illustrating reservoir thicknesses possessing such attributes.

Tabla 3. Criteria for classification selected map types illustrating interval thickness.

The «quality control program»

No matter how well-trained or experienced the personnel, errors will occur. Implementation of a strong quality control (QC) program (1) ensures compliance with the rules and internal standards, and (2) reduces the frequency of errors. The QC program should be performed systematically throughout the life of the data management project, that is, during initial data capture and also during subsequent updates or additions to the file. In some cases, a data base modification to track handling of files by specific staff members may be needed. Quality control should be performed by the data management staff at the supervisory or professional level.

Cost effectiveness

The value of a well-organized, well-maintained and easily accessible technical information system cannot be overstated. The resulting benefits are technical efficiency and cost savings.

Technical efficiency is gained through time savings. Search and retrieval time is significantly reduced. Because critical data are quickly identifiable and retrievable when needed, company professionals are able use their time more effectively. Once the database is in place, ongoing maintenance and quality control will require less labour. At this point data management staff can be reduced or reassigned to other tasks.

Cost savings are achieved through tangible and intangible savings. Properly catalogued technical data eliminates the wasteful repurchase of data already available, as well as duplication of previous works. In addition, the inventory helps a company identify data to be used in joint ventures, trades, divestment efforts and strategic planning, and helps establish a concrete monetary value of the data owned.

Summary and conclusions

The formula for success regarding geological data management translates to four basic ingredients: the «right personnel», the «proper format», the «internal standards» and the «quality control program». These four fundamental factors constitute the essence of successful geological data management; all other elements are subordinate to them. The proper capture of technical data results in palpable advantages that improve internal efficiency and generate income. Any firm that achieves these results will posses a competitive edge.

Acknowledgments

We express sincere gratitude to our company colleagues and staff members for their support and for furnishing, through their work and efforts, the practical evidence which sustains the ideology and conclusions arrived at in this paper. A very special thanks is directed to our clients, ORYX ENERGY COMPANY, UNION PACIFIC RESOURCES, EXXON COMPANY USA, MAXUS ENERGY CORPORATION and NEARBURG PRODUCING COMPANY; without an opportunity to serve them, we would not have acquired the practical knowledge pertinent to this discussion.

References

FONT, R. G. (1996): «On the Subject of Technical Data Capture and Cataloguing Procedures Related to Geological Data Management». Abstract, Proceedings of II AAPG/SVG International Congress and Exhibition, Caracas, Venezuela.

LANGEMO, M. and R. J. Bloomquist (1985): «Overview of Records and Information Management». ARMA - ISBN: 0-933887-16-7, 46 p.

RICKS, B. R., A. J. Swafford and K. F. Gow (1992): «Information and Image Management: A Records System Approach». Southwestern Publishing, (ARMA - ISBN: 0-538-70068-8), 591 p.

EXTRACTION OF MINERAL AND THE AQUATIC ENVIRONMENT. FIELDS AND SIZE OF THE CONFLICT IN POLAND

LA EXTRACCIÓN DE MINERALES Y EL MEDIO ACUÁTICO. ÁMBITO Y DIMENSIÓN DEL CONFLICTO EN POLONIA

L'EXPLOITATION MINIÈRE ET SON IMPACT SUR L'EAU. RAISONS ET AMPLEUR DU CONFLIT EN POLOGNE

by Zbigniew Wilk

University of Mining and Metallurgy. Faculty of Geology, Gephysics & Environmental Protection. Al. Mickiewicza, 30. 30059 Krakow. wilk@geolog.geol.agh.edu.pl

Abstract

The author revises the types of environmental impact exerted by the various subsectors of the Polish mining industry upon surface and underground water resources in the country. Lowering of free groundwater table or piezometric head of confined aquifers and pollution of river water by highly mineralized mine waters represent the most outstanding problems detected in several regions of the country. A foresighted decline of mining production in Poland and the implementation of specific preventive measures, point towards an improvement in the current situation in the coming future.

Resumen

El autor pasa revista a los tipos de impactos ambientales que producen los diferentes subsectores de la minería en Polonia sobre los recursos hídricos superficiales y subterráneos del país. El descenso de los niveles freáticos o de los niveles piezométricos de los acuíferos confinados y la contaminación de las aguas de los ríos a causa de aguas mineralizadas procedentes de las minas, son los principales problemas detectados en diversas regiones del país. La prevista reducción de la producción minera en Polonia y la puesta de marcha de medidas preventivas específicas parecen apuntar a una mejora en la actual situación en el futuro inmediato.

Résumé

L'auteur passe en revue l'ensemble des répercussions sur l'environnement, liées aux différents secteurs de l'industrie minière polonaise vis à vis des ressources en eau de surface et souterraines du pays. La baisse du niveau des nappes phréatiques ou du niveau piézométrique des aquifères confinés ainsi que la pollution des rivières par des eaux fortement minéralisées en provenance des exploitations minières, constituent les problèmes les plus préoccupants et actuels, dans plusieurs régions du pays. Le déclin attendu de la production minière en Pologne et la mise en œuvre de mesures préventives adaptées vont dans la bonne direction, celle d'une amélioration de la situation actuelle pour les années à venir.

Introduction

Within the last two decades, contribution of the mineral industry to Poland's GNP had decreased. In this period of time, an entire mining district was abandoned, several coal mines, three zinc-lead ore mines, four salt mines and one native sulphur open pit mine were closed. The extraction of coal dropped from about 180 million tonnes in 1979, to about 120 million tonnes in 1998. Nevertheless, mining still plays an important role in the Polish economy. Over one hundred underground mines and 2500 lar-

ge and medium size open pits are in operation. In terms of world mineral production, Poland occupies 7th place for hard coal, 5th place for lignite, 9th place for copper ores, 12th place for zinc-lead ores, 5th place for native sulphur. In 1997 the total amount of various minerals mined in Poland reached a level of nearly 500 million tonnes. The mining industry is known to create many hazards for most componente of the environment, among them for ground- und surface waters.

Forms of impacts of mining upon aquatic environment

The undesired but likely results of mineral extraction are:

a) deformation and displacement of the rock mass as result of the loss of mass under the landsurface;

b) drainage of the rock-mass as result of the necessary dewatering of mine workings;

c) disposal into surface streams of ground waters pumped out of mines;

d) dumping on the landsurface of flotation waste and dead (barren) rocks.

Deformation and displacement of the rock mass manifests itself as subsidence of the surface above and around the extracted portions of the deposit, which is preceeded by rockfalls as well as cracking and relaxation of rocks. The overall effect is the increase of rock permeability, and disruption of continuity of impermeable strata insulating the separate waterbearing horizons from each other, as well as mining workings from surface waters. As a result the whole rock mass above mining workings transforms its natural hydrogeological model. Originally it was characterized by the existence of more or less independent waterbearing horizons overlying the deposit. The new model very often represents a joint, complicated hydrodynamic and hydrochemical system into which surface waters also are included.

Even if the presence of thick, impermeable, plastic strata in the uppermost section of the hydrogeological profile of the mineral deposit does not allow the effects of mining drainage to reach the surface, the land subsidence above mining workings results in a rise in the groundwater level in relation to the landsurface. As an effect general transformations in the ground and surface water regime around the mine come into being. They are caused by changes in the position of the local watershed, surface inclination, conditions of ground- and surface water movement, infiltration, retention and deformation of stream beds etc. This results in further effects such as changes in conditions of vegetation, suitability of the ground for building purposes, changes in groundwater chemistry among others. Extreme form of impact of post exploitation land subsidence upon the aquatic environment is creation of wet soils, marshes and ponds.

In connection with mine water withdrawal accompanied by results of rock replacement and surface deformation, drastic rearrangement of natural water circulation system is caused. This primarily means radical changes to the groundwater flow pattern and velocity within the so called «cone of depression (drawdown)». In most cases, the shape of the dewatered space is enforced by facial changes of the drained permeable stratas and their tectonics. Practical consequences of the above mentioned transformations are the reduction of grounwater resources, disappearance of springs, drying out of marshes and ponds, increase in the rate of infiltration, decrease of runoff and stream flow and agrar land productivity etc.

The most important harmful impact of mineral extraction upon surface waters is the disposal of mine water into streams and rivers. The size and environmental significance of this depend on the magnitude of the load of contaminant contained in mine water (*e.g.* salt, sulphate acid, heavy minerals etc), and on the volume of stream flow. The result may be partial or even total degradation of good quality stream water.

Size of impacts of different branches of mining on aquatic environment

Hard coal mining. Hard coal is mined in Poland in three regions: Upper Silesian Coal Basin (GZW), Lower Silesian Coal Basin (DZW) and Lublin Coal Basin (LZW).

Upper Silesia is the largest region (5600 km^2) and is the main coal producing mining district in Poland. The extraction of coal on industrial scale in Upper Silesia has been carried out since the middle of the 18th century. The depth of mine workings covers a wide span from the outcrops to about 1200 metres. All mine workings represent a common hydraulic system producing one huge «cone of depression». Its «diameter» counts about 70 km, and the size of the drained out area is estimated at about 1750 km^2. Since the base of the drainage amounts 600 m in average and locally more than 1000 m therefore the volume of the drained out Carboniferous and of the overlying rocks amounts about 100 km^3. Under these circumstances, surface water bodies and groundwaters are drained by underground workings in the zones of natural hydraulic contacts such as outcrops of Carboniferous sandstones, joints and water-conducting fault zones as well as through post-explotation fractures.

The cumulative thickness of the Carboniferous Coal Measures within the GZW reaches up to 80 m and locally even more. Since the coal seams are mined in 80% with caving, the extraction of coal results in subsidence of ground surface by up to 20 metres. As result, in the areas with impermeable overburden of the Carboniferous groundwater level relatively rises with regard to the landsurface and ponds and marshes are coming to existence. The present number of such artificial ponds amounts 350, and their volume about 15 million m^3.

The most acute and, from the economic point of view, the most important adverse environmental effect of coal mining in the GZW is the discharge of saline water from the mines into the rivers. The underground waters occuring in the Carboniferous formations exhibit mineral content varying from several hundred milligrams to 250 g/dm^3. The regular rise of water mineralization with the progressing depth is observed over the whole GZW area.

According to data for 1996, the mine water inflow within the GZW totals about 837.000 m^3/day. Mine waters are disposed into two main Polish rivers; 77% into the Vistula and the rest into the Odra. The volume of mine water has decreased within the last few years to about 118.000 m^3/day due to the decrease of hard coal production in the GZW. The importance of the problem can be illustrated with the following numbers: Odra river - average low flow 1800 thousand m^3/day, NaCl load in discharged mine waters 5120 tonnes/day; Vistula river - average low flow 2350 thousand m^3/day, NaCl load in discharged mine waters 6874 t/day.

The pollution of the main Polish rivers the Vistula and Odra, with saline mine waters originating from the Upper Silesian coal mines, results in the degradation of natural water habitat. No use can be made of the rivers for water supply for municipal and agricultural purposes. The industrial plants supplied with river water incur tremendous costs for its treatment, inevitable losses are suffered caused by the increased corrosiveness of the polluted water, and many other adverse phenomena are observed. According to current estimations, failure in protecting the rivers against salinity results in about 30 billion USD cost being incurred every year for the treatment of the Vistula and Odra rivers.

The prognoses indicate that by 2005 the total volume of mine water will decrease to about 14%, while the concentration of chloride and sulphate ions will increase to about 67% due to the increase in the depth of coal extraction.

During the last few years, wide preparatory programme is under way, focusing on the implementation of large investments to finally solve the problem of saline mine waters. Its goal is the reduction of the mineralisation of the water in the Vistula river to such extent that it could meet the requirements of the Ist class of quality (mineral content below 250 mg/dm^3).

A very important harmful effect of coal mining in the GZW is the dumping of mine-spoil on the land surface. In terms of quantity, hard coal mine-spoil constitutes the largest group (about 45%) of industrial waste in Poland. The contamination of ground- and surface waters by leachate from dead rock which has been dumped from the coal mines on the surface causes very serious problems. Said contaminations, known as «local polluctions» are difficult to control, mainly because of inhomogenity of the material.

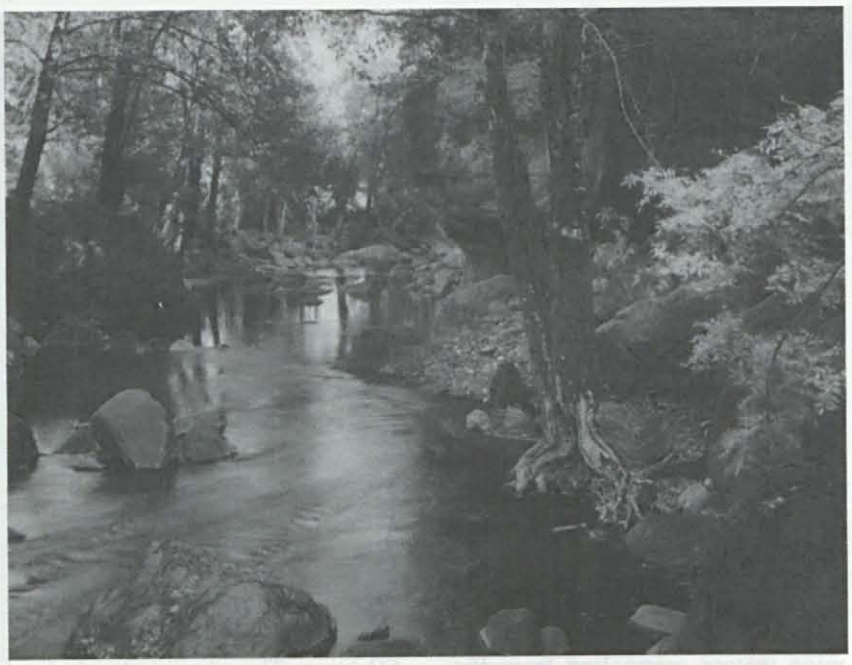
Taking into consideration the annual production of coal mine-spoil in the GZW and the mean sulphate production which is estimated at a rate of 20,8g/t of spoil/day, the total annual production in spoil deposited on the tips has been found amount to some 740 thousand t SO_4/year. The annual cloride load has been estimated to be about 65 thousand t/year. The heavy metals which are present in trace concentrations, are also an essential factor in water contamination in the vicinity of tips.

Within the Lower Silesian Coal Basin (DZW) which is situated in the Sudety Mts (South-Western Poland), the draining of Carboniferous rock-mass has been occuring for over two centuries. The coal resources have already been exausted and due to this coal extraction ceased in them, and in the next time they be flooded up to a certain level below landsurface.

The Carboniferous formations, which have very good permeability, mostly crop out directly at the surface. Due to this, as well as due to the caving in the extraction system used, and to prolonged exploitation, the entire rock-mass above the lowest workings, which are situated at the depth of about 1000 m has been dewatered. Its volume is estimated at about 32 km^3.

The original draining regime of several streams occuring within the area changed into an infiltrating one. In order to prevent surface water invasion into the mines the stream beds were artificially isolated over a length of about 20 km.

Mine water mineralization amounts to a few hundred mg/dm^3, and only



exceptionally reaches 8 g/dm³. The total volume of mine water pumped out of the mines amounts to some 22.000 m³/day, and the total load of dissolved solids is about 180 t/day.

Hard coal deposits within the Lublin Basin (East-Central Poland) were not discovered untill after World War II. The first and only mine was built in the 1970's. The extracted coal seams are situated at a depth of about 1000 m. Due to this, as well as to the plastic properties of the Carboniferous strata hosting the coal seams and the presence of thick impermeable clayey limestone within the Cretaceous obverburden, the impact of mining upon ground- and surface waters is insignificant.

Lignite mining. The extraction of lignite from nine open pits is concentrated in three mining districts in the central and southwestern parts of the country. The deposits occur within Tertiary continental, loose, partly waterbearing, partly watertight sediments. Due to good mine water quality, the total volume of which amounts to over 1000 thousand m³/day, it can be discharged into streams and lakes without, or after only light, treatment. Therefore the adverse impact of open pit extraction is limited to the drainage of ground- and surface waters at different scales, depending on the depths of the excavations and the permeability of the sediments being drained.

The second largest open pit lignite mine in Europe «Belchatów», some 200 m deep, is dewatered mainly by means of deep draining wells pumping on average over 450 thousand m³/day of water, This results in the creation of an extensive «cone of depression», the area of which is estimated at about 700 km². In order to avoid loss of water and to limit mine water inflow. the main stream Widawka which flowed by the area affected by dewatering had to be replaced. Its bed has been isolated against the underground for a length of about 35 km. Many other harmful effects have been observed in the water supply, plant vegetation, agrar land productivity, drying off of marshes and peatbogs etc.

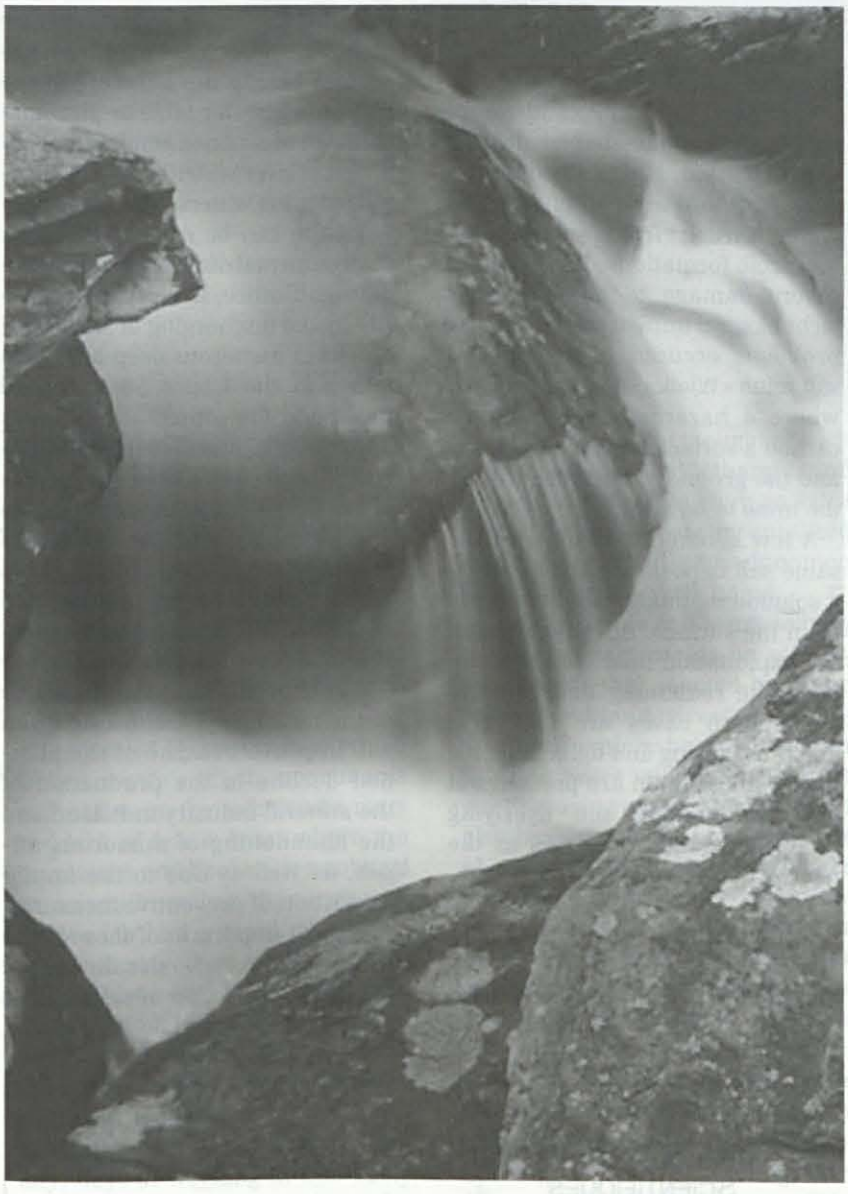
Zinc-lead ore mining. The impact on the aquatic environment resulting from the exploitation of these ore deposits is very serious. They occur within karstified dolomites and limestones of the triassic age, and are situated along the northern and northeastern rim of the Upper Silesian Coal Basin at a depth of few to 200 m.

The extraction of the ores has been carried out since the Middle Ages. At present, the extraction of the ore takes place in four mines situated to the west and northwest of Cracow. The present water inflow to the above mentioned mines totals 400 thousand m³/day.

Since the permeability of the ore-bearing carbonate rocks is extremly high, the «cone of depression» generated by mine dewatering is very large. Observations indicate that the ore mining, municipal and industrial water supply wells and deep open pits in which sand for backfilling of hard-coal mine workings is extracted, generate a common «cone of depression» within the confined Triasic aquifer estimated at about 500 km². Due to the effects of mine draining, an artificial retention pond disappeared and the neighbouring streams dried out complety over a total length of about 22 km.

Copper ore mining. Sulphidic copper ore deposits of sedimentary type occur in Lower Silesia (South-Western Poland) within the Fore-Sudetic Monocline at the bottom of the Upper Permian (Zechstein). The overburden of the copper-bearing shales consists of Zechstein, Triassic, Tertiary and Quaternary formations.

The regular extraction of the ore started at the beginning of the 1950's. At present four mines (24 deep shafts) at depths of between 650 m and 1200 m are operating. From the start of mine drainage until 1995, the total amount of mine water pumped out amount to 600 mln m³. The piezometric head of the directly drained Zechstein carbonate series has been lowered by more than 1000 m. Within it, around the extracted mine fields, a large scale depression zone arose. It has the shape of an ellipse, the longer axis of which is about 50 km long and the shorter one about 15km. According to various estimations its area amounts 600 km². Even larger is the area affected by the indirect influence of mine drainage within the Lower Tertiary waterbearing horizon. The area of the



respective «cone of depression» is estimated at 750 km^2. Oservations show that its growth has not ceased and that it is still expanding. The lowering of the piezometric head of the Lower Tertiary aquifer caused compaction of very thick sandy layers of this formation followed by land subsidence above the outcrops of the drained Zechstein limestones and dolomites.

The mineralization of Permian waters increases with the depth of occurence from 4 g/dm^3 to 350 g/dm^3. The highly mineralized mine water is used for ore flotation. The excess volume is stored in an open resorvoir and discharged into the Odra river at periods of high flow rate.

Native sulphur mining. Poland belongs to countries with a tradition of native sulphur mining lasting many centuries. A new period of sulphur mining began after World War II with the discovery of native sulphur deposits in marine Miocene formations in the northern part of the Carpathian Foredeep. The shallow part of the deposit was open-mined until recent years. Presently sulphur is mainly exploited by underground melting.

The sulphur-bearing formation is represented by gypsum and porous and cavernous very permeable limestones, the thickness of which ranges from a few to 60 m in the mining areas. In the overburden of the deposit two water-bearing horizons occur: the Quaternary and the Miocene.

The size and forms of the impact of native sulphur mining depend on the system used for its exploitation. Open-pit mining was possible after the water table in both mentioned aquifers was lowered below the bottom of the sulphur-bearing limestone by means of a surrounding barrier of deep draining wells armed with underwater pumps. Thus the water-table was artificially lowered from 30 to 90 m. As result the area of the cone of depression in the Miocene confined aquifer amounts to about 150 km^2. Within the Quaternary water-bearing horizon the size of the area with lowered free water-table is estimated at 23 km^2.

The mineral content of groundwater pumped from Miocene formations amounts to between 10 and 20 g/dm^3, and the content of H_2S is between 150 and 300 mg/dm^3. Mine water is transported to the treatment plant where the mineral and H_2S content is reduced. Nevertheless the load of chlorides and sulphates in the Vistula river increases significantly downstream of the location where mine water is discharged into it.

The essence of the underground melting method is the heating of the deposit up to 140°C by means of overheated water injected through bore-holes. At this temperature sulphur occuring in the limestone strata is melted. Due to its larger specific weight in comparison to water, it cumulates at the bottom of this strata. From there with the assistance of compressed air it is forced to flow up to the surface. The injection of hot water results in the creation of the «cone of depression» (!) within which the groundwater head rises to about 100 m. The range of the zone with increased groundwater head depends on both the hydrogeological and technological parameters. In the last years it amounted to about 280 km^2.

The most adverse form of environmental impact of underground-melting method of sulphur exploitation is the eruption and uncontrolled outflow of hot water onto the surface and into the Quaternary aquifer, resulting in groundwater contamination. The mineralization of the formely potable groundwater increased in the vicinity of the sulphur mines by up to 2 g/dm^2. The size of the area with polluted groundwater can be estimated at about 200 km^2. Above the extracted portions of the deposit, subsidence of the landsurface by about 5 m is observed. In places with shallow occurence of groundwater the table, local floodings and ponds are found.

Rock salt mining. In Poland, salts of Zechstein and Miocene formations have been mined for a long time. The deposits of Zechstein age have the form of salt domes and occur in the cental part of the country, whereas the ones of Miocene age occur in the Carpathian Foredeep and have the form of strongly folded and uplifted narrow anticlines overlapping each other.

The disturbance of hydrogeological conditions and groundwater pollution in the vicinity of these mines occurs only as result of sudden break down of safety pillars. Such situation happened the salt mine «Wapno» in Central Poland where salt form a dome-shaped deposit was extracted. It was flooded in a very short time after an unexpected water inrush from surrounding Mesozoic formations. It resulted in severe damage to buildings and technological infrastructure. Similar problems occured in the ancient salt mine «Wieliczka» near Cracow, where a hazardous water inflow caused a surface pond to disappear and the groundwater table around the mine to be lowered.

A few kilometres to the east the same salt deposit was exploited by a solution method using bore-holes from the surface. A few years ago, the exploitation field was abandoned. The remaining underground exploitation caves are now gradually collapsing and tightening, the brines filling them are pressed out and contaminate the overlying Quaternary aquifer as well as the nearby Raba river.

Conclusions

In Poland almost all possible forms of harmful impact of mining industry upon the surface- and groundwater bodies are observed. To the most important belong the lowering of the free groundwater table or piezometric head of confined aquifers and pollution of river water by highly mineralized mine waters. The latter phenomenon can be considered as an environmental disaster of international significance. It is caused primarily by the discharging of saline waters from numerous deep hard coal mines in the Upper Silesian Coal Basin and the copper ore mines in Lower Silesia, into the main Polish rivers Vistula and Odra. Acute problems occur due to the interference and cumulation of the results of groundwater drainage by hard coal mining, zinc-lead ore mining and backfilling sands mining in the northeastern part of Upper Silesia.

It is expected that in the course of the next few years the situation will improve because of the planned decline in the production of the mineral industry in Poland and the abandoning of numerous mines, as well as due to the implementation of preventive measures. The most important of these is the constructing of desalinization plants and injection of saline mine water underground.

HOMELAND

PATRIA

PAYS NATAL

by Mary J. Byrne

All of them were geologists. They lived alone now in this dusty city where they had silted up after stays in other dry countries which would only inspire people such as them, who could see a certain beauty in bare hills and burnt earth redeemed by the occasional outcrop which made their job possible.

They lived in apartments which lacked a wife's touch, apartments with stains on the sofas and a marked lack of *bric à brac*, where the magazines and books were political or scientific rather than cultural. They each had a maid, of course, who had stayed on when the wife and children had left, a maid who cleaned and washed and cooked and, in any time left to her, sewed the now bursting cushions that had been put together by a wife with tender loving care in the early (heady) days of working in this dusty country and doing something for the Third World (as it had been honourable to call it then). It was, however, beyond such maids to know that for a few pence a bottle of spirit could be bought at the market which would remove the stains on the sofa, just as it was beyond the men to notice the stains at all. The maid's solution would have been a thorough scrubbing of sofa coverings, of blankets and henbels, on the terrasse, a hosing down and then a dumping over the balcony to dry. And, much as she loved and served the remaining lord of the mansion (whom she had always respected more than the wife in any case, although she missed the kids), the maid too was getting old and weary and even the thought of such work made her feel lethargic, and she settled for making him an extra special dessert, or leaving out sliced oranges sprinkled with cinnamon before leaving to walk home.

And they came and went, solitary to their solitary maids, in solitary apartments that seemed bare and echoing without wives and children, but which, because of their salaries, were still cheap and not worth moving out of. Moving would also have meant making decisions about what to do with the books and toys that the children had not wanted or had been unable to bring with them to a new life in the homeland which was France, or Belgium, or Switzerland, and from which they would never return.

So they stayed where they were, these men, and although each of them had some way of passing his spare time (hunting, reading, working, writing theses; one was interested in following the trail of Don Quixote when on holidays in Spain), these activities were dropping off, and there were moments when they seemed completely aimless, beached, meaningless; moments when they sat slouched, their hands in their pockets, and looked into space or down at their knees, and almost ceased to exist. At such moments, more than at others, they took on some of the features of the rocks and mountains they studied and mapped and loved: they looked like nothing so much as hills that had been left behind when that which had watered them –or even formed them– a sea, or a lake, and in this case the wifely, childly influence on their lives, had receded. The colour of their clothes –cord trousers, plaid shirts, wool pullovers, parkas– were the colours of the mountains: the greys, browns, greens of Europe or the beiges, yellows, rusts of North Africa in Summer and Autumn; and their hair –thinning, greasy or dusty and infrequently washed– resembled the scraggy bushes that lean against the harsh winds on any desert mountain. Their clothes and minds contained little fossils: their clothes of food stains and their minds of memories, coiled and life-like but thoroughly dead, memories of childhood, adolescence and a white wedding in the villages and towns, or student life in the cities of France, Belgium, Switzerland...., of mountains, valleys, *douars* and forest *nouala* in the Maghreb, of Berber and Arab speakers in the High Atlas or the Ahaggar, or of 48 hours spent circling and lost in the Ethiopian bush. The food stains were relics of carelessly slopped olive oil over a lone salad at home, of tinned sardines on a field trip, or from the single man's table at the restaurant near the American Peace Corps office with its solitary policeman.

Their ages and length of service abroad were like the laying down of successive geological strata: a few had grown up abroad, some had come before and some after independence from the various colonial powers. Many had left home in the '60s (pre–and post '68 itself), others in the 70s, and somewhat fewer in the '80s since the whole thing looked like dying out and governments had started to replace them with eager young men educated at home

and wishing to stay there and contribute to its new life. 'Arabisation', it was called, in North Africa. And they all worked for companies and ministries in pursuit of gold or petrol or whatever was expensive or relevant or could be dug up and made to be expensive or relevant. And these strata overlapped and knew each other and some had been folded, others thrust upwards, and some both of these, in their various offices and jobs.

Their politics, too, took on a tectonic nature which was related to their age and positioning: some were more or less right-wing and some more or less *gauchiste*. All were up to date with developments in their homeland –if indeed it could still be called that –and voted assiduously at their consulates whenever the occasion arose.

The question arises: why had the seas, the lakes, the lubricating waters, receded? Why do they do so either in geology or in human affairs? There is always a reason, but that is just to satisfy the needs of science, which likes accompanying reasons, extenuating factors. In any event, the wives –for it was they and not the children or the husbands who had made the decision –left on a variety of pretexts which included the end of their teaching contracts, the death or –better –the illness of an ageing parent, or the children's education. The only thing that can be said with any certainty is that they had had enough. They needed to get out quickly, and very badly. There came a day when it was all too much: it was not because they wanted to be back in France or Belgium or Switzerland....., although many of them had sufficient excuses. Maids were often mentioned (and sometimes fired), *drageueurs* in the streets –flattering perhaps in one's 20s and 30s, but merely annoying in one's 40s –underlined the need to walk alone and unmolested; there was even the desire to window-shop, for there were few windows that fitted the bill in the Third World. The latter, of course, was never offered as a respectable reason, since there were enough others to mask it, it merely recurred in conversations. The main thing is this: the women left. Lock, stock, *bric à brac* and kids, leaving only the most unaesthetic of the furniture, the most useless of the sewing gear, dog-eared comic books of Asterix and Babar (Tin-tin was frowned on as being slightly racist), and outgrown school-books that no one had bothered to sell to the *bouquiniste* on the corner. Pure-bred cats and dogs were either given away or transported by car to the homeland, and a series of going-away parties were held, which corresponded with a series of welcoming ditto on the other side of the Strait and far away.

When the waters had thus receded, the men settled down to their lives, as if nothing had happened. Perhaps they even did so with a sigh of relief. Had they not, in spite of warnings, previously been left with full responsibility for the dog and the cat, not to mention ferrying the kids about, because their wives were being constantly whistled to stop –unnerving experience– by friendly gendarmes or policemen wanting to chat or flirt or who were simply bored with their lives and the slow time in bribes.

They settled down to their solitary lives yet it was never clear if they had adopted North Africa forever (in spite of flaky and crumbling national identity cards in each of the patina-ed bags with its row of coloured pencils) or if they thought they might, one day, retire to the homeland to which their votes were conveyed, or if they simply didn't know or even care.

Such things were never discussed at their only get-together with other human beings: a weekly meal at the apartment of one of them. This was the exception to the solitary habits of the rest of the week. This was the occasion to meet, like a bunch of schoolboys who never mentioned where they had come from or were going to, and who amused each other with some new and some very old card-tricks and stories, swapped hunting anecdotes, discussed what serums and anti-venins were required against bites acquired in the field. Stories gone over again and again with increased amusement were the one about F., who, when working in some parched mountains had mentioned to a local that the rocks showed the presence of water, but had failed to specify that he was referring to 100 million years previously and who had almost been lynched on a subsequent visit. Or X, who had been sent on mission –complete with *ordre de mission*,

driver, jeep, maps, tinned sardines and boots– to the house of a colonel who simply refused to believe the evidence presented by a dry well sunk at his country residence. M. had been bitten by a dog and started a rabies scare, causing the dog to be killed and its brain removed for analysis; passing through the region some years later, he learned that the owner had called the replacement dog *muhandis*, engineer, after him. Most of them had descriptions of the children who followed them around hills and mountains, imitating them: hammer rock, lick sample, apply magnifying lens; hammer, lick, lens.... Some children were excellent imitators without the least theatrical prop or even an idea of what the whole thing was in aid of.

And so old-timers and newcomers ate and drank and tricked around and told stories. Occasional, half-hearted arguments would arise when one of the older ones would accuse the less rugged ones of being softies who had come to the Third World –he still called it that– to amuse themselves by building boats or going on mission with the sailboard tied to the roof of the jeep. But it wasn't serious, and nothing could set an argument on fire so much as their geological differences and theories, to which they always returned in the end, for science was their only passion, their only rule. They had no respect for anything else.

They did not discuss their wives, those women who had married them for love, or to escape home and parents, or to travel in exotic countries, these women who, in those early stages, had had to travel as far as 50 kilometres in a horse-drawn cart in order to be delivered of a baby by the only doctor around, and those wives who, as time went on, had had babies painlessly and efficiently in clinics managed by liberated North African women obstetricians, while their enlightened and unembarrassed post '68 husbands had assisted. A lotta water under the bridge, as Sam had pointed out in *Casablanca* (a film which annoyed them for various reasons, not least because it was studio made). And the babies had grown and gone to the *Lycée* and prepared to be citizens of the homeland they didn't know, except for the summer holidays spent *chez* Mémé and Pépé.

Had the seas and lakes that once enlivened them now been present, the dinners would have taken on a different complexion: those who refused *crudités* at home would have eaten them and said nothing while their wives discussed nuances of recipes. Now, although they ate each other's bad cuisine without a murmur, they refused the *crudités* with vigour. They were more at home. In the past they would have made small talk about the last town they had lived in, and the parties and get-togethers held in their own little foreign ghetto, of how boring Rabimbi was or how Fez was rapidly drying up its stock of foreigners. They would have discussed contracts or exchange rates or how to get currency out or where they had been for holidays or the quality of the fish they were eating and the manners of the fishmongers in the market. Just as others were even now still doing, their wives would have made inconsequential and above all unscientific remarks which they would have dusted over or ignored. Their wives would have come and gone from the kitchen with plates and dishes and courses, and, when all the women were momentarily absent in the kitchen or the bathroom or seeing the children to bed and the table found itself with a majority of geologists, they would have naturally fallen into talking shop, and arguing about the finer points of pet theories, or the movement of continents back in some bleary past.

When the wives and children, the waters of life, had still lapped around them, the men had, on occasion, commiserated with each other on the foibles of their own wives. Some of the fathers –whom one child had dubbed, in her innocence, *gigologues*, causing much hilarity– felt that the less gifted, beautiful, or healthy children were so because of the flustering and fussing of the mother in question, which had caused neuroses. Another common criticism was the wives' consumerism. Even in a (rare) Third World supermarket, the women found it necessary to peruse each shelf rather than go straight for what they had come to buy, they said. Occasionally, even now, like a cloud flitting its shadow across a mountain, a vision of their wives came to them; their wives in the homeland poring through well-stocked super-

market shelves. But, like North African skies, vivid blueness returned quickly and the vision disappeared.

Although they did not use their services, many of them took an interest in prostitutes, their activities and habits. One of them amused himself by watching the scene from his balcony before the police jeep came, scattering prostitutes and *maquereaux* in all directions. Their interest was purely scientific: it might be that such activities seemed more shocking in an Islamic context and it must be said that the business did not hold, had not held, the same appeal in the homeland; but then living abroad enables one to frame questions that don't even come to mind at home, as they often pointed out. So they did not avail of the services offered all over the city by women old and young, poor and rich, women of taste and women of vulgarity. Nor did they frequent the palpitating bars and might clubs behind the city centre, with their watchful vans of policemen parked nearby.

Then, one day, one of them fell prey to a second passion. He shook his friends, the chain of mountains, to their foundations.

His name was Zachary. He was short, squat and handsome, and like the others he loved his work which maintained a perfect equilibrium between the field –with its boots, jeep, sardines, where his driver (like those of the others) took care of the interface between society (by answering questions from curious locals about the possibility of jobs, whether machines would be coming to build roads, if water would be found or if houses were about to be built) –and the office, where solitary map-making ensued, the Shaoush took care of letters, cigarettes and minor disturbances. There was little need for socialising.

Zachary was different from the others in that he had been born in North Africa, of Spanish parents. His childhood had been spent in the European quarters with local children as playmates, and therefore he spoke Arabic fluently. Another thing which marked him off from the others was the fact that he had gone to Spain to get a wife. She had lasted such a short spell that even the Catholic Church had been willing to discuss annulment.

He had a line in jokes which often caused discomfort among the members of the group, and would these days be considered politically highly incorrect. «This place is great», he would trot out faithfully –especially if there were a new recruit– «except for the Arabs». When newcomers invariably fell for it, saying «But North Africans are not Arabs», Zachary simply ignored the remark. It was not relevant, and the newcomer would, in time, learn why. The others just looked at their stony-coloured knees or boots, and smiled. Another joke which many of them actually found spot-on, was the one about the 'Arab appointment' as Zachary called it, which ran: «I have an appointment with him at 8, I'll go over there at 9, wait until 10, and if he's not there at 11, I'll give up on him and go home». It never failed to raise knowing laughs. And Zachary would sit there, proud of himself, a man like the rest of them, but a man apart.

In spite of his jokes, he loved the Maghreb, and had fitted himself, as sand does, into all its nooks, crannies and ways, and was thus able to enjoy both its European and Maghrebin advantages to the full. He drank with ambassadors and hunted boar with smugglers, spoke three languages fluently. It may, indeed, have been his knowledge of Arabic which made him more vulnerable than the rest of them, but to say vulnerable would suggest a danger or some 'other side'. No, he was simply weakened by his moment of passion that was unscientific, that was not geology.

One evening he failed to turn up to a gathering. The following evening, the news was out: he had fallen in love with a dentist's wife. His relative seniority over others, in years and experience, came to nothing. He changed the habits of his maid so that his new mistress could visit him when it suited them both.

At first the group was thrown into disarray: the whole business puzzled men who, unlike Zachary, had been largely cut off from Moghrebi life in some fundamental way that they all agreed was due both to them and to their lack of mastery of the language, and on the other hand to the Moghrebi closing of ranks against foreigners, *nsara*, and what could be seen as predatory males by local men for the very same reason that local women found them single, rich, and inte-

resting. If they had been Moghrebi they would have had difficulty renting an apartment as single men; as Europeans this didn't matter. Now they tried to understand how Zachary managed to have a Moghrebi married woman visit him at his apartment and why neighbours turned a blind eye. It did not take long to emerge.

By the time a few weeks had passed, the adventures of Zachary, and therefore the presence –if only at the edge of their lives– of a woman, had begun to water areas that had not been thus refreshed for many years. They continued to enquire after him and when possible to encourage him to attend their moveable feasts.

When he arrived one evening looking thinner than usual and somewhat crestfallen, they were at once disappointed, and even felt that something had been lost. Had she decided she loved the dentist better? Had her husband found out?

It was not exactly clear. Zachary seemed in no mood for jokes –he came straight to the point. Hafida, the dentist's wife and Zachary's mistress, was convinced she was bewitched. There, it was out. *Les scientifiques* looked at each other in monstrous silence. One of their rank had fallen into decidedly shaky reasoning. It was appalling. They tried to convince him of the lack of logic in the affair, but he left for home unconvinced and the group disbanded in despair. Passion, it seemed, did not behave like rocks: not only did they not know where to find a solution to the puzzle, but they even doubted that one existed.

It took a month for Zachary to get over whatever scientific doubts had lingered amidst his passions: it was getting on for October when he came, ashen-faced, and said that Hafida had aged 20 years since their affair had begun. The dentist had become nasty and had told her she was being bewitched and why. She had tried to explain the passion that drove her –Zachary made a helpless gesture but it was no use. How could a man– who'd taken higher training in Montpellier –make his wife suffer so?

There was more, so they waited. The chicken claws that Zachary had been finding in strange places in his own apartment, around the doors and windows, and had been throwing nonchalantly to his dog –a mongrel which had remained when his wife had deserted– while muttering to himself about slovenly (Arab) maids, were perhaps not an indication of untidiness at all: perhaps he too was being involved in the evil spell. He had begun to feel unwell, he said. They all looked at their knees.

Not only did Zachary speak Arabic, he also followed certain local habits, one of which was getting shaved by a barber each morning. His barber worked in a tiny barber shop in the *medina*, decorated with everything from lilac-coloured paint to lace-edged pictures, one of which suspiciously resembled the Infant Jesus in an attitude of prayer. Zachary had never asked himself about this picture or indeed the rest of the decor; he was used to it, could live with it, and had long since ceased to give any obeisance to European gods. The barber, keeping his eye on a football re-run on the video positioned high on the wall, was now to plant a seed in his ear, a seed of further doubt. (Was the barber story about the king who had donkey's ears originally oriental?) This was the final piece of the puzzle which caused Zachary to notice that his neighbour's apartment smelt increasingly of incense –what was it?– the incense of the night of Destiny, towards the end of Ramadan. As he looked up now at the barber's picture of what seemed to be the Baby Jesus, remembering the smell of incense which linked both Ramadan –and therefore Islam –with the Benediction of his Catholic childhood (in the church that had since been converted into a games centre and still stood in the middle of a huge junction, large and monstrous in its assumption of its central role in a world now defunct) he suddenly realised that his neighbour was the link.

The barber was confirming his suspicions: Your neighbour is rumoured to be a witch, the barber was whispering. There they were, framed in the baroque surroundings, the scientific and the superstitious, as the light from the TV screen flickered on their faces: the old, the new, the timeless.

From then on, Zachary kept his eyes open. And it all fell into place: the smell of incense from the next door apartment followed a pattern, and seemed related to his own movements. The solitary woman who lived there –small, tubby, often seen

praying on the balcony or tending raggedy-window plants– who had tried to befriend him when his wife had left by tapping frequently at his door in search of salt, bleach, flour, cumin, garlic, had long since ceased to do so because she had received no encouragement. She was rarely in evidence as he passed, although her door was always open. He had hardly been aware of her existence for years, had never wondered about her present or her past, because rocks and mountains had interested him more.

When he'd questioned his maid about the little packets of herbs and the hens' claws, she had at first been timorous then distant and hyper-efficient, and had finally given her notice. Only the dog seemed to be thriving.

Meanwhile the group's get-togethers had become irritable. The men began to argue, not about whether such a thing was possible or whether they sympathised, but about how Zachary, a scientist, could give in to such a business, could allow himself to be duped. And here was an interesting thing: the pre-and post-'68ers fell into even more defined groupings, and the pre-'68ers, the older ones, could better relate to what had happened.

There was much discussion about the role of the barber: was he part of the plot? It was clear, some of them said, that he was, and without him the whole thing could have been ignored. The more enlightened of them were inclined to agree that the whole point of witchcraft was that the victim had to know he was bewitched –otherwise it didn't work. Some pointed out that Zachary had not known before he began to be affected. Then there was the woman: she had known all along, they surmised, that her husband was capable of witchcraft, or rather of using the services of a witch, and had therefore been affected by it before Zachary. Besides, she was local, and far more likely to be affected. They were too disturbed to analyse just how Moghrebi Zachary actually was.

When Zachary called in sick and no longer appeared either at work or at their dinners, they went as a group to check him out. They found him one Saturday morning in bed, pale and sticky, in the maidless and malodorous apartment –socks, dark tobacco, spoiled food, unwashed body, glazed eyes. Flies. Hafida had gone, he explained. It was over– with her, at any rate. She had come, frightened to death, and had stayed the night. The following day, the dentist had come and forcibly removed her. She had since sent Zachary a little note saying it was over between them. The dentist was having her cared for in a sumptuous clinic, where the staff had instructions not to admit him. Zachary said the dentist loved her very much, and that, after all, she was his wife. After questioning he wasn't sure how he felt about her. Some of them sighed with relief inwardly as he said, with a gesture of the hand that signified the end of something, «*Baraka*». He had the contradictory air of someone at once relieved and destitute. And there was something on his mind.

«I want to become well again», he said.

Wouldn't he become well now that it had all stopped? they asked. He didn't answer them, but after a while he said he wanted to go to the barber. Then they understood that this was the closing of the circle. In fairness to them they did not argue. They got him out of bed, showered and dressed and agreed to meet him at a nearby cafe in a hour.

Exactly an hour later, as they sat in unaccustomed midday cafe-terrace warmth and listened with understanding which varied according to their ages and terms spent in this dusty country, while Zachary told them what he now had to do in order to shake off a spell that still kept him weak and ill. They didn't even bother to ask if the barber had recommended this course of action. The barber had once again whispered, and Zachary would have to have himself de-bewitched. Zachary had found the Moghrebi to a Moghrebi problem. The younger ones groaned and the older ones asked how this might be done.

And so it fell out: they drove him first to the *rabbi* and then to the *fqih*, and they waited. It was Saturday after all, and there were no wives or children to be catered or shopped for. And while Zachary had himself de-bewitched with prayers and amulets and verses of this and that soaked in this and that and sewn up in scapulars, they waited at another cafe, felt with him a certain cleansing and re-affirmation of life. Their lives. They resolved to go home and wash down the mountains, shake out the fossils, water the thatches, renew interest in their various hobbies, and perhaps go hunting soon. They gazed out at diesel Peugeot estates with yellow licence plates –that signified temporary stays in the Maghreb and therefore other, still-married, engineers –that were being loaded up with goodies for tomorrow's Sunday lunch with family and friends. They watched the darling European children dressed in pink and blue tracksuits, children in whom considerably more had been invested than in the ragged shoeshine boys that scurried past them in search of dusty shoes. They looked at the children's mothers, women with tight or floppy posteriors who looked like they might be hell to live with, and they breathed easily once more. The crisis was over. Zachary would recover. Their weekly dinners would go on as before, mountains would erode, dissolve, and regroup with that excruciating slowness that they understood and could cope with. They would stay on in the Maghreb too, where their own particular mountain formation would erode with natural wastage (one had died already) at one end, and gain layers at the other. Like Zachary, they would stay here, for this is where they belonged. Here, they were not exceptional, nor were they disadvantaged because they had no wives or children, here they had peace. And as they sat there, one of the men shopping from the family Peugeots noticed them and, little realising that he would one day join them, thought how dignified they looked.

PAST PRESIDENT HONOURED

Gunnar Hultquist, Past President of the EFG.

In October 1998, at the annual méeting of the *American Institute of Professional Geologists* (AIPG) in Baton Rouge, Louisiana, USA, Past President Gunnar Hultquist was presented with the Presidential Certificate of Merit by Stephan M. Testa, 1998 President.

The certificate was for his work in helping build the strong professional relationship between the AIPG an the EFG since 1991.

The EFG is also honoured by the well-deserved award of this certificate to Gunnar Hultquist.

EUROPEAN-AMERICAN AGREEMENT

At the June meeting of the EFG Council at Cologne, Germany, negotiations were concluded with the American Institute of Professional Geologists (AIPG). The AIPG was accepted as an associate member of the EFG, whilst the EFG was accepted as an associate member of the AIPG.

This agreement means that a holder of the EurGeol title can now apply directly to the AIPG to become certified professional geologist. Application forms can be obtained from: AIPG National Headquaters. 7828 Vance Drive, Suite 103. Arvada, Colorado 80003. Tel: +1 3034310831. Fax +1 3034311332. E-mail: aipg@aipg.org. Internet: http://www.aipg.org

A TRIBUTE TO WILLIAM V. (BILL) KNIGHT

William Knight.

With the 30th April 1999 fast approaching when Bill Knight retires, I felt it was appropriate that there should be a «tribute» from someone in the «Old Countries» of Europe who has had privilege to know Bill and the AIPG in those busy years from 1989, when Bill became Executive Director.

As some of the fellow AIPG members wil know it was a chance meeting with Bill at the World Geological Congress in Washington in 1989 that John Shanklin and I representing the Institution of Geologists (UK) and the European Federation of Geologists (EFG) (based in Paris) were able to share some of the problems with AIPG. It was from that meeting that the strengthening links were established between the Geological Society (merged in 1990 with the Institution of Geologists in the UK), EFG and the AIPG and much of the credit must go to Bill for giving such fantastic support to the International scene when he was so busy at home.

He set such a good example for us here in Europe and we learnt much from all that AIPG were doing to raise the profile of professional geology.

It was a great privilege that Bill and a sucession of superb AIPG Presidents were able to travel to Europe to attend so many Council meetings of AIPG and President meetings over the last 10 years. We also appreciated the kind hospitality that we recived from AIPG Annual meetings that we attended in the USA.

The common ground that we covered on such different subjects were so stimulating for the EFG, the Geological Society and other member Associations of the European Federation and there is no doubt in my mind that the continued links were maintained very much through the tireless efforts of Bill Knight. I know he will be missed on the American and World Stage of professional geology but he has made his mark in such a truly professional (and unique) way. Howewer, he moves on to a much deserved rest which he and Martha have earned more than most.

I very much support your Vote of Thanks and sincere «well done» from every CPG. I have learnt much from Bill and hope that in the years ahead the «Foundation Stones» that he has laid for geologist throughout the world will continue to grow.

I would also wish Bill Siot, his successor every good luck for the future and hope that we have the opportunity to meet him with you Tom on your next trip to Europe.

Eur. Geol. *Richard A. Fox*

THE EFG IN THE PRESS

The EFG Council in Cologne drafted the following press realese:

PRESS RELEASE. Saturday 6th June 1998

Geologists state that proper geological investigations would prevent damage and catastrophes caused by geological hazards, saving property and lives

The *Council of the European Federation of Geologists (EFG),* representing 75 000 geologists from 18 countries, met in Cologne, Germany and issued the following statements:

The Alnazcollar Disaster

The EFG Council is shocked by the recent disaster associated with mining activities in Huelva, Spain. The EFG believes that this was a unique event as generally the aplication of modern mining methods and waste management minimises the risks when used with a thorough understanding of the geological factors involved. *Proper and consistent use of professional knowledge can ensure that the raw material required by society is produced in harmony with the environment.*

Mining and the Environment

Modern mining attempts to minimise the impact on the environment with subsequent rapid remediation. However the legacy of *past* mining activities may have a major impact. This may include hazards such as subsidence, collapse of shallow workings and mine shafts and induced earthquakes. In addition there may be groundwater pollution such as acid drainage due to the flooding of abandoned workings. *The detection, assessment and remediation of these problems are a major concern of the EFG.*

Geotechnical Studies are Essential

The Federation encourages public awareness of understanding geological conditions and their consequences in engineering construction. Problems such as landslides and foundation failures can be predicted and even prevented through an understanding of the local geological setting. In general there are not enought geological studies in both public and private construction in Europe. This results in ground failures that may translate into economic disaster and loss of property and life. A small initial investment of 1-3 % of a project's budget, can ensure the proper geological analysis and the ensuing safety of engineering structures. *The EFG recommends the establishment of a European public directive that incorporates the necessity for geological studies in engineering projects.*

Recent geohazard Disasters in Italy

The EFG has also analysed the disasters that have occurred in Italy in recent years. Some of these are due to heavy rains, however the mud slides un the Sarno Valley of the Campania Regio (5th May 1998) that caused 250 deaths, found their fundamental cause in the fact that an old efficient (17th century!) system of hydraulic drainage had been closed and landscaped, and the construction of building on geologically hazardous areas. *Incorporating geology in land-use planning most probably would have prevented this disaster.*

The following note appeard in the magazine *Nature*. Vol 393 of 18 June 1998 in the News in Brief section:

Mudslide prompts call for geological surveys

[LONDON] Geological investigations should be made compulsory for all civil engineering profects, according to the Paris-based European Federation of Geologists. The federation is calling on European Union member states to consider legislation to this effect following the recent tragedy at Campania, Italy, where a mudslide caused 250 deaths in the Sarno valley.

The mudslide was caused partly by the fact that buildings had been erected over a disused seventeenth-century system of drainage. The federation says that landslides and foundation failures can often be predicted and prevented by a proper understanding of regional geological history.

EUROPEAN GEOLOGISTS 1998

Since the edition of the EurGeols Directory, where a list of 1998 EurGeols was included, the following geologists have been awarded the title of European Geologist:

EurGeol n° 155
ALLEN, Robert Gordon
MIMM
14/12/60 Brighouse, British
Costain-Taylor Woodrow J.V.
Axe & Bottle Court 70 Newcomen Street
London SE1 1YT United Kingdom
Tel: 44 171 357 8133 ext 103/104
Fax: 44 171 357 8141
Eng geol
12/9/98

EurGeol n° 153
ANTAO, Ana Maria
15/2/58 Porto, Portuguese
Instituto Politécnico da Guarda
ESTG Dpto Eng Civil
Av. Dr Francisco Sr Carneiro,
50 6300 Guarda Portugal
Tel: 351 71 222 634 ext 401. Fax: 351 71 220 150
Eng geol - 12/9/98

EurGeol n° 156
HELM, John Anthony
13/8/61 Skipton, British
Stag Geological Services Ltd
107 A rue de la république 67720 Hoerdt France
Tel: 33 3 88 51 72 31
Geoph - 12/9/98

EurGeol n° 154
LARKIN, Peter David
Cgeol
5/12/59 London, British
Costain Civil Engineering
Geotechnical Services Div. P.O. Box 2526
Dubai United Arab Emirates
Tel: 971 4 45 02 47. Fax: 971 4 45 76 41
12/9/98

EurGeol n° 157
POULTER, Stephen Roy
25/5/60 Derby, British
Sarnia Fairmile
Henley on Thames RG9 2JY United Kingdom
Hydro - 12/9/98

The Registration Committee is currently dealing with the following applications:

- Blachère, Hughes
- Vérriére, Hervé
- Boissavy, Christian
- Parkes, Mattew
- Ward, Mary-Claire
- Robert, Jean-François.

CHANGE OF ADDRESS & 1998 DIRECTORY ERROR CORRECTION

Take note of the following EurGeols new co-ordinates:
Alex Carbray
Pear Tree Cottage
Virginia Water
Surrey, GU25 4 LH
U.K.

The editors of the 1998 Directory apologise for the errors or omissions that have been included in some entries. Some corrections are included below:

DUNCAN, Neil
BSc Eur Ing, Geol Ceng FIMM
28.07.27 Lambert (UK), British
March House, 12 Victoria Close,
Diss, Nordfolk IP22 3JH, UK
Tel. 44 1379 651 792
Fax: 44 1379 651 526
Eng Geol, Env, Min
05.11.94

EFG ASKS THE EU COMISSION ABOUT FREE MOVEMENT OF GEOLOGISTS AND HAZARD PREVENTION USING GEOLOGICAL KNOWLEDGE

The following question to the EU commission were presented last December 1998, on behalf of the EFG by Niall Andrews, Irish MEP. Reply of the Commission was received 24 February 1999. Follows both texts.

WRITTEN QUESTION P-0152/99
by Niall Andrews
to the Commission

Subject: Free movement of professionals throughout Europe

1. *Does the Commission monitor the operation and results of the Mutual Recognition Directive (initiated as 89/48/EEC[1] and completed as 92/51/ EEC[2])?*

2. *Are there any proposals to ban the barriers created by Member States to, the practice of geology by foreign nationals in other countries?*

3. *Is the Commission ready to draft new legislation to allow the free movement of geologists between present and potential Member States of the.EU?*

4. *What measures does the Commission propose to ensure the recognition of professional European titles (such as EurGeol) established by professional bodies (such as the European Federation of Geologists) in order to comply with the Mutual Recognition Directive?*

5. *Does the Commission have plans to make it mandatory for professional geological advice to be sought during land-use planning in order to minimise or avoid the results of natural catastrophes!*

6. *Is the Commission considering the inclusion of advice from professional, geologists in aid granted for reconstruction to countries devastated by Hurricane Mitch?*

[1] OJ L 19,24.1.1989, p.16
[2] OJ L 209, 24.7.1992, p.25

P-0152/99EN
Answer given by Mr Monti on behalf of the Commission
(24 February 1999)

1. In line with Article 13 of Directive 89148/EEC, the Commission reported to the Parliament and the Council on the state of the application of the general system for the recognition of higher Education diplomas[1]. The Commission will, in line with Article 18 of Directive 92151/EEC report on the progress of the application of this directive before the summer. Apart from these reports, the Commission always ensures that the provisions of the Treaty and he measures taken by he institutions pursuant thereto are applied. This obligation incumbent on the Commission under Article 155 of the EC Treaty also concerns the implementation of the directives in the Member States. For the time being the Commission is not aware of problems concerning. The professional recognition of geologists. However, the Commission will deal with all information, issues or complaints submitted to it.

2. Directives '89148/EEC and 92151/EEC aim to make it easier for nationals of Member .States to pursue a profession in a Member State other than. that in which they acquired their professional qualification. The value of the general system for professional recognition is described in detail in the abovementioned report. These directives ensure free movement within, the Community for a range of professions including any involving the practice of geology. The Commission would hot exclude, the adoption of a specific directive for a certain profession if this brings an «added-value» to free movement, but this would need to be with the agreement of the profession and at its initiative, and with the support of Member States.

3. No. The Commission has not recently received any reasoned request for such action, nor any information about any problems currently arising in relation to free movement in this area.

4. The Commission welcomes common platforms and initiatives taken by the private sector, such as that mentioned by the Honourable Member. Such initiatives might be particularly valuable in the field of non-regulated professions.

5. The Commission has no competence in land use planning. Thus, it is not envisaged to make it mandatory that geological advice should form part of land use planning procedures in Member States.

6. The Commission is indeed considering including the advice of professional geologists in the regional reconstruction programme in Central America to the extent that the nature of the projects currently under identification so require.

1 COM (96) 46 final

MEMBER NATIONAL ASSOCIATIONS

AUSTRIA

* ÖGG. AUSTRIAN GEOLOGICAL SOCIETY
Chairman: Eckart Wallbrecher
1Rasumotskogasse, 23
PO. Box 127
A-1030. VIENNA. Austria
Tel: (431) 712 56 74 - 54 or - 67
Fax: (431) 712 56 74 56
e-mail: oegg@cc.geolba.ac.at

Eckart Wallbrecher, Prof. Dr.
Karl-Franzens-Universität. Institut für Geologie und Paläntologie
Heinrichstrasse 26, A-8010 Graz
Tel: 49 316 380 55 88
Fax: 00 49 316 380 98 70
e-mail: Eckart. Wallbrecher@ Kfunigraz. ac. at.

BELGIUM

* UNION BELGO-LUXEMBOURGEOISE DES GEOLOGUES (UBLG)
President: Jacques Vercruysse, Eur Geol
13 rue Jenner
1000 BRUXELLES
Tel: 32 2 627 04 18. Fax: 32 2 647 73 59

André Chabot, EurGeol
prof: Géobel Conseil, Place communale 13-15
B-1495 VILLERS LA VILLE (BELGIUM)
Tel: 32 7 187 83 16. Fax: 00 32 7 187 83 16

Jacques VERCRUYSSE, EurGeol
prof: WATCO R.S.
Westvaarddijck, 83
B-1850 Grimbergen
Tel: 32 2 257 18 11. Fax: 32 2 253 46 60
e-mail: wrs.demets@pophost.eunet.be

DENMARK

DANSK GEOLOGISK FORENING (DGF)
* The Geological Society of Denmark. Dansk Geologisk Forening Geological Museum
Øster Voldgade 5-7 -DK-1350 COPENHAGEN
web: www.2dgf.dk
President: Svend STOUGE
Prof. The Geological Survey of Denmark and Greenland.
Thoravej, 8
DK-2400. COPENHAGEN NV
e-mail: ss@geus.dk

Poul Henrik DUE
prof: Dansk Geologisk Forening
Bernhard Olsensvej 7
DK-2830 VIRUM
Tel: 45 45 85 95 80

Marianne VASARD NIELSEN
prof: Dansk Geologisk Forening
Elstedvaenge 27
DK-8520 LYSTRUP
Tel: 45 86 22 24 33. Fax: 45 86 74 24 33
e-mail: mvn.pka@po.ia.dk

FINLAND

* FINNISH UNION OF ENVIRONMENTAL PROFESSIONALS (FUEP)
President: Vesa VALPASVUO
Ympäristöasiantuntijoiden Keskusliitto YKL ry
Vuorikato 22 a 15 - 00100 HELSINKI
Tel: 358 9 622 68520. Fax: 358 9 622 68550
e-mail: tuula.kilpelainen@ykl.fi

Karita ÅKKER
prof: Soil & Water Iltd
Itälahdenkatu 2
00210 HELSINKI (FINLAND)
Tel: 358 9 682 6673. Fax: 358 9 682 6600
e-mail: karita.aker@sw.poyry.fi

Jukka MARMO
prof: Geological Survey of Finland
Betonimiehenkuja 4
PL96-FI-02150 ESPOO (FINLAND)
Tel: 358 205 50 24 45. Fax: 00 358 205 50 12
e-mail: jukka.marmo@gsf.fi

FRANCE

* UNION FRANCAISE DES GEOLOGUES (UFG)
President: Antoine Bouvier, Eur Geol
Maison de la Géologie, 77 rue Claude Bernard
75005 PARIS (FRANCE)
Tel: 33 1 47 07 91 95. Fax: 33 1 47 07 91 93
e-mail: ufg@hol.FR

Antoine BOUVIER, Eur Geol
Prof: CGG
1 rue léon Migaux
91341 MASSY (FRANCE)
Tel: 33 1 64 47 36 72. Fax: 33 1 64 47 39 86
e-mail: abouvier@cgg.com
Dom: 10 rue de l'ermitage - 78000 Versalles
Tel: 331 39 54 07 49

Gérald CLEMENT, Eur Geol
5 résidence de la poste
91370 VERRIÈRE LE BUISSON (FRANCE)
Tel: 33 1 69 30 68 64

Jean-Michel QUENARDEL, Eur Geol, Dr
prof: Labo géologie Struct., B,t. 504
Université Paris-Sud
91405 Orsay cedex
Tel: 33 1 69 15 67 53. Fax: 33 1 69 15 49 22
e-mail: jmq@geol.u-psud.fr
Dom: 208 rue du Faubourg Saint Denis
75010 Paris
Tel: 331 40 37 06 29

GERMANY

* BERUFSVERBRAND DEUTSCHER GEOLOGEN, GEOPHYSIKER UND MINERALOGEN EV (BDG)
President: Detlev Doherr
Oxfordstr. 20-22
D-53111 BONN
Tel: 0 228 69 66 01
e-mail: BDGBonn@t-online.de

Detlev DOHERR, Eur Geol
prof: Direct all communications to the BDG office in Bonn
Panoramaweg, 6
D-77723 Gengenbach
Tel: 07803/2024
e-mail: doherr@aol.com

GREECE

* ASSOCIATION of GREEK GEOLOGISTS (AGG)
President:
Didotou 26
10680 - ATHENS
Tel: 30 1 36 05 579. Fax: 30 1 36 05 436

Maria-Hara ALEXIADOU
prof: GEOSCOPIO LTD
Delfon 5B
15125 Maroussi
Tel: 30 1 68 97 568. Fax: 0030 1 68 97 581

HUNGARY

* THE HUNGARIAN GEOLOGICAL SOCIETY
President: Dr. István Bérczi
Hungarian Oil and Gas Co.
Tel: +36 1 243 17 23
Nol, Exploration and Production Division
Batthyany ùt 45 - H-1039. Budapest
Tel: 36 1 243 17 23
Fax: 36 1 243 23 69
e-mail: iberczi@mol.hu

Peter SCHAREK. Dr (Hungary)
Hungarian Geological Survey, Geological Institute of Hungary
14 Stetania St - H - 1143 BUDAPEST
Tel: 36 1 267 14 26
Fax: 36 1 251 07 03
e-mail: scharekp@mgsz.hu
web page: http://www.mafi.hu/kisalf.html/

IRELAND

* INSTITUTE OF GEOLOGISTS OF IRELAND
President: Dr. Eibhlín Doyle PMIAEG
Department of Geology
University College Dublin
Belfield, Dublín, 4

Gareth Ll. JONES, EurGeol
prof: Conodate International Ltd
Unit 7, Dundrum Business Park
Windy Arbour DUBLIN 14
Tel: 353 1 296 51 51. Fax: 00353 1 296 51 52
e-mail: conodate@iol.ie
mobile: 353 086 811 88 82

Christian SCHAFFALITZKY, EurGeol
prof: ENNEX International Plc
162 Clontarf Road
DUBLIN 3
Tel: 353 1 833 22 11. Fax: 00353 1 833 24 56
e-mail: schaff@indigo.ie

John COLTHURST, EurGeol
Blackhall
Clane Co Kildare
Tel: 353 45 688 68
Fax: 00353 45 689 34

ITALY

* ASSOCIAZIONE NAZIONALE FRA I GEOLOGI ITALIANI (ANGI)
Via Cesare Battisti, 4
I-20122 Milano. Italy
Tel: 39 2 551 28 42
Fax: 39 2 76 00 71 82

Honorary President:
prof: Ardito DESIO
President: Floriano Villa
via C. Battisti n 4
I-20122 MILANO (ITALY)
Tel: 39 2 551 28 42. Fax: 39 2 760 071 82

Carlo Enrico BRAVI
Via C. Battisti n 4
I-20122 MILANO (ITALY)
Tel: 39 2 29 00 15 21. Fax: 39 265 55 034

POLAND

* POLSKIE TOWARZYSTWO GEOLOGICZNE (PTG)
President: Andrzej Slaczka
2a Oleandry
30063 KRAKÒW (POLAND)
Tel: 48 12 332270. Fax: 48 12 33 22 70
e-mail: slaczka@ing.uj.edu.pl

Andrzej SLACZKA
prof: Universytet Jagiellonski Institute of Geological Sciences
Oleandry 2a,
30063 KRAKÒW (POLAND)
Tel: 48 12 633 22 70. Fax: 48 12 633 22 70
e-mail: slaczka@ing.uj.edu.pl
Dom: Szlachtowskiego 6 31 132 Krakow

Zbigniew WILK
prof: Technical University of Mining and Metallurgy, Faculty of Geology, Geophysics & Environment Protection
Al. Mickiewicza, 30
30059 KRAKÒW (POLAND)
Tel: 48 12 17 24 27. Fax: 48 12 63 32 936
e-mail: Hwilk@geol.agh.edu.pl
web: http://www.agh.edu.pl
Dom: ul. Szewska 27/431-009 Krakow
Tel: 48 12 4 22 39 35

PORTUGAL

* ASSOCIAÇÃO PORTUGUESA DE GEÓLÓGOS (APG)
President: Bernardo F. Reis
APG. Associação Portuguesa de Geólogos
Apartado 2109. 1103 Lisboa Codex
Tel: +351 134 776 95
Fax: +351 134 246 09 or +351 138 827 75
Rua da Academia das Ciências, 19-2°
1200 LISBOA

José CARVALHO, EurGeol
prof: Sondagens E Fondacões A. Cavaco Lda
Av Eng. Duarte Pachec 21
1070 LISBON
Tel: 351 1 387 80 71. Fax: 00351 1 388 07 05
e-mail: martinscarvalho@mail.telepac.pt

Pedro Artur NOGUEIRA DE CARVALHO
prof: SOMINCOR, Mina Neves-Corvo
Sta Bárbara dos Padrões
7780 CASTRO VERDE (PORTUGAL)
Tel: 351 86 68 000. Fax: 00351 86 68 250

Bernardo José FERREIRA REIS SPE S.A.
Rua dos Franqueiros, 12, 2°
P. 1100 Lisboa. Portugal
Tel: 351 53 263 250

Joao M.M. TELO PACHECO
prof: GPEP
Rua Vale do Pereiro, 4
1250 LISBOA (PORTUGAL)
Tel: 351 1 388 35 41. Fax: 00351 1 388 27 75
e-mail: jpp@ip.pt

SLOVAKIA

* SLOVAK ASSOCIATION OF ENGINEERING GEOLOGISTS (SAEG)
President: Vajtech GAJDOS
Department of Applied and Environmental Geophysics
Mlynska dol; 6
84215 BRATISLAVA (SLOVAKIA)
e-mail: gajdos@fns.uniba.sk

Rudolf ONDRASIK
prof: Department of Engineering Geology Faculty of natural
Sciences, Comenius University
Mlynska dolina
84215 BRATISLAVA (SLOVAKIA)
Tel: 42 7 72 89 81. Fax: 42 17 72 89 81
e-mail: ondrasik@fns.uniba.sk

SLOVENIA

* SLOVENIAN GEOLOGICAL SOCIETY (SGS)
President: Uroš Herlec
Slovenian Geological Society
Aškerčeva 12
1000 LJUBLJANA

UROŠ HERLEC
prof: Univerza u Ljubljani
Naravoslovno-tehnična fakulteta
Oddlex za geologijo
Aškerčeva 12
1000 LJUBLJANA
Tel: 00 386 170 46 22.
e-mail: uros.Herlec@unilj. sl

Slavko SOLAR
prof: Geological Survey of Slovenia
Dimičeva 14
1000 LJUBLJANA
Tel: 00 386 61 1682 461. Fax: 00 386 61 16 82 557
e-mail: svsolar@i-ggg.si

SPAIN

* ASOCIACIÓN DE GEÓLOGOS ESPAÑOLES (AGE)
President: Luis Suárez Ordóñez, Eur Geol
Avenida Reina Victoria, 8, 4.° B
E-28003 MADRID
Tel: 34 91 553 24 03 Fax: 34 91 533 03 43

* ILUSTRE COLEGIO OFICIAL DE GEÓLOGOS (ICOG)
President: Luis Suárez Ordóñez, Eur Geol
Avenida Reina Victoria, 8, 4.° B
E-28003 MADRID (SPAIN)
Tel: 34 91 553 24 03 Fax: 34 91 533 03 43
e-mail: icog@icog.es
web: http://www.telprof.es/icog

Manuel REGUEIRO Y GONZÁLEZ-BARROS, Eur Geol
prof: Instituto Tecnológico Geominero de España
Ríos Rosas, 23
E-28003 Madrid
Tel. 34 91 349 57 78. Fax: 34 91 442 62 16
mobile: 34 649 85 63 98
e-mail: mregueir@santandersupernet.com
e-mail: mregueiro@itge.mma.es

Luis SUÁREZ ORDÓÑEZ, Eur Geol
prof: RENFE, Jefe de Geotecnia
Estación de Chamartín, Caracola 22
Prolongación del Andén 1
E-28007 MADRID
Tel: 34 91 300 76 36. Fax: 34 91 323 20 93

SWEDEN

* SVERIGES NATURVETAREFÖRBUND/
GEOLOGSEKTIONEN (SN)
President: Christer Åkerman
Box 760
S-13124 NACKA
Tel: 46 8 466 24 80. Fax: 46 8 466 24 04
e-mail: Christer.akerman@sgu.es

Christer ÅKERMAN
prof: Sveriges Geologiska Undersökning (SGU)
Högasv.43, 74141. Knivsta
Box 670,
S-75128 UPPSALA
Tel: +46 18 17 93 18. Fax: 0046 18 17 92 10
e-mail: christer.akerman@sgu.es
mobile: 010 289 49 39

Gunnar HULTQUIST
prof: Ålandsdal
S-740 20 VÄNGE
Tel: +46 18 39 21 38. Fax: +46 18 39 21 38
mobile: +46 708 65 49 66
e-mail: gunnar.hultqvist@swipnet.se

SWITZERLAND

* SWISS ASSOCIATION OF GEOLOGISTS
President: Pieter Ouwehand
c/o Wanner Ag Solothum
Dornacherstcasse, 29
4501. Solothum
Switzerland
Tel: +41 32 625 75 75
Fax: +41 32 625 75 79
e-mail: pouwehand@cuenel.ch
Web: http://www.chgeol.org

Johannes VAN STUIJVENBERG
prof: Umweltgeologe
Bernstrasse 34
3072 OSTERMUNDIGEN
Tel: 41 31 931 16 57. Fax: 0041 31 931 34 79
e-mail: johannes.vanstuijvenberg@swissonline.ch

THE NETHERLANDS

* KONINKLIJK NEDERLANDS GEOLOGISCH
MIJNBOUWKUNDIG GENOOTSCHAP (KNGMG)
President: Dr Elisabeth C. Kosters
C/o NITG-TNO
Postbus 157
2000 AD HAARLEM
Tel: 31 235 300300. Fax: 31 235 35 16 14
e-mail: kngmg@nitg.tno.nl

Elisabeth KOSTER
prof: ITC
Hengelosestraat 99
P.O. Box 6
7500 AA ENSCHEDE
Tel: 31 53 487 44 11. Fax: 31 53 487 42 00
e-mail: kosters@itc.nl

Pieter STIENSTRA
prof: Mijnbouwplein 3
2628RT DELFT
Tel: 31 15 257 25 28. Fax: 31 78 631 18 71
e-mail: p.stien@net.hcc.nl

UNITED KINGDOM

* GEOLOGICAL SOCIETY (GS)
President: Dr. L.R.M. Cocks
Burlington House, Picadilly
LONDON W1V 0JU
Tel: 44 1 714 34 99 44. Fax: 44 1 714 39 89 75
Tel: 44 1 932 56 88 33. Fax: 0044 1817 51 00 06
Web: http://www.geoisoc.org.uk

Edmund NICKLESS
GEOLOGICAL SOCIETY (GS)
Burlington House, Picadilly
LONDON WIV OJU
Tel: 441 714 349 9944. Fax: 00 441 714 398 975
e-mail: nicklesse@geolsoc.org.uk

Peter STYLES, Eur Geol
prof: Department of Earth Sciences. University of
Liverpool Brownlow Street
LIVERPOOL L69 3BX
Tel: 44 151 794 51 79. Fax: 44 151 794 51 57
e-mail: sr15@liverpool.ac.uk

ASSOCIATED MEMBER

USA

* AMERICAN INSTITUTE OF PROFESSIONAL GEOLOGISTS (AIPG)
President: Stephen M. Testa
Testa Environmental
19814. Jesús María Road
Mokelumne Hill CA 95245
Tel: 12 09 754-1422.
Fax: 00 12 09 754-1422
e-mail: stesta@goldrush.com

Robert G. FONT, Eur Geol
prof: Geoscience Data Management
P.O. Box 79 51 51
DALLAS 75379-5151
Tel: 1 972 516 4725.
Fax: 1 972 516 4725
e-mail: 72263.1036@compuserve.com

William Siot
prof: AIPG National headquarters
7828 Vance Drive, Suite 103
Arvada, Colorado 80003
Tel: 1 303 431 0831. Fax: 1 303 431 1332
e-mail: aipgwvk@aol.com
Internet: http: // www.aipg.org

OBSERVER NATIONAL ASSOCIATIONS

CANADA

* CANADIAN COUNCIL OF PROFESSIONAL GEOCIENTISTS
Suite 1600, 734 Seventh Avenue Sw, Calgary AB
T2T 3P8 (CANADA)
Tel: (403) 232-8511.
Fax: 403 269-27
http: //www.ccpg.ca

Hugh G. MILLER
Dept. of Earth Sciences
Memorial University of New found land
St. John's, New foundland A1B 3 x 5
Tel: 709 737 3001. Fax: 709 737 2589
e-mail: hmiller@waves.esd.mun.ca CANADÁ

CZECH REPUBLIC

* CZECH ASSOCIATION OF ENGINEERING GEOLOGISTS (CAIG)
President: Ing. Zdenek Hroch Csc
CS-118 21 Praha 1 Klárov, 3 Czechoslovaquia

* CZECH ASSOCIATION OF HYDROGEOLOGISTS (CAH)
President: Miroslav Labontka
Dpt of Hydrogeology & Eng Geology, Faculty of Sciences Albertov 6 12843 PRAHA 2

ICELAND

* GEOSCIENCE SOCIETY OF ICELAND (GSI)
President: Helgi Torfason, Phd
Orkustofnun National Energy Authority
Grensásvegur 9
IS-108 Reykjavik Iceland
Tel: + (354) 569 60 00 Fax: + (354) 568 88 96
e-mail: heto@os.is http: // www.os.is

TURKEY

* THE CHAMBER OF GEOLOGICAL ENGINEERS OF TURKEY (CGET)
President: Ayhan Kösebalaban
P.O. Box. 464 - Yemisehir
06444 ANCARA/TURKEY
Tel: (90-312) 435 07 17 - 432 30 85 - 434 36 01
Fax: (90-312) 434 23 88
e-mail: Tmmobj-o@Servis2.net.tr
Web: http//:www.jmo.org.tr

EFG. Represectative:
ÖZGÜR, Nevzat
Frei Universität Berlin
FR. Roust off-und unneltgeologie
Maltese St 74-100 D-12249. Berlin
Tel: 49 30 77 92 469
Fax: 49 30 77 92 469
e-mail: silber@zedat.fu.berlin.de

PARIS OFFICE

Maison de la Géologie
77 Rue Claude Bernard
F- 75005 PARIS (FRANCE)
Tel: 33 1 47 07 91 95. Fax: 33 1 47 07 91 93
e-mail: efgparis@wandoo.fr
http: //efg.gsf.fi http: //perso.hol.fr/~aefg/

CGEU OFFICE

C/O UBLG
Service Géologique de Belgique
Rue Jenner 13
1040 Bruxelles (Belgium)
Tel: 32 2 627 04 18.
Fax: 32 2 647 73 59

REGISTRATION COMMITTEE MEMBERS FOR THE TITLE OF EUROPEAN GEOLOGIST

Dr. Eric Groessens. Eur Geol. Chairman
Service Géologique de Belgique
13 rue Jenner, B-1040 Bruxelles
Tel: 32 2 627 04 02. Fax: 32 2 647 73 59

John Shanklin. Eur Geol. Member
The Old Rectory, Dodleston
Chester H4 9JR, UK
Tel: 44 244 66 03 18

Dr. José Carvalho. Eur Geol. Member
Sondageus E Fundacões A Carvaco LDA
Av Eng. Duarte Pachec 212
1018 Lisboa codex. Portugal
Tel: 351 1 65 80 71/4. Fax: 351 168 07 05

Reserve Members

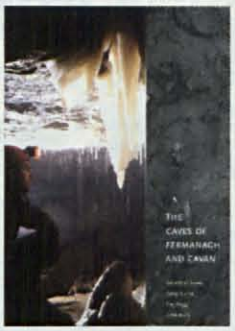
Leif Carserud
Kastanjegatan 20
22359 Lund (SWEDEN)
Tel: 46 46 13 14 56

John Colthurst. Eur Geol
Blackhall Clane,
co Kildare (IRELAND)
Tel: 353 45 868868. Fax: 353 45 868934

Richard A. Foxt. Eur Geol
prof: Land Search & Exploration Dept.
Ready Mixed Concrete (UK) Ltd., RMC House,
High Street
FELTHAM, MIDDLESEX TW13 4HA (UK)
Tel: 44 932 56 88 33. Fax: 44 817 51 00 06

J. M. Baltuille. Eur Geol
prof: Instituto Tecnológico Geominero de España
C/ Ríos Rosas, n.° 23
28003 Madrid (SPAIN)
Tel: 34 1 3495788. Fax: 34 1 4426216

Gérald Clément. Eur Geol
5 Residence de la poste
F. 91370 VERRIERES LE BUISSON (FRANCE)
Tel: 33 1 69 30 68 64



The caves of Fermanagh and Cavan

by Gareth Ll Jones, Gaby Burns, Tim Fogg and John Kelly

The Lough Nilly Press, Florencecourt, 128 pp. 1997
Fermanagh, N. Ireland

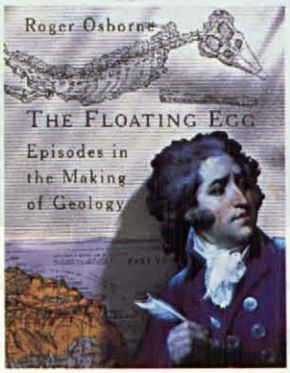
Price ST£20 draft including post & packing, to the Lough Nilly Press.

This book is a revised and enlarged edition of the first one, published in 1974. These twenty three years of difference can be noted - and very well- in the care and detail that this new edition shows, with maps of great quality and many colour photographs. Maybe this is the most outstanding feature of this book, together with the profuse bibliography about Irish caves included.

The book contains a detailed inventory of karstic cavities (caves and sinks) from the Fermanagh and Cavan mountains in Ireland. Geological, hydrogeological and biological features of the cavities are detailed together with the classical speleological and cartographical description of each individual cave. Among other interesting information offered, there are some related with the conservation of the natural environment, safety in exploration or etymology of names of the caves.

In summary, an integrated and multidisciplinary study of a great number of Irish caves which will no doubt contribute to a better knowledge of this caves in the international speleological and scientific panorama.

Juan José Durán Valsero



The Floating Egg. Episodes in the Making of Geology

by Roger Osborne

Jonathan Cape. London. 372 pp. 1998.
ISBN 0-224-05028-I - 33,95 CAN$

I came across this curious volume searching on the science shelves of the self-styled «The World's Biggest Bookstore» located in Toronto, Canada, where I attended a professional meeting. I have always been very fond of historical novels, but this is the first time that I found a book where such novelised histories refer to geological discoveries or turning points. It must be recognised that England had a lot to do with the birth of geology as a science, although at the time many more places in Europe also contributed to the changing of established ideas.

Much of the text refers to the fossil trade from discoveries in Whitby (Yorkshire) north-east England at the alum exploitations that existed in that region over three centuries. This represented a considerable industrial revolution at the time, as alum was indispensable in the cloth and leather industries. The importation of the chemical process to England is described as well as the resulting development of the mine works. The book owes its title precisely to these historical events.

Aside from a very interesting insight into the story of meteorites and how the scientific world finally accepted that they were really stones from outside this planet, I found especially enlightening the financial troubles of William Smith, father of the first geological map and of the science of stratigraphy. A common brotherhood of being usually not very well off appears to follow geologists from the origin of the profession. Mr Smith had to sell his extraordinary fossil collection to the British Museum to cover for the debts from a bad coal mining experience. In 1820 the father of geological mapping spent ten weeks in a debtor's prison to prove the fact that earth sciences are not a very productive business (see box in page 65 for a scientific explanation).

All stories are backed with documented sources, so it reflects in a very entertaining but at the same time scientific manner the changes in philosophic ideas by means of scientific findings and method, that lead to the development and popularisation of our dear geology as a new science.

Manuel Regueiro

LIST OF ADVERTISERS

COMPANY/ORGANISATION	COUNTRY	SUBJECT	PAGE
AGAP QUALITÉ	FRANCE	CODE OF PRACTICE	10
AMERADA HESS	UK	OIL CONSULTANTS	59
AMERICAN GEOLOGICAL INSTITUTE	USA	PUBLICATIONS	50
EUROPEAN GEOPHYSICAL SERVICES, S. A.	LUXEMBOURG	GEOPHYSICS	57
ERA-MAPTEC LTD	IRELAND	REMOTE SENSING	9
CSA GROUP	IRELAND	GEOLOGICAL CONSULTANTS	outside back cover
FORALITH AG	SWITZERLAND	DEEP DRILLING	59
GEOLOGICAL SURVEY OF FINLAND	FINLAND	GEOLOGICAL SURVEY	30
TRADUCTONET	SWITZERLAND	ETUDES ET TRADUCTIONS STIENTIFIQUES	40
K. T. CULLEN & CO LTD	IRELAND	HIDROGEOLOGICAL & ENVIRONMENTAL CONSULTANTS	56
SOIL & WATER	FINLAND	HIDROGEOLOGICAL & ENVIRONMENTAL CONSULTANTS	62
TERRIER s.n.c.	ITALY	CORE DRILLING BOXES	56
PAGANI	ITALY	GEOTECHNICAL EQUIPMENT	Inside back cover
PREMESA	SPAIN	TUNNELLING	Inside front cover
SPANISH ASSOCIATION OF GEOLOGISTS	SPAIN	PUBLICATIONS	61
BAKER HUGHES	UK	OIL CONSULTANTS	26
WATCO REMEDIATION SERVICES	BELGIUM	LAND AND GROUNDWATER DECONTAMINATION	57
SPANISH GEOLOGICAL SURVEY	SPAIN	150 YEARS ANNIVERSARY	18
INDUSTRIAL MINERALS	UK	EUROMIN 99	Insert
GEA BOOKSHOP	SPAIN	BOOKS	66

SUSCRIPTION FORM - EUROPEAN GEOLOGIST MAGAZINE

EUROPEAN GEOLOGIST

Send to
European Federation of Geologists
ICOG
Avda. Reina Victoria, 8, 4.° B
28003 Madrid
Tel.: 34-91-3495778
Fax: 34-91-5330343
e-mail: icog@icog.es

☐ Yes, I want to receive the European Geologist magazine (2 issues year)

Name ..... VAT n.° .....
Company .....
Activity .....
Address .....
P.O.B. ..... City ..... Country .....
Tel .....
Fax .....

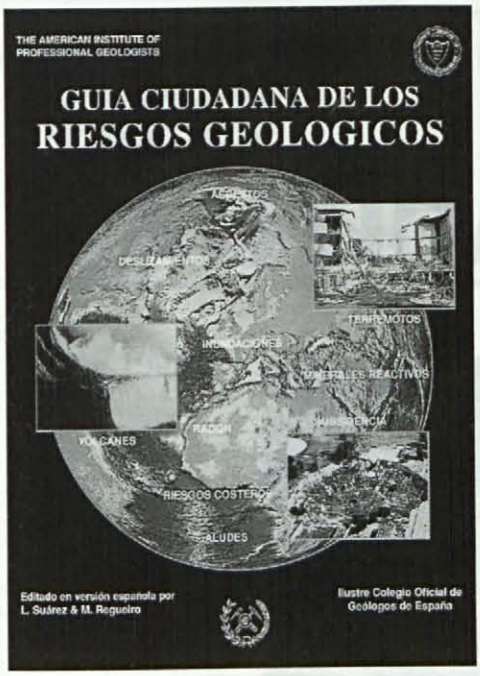
Payment: by credit card: Access / Mastercard / Visa / American Express

Amoun due: .....
Card n.° .....
Expiry date: .....
Name of bearer: .....
Signature: .....

Annual suscription: 13 EURO
1 EURO = 6,559 FF = 1,12 US$

(Company seal)

PUBLICATIONS OF THE SPANISH ASSOCIATION OF GEOLOGISTS



TARJETA DE PETICION

¡Sí! ruego me envíen ..... ejemplares del libro, al precio de 3.495 PTA.
+ 700 ptas. para gastos de envío

TOTAL .....

CIF o DNI: .....
NOMBRE: .....
EMPRESA: .....
CALLE: .....
POBLACION: .....
CP: ..... TFNO.: .....
FECHA: ..... Firma:

FORMAS DE PAGO

A nombre del Colegio Oficial de Geólogos de España

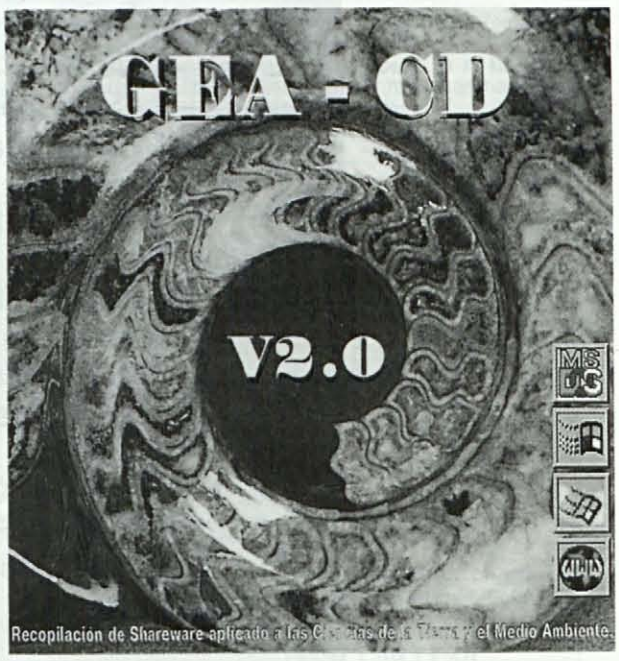
❒ Adjunto cheque por ..... ptas.

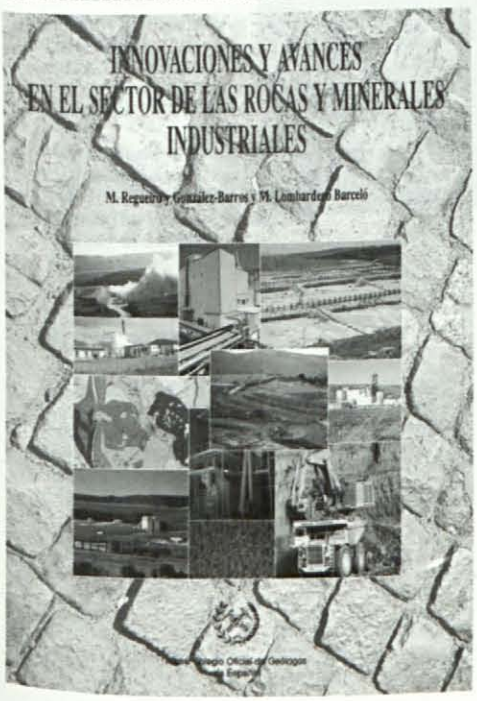
❒ Transferencia Bancaria a la C/C n.º 0075/0075/77/0601372378 BANCO POPULAR (Ag. 0075). Glorieta de Cuatro Caminos, n.º 4. 28003 MADRID. (Adjuntar fotocopia)

Se ruega remitan sus pedidos a: ICOG, Avda. Reina Victoria, n.º 8, 4.º B. 28003 MADRID
Teléfono: (91) 553 24 03 - Fax: (91) 533 03 43

La más amplia recopilación de shareware en soporte CD-ROM

- Ingeniería Geológica
- Hidrogeología
- Medio Ambiente
- SIG - Teledetección
- y mucho más, 250 aplicaciones, fotografías, textos, etc...





TARJETA DE PETICION

Les ruego me envíen ..... ejemplares, al precio de 3.500 ptas.
+ 700 ptas. para gastos de envío

TOTAL .....

CIF o DNI: .....
NOMBRE: .....
EMPRESA: .....
CALLE: .....
POBLACION: .....
CP: ..... TFNO.: .....
FECHA: ..... Firma:

FORMAS DE PAGO

A nombre del Colegio Oficial de Geólogos de España

❒ Adjunto cheque por ..... ptas.

❒ Transferencia Bancaria a la C/C n.º 0601372378 BANCO POPULAR (Ag 0075). Glorieta de Cuatro Caminos, n.º 4. 28003 MADRID. (Adjuntar fotocopia)

Se ruega remitan sus pedidos a: ICOG, Avda. Reina Victoria, n.º 8, 4.º B.

GEO CALENDAR

May 1999

2-5. 101st Annual General Meeting of the Canadian Institute of Mining & Metallurgy (CIM) and CIM Tradex '99* - Mining: Catalyst for social and economic growth, Calgary, Canada. Chantal Murphy, CIM, 3400 de Maisonneuve Blvd. West - Suite 1210, Montreal, Quebec, Canada H3Z 3B8. Tel: (+1 514) 939 2710. Fax: (+1 514) 939 2714. E-mail: gaydos@cim.org

3-8. FEMATEC'99. VIII Feria Internacional de Materiales y Tecnología para la Construcción. Buenos Aires, Argentina. Servi Expo, S.A. Avda. Alicia Moreau de Justo 1750, piso 3º C. Capital Federal República Argentina.
Tel. 0054-1/776-2500 Fax: 0054 - 1/773-4081.

4-6. Gold '99 Trondheim, Trondheim, Norway. Krister Sundblad, Dept of Geology and Mineral Resources Engineering, NTNU, N-7034 Trondheim, Norway.

4-7. Arminera '99, International Mining Exhibition, Buenos Aires, Argentina. Viewpoint, M.T. de Alvear 1371, Piso 3o Of.F, 1058 Buenos Aires, Argentina. Tel: (+54 1) 816 5818. Fax: 814 3833. E-mail: viewpoint@holcom.com.ar

10-13. ALTA 1999 Nickel/Cobalt Pressure Leaching & Hydrometallurgy Forum, Perth, Western Australia. ALTA Metallurgical Services, PO Box 126, Blackburn South, Vic, 3130, Australia.
Tel: (+61 3) 9877 9335. Fax: 9877 9336.
E-mail: info@altamet.com.au

20-21. New South Wales - Mineral Exploration & Investment '99 Conference, Sydney, Australia. David Barnard, NSW Department of Mineral Resources, PO Box 536, St Leonards, NSW 1590, Australia.
Tel: (+61 2) 9901 8463. Fax: 9901 8493.
E-mail: barnardd@minerals.nsw.gov.au

23-26. North American No-Dig '99. Prospectus from NASTT, tel: +1 312 644-0828, fax: -8557. E-mail: NASTT@Bostrom.com

23-27. VII International Conference on Low Traffic Roads. Baton Rouge. Lousiana. Estados Unidos. G.P. Jayaprakash. TRB. 2101 Constitution Avenue, NW 20418 Washington D.C. Estados Unidos. Tel: 1 202 334 29 52. Fax: 1 202 334 20 03.

May 29-June 3. World Tunnel Congress '99. 25th general assembly of ITA organised by NFF and ITA/AITES for Oslo, Norway. Contact Norsk Forening for Fjellspreninsteknikk.
Fax: +47 675 65533.

June 1999

2-3. North East Investment in Mining Conference*, New York, US. International Investment Conferences, 6310 Sunset Drive, Miami, FL 33143-4823, US.
Tel: (+1 305) 669 1963. Fax: 669 7350.
E-mail: iiconf@iiconf.comWWW: www. iiconf.com

3-5. ICADD-3:from Theory to Practice (3rd International Conference on Analysis of Discontinuous Deformation), Marriot's Mountain Resort, Vail, Colorado. Sponsored by American Rock Mechanics Association and the ARMA Foundation. Professor Benrard Amadei, University of Colorado, Dept. of Civil Engineering, CB 428, Boulder, CO 80309-0428. Tel: (303) 492-7734. http://www.tmn.com/arma. E-mail: amadei@spot.colorado.edu

6-8. Euromin'99. Athenaeum Inter-Continental, Athens, Greece. Industrial Minerals. Park House, Park Terrae. Worcesler Park. Surrey KT 4744. England. UK. Tel: +441718275233. Fax: +441718275233.

6-9. 37th US Rock Mechanics Symposium, Vail Rock '99, Vail, US. Expomasters, 7632 E. Costilla Ave, Englewood, CO 80112, US.
Tel: (+1 303) 771 2000. Fax: 843 6212.
E-mail: mcramer@expomasters.com

8-10. SIIF'99. Paris, Francia. Thomas Ho, Interfama Brooks Exhibitions, Forum Place, Hatfield, Herts AL10 ORN (Inglaterra).
Tel: (+44 0 1707) 275 641.
Fax: (+44 0 1707) 275 544.

9-15. Minetime 99/Geospectra'99. Salón Internacional de Tecnología Minera y Geológica. Düsseldorf, Germany. Messe Düsseldorf, Postfach 101006, D-4001 Düsseldorf, Germany.
Tel: (+49 211) 456001 Fax: 4560668.
Internet: http://www.tradefair.de

14-16. 5th International Symposium on Mine Mechanization and Automation - Mining in the 21st Century, Sudbury, Ontario, Canada. Dr. Nick Vagenas, School of Engineering, Laurentian University, Sudbury, Ontario, Canada P3E 2C6.
Tel: (+1 705) 675-1151. Fax: (+1 705) 675 4862.
E-mail: nvagenas@nickel.laurentian.ca

14-16. Pacrim '99, Bali, Indonesia. Australian Institute of Mining and Metallurgy, PO Box 660 Carlton South, Victoria 3053, Australia.
Tel: (+61 3) 9662 3166. Fax: 9662 3662.
E-mail: conference@ausimm.com.au

14-17. 8th US Mine Ventilation Symposium, University of Missouri-Rolla, US. Buddy Poe, Conference\Course Coordinator, Continuing Education, University of Missouri-Rolla, 103 ME Annex, Rolla, MO 65409-1560, US.
Tel: (+1 573) 341 6061.
E-mail: buddyp@shuttle.cc.umr.edu WWW: www.umr.edu/~conted/currentconferences.html

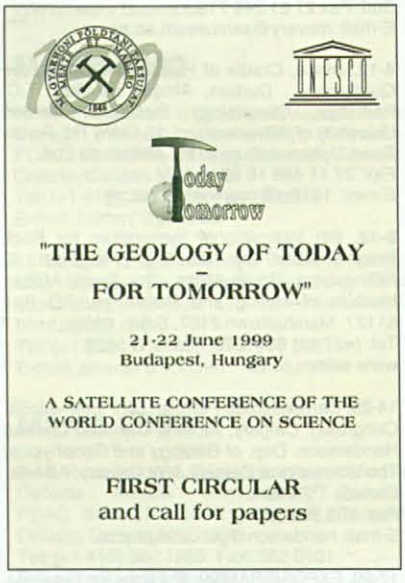
15-18. 2nd International Underground Coal Conference, Sydney, Australia. Coordinator, 2nd IUCC, Isabel Moreno, ACIRL Ltd, Locked Bag 2021, Strathfield, NSW 2135, Australia.
Tel: (+612) 9736 1255. Fax: 9736 1355.
E-mail: imoreno@acirl.com.au

15-18. 16th Mining Congress and Exhibition of Turkey, Ankara. Prof. Dr. Ümit Atalay, The Chamber of Mining Engineers of Turkey, Selanik Caddesi No: 19/3, 06650 Kizilay, Ankara, Turkey.
Tel: (+90 312) 425 1080. Fax: 418 3657. E-mail: atalay@narwhal.cc.metu.edu.tr

15-18. International Symposium on Mine Environmental and Economic Issues, Denproetrovsk, Ukraine. Dr Raj K. Singhal, PO Box 68002 Ranchlands RPO, 7750 Ranchview Drive N.W., Calgary, AB, Canada T3G 3N8.
Fax: (+1 403) 241 9460.
E-mail: Singhal@agt.net

20-23. International Biohydrometallurgy Symposium, Madrid, Spain. Departamento de Ciencia de los Materiales e Ingeniería Metalúrgica. Facultad de Ciencias Químicas. Universidad Complutense. 28040 Madrid.
Tel: (+34) 1 394 4339. Fax: 394 4357.
E-mail: ibs99@eucmax.sim.ucm.es
E-mail: ibs99@trasto.cbm.uam.es

21-22 «The Geology of Today - for Tomorrow» Budapest. Hungary. Hungrian Geological Society. H-1027 Budapest, Fö n. 68. János Halmai. Tel. 36 12 51 77 70. Fax: 36-1-356 12 15
e-mail: mail.inft@intesa.hu
www.mafi.hu/mft/alap.html



21-23. RETC. International tunnelling conference and exhibition sponsored by the Society for Mining, Metallurgy and Exploration and American Society of Civil Engineers at Renaissance Hotel, Orlando, Florida, US. Papers invited by way of 100-word abstract to Tara Davis, fax: +1 303 979 3461.
E-mail: davis@smenet.org

22-24. Hillhead '99*, Hillhead Quarry, UK. Quarry Management, 7 Regent St, ottingham NG1 5BS, UK.
Tel: (+44 115) 941 1315. Fax: 948 4035.
E-mail: mail@qmj.co.uk

25-27 European Federation of Geologists. Council meating. Budapest. Hungary. Hungarian Geologica Society.

July 1999

14. International Conference on Geomechanics/ Ground Control in Mining and Underground Construction. Wollongong, NSW, Australia.
Tel: (+61 42) 213 449. Fax: 213 238.
E-mail: n.aziz@uow.edu.au

14-17. Conet '99. International exhibition of construction equipment and technology at Tokyo, Japan. Details from JCMA.
Fax: +81 3 3432 0289.

27-29. Mine Entra 99, Bulawayo, Zimbabwe. Zimbabwe International Trade Fair Co., Zimbabwe International Exhibition Centre, PO Famona, Bulawayo, Zimbabwe.
Tel: (+263 9) 64911. Fax: 79298.
E-mail: zitf@acacia.samara.co.zw

August 1999

3-5. Ground Control in Mining, Morgantown, US. Dr. S.S. Peng, Dept. of Mining Engineering, College of Engineering and Mineral Resources, West Virginia University, PO Box 6070, Morgantown, WV 26506-6070, US.
Tel: (+1 304) 293 7680. Fax: 293 5708.
E-mail: speng2@wvu.edu

3-11. INQUA, XV International Congress The environmental bacground to hominid evolution in Africa. Durban, Afrique du Sud. D. Margaret Avery, INQUA Congress, PO Box 61, South Africa Museum, Cape Town, 8000, Afrique du Sud .Fax 27 21 246 716.
E-mail: mavery@samuseum.ac.za

4-12. Africa, Cradle of Humankind During the Quaternary . Durban, Afrique du Sud. T.C. Partridge, Climatology Research Center, University of Witwatersrand, 13 Cluny Rd, Forest Town, Johannesburg 2193, Afrique du Sud.
Fax: 27 11 486 16 89.
E-mail: 141tcp@cosmos.wits.ac.za

8-12. 6th International Symposium for Rock Fragmentation by Blasting, Fragblast 6, Pilanesberg, South Africa. The South African Institute of Mining and Metallurgy, PO Box 61127, Marshalltown 2107, South Africa.
Tel: (+27 11) 8341273. Fax: 838 5923.
www.saimm.co.za

14-25. Carboniferous-Permian (XIV International Congress). Calgary, Alberta, Canada. Charles Hendersson. Dep. of Geology and Geophysics, The University of Calgary, NW Calgary, Alberta, Canada T'2N IN4.
Fax. 403 285 00 74.
E-mail: henderson@geo.ucalgary.ca

17-20. EXPOSIBRAM'99. 8ª Exhibición Brasileña y 8º Congreso Brasileño de Minería. Belo Horizonte, Brasil. Jerry Estévez. Mining Machinery, Quarry & Mineral Processing. 5600 Southwest 135th Avenue. Suite 107. Miami. FL 33183-5135. Florida USA.
Tel: (305) 388-4890. Fax: (305) 388-4991.

18-20. Industrial Minerals of Peru, Lima. Instituto Mario Samame Boggio, Calle Las Castañitas 117, Of. 201, San Isidro, Lima Peru.
Tel: (+511) 422 8225. Fax: 421 6456.
E-mail: mineria@amauta.rcp.net.pe

20-22. III International Conference on Precious Metals Metallurgy and IV National Conference on Gold and Silver Metallurgy, Oruro, Bolivia. Sociedad de Ingenieros de Bolivia, Casilla 572, Oruro, Bolivia.
Tel: (+591) 52 56310. Fax: 52 60008.
E-mail: fnimet@fnimet.uto.edu.bo

22-25. Mineral Deposits: Processes to Processing. http://www.nhm.ac.uk/mineralogy/c urse/ for further details contact Dr Chris Stanley at the Natural History Museum. Fax: 0171 938 9268.
E-mail: cjs@nhm.ac.uk

22-26. 38th Annual Conference of Metallurgists - Gateway to the 21st Century. Quebec, Canada. Inquiries to: Mining & Metallurgy Dept. Laval University, Sainte-Foy, Canada G1K 7P4.
Fax: +1 418 656 5343 (att. Daniel Hodouin).
E-mail: controlcim99@gel.ulaval.ca

25-28. Back to the Future. Parigi. F.Wojtkowiak. B.R.G.M. B.P. 6009 - 45060 Orléans Cedex 2, France.
Tel. 33 38 64 31 21

29-31. '99 International Symposium on Mining Science & Technology (ISMST), Beijing, China. Prof. Peng Suping, China University of Mining & Technology, D11 Xueyuan Road, Haidian District, Beijing 100083, China.
Tel: (+86 10) 6233 1288. Fax: 6231 8122

September 1999

1-10. XXI Congreso Mundial de Carreteras de la AIPCR. Kuala Lumpur, Malasia. AIPCR, La Grande Arche, Paris Nord, La Défense. Cedex 04. Francia.
Tel: 33 1 47 96 81 21. Fax: 33 1 49 00 02 02.

2-9. BSRG/BGRG Joint Field Meeting, Almería Province, SE Spain (BSR0219). at the Cortijo Urra field centre, Sorbas, Spain. Dr Anne Mather and Dr Martin Stokes, Department of Geographical Sciences, University of Plymouth, Drakes Circus, Plymouth PL4 8AA.
Tel: 01752 233056. Fax: 01752 233054.
E-mails: amather@plymouth.ac.uk
m1stokes@plymouth.ac.uk

6-10. Katowice 99*, International Exhibition for Mining, Power Industry, Metallurgy and Chemical Industry, Katowice, Poland. International Katowice Fair, ul. Bytkowska 1b, 40-955 Katowice, Poland.
Tel: (+48 32) 204 2462. Fax: 254 0227

6-10. EXTEMIN '99 - XXIV Peruvian Mining Engineers Convention and Exhibition*, Arequipa, Peru. Instituto de Ingenieros de Minas del Perú, Los Canarios 154-156, Urb. San Cesar - 2 Etapa, Lima 12, Perú.
Tel: (+51 1) 349 4262. Fax: 349 3721.
E-mail: mailto:convmin@amauta.rcp.net.pe
WWW: www.conv-min.com

7-8. The Deformation of Glacial Materials. Alex Maltman, Institute of Geography & Earth Sciences, University of Wales, Aberystwyth, Wales SY23 3DB. Tel:01970 622 655.
Fax: 01970 622659. E-mail: ajm@aber.ac.uk ; Mike Hambrey and Bryn Hubbard (IGS) also at University of Wales, Aberyswyth.

7-10. China Coal & Mining '99, Beijing. Together Expo, Units A & B, 14/F, Guangdong Tours Centre, 18 Pennington St, Causeway Bay, Hong Kong. Tel: (+852) 2881 5889. Fax: 2890 2657.
E-mail: tgrexpo@netvigator.com

8-10. Tunnel Construction and Piling 1999. Conference and exhibition for Olympia 2 in London, England organised by Institution of Mining & Metallurgy in association with British Tunnelling Society and Federation of Piling Specialists. This event replaces Tunnelling '99 previously advertised for same venue.
Fax +44 (0)171 436 5388 for further details. Brintex Ltd, fax +44 (0)171 233 5054 will be organising the exhibition.

12-16. Sudbury '99, Mining and the Environment II, Four Points Hotel, Sudbury, Ontario. Sudbury '99, c/o Laurentian University/CIMMER, Sudbury, Ontario P3E 2C6, Canada.
Tel: (+1 705) 673 6572. Fax: 673 6508.
E-mail: cmosher@nickel.laurentian.ca

18-23. 43rd Canadian Conference on Coal, Banff, Alberta, Canada. The Coal Association of Canada, #502, 205 - 9 Avenue SE, Calgary, Alberta, Canada.

19-21 North Atlantic Mineral Symposium. NAMS. Trinity College. Dublin. Ireland. Geological Survey of Ireland. Beggar Bush. Haddington Road. Dublin. Ireland. Dr John Morris.
Tel: 353-1-604 14 73. Fax: 353-1-668 17 82.
E-mail: morrisj@tec.irlgov.ie
www.gov.nf.ca/naws/

October 1999

5-8. 36th Annual AIPG National Meeting. Anchorage, Alaska. The American Institute of Professional Geologists. 7828 Vance Drive, Suite 103. Arrada. CO 80003-2125.
Tel: 303 431 08 31. Fax: 303 400 431 13 32.
e-mail: aipg@aipg.com
www.nbmg.unr.edu/aipg/

5-8. Baucon Asia '99, Singapore. Messe München GmbH, Messegelände, D-81823 München, Deutschland. Tel: (+49 89) 9 4901 Fax: 9 4909. E-mail: infomosher@nickel.laurentian.ca WWW: www.messe-muenchen.de

11-13. Investing in Central and Eastern Europe & Central Asia, Berlin, Germany. International Investment Conferences, 6310 Sunset Drive, Miami, FL 33143-4823, US.
Tel: (+1 305) 669 1963. Fax: 669 7350.
E-mail: iiconf@iiconf.com WWW: www.iiconf.com

17-19. Mining Indonesia '99, Jakarta, Indonesia. Overseas Exhibition Services, 11 Manchester Square, London W1M 5AB. Tel: (+44) 171 862 2090/2000. Fax: 171 862 2098/2001. E-mail: indo@montnet.com WWW: www.montnet.com

19-22. AIMEX '99, (Australia's International Mining Exhibition), RAS Homebush Bay, Sydney, NSW, Australia. George Martin, Reed Exhibition Companies, Tower 2, 475 Victoria Avenue, Chatswood, Sydney, NSW 2067, Australia. Tel: (+61 2) 9422 2511. Fax: 2555.
E-mail: igeorge.martin@reedbusiness.com.au

25-28. Underground Works. International symposium of the French Tunnelling Association (AFTES) to be held in Paris. Call for papers April, 1998; deadline for summaries September, 1998. Tel: AFTES secretariat at SNCF, +33 1 5342-9469. Fax: -0820.

November 1999

2-6. X Congreso Iberolatinoamericano del Asfalto. Sevilla, España. Asociación Española de la Carretera. Goya, 23 -4º. 28001 Madrid.
Tel: (91) 577 99 72. Fax: (91) 576 65 22.

18-20. Manitoba Mining and Minerals Convention, Winnipeg. Shirley Henrie, Convention Coordinator, 360-1395 Ellice Avenue, Winnipeg, Manitoba, Canada R3G 3P2.
Tel: 1-800-223-5215. Fax: (+1 204) 945-8427.

28-29. Western Investment in Mining Conference*, San Francisco, US. Martin Rothman, International Investment Conferences, 6310 Sunset Drive, Miami, FL 33143-4823, US.
Tel: (+1 305) 669 1963. Fax: 669 7350.
E-mail: iiconf@iiconf.comWWW: www.iiconf.com

30 Nov- 2 Dec. RAILTEX'99. Londres, Inglaterra. Thomas Ho, Interfama Brooks Exhibitions, Forum Place, Hatfield, Herts AL10 ORN (Inglaterra).
Tel: (+44 0 1707) 275 641.
Fax: (+44 0 1707) 275 544.

–. Inter Tuneli Asia'99. Bangkok, Thailandia. Thomas Ho, Interfama Brooks Exhibitions, Forum Place, Hatfield, Herts AL10 ORN (Inglaterra).
Tel: (+44 0 1707) 275 641.
Fax: (+44 0 1707) 275 544.

–. ExpoRail Asia'99. Bangkok, Thailandia. Thomas Ho, Interfama Brooks Exhibitions, Forum Place, Hatfield, Herts AL10 ORN (Inglaterra).
Tel: (+44 0 1707) 275 641.
Fax: (+44 0 1707) 275 544.

March 2000

5-10. Mining Millenium 2000*, international convention and trade show, including the PDAC, Toronto, Canada. PDAC, Suite 900, 24 King Street E., Toronto, Ontario, Canada M5C 2X8.
Tel: (+1 416) 362 1969. Fax: 362 0101.
E-mail: hsklarz@pdac.ca
and Canadian Institute of Mining, Metallurgy and Petroleum, Xerox Tower, Suite 1210, 3400 de Maisonneuve Blvd. West, Montreal, Quebec, Canada H3Z 3B8.
Tel: (+1 514) 939 2710. Fax: 939 2714.
E-mail: gaydos@cim.org

6-9. SME Annual Meeting & Exhibit, Salt Lake City, US. Society for Mining, Metallurgy and Exploration, PO Box 625002, Littleton, CO 80162-5002, US.
Tel: (+1 303) 973 9550. Fax: 979 3461.

12-16. ASEG 14th International Conference and Exhibition - Exploration Beyond 2000, Perth, Western Australia. Mike McLerie.
Tel: (+61 8) 9263 6567.
E-mail: mkm@wapet.com.au

April 2000

17-20. Geoscience 2000. Geological Society. Burlington House, Pycadilly, London WJVOU. Tel.: 01714349944. Fax: 01714940379. E-mail: geozoo@geolsoc.org.uk web site: http://wwwgeolsoc.org.ula.

May 2000

16-21. Intermat 2000 - International Exhibition of Equipment and Techniques for the Civil Engineering and Construction Industries, Paris, France. Intermat, 1 Rue du Parc, F-92593 Levallois-Perret Cedex, France. Tel: (+33 1) 49 68 52 48. Fax: (+33 1) 49 68 54 75. E-mail: Intermat@intermat.fr

July 2000

10-14 1st International Conference of Professional Geology. Alicante. Spain. Organising Committee. Spanish Association of Geologists (ICOG). Reina Victoria, 8. 28003 Madrid. Spain.
Tel: 34 91 5532403 Fax 34 91 5330343.
E-mail: icog@icog.es Web: http://www.icog.es . European Federation of Geologist (EFG). Rue Claude-Bernard 75005. Paris. France.
Tel: 33 1 47079195 Fax: 33 1 47079193.
E-mail: efgparis@hol.fr.

10-14. Spanish National Geological Congress. Alicante. Spain.
Spanish Geological Society. Departamento de Ciencias de la Tierra y Medio Ambiente. Facultad de Ciencias. Campus de San Vicente de Raspeig. Universidad de Alicante. Apt. 99. 03080 Alicante. Spain. Dr Salvador Ordoñez. Chairman. Tel 34 65903552 Fax 34 65903552.
E-mail: salvador@ua.es.

23-28. XXI International Mineral Processing Congress, Rome Italy. XXI IMPC Organising Committee, c/o Dipartimento di Ingegneria Chimica, dei Materiali, delle Materie Prime e Metallurgia, PO Box 5077, 00153 Roma Ostiense, Italy.
Tel: (+39 6) 44585 891. Fax: 44585 891.
E-mail: impc2000@imagemp.ing.uinromal.it

August 2000

Dates to be advised. 31st International Geological Congress, Rio de Janeiro, Brazil. Secretariat Bureau, 31st International Geological Congress, Av. Pasteur 404 - Anexo 31 IGC, Urca, Rio de Janeiro, RJ - CEP 22.290-240, Brazil.
Tel: (+55 21) 295 5847 Fax: 295 8094.
E-mail: 31igc@31igc.org.br WWW: www.31igc.org.br

September 2000

11-13. Minprex 2000, Melbourne, Australia. Australian Institute of Mining and Metallurgy, PO Box 660 Carlton South, Victoria 3053, Australia.
Tel: (+61 3) 9662 3166. Fax: 9662 3662.
E-mail: conference@ausimm.com.au WWW: www.ausimm.com.au

11-15. Electra Mining Africa '2000*, Johannesburg, South Africa. John Kaplan, Director, Specialised Exhibitions, PO Box 2900, Johannesburg 2000, South Africa.
Tel: (+27 11 11) 835 1565. Fax: 496 1161.

October 2000

9-12. MINExpo International 2000. At Las Vegas, Nevada, US. Contact National Mining Association, Manufacturers and Services Division, Tel: +1 202 463-2607. Fax: -9799.

11-15. 37th Annual AIPG National Meeting. Milwaukee, Wisconsin.

February 2001

26-28. SME Annual Meeting & Exhibit*, Denver, US. Society for Mining, Metallurgy and Exploration, PO Box 625002, Littleton, CO 80162-5002, US.
Tel: (+1 303) 973 9550. Fax: 979 3461.
E-mail: smenet@aol.com

March 2001

11-14. Prospectors & Developers Association of Canada Annual Convention*, Toronto. PDAC, Suite 900, 24 King Street E., Toronto, Ontario, Canada M5C 2X8.
Tel: (+1 416) 362 1969. Fax: 362 0101.
E-mail: hsklarz@pdac.ca

April 2001

2-8. Bauma 2001. The world's largest construction exhibition to be held at Messe Munchen, Germany.
Tel: +49 89-51070. Fax: -5107506.
WWW: www.bauma.de

March 2002

10-13. Prospectors & Developers Association of Canada Annual Convention*, Toronto. PDAC, Suite 900, 24 King Street E., Toronto, Ontario, Canada M5C 2X8.
Tel: (+1 416) 362 1969. Fax: 362 0101.
E-mail: hsklarz@pdac.ca

11-13. SME Annual Meeting & Exhibit*, Phoenix, US. Society for Mining, Metallurgy and Exploration, PO Box 625002, Littleton, CO 80162-5002, US.
Tel: (+1 303) 973 9550. Fax: 979 3461.
E-mail: smenet@aol.com

March 2003

9-12. Prospectors & Developers Association of Canada Annual Convention*, Toronto. PDAC, Suite 900, 24 King Street E., Toronto, Ontario, Canada M5C 2X8.
Tel: (+1 416) 362 1969. Fax: 362 0101.
E-mail: hsklarz@pdac.ca

WHY IS MY SALARY SO LOW?

Here's the answer to the question «why is my salary so low?»:
About your salary:
Engineers and scientists will never make as much money as business executives.
Now a rigours mathematical proof that explains why this is true:
Postulate 1: Knowledge is Power.
Postulate 2: Time is Money.
As every engineer knows,

$$\frac{\text{Work}}{\text{Time}} = \text{Power}$$

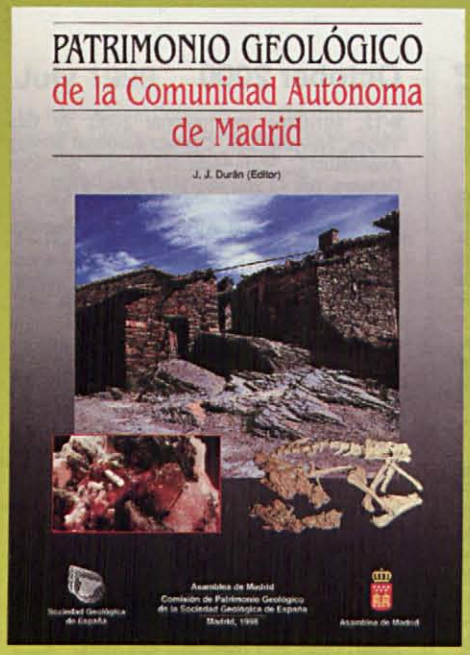
Since Knowledge = Power, and Time = Money, we have

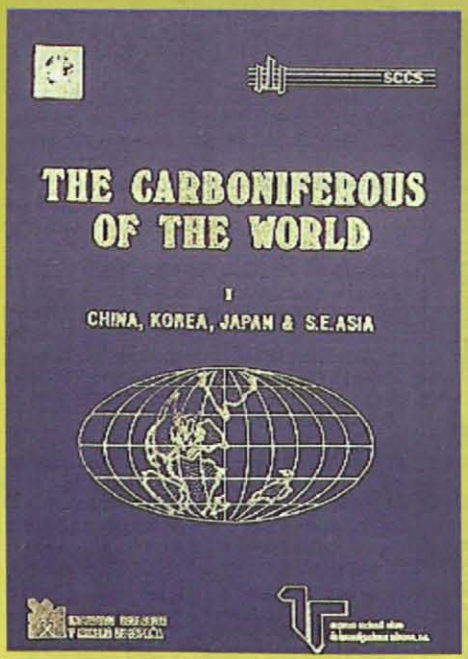
$$\frac{\text{Work}}{\text{Money}} = \text{Knowledge}$$

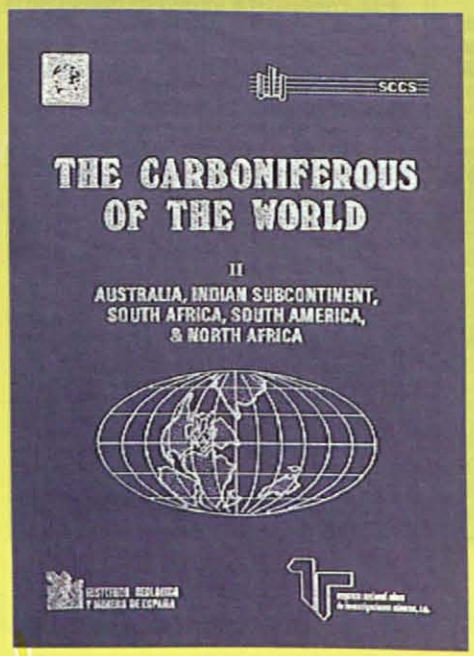
Solving for Money, we get:

$$\frac{\text{Work}}{\text{Knowledge}} = \text{Money}$$

Thus, as Knowledge approaches zero, Money approaches infinity regardless of the Work done.
Conclusión: The less you know, the more money you make.







LIBRERÍA GEA

BOOKSHOP SPECIALISING IN:

- Geology – Environmental Sciences
- Biology – Maps
- Ecology – Nature Guides

Exclusive distributors for the Instituto Tecnológico Geominero de España

SERVICES WE OFFER:

- A range of old and new publications (books and journals) in Spanish and other languages.
- Bibliographical Information.
- Subscription.
- Regular Newsletters and Catalogues.
- Exhibitions, Congresses and Book Fairs.

ORDER DIRECTLY FROM THE ABOVE ADDRESS / TELEPHONE / FAX / E-MAIL / WEB PAGE
PAYMENTS: CREDIT CARDS, TRANSFERS

Monday to Friday: 10-14 h and 17-20 h
Saturday: 10-14 h

LIBRERIA GEA
C/ Reina, 15 - 28004 Madrid
Tel. and Fax: 00 34 91 5324118
e-mail: gea@coverlink.es

EUROPEAN GEOLOGIST ARTICLES

The EFG needs quality articles for future issues of European Geologists. EFG members and readers are encouraged to submit articles or contact the Editor to recommend individuals who should be asked to submit articles. Submissions should be 1000 to 2000 words in length, although longer texts could be accepted. A brief abstract should be included in English, French and in the language of the article. Articles submitted on diskette along with a hard copy are appreciated. The Editor uses Word 6, Word 7, WP for Windows 95, or Mac files, both preferably in 3,5 diskettes. Photographs, figures, tables, etc are welcome. Photographs enhance articles and make great EG covers. Be sure to send photographs when possible with your article, or send your favorite photograph for considerations for a future EG issue. Submission deadline is 4 weeks preceding month of issue. 1st May for June issue and 1st November for December issue.

Photographs or graphics should be sent uncompressed in optical disk, removable disk or zip (100 Megabyle) disk when in computer format. Alternatively slides or paper copies are also welcomed.

Acceptable languages will be Spanish, English and French, although for the sake of uniformity it would be desirable to have them in English. Several methods of submitting reports and articles are available. Listed below in order of preference, are the methods of submitting materials to the European Geologist magazine.

1.–Send files via e-mail to m.regueiro@itge.mma.es and follow with a fax to 34-91-4426216 for confirmation of the text.

2.–Send an IBM or MAC compatible computer disc (3,5") in Word 6, Word 7, Wp, RFT with a printout.

EDITORIAL EMPHASIS

Professional Topics
- –Geology in EUROPE
- –Education of Geology
- –Employment
- –Ethics & Standards of Practise
- –Public perception of Geology & Geologists
- –Certification & Licensing
- –Practising Geology Internationally
- –Governments & Geologists

Euronews
- –European Parliament news. Laws
- –European Commission news. Contracts
- –CGEU news. Activities

Technical Topics
- –Mineral Resources
- –Petroleum Geology
- –Hydrogeology
- –Environmental Geology
- –Engineering Geology
- –General Geology

Opinion
- –Political Geology
- –Future trends

Geonews
- –European Geologist news
- –European Geologist Title page
  - –EUR.GEO Benefits
  - –New members. Applicants
  - –FEG news
  - –Actions, Meeting Schedule
  - –New members
  - –International contacts
- –EFG membership
  - –Statistics
- –EFG Working Groups
- –Jobs
- –Geological news
  - Mineral Industry
  - FOREGS, EuroGeosurveys
  - Public Works
  - Hydrogeology

Publications

Geo Calendar

WORLD GEOLOGISTS A NEW NGO HAS BEEN CREATED

Last 4th February a new NGO World Geologists, (Geólogos del Mundo) was promoted by the Spanish Association of Geologists (ICOG) under the patronage of the European Federation of Geologists.

Its main objective is to use the professional experience of geologists to improve man's welfare and to correct and/or mitigate the environmental aggressions affecting the Earth.

To comply with such objectives the following activities will be carried out:

1. Development of projects to prevent, mitigate and correct the effects of natural disasters and geological hazards (earthquakes, volcanoes, subsidence, landslides, avalanches, erosion, coastal hazards, tsunamis, floods, droughts and any other natural catastrophes related with Earth Sciences.

2. Collaboration with other Associations and NGO (Red Cross, Medicus Mundi, etc) to provide them with logistic support in the organisation of camps and field hospitals as a result of geological hazards or disasters, wars or human activities. Selecting locations for camps, hospitals, villages etc, with a minimum geological hazard and with an adequate emplacement for easy water supply and effectively controlling the water supply treatment.

3. Collaboration with other NGO, Institutions and national and/or international entities to provide the necessary technical support to improve the quality of life in any place of the world (water supply for villages, for irrigation, etc.)

4. Technical support in the evaluation and elaboration of development projects in any place of the world by collaboration with other NGO (water treatment plant installation, industrial minerals & rocks deposits locations and development, etc, in order to substantially improve life quality of the human population).

5. Hydrogeological and water resources studies to locate water for human consumption or irrigation purposes.

6. Geotechnical and geological engineering studies in the design of infrastructures, roads, location of towns and villages, water supply works, fuel storage, etc.

7. Protection of camps, field hospitals, villages, etc, by a hydrogeological-sanitary study of the sewerage system to avoid underground water contamination or human infections.

8. Technical collaboration in the prevention, correction and remediation of human provoked disasters (mine tailings dams failure, water reservoirs collapse, soil contamination, etc.) with any demanding association, organism and institution.

9. Publicising everywhere the aims of this organisation and helping to create similar organisations all over the world.

10. Denouncing in the appropriate instances and helping in the solution of overexploitation of groundwater aquifers, saline intrusion and solid, liquid and toxic wastes pollution which might result in the impossibility of using aquifers for human supply.

11. Facilitate the use of underground water extraction and location with modern and simple technologies (photovoltaic, etc).

12. World Geologists will make use of the following type of technicians:
Vulcanologists
Earthquakes experts
Flood experts
Marine erosion and tsunami experts.
Climatologic experts (Hurricanes, droughts, etc.)
Hydrogeologists
Engineering geologists
Laboratory experts and hydrochemists (water quality, etc)
Geologists
Mining geologists
Other

13. Organisation of courses, seminars and conferences to educate people, volunteers of other NGO and technicians of any other institution or country demanding it on the following subjects:
   * Forecast and evaluation of natural geological hazards.
   * Land use.
   * Environmental Impact assessment and correction.
   * Hydrogeological and mining resources exploration.
   * Civil protection courses for natural disasters cases, emergency plans.
   * New technologies applied to prevention of natural hazards and inenvironment.

14. Courses, seminars, and conferences to specialise young volunteer geologists on modern technologies to prevent natural and geological hazards so that they have the best education to act in areas of maximum risk with best effectiveness.

15. Land use planning projects in hazard zones (operational logistics, camp, hospitals, infrastructure location, etc.)

16. Any other objective not described above in which the professional performance of geologists might help human kind.

This NGO is open to anybody, professional geologists or non-professionals who are interested in collaborating with its aims and activities. Participation in this NGO as a volunteer is also envisaged in international projects.

The association has its headquarters in Madrid, Av Reina Victoria 8, 4° B. 28003 Madrid, and its activities cover the whole world.

If you are interested, please contact us by telephone (+ 34 91 5532403)
fax (+ 34 91 5330343) or
e-mail (icog@icog.es), or visit our web page at:
http://tierra.rediris.es/ong

II CERTAMEN NACIONAL DE FOTOGRAFÍA GEOLÓGICA

ORGANIZADO POR T&T

PATRIMONIO GEOLÓGICO

1er. PREMIO : 100.000 pts.
2º. PREMIO : 50.000 pts.
3er. PREMIO : 25.000 pts.

*Cantidades aportadas por el ICOG que podrán ser incrementadas por el aporte de otros patrocinadores.

Además se concederán seis accesit a las mejores fotografías en las siguientes modalidades:

-Recursos energéticos
-Medio Ambiente y Riesgos geológicos
-Hidrogeología
-Geotecnia
-Historia de la Geología
-Geología y Sociedad

La revista "Tierra y Tecnología" y/o el "Geólogo" publicarán a lo largo del año 2000 las fotografías que estimen oportunas. Con una selección de éstas se elaborará un "calendario fotográfico" para el año 2000. Las fotografías seleccionadas en los accesit serán premiadas con un lote de material fotográfico.
Asimismo durante el més de diciembre se realizará una exposición de las fotografías más destacadas.

BASES

1.-Podrán participar en el presente Certamen, tanto aficionados como profesionales de la fotografía y de las Ciencias de la Tierra .

2.-El número de originales a presentar por participante es ilimitado .

3.-El formato de las obras podrá ser en B/N o color, en diapositiva o en papel (min. 20x24). Todas las obras en papel se enviarán montadas sobre cartulina rígida indicando al dorso el título, nombre del autor, lugar de realización y técnica empleada.

4.-El plazo de presentación de originales comenzará desde la publicación de este anuncio hasta el día 1 de diciembre de 1999.

5.-Las fotografías se enviarán en sobre cerrado a "T&T" a la siguiente dirección:

II Certamen Nacional de Fotografía Geológica "Emilio Elízaga"
Ilustre Colegio Oficial de Geólogos de España
Av. Reina Victoria, 8. 4º-B
28003-Madrid
Incluyendo además los siguientes datos: Nombre, apellidos, DNI, dirección, teléfono, fax y correo electrónico.

6.-Las fotografías enviadas al Certamen permanecerán a disposición de T&T durante todo el año 2000, pudiendo ser publicadas en el medio que considere oportuno, cediendo los autores todos los derechos de su publicación.

7.-Las fotografías premiadas quedarán en propiedad de T&T. Los autores de las fotografías declaradas finalistas así como las premiadas ceden todos los derechos de reproducción y comercialización a T&T.

8.-Las fotografías no premiadas se podrán recoger durante el més siguiente al fallo del Certamen que será en diciembre de 1999. Pasado dicho plazo quedan en propiedad de T&T. Las fotos enviadas del extranjero se devolverán a los autores.

9.-El Jurado estará compuesto por personalidades de reconocido prestigio en el mundo de la fotografía y de las Ciencias. de la Tierra.

10.-El fallo del Jurado tendrá lugar en el més de diciembre de 1999 y los ganadores se darán a conocer durante la cena que el ICOG celebrará a final del año, donde se procederá a la entrega de los premios.

11.-El fallo del Jurado será inapelable.

12.-La participación en este concurso implica la total aceptación de estas bases.

II GEOLOGICAL PHOTOGRAPHY CONTEST

ORGANIZED BY THE SPANISH ASSOCIATION OF GEOLOGISTS

GEOLOGICA HERITAGE

1ª. PRIZE: 600 EURO.
2º PRIZE: 300 EURO.
3ª. PRIZE: 150 EURO.

Six additional prizes will be awarded to the best photographs in the following subjects:

- *Energy resources*
- *Environment & Geological Hazards*
- *Hydrogeology*
- *Geological Engineering*
- *History of Geology*
- *Geology & Society*

The magazines "Tierra y Tecnología", "El Geólogo" or the European Geologists will publish during 2000 tho se photographs considered adequate. With a selection of those presented a "Geological Calendar" for the year 2000 will be completed. Those photographs awarded with ad additional prizes will receive a set of photographic material. In Decèmber an exhibition with the most outstanding photographs will be organised.

REGULATIONS

1.-Both professional and amateur photographers of Earth Sciences can participate in the contest.

2.-The number of originals to be presented by participant is unlimited.

3.-Picture format will be either B&W or colour, slide or paper (minimum 20x 24 cm). All works should be presented mounted on a cardboard and including on the back the title, name of the author and place of the picture and techniques used.

4.-Deadline for presenting work will end the 1st December 1999.

5.-Pictures should be sent in a sealed envelope to:

II Geological Photography Contest "Emilio Elízaga"
Ilustre Colegio Oficial de Geólogos de España
Av. Reina Victoria, 8. 4º-B
28003-Madrid
Including the following data: Name, surname, address, telephone, fax and e-mail.

6.-Pictures sent to the contest will remain at the disposal of ICOG during the year 2000, and might be published in the media that is considered adequate. Authors transfer all publication rights to the ICOG.

7.-Awarded pictures will remain as property of the ICOG. The authors of all awarded pictures and those declared as finalists, transfer all reproduction and marketing right to the ICOG.

8.-Those pictures not awarded can be collected during the month following the decision of the Jury which will be on december 1999. After that period pictures will be the property of the ICOG. Pictures sent from abroad will be returned to authors.

9.-The Jury will be composed by recognised professionals of the photography and Earth Sciences world.

10.-The decision of the Jury will take place on December 1999, and winners will be publicised during the ICOG annual Christmas dinner, where the different prizes will be officially awarded.

11.-The decision of the Jury will unappealable.

12.-Participation in this contest means acceptation of these regulations.

EUROPEAN GEOLOGIST MAGAZINE

Characteristics

Name: EUROPEAN GEOLOGIST
Print run: 6000
Periodicity: Twice per year
Print mode: Offset
Size: 210 × 297 mm

1999 ADVERTISING RATES

INSERTIONS	ONE INSERTION	TWO INSERTIONS
Outside back cover	930 euro	1.480 euro
Inside front and back cover	792 euro	1.260 euro
Full page (colour)	660 euro	1.040 euro
Half page (colour)	330 euro	550 euro
Quarter page (colour)	198 euro	330 euro
Full page (b&w)	330 euro	550 euro
Half page (b&w)	187 euro	275 euro
Quarter page (b&w)	110 euro	165 euro
Preferential location	20 % plus	
Advertising Article	20 % plus	
Inserts	Contact editor	

1 EURO = 6,559 FF = 1,12 US $

METHOD OF PAYMENT

☐ By cheque in euros made payable to Ilustre Colegio Oficial de Geólogos de España (ICOG). Att: Enrique Pampliega. Accounting. European Geologists magazine. Reina Victoria nº 8. 4º B. 28003. Spain.

☐ By bank transfer to ICOG. **Reina Victoria, 8. 28003 Madrid. Spain Bank: Bankinter Bank account: 0128-0035-68-0502258883. Bank Address: Agustín de Foxá, 32. 28036 Madrid. Spain.**

☐ By credit card: Access / Mastercard / Visa / American Express.

Card. n.º:.....
Expiry date:.....
Name of bearer:.....

EUROPEAN GEOLOGIST MAGAZINE ADVERTISEMENT ORDER FORM

Please reserve a: quarter/ half/full page advertisement *
The advertisement will be black & white/ colour *
in the following issues of European Geologist:
June99/ Dec99/ June2000/ *
Advertisement material is enclosed/ will follow/ other * (please state) .....
.....
.....
.....
Date:.....
Total remittance payable with this form:..... EURO
(* delete as appropriate)

◄ **TG 30-20** DPM-DPH
DYNAMIC PENETROMETER
4x4 SELF-PROPELLED

PENETROMETER **TG 63-100 kN** ►
SELF - ANCHORING SYSTEM
STATIC - DYNAMIC - ROTARY
RUBBER TRACKED SELF-PROPELLED

PENETROMETER TG 73-200 kN
SELF-ANCHORING SYSTEM
STATIC-DYNAMIC- ROTARY
6x6 SELF-PROPELLED

PENETROMETER TG 73-200 kN
STATIC-DYNAMIC- ROTARY

PENETROMETER TG 73-200 kN
STATIC-DYNAMIC- ROTARY
WITH WORK CABIN

PAGANI
GEOTECHNICAL EQUIPMENT

FOR FURTHER INFORMATION AND COMPLETE CATALOGUE SEND REQUEST TO:

PAGANI GEOTECHNICAL EQUIPMENT

VIA CAMPOGRANDE, 18
29010 CALENDASCO - PIACENZA (ITALY)
TEL/FAX .. +39 - 523 - 58520 / +39 - 523 - 771535

ATT. NR. MASSIMO CONTINI SALES MANAGER DISTRIBUTORS AND AGENTS WANTED

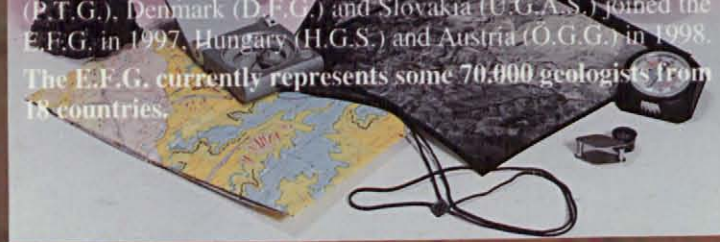
EUROPEAN FEDERATION OF GEOLOGISTS (EFG)

The representatives of the British, Spanish, French and Italian National Associations of Geologists met in London in 1978 in order to establish the European Federation of Geologists and outline its Statutes, the final text being drafted during the meetings that took place in Paris and Madrid in the months of March and November 1979. Belgian and Irish geologists attended those meetings as observers.

The E.F.G. was officially horn in Paris en 1980 during the 26th International Congress of Geology, and was composed of Professional Associations from Spain (A.G.E.-I.C.O.G.); Italy (A.N.G.I.-O.N.G.); Portugal (A.P.G.); United Kingdon (I.G. now incorporated in the G.S.); France (U.F.G.); Belgium and Luxembourg (U.B.L.G.) In July of the same year the Statutes were presented to the European Economic Community in Brusels.

The geologists of the Federal Republic of Germany (B.D.G.) became members of the E.F.G. in 1985, Ireland (I.A.E.G.) in 1988, Finland (F.U.G. now F.U.E.P.) and Sweden (S.N.) in 1989, Greece (A.G.G.), The Netherlands (K.N.G.M.G.) in 1993, Poland (P.T.G.), Denmark (D.F.G.) and Slovakia (U.G.A.S.) joined the E.F.G. in 1997, Hungary (H.G.S.) and Austria (Ö.G.G.) in 1998.

The E.F.G. currently represents some 70.000 geologists from 18 countries.



OBJECTIVES OF THE E.F.G.

1. To represent the geological profession in Europe. The Committee of Geologists of the European Community (C.G.E.C.) of the E.F.G. is the organization authorized to make representation to the European Union and its various bodies.
2. To safeguard and promote the present and future interests of the geological profession in Europe, including:
   - To guarantee the free movement of geologist in Europe, with the mutual recognition of their academic and professional qualifications by the adoption of the title of European Geologist.
   - 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 E.F.G.
   - To provide advice and assistance to constituent members National Associations.
3. To promote a European geological policy with regard to the responsible use of the Earth's Natural Resources and in particular:
   - Energy Resources.
   - Mineral Resources.
   - Hydrogeological Resources and their pollution problems.
   - Geological problems in land development, environmental protection and the exploitation of raw materials.