1996

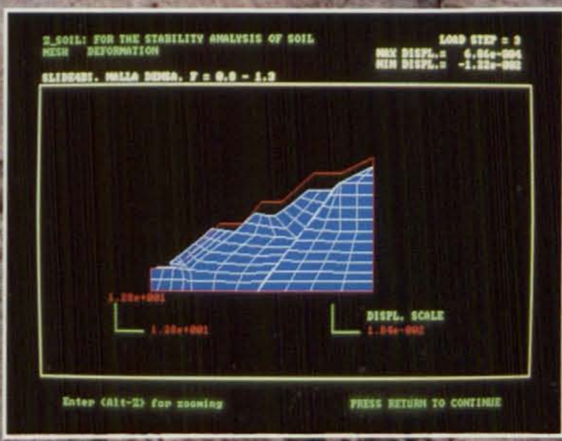
European Geologist

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

THE COST OF DELAY IN METAL MINING

LEGISLACION EUROPEA SOBRE AGUAS MINERALES

GEOPHYSIQUE ET PRESERVATION DU PATRIMOINE

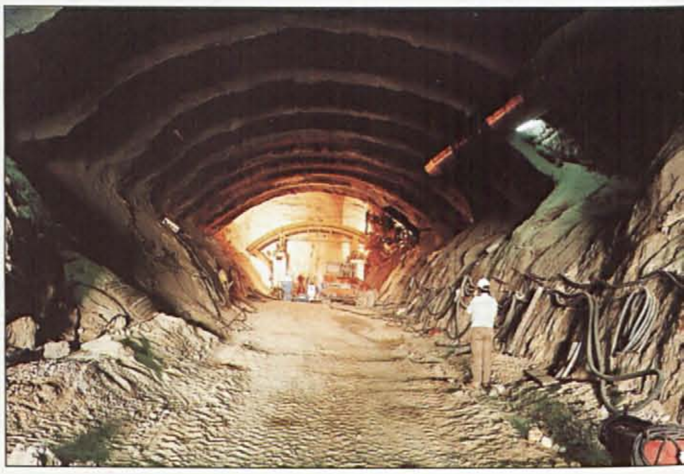


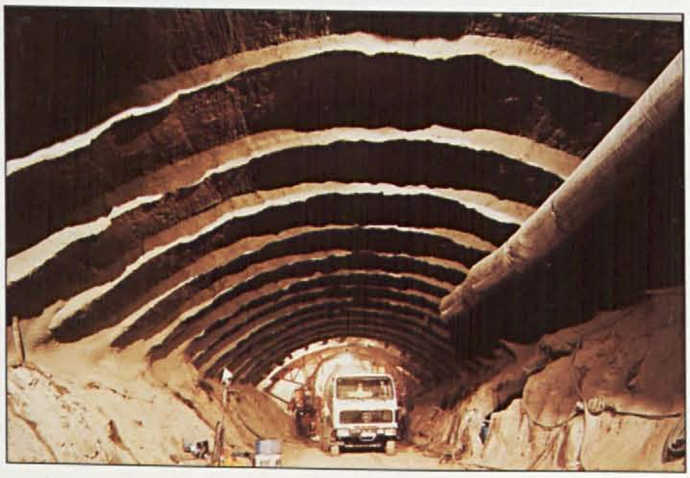
GEOLOGY AND THE HUMAN ENVIRONMENT IN EUROPE

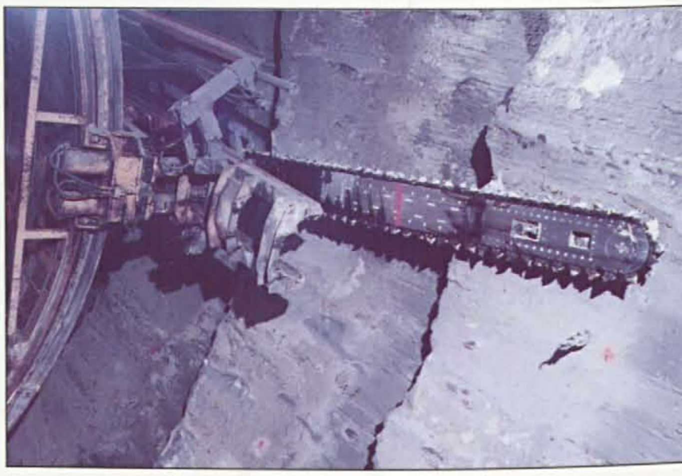
EFG

EFG - GEOCALENDAR - BOOKS

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







PRECORTE MECANICO
Velázquez, 134 - 28006 MADRID
Tel. (91) 396 86 11 - 396 77 81
Fax (91) 396 77 60 - 396 77 99

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

Officers
PRESIDENT
EurGeol Manuel Regueiro y González-Barros
Instituto Tecnológico Geominero de España
Dirección de Recursos Minerales
Ríos Rosas, 23. Planta Baja
28003 Madrid (Spain)
Tel: 34 1 3495778. Fax: 34 1 4426216
E-mail: eurgeomr@eucmax.sim.ucm.es

VICE PRESIDENT
EurGeol Gareth Jones
Conodate International Ltd
Parkview House Beech Hill
O.C. Clonskeagh. Dublin (Ireland)
Tel: 353 12698464. Fax: 353 12601635
E-mail: csa@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: tuula.kilpelainen@ykl.fi

PRESIDENT CGUE WG
Vittorio Illicetto
Consiglio Nazionale dei Geologi
Via Vittorio Colonna 40
I-00186 Rome (Italy)
Tel: 39 6 68807736. Fax: 39 6 68807742

EDITORS
Manuel Regueiro
Gareth Jones

ASSISTANT EDITORS
EurGeol Kevin T. Cullen
Natalia García Corrales

EDITORIAL BOARD
Antoine Bouvier
CGC
1 Rue Léon Migaux
F-91341 Massy cedex (France)
Tel: 33 1 64473672. Fax: 33 1 64473986
E-mail francis.bruere@qm.cgg.com

Richard Selley
Department of Geology
Royal School of Mines. Imperial College
Prince Consort Rd.
London SW7 2BP (UK)
Tel: 44 1 715946425. Fax: 44 1 715946464

Renzo Zia
Via Cavalloti 18
I-55048. Torre del Lago Puccini
Lucca (Italy)
Tel & Fax: 395 84341795

Advertising & Subscriptions
Jean Claude Vidal
Assistant Secretary
EFG Headquarters
Paris

Printed by
Gráficas Summa, S. A.
Polígono Ind. de Silvota
Llanera. Asturias. Spain
Depósito Legal: AS. 1.184-1995

Cover Pictures:
Manuel Regueiro
PREMESA
Mercedes Ferrer
A. F. Castro Gámez

Geologists learn how to read from the rocks a past that always goes beyond their own imagination, but they often lack the ability to make this incredible knowledge available for everybody else.

Somehow the way we learn to master our erudition is responsible for our own distance from reality, as Geology implies a need to view things from an external reference. One must look from out of the mineral, out of the sediment, out of the igneous chamber, out of the mid-ocean range, out of the Earth and even out of the whole Universe. We use time units such as a million years, that are impossible to account for, even when you are conscious of their immensity.

All these things give geologists a better perspective of man's true reality in the realm of the Universe than any other scientist might have, and probably accounts for the scarce self esteem that geologist have for themselves and their work.

Most geologists tend to underestimate the value of the simple knowledge which constitutes their main working ability, as for them, the difference between a granite and a limestone or the dipping of strata is something self-evident that requires no further explanatory effort. But such obvious things are still, for the majority of the population -including many potential employers- almost "magic". Even recognising the fact that primary education includes - or, sometimes includes- this information, it is clear that many do not pay attention to it.

Learning to value geological knowledge is the clue to gain the respect of society and in turn of the industrial sector, that will provide geologists in Europe with a job. It takes many years of geological training and experience to know what has happened down there and to apply it to what happens up here. Those who desire to know why, how and where, should understand that such knowledge goes far beyond the books and manuals, and that hiring the mind that will open the book of nature to solve everyday problems will soon be as important as visiting the dentist every year, or as asking our financial advisor to prepare our tax declaration.

"Geology, the heart of it all", was the motto of the American Institution of Professional Geologists 1996 National Meeting in Columbus (Ohio). I think that is probably every geologist's motto, but for our own professional sake we should move forward to educate the rest of the world to the fact that Geology was at the beginning and will be at the end of the true heart of everything. Understanding that, will help to improve the life of millions, and then hopefully supply employment for some more geologists.

Manuel Regueiro
President of the EFG

CONTENTS

WHAT ON EARTH IS A GEOLOGIST?

by Richard C. Selley

Secretary, External & Foreign Affairs, the Geological Society

This article is modified from a discussion paper that was presented to the Council of the Geological Society, and *was subsequently published in the GEOSCIENTIST (Vol. 5, No. 6), where it stimulated a lively correspondence for several issues.*

Geologists are facing a paradox caused by major changes taking place in the education and training of geologists. (By *geology I* mean the study the earth - the original etymology of the term. By *geologists, 1* mean people who study the earth, be it by hammer, geophone or electron probe, noting that some geologists may prefer to call themselves earth scientists, geoscientists, geophysicists or geochemists, and so forth.)

Historically three eras may be recognised in the education of geologists. The founders of geology did not, of course, have any formal geological training, since none was available. They came from such diverse backgrounds as civil engineering (William Smith), medicine (Parkinson) and the church (Buckiand). By the middle of the last century, however, formal geological training began at centres such as the Royal School of Mines established by Sir Henry de la Beche in 1863.

For over a century it was considered that, as in Sir Henry's words, all you needed to be a geologist was "common sense, and a stout pair of legs". it is implicit in this sentence that geology is a practical subject that is best pursued out of doors. From the beginning fieldwork was the core of any geology degree syllabus.

A corollary to this axiom was that any member of staff of a university geology department could conduct a field trip. A university geology teacher was also expected to be able to lecture across the whole of a first year geology degree syllabus.

Of its very nature, however, geology arouses the interest of, and demands the knowledge of, physicists, chemists and life scientists. Geology, perhaps more than any other branch of science, advances by synergy. Thus university geology departments have also recruited scientists whose first degree was not in geology. Some years ago a chemist appointed to a lectureship in a British geology department was required to gain a geology degree by private study so that he could teach any first year lecture, and conduct a field trip, before being granted tenure.

Today this notion might seem quaint as geology enters a third era. ft is now not only common for university geology departments to have a high percentage of staff who lack any formal training in geology in general, and in geological field work in particular, but such staff often do not regard themselves as geologists, sufficient even to join a geological society, let alone apply for chartered status. A recent survey showed that 40% of heads of UK geology departments had not reached chartered status, and 20% were not even Fellows of the Geological Society.

Simultaneously geology is undergoing a major revolution, not so much conceptual as technical. A generation ago geologists were tanned tweed-suited booted pipe smokers, whose bodies commonly contained traces of divers interesting tropical diseases. They exemplified De la Beche's dictum, referred to earlier, that a, geologist requires no more

Figure 1. Geologist exploring for oil in Iran c.1910 (Photograph by British Petroleum).

than "common sense and a stout pair of legs". Modern geologists, by contrast, tend to be pale-faced white-coated clip-board-clutching technicians, or computer buffs in smart city suits and high heels. They may or may not have first degrees in geology, or have worked in the field, but either way they are clever with calculus, agile with algorithms and fluent with fractals.

The advance of geology lead by ever improving geophysical and geochemical data, manipulated and displayed by computers, is concomitant with a decline in field work. Sir Ron Oxburgh in his report on British geology considered that a geology degree should have a component of 35 days of field work in each year of study, culminating therefore in the untidy figure of 105 days for a 3 year geology degree. This number has since been endorsed by the Geological Society. Few British geology degrees reach this target.

Geological field work has been under severe pressure for some years. This pressure is partly imposed by university accountants on financial grounds, and is partly imposed by the nanny-state, in the form of the Health and Safety at Work Act. As the number or geologically-trained geologists in academe declines, one may expect that the importance of field work will be less vigorously defended than heretofore. Indeed, geology departments may lack enough field-trained staff to mount a coherent field work programme.

Hand in hand with the decline of field-trained academic geologists, and the decline in field work, goes a change in the nature of geology degrees. The single subject geology degree is on the decline. There are now many degrees that combine geology with something, often offering chemical or physical components, or with an environmental bias. As the teaching of geology fans out into para-geological degrees, taught by para-geologists, the field-work component becomes rapidly diluted.

Thus there are now two intertwined issues that geologists needs to consider:

- Geology is pursued by a declining number of scientists with a formal geological training that includes field work. Such people may be termed "ortho-geologists'.
- Geology is also pursued by increasing numbers of scientists with little or no formal geology training, and who may never have been in the field. These people may be termed "para-geologists".

The touch-stone that differentiates the ortho- from the para-geologist is field work. No value judgement is implied by this categorisation, which is essentially factual. As I wrote earlier, geology advances by interdisciplinary synergy, or it dies.

The problem is therefore that, though para-geologists make major contributions to the advancement of geology, and train its future practitioners, too few regard themselves sufficiently metamorphosed into geologists to join a geological society, or to apply for chartered status

Figure 2. Geologists exploring for oil in Malaysia, 1995 (Photograph by British Petroleum).

The admission requirements for the Geological Society are specifically framed to permit the entry of para-geologists with a diversity of first degrees ("cognate subjects", helpfully listed in the Rules of Admission), provided that these degrees were followed by sufficient years of the practice of geology.

It is apparent that, despite this broad entrance, many para-geologists, both in academe and in certain sectors of industry (notably the oil industry), do not feel a need to join the Geological Society either as Fellows, or as Chartered Geologists. The Society only offers the title of Chartered Geologist. There are no subsets of Chartered Geophysicists, Chartered Hydrogeologists, and so forth. Herein perhaps, lies part of the problem. Many para-geologists happily call themselves geophysicists, or geochemists, as appropriate, if their first degree was in physics or chemistry. They do not seem to feel comfortable, however, with the idea of calling themselves geologists, even though it is by geology that they earn their living.

Thus geologists now face a paradox, with two apparently opposed points of view:

We must uphold the importance of field work as a major and essential component of the geology degree. It is hard to practice geology if one cannot identify rocks, cannot read a geological map, has no concept of the geological time scale, and is unable to visualise the shape of rocks in 3D. These skills are best learnt in the field. Geologists who have to liaise with engineers know these problems only too well, and we all have our own anecdotes to tell.

Thus we must make a strong stand to defend field work. When we start to accredit geology degrees, there must be strict rules about the number of field days in the course.

At the same time, however, we acknowledge the contribution that para-geologists make to the advancement of geology, and we must make para-geologists welcome into the Geological Society, and encourage them to proceed to Chartership, when they have sufficient relevant geological experience.

The paradox outlined above exists. Something must be done. Geologists cannot sit on the horns of a dilemma for ever.

Subsequently Council have set up a working party of Vice-Presidents to consider these issues and to report back to Council with recommendations. ■

N.B. (Photograph by British Petroleum) is the form of acknowledgement requested by B. P.

REGISTRATION OF GEOSCIENTISTS IN CANADA

Canadian Council of Professional Geoscientists
Consell canadien des géoscientifiques professionnels
Implementation Task Force

by Gordon Williams, Ph.D., P. Geol.
Chairman[1]

The registration (licensing) of professionals such as doctors, lawyers, engineers and, increasingly, geoscientists in Canada is the responsibility of individual provinces and territories, under acts. of their respective legislatures. These acts limit or restrict the practice of the professions to those persons who are registered by self-governing professional associations established under the legislation.

Approximately 5000 geoscientists are registered under combined engineering and geoscience right-to-practice legislation in Alberta, British Columbia, Newfoundland and the Northwest Territories as Professional Geoscientists (P.Geo.), Professional Geologists (P.Geol.) or Professional Geophysicists (P.Geoph.). Saskatchewan will begin registering geoscientists in 1997. We anticipate that approximately 10,000 geoscientists will ultimately be registered over the next few years as geoscientists become registered in other provinces.

[1] CCPG: Suite 1600, *734 Seventh Avenue SW*. CALGARY, AS T2P 3P8. Tel: (403) 232-8511 Fax: (403) 269-2787 G. Williams: Tel / Fax: (403) 247-3225 e-mail: williago@cuug.ab.ca.

The Nova Scotia legislature gave first reading to a bill establishing the Association of Professional Engineers and Geoscientists of Nova Scotia in May, before it adjourned for the .summer. The bill will probably be passed when the house reconvenes this Fall.

In Manitoba, a joint committee of geoscientists and engineers has developed a new act to create the Association of Professional Engineers and Geoscientists of Manitoba. The result of several years of intense effort on the part of geoscientists and engineers, the act is currently undergoing a final revision and will be introduced into the legislature at Fall, 1996, sitting.

Geoscientists in Ontario, who have been working with the Association of Professional Engineers of Ontario since 1990, have formed the Association of Geoscientists of Ontario to assist in preparing new legislation to require registration of geoscientists. It is anticipated that the first draft of a new, combined engineering and geoscience act will be completed by the end of 1996 or early 1997.

In New Brunswick, the Association of Professional Geoscientists of New Brunswick and the Association of Professional Engineers have been working together on new legislation to register geoscientists in their province but no timetable for submission to the legislature has been established.

The body responsible for registering engineers in Quebec, the Ordre des Ingénieurs du Québec (OIQ), has resisted requests from geoscientists in that province for combined registration (licencing) for many year. The result has been that the geoscience community has sought inclusion under blanket legislation that provides only the right to use of a protected title. The Association of Professional Geologists and Geophysicist of Quebec (APGGQ) has been in existence to certify geoscientists for many years and continues to encourage the government to recognise it as the professional geoscience association in Quebec.

Only a few geoscientists practice in Yukon and Prince Edward Island and interest in registration currently appears to he very low. Ultimately, it is likely that the engineering associations in these jurisdictions will recommend revising their acts to include geoscientists. Meauwhile, geoscientists in PEI who wish to be registered will probably do so in Nova Scotia or New Brunswick while in Yukon, those

M. Regueiro adresses the EFG Council in Haarlem after elections last June.

who wish to be registered will do so in Alberta, British Columbia or the Northwest Territories.

The need for co-ordination and standardisation has grown dramatically in the past few years as more professional associations move to register geoscientists. To respond to this need, a new 'umbrella' organisation, the Canadian Council of Professional Geoscientists (CCPG), is being established to provide this coordination. An application for a federal charter for the CCPG has been submitted to the Canadian government in Ottawa and the organisation shoold have legal status by the end of 1996.

The task force charged with implementing the CCPG, consists of ten practising geoscientists representing registering or certifying association all provinces and territories except Prince Edward Island and Yukon :

Michel Bouchard, géol. (Québec).

Terry Hennigar, P.Eng. (Nova Scotia).

Bob Leech (Ontario).

Hugh Miller, P.Geo. (Newfoundland).

Phil Reeves, P.Eng. (Sakatchewan).

Carolyn Relf. P.Geol. (Northwest Territories).

Brian Stimpson, P.Eng. (Manitoba).

Linda Thorstad, P.Geo. (British Columbia).

Reg Wilson (New Brunswick).

Gordon Williams, P.Geol. (Alberta), Chair.

The Task Force has met three times in 1996 and a fourth meeting is scheduled for early November. The Task Force, operating as the interim Board of Directors of CCPG has established the following principles and objectives and, in addition to establishing the CCPG, the task force has been directed to begin working towards those objectives.

Membership in the CCPG will he restricted to associations which licence or certify geoscientists, or which may be established for the purpose of licensing or certifying geoscientists in any province or territory of Canada.

Individual geoscientists will not be eligible for membership in the CCPG, nor will the CCPG register or certify individual geoscientists. These are functions of the provincial or territorial member associations of the CCPG.

The CCPG will assist its member associations by providing a national focus for their activities and concerns. The following are the principal objectives of the CCPG:

- to safeguard and promote the present and future interest of the geoscience professions in Canada;
- to establish and maintain liaison among the provincial and territorial associations and corporations of professional geoscientists in Canada and to assist them in:

1. Co-ordinating, correlating and standardising their activities, particularly in the areas of registration of geoscientists, mobility of registered practitioners and interprovincial practice;
2. promoting and maintaining high standards in the geoscientific professions;
3. developing effective human resources policies and promoting the rofessional, social and economic welfare of the members of the geoscience professions;
4. promoting a knowledge and appreciation of geoscience and of the geoscience professions, and enhancing the usefulness of the professions to the public;
5. promoting the advancement of geoscience and related education;
6. generally carrying out their various objectives and functions;

- to act on behalf of and to present the views of its constituent associations and organisations in matters that are national or international in scope, including international registration or certification of geoscientists, and reciprocal practice;
- to act in respect of other matters of Canada-wide or international nature concerning the geoscience professions either alone or together with other bodies;
- to affiliate with, join or enter into arrangements or agreements to carry on, any undertaking with any society, association or other body having similar or comparable objectives.

As it can be seen from the above, liaison with other organisations such as the European Federation of Geologists is an explicit objective of the CCPG and we welcome opportunities to marke possible the international recognition of professional qualifications in the geosciences. ■

GEOLOGY, ENVIRONMENT AND EDUCATION

by Franz Goerlich, BDG
Past Chairman EFG Registration Committee

Abstract

The development of an *Environmental Behaviour* in modern society implies the need to intensify geological training and regard environmental geology as a multi-disciplinary partner in the discussion and decision making of environmental problems.

The exploration of our planet started with the development of mankind using the first tool for success in the struggle of life. With the ever increasing number of individuals the need for resources also increased, but it was the impact of industrialisation beginning in the last century which enforced a new order of magnitude and set up new standards.

Geology as a whole has two roots of genesis:

– the exploration of resources for an increasing standard of living for a continuously increasing world population,

– the reconnaissance of our planet especially intensified after the 16th century.

These two activities culminated in the last two centuries through industrialisation and enabled mankind to develop the living standard of today. But with this process the production capacities and the output of goods for an ever increasing world population more and more made clear that mankind approaches the limits of growth.

Like other sciences, geology has also made great progress in understanding the history, structure and behaviour of our planet. The result was that the outlook changed from the former static consideration to a growing concept of conceiving the Earth as a complicated system of processes which developed our planet as it is today. This was made possible by new methods of investigation, using and adapting the research results of mathematics, physics and chemistry, which helped to understand this planet as a system of continuously interacting forces.

The revolution of geology - and all adhering solid-earth-sciences - within the 60s and 70s of this century not only introduced a new dimension into geology but also produced a new understanding of the genesis and delimitation of resources, their value and the necessity of their thrifty use. Additionally it turned out that the more goods that were produced, the more waste material was generated. This national and international phenomenon led to a new consciousness that we call *Environmental Behaviour*.

What in this context is the role of (modern) geology? Knowing that most of our waste is deposited on land and therefore infects soil and groundwater, geology has to take over a new responsibility towards society. She has to care for our Earth as a whole, sharing the responsibility with other sciences.

The special legitimisation for geology is:

1) The singularity of knowledge of the Earth's history and the development of life on our planet and the interactions of life with the inorganic environment. For example, the interactions of early life with gases and the formation of the first oxygen atmosphere, of the balance of CO_2 within the atmosphere and large limestone deposits during earth history, the behaviour of life during ice-ages, etc. All these considerations only can be deciphered against the background of a solid knowledge of Earth history.

2) The multi-disciplinary thinking of geology is - like biology - a prerequisite for a modern interpretation of "what is going on" on our planet, in order to find new solutions elucidating the complexity of processes on our planet.

3) The development f a new understanding of geology as an Earth-system-science and the interactions of the different processes has opened a new dimension of geology.

What does that mean for geology and environment? Geology has to be an active partner in the discussion of environmental problems with a special responsibility on all levels "vis à vis" society. The education of geologists has to cope with this new quality of education. This point needs especially careful consideration which influences future education as a whole.

The basis must be a solid and widespread basic knowledge in geology, this includes:

- solid cognisance of Earth history and the processes that have governed the past,
- an unusually large palette of different methods to investigate the Earth and their special adaptation to environmental geology,
- the presentation of the results to other users like engineers, hygienists, politicians and the participation in decision-making processes.

The new dimension that geology faces with environmental geology, forces us to intensify training so as to be able to decipher the process behind the facts. It would be dangerous and even irresponsible to regard environmental geology as a lateral deviation of "main geology" reserved for a small group of "narrow gauge" young geologists. This would not only influence the efficiency of geology as a whole in the solution of urgent problems, but would also lead to the long term loss of geology to our society. ■

THE GEOLOGICAL INSPIRATION FOR THE DENBIES VINEYARD

by Professor Richard C. Selley

Abstract

The geological nature of the Denbies estate substrate is reviewed in the text, enhancing the geological and morphological reasons why the area was considered by the author suitable for a "small vineyard" when purchased by the current and successful developers of one of the most important vineyards in the UK.

The Denbies estate lies along the North Downs, a line of hills that form the northern boundary of the Weald, a major physiographic feature of south east England (Figure 1).

I was born on a farm at Effingham, have known Denbies for all of my life, and, apart from intermittent spells abroad, have lived in Dorking for nearly thirty years. My house lies on the Greensand Hills of Deepdene. From my study window I used to look out across Dorking towards the slopes of Denbies, and thought what an ideal vineyard those south-facing Chalk slopes would be (Fig. 2).

I am a geologist. Like all geologists' I enjoy the fruits of the vine, and know that there is a close correlation between geology and viticulture (Eg. Wallace, 1972 and Pomerol, 1989).

Dorking has a long history of association with the wine trade. The coinage of the local pre-Roman Celtic tribe, the Atrebates, featured a vineleaf as a logo. This may not necessarily indicate that the Atrebates cultivated vines. It more probably indicates an early appreciation of the advantages of a

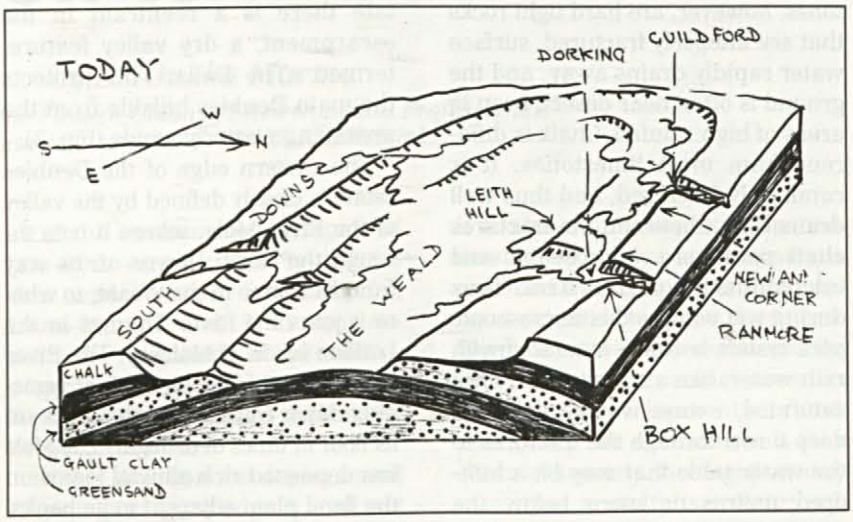


Fig. 1. Diagram to show the geological structure of the Weald. Note how the soft clay formations have been eroded, to leave the more resistant stands and chalk as lines of hills.

European common market. There are historical accounts from the seventeenth and eighteenth centuries of vineyards along the Holmesdale between Dorking and Guildford. There was one at Albury Park, laid out by John Evelyn for Henry Howard, 6th Duke of Norfolk. Defoe (1724-6) commented at some length on a vineyard on the Deepdene estate. Both of these grew on Lower Cretaceous Greensands, a dry acid soil, less suitable for viticulture than the Chalk of Denbies.

Denbies, and the North Downs, is composed of one of the most remarkable rock formations in the world. Chalk is a marine limestone that is found, not only in southeastern England, and much of Europe, but also in many parts of the world, including the Middle East, Africa and north America. Chalk is a very fine grained limestone. When examined under a very powerful microscope one can see that the chalk is composed almost entirely of fossil fragments. These are termed coccoliths, and are the skeletons of a particular group of calcareous algae, a primitive plant. These algae bloomed to great effect during the late Cretaceous, some 100 to 60 million years ago. This was a time when the earth seems to have enjoyed a uniform warm climate and, without any ice caps, the sea encroached far over the ancient continents to deposit this gentle rain of white algal lime mud, up to several hundred metres thick. The chalk also contains other larger more visible fossils, such as ammonites, bivalves, fish, sponges and occasional corals.

Chalk has some very special properties. It is a limestone, rich in calcium carbonate, an essential ingredient for plant growth. Most limes-

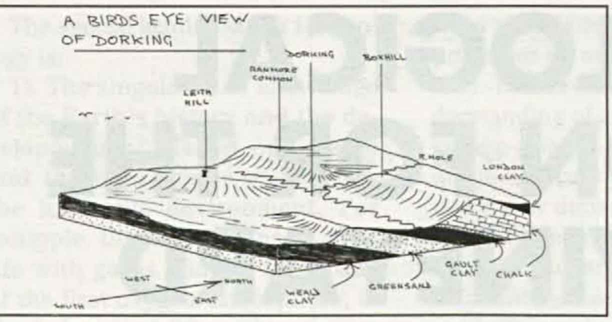


Fig. 2. Sketch geological block diagram showing the setting of the Denbies estate.

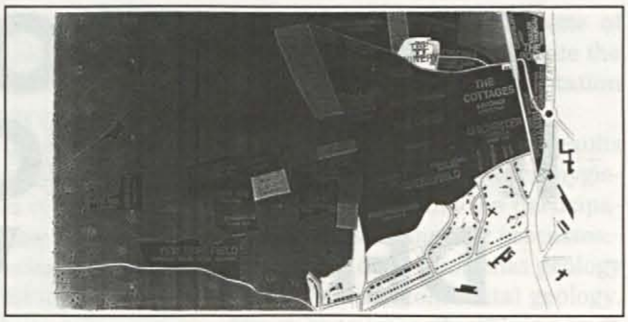


Fig. 3. Map of the Denbies estate to show the distribution of the various grape varieties. Note how most of therm occur in two different aress, on the chalk slopes in the west, and also on the lower alluvial soils, to the east.

tones, however, are hard tight rocks that are intensely fractured, surface water rapidly drains away, and the ground is often near desert, even in areas of high rainfall. Chalk is different from most limestones. It is commonly fractured, and thus well drained, but between the fractures chalk contains a microscopic and interconnected pore system. Thus during wet winters this microscopic pore system becomes saturated with rain water, like a sponge. But, once saturated, excess water percolates deep down through the fractures to the water table that may be a hundred metres or more below the ground. This explains why chalk is so suitable for growing crops in general, and vines in particular. Vines like a limey soil, they need some moisture throughout the dry summer period, but cannot tolerate water logged conditions (Hancock and Price, 1990).

The champagne wines of France grow on Chalk, at the foot of an escarpment of younger Tertiary age formations. It is locally remarked that «Champagne grows with its head in the Tertiary and its feet in the Chalk» (Wallace, 1972).

Looking across Dorking from Deepdene towards Denbies I was struck, not only by the favourable geology, but also by the favourable topography. Commercial cultivation of wines is now widespread across southern and central England, and even into Wales, but the climate is marginal and fickle. The gentle southerly slopes of Denbies are ideally positioned to receive the maximum amount of sunlight. Furthermore, at the western edge of the estate there is a reentrant in the escarpment, a dry valley feature, termed «The Dell». This protects the main Denbies hillside from the prevailing westerly winds (Fig. 3).

The eastern edge of the Denbies estate is clearly defined by the valley of the River Mole, where it cuts through the North Downs on its way from its source in the Weald, to where it joins the River Thames in the London basin at Molesey. The River Mole is famous for its habit of vanishing down fractures in the chalk on its floor in times of drought. The Mole has deposited rich alluvial loams on the flood plain adjacent to its banks. Here, because the ground level lies close to the water table, the peculiar moisture-retaining properties of the Chalk are unnecessary, indeed, on the lowest ground, waterlogging may in fact be deletrious.

On the slopes adjacent to Bradley Farm, however, the Chalk is overlain by a thin superficial deposit known as Brick Earth (because it was once deemed suitable for brick making). We are living within an Ice Age, luckily during one of the warmer interglacial phases. Within the last million years ice sheets have covered the British Isles as far south as the Thames valley. The light soils of the Brick Earth are believed to have settled out from winds that blew around the edges of the glaciers. These wind blown soils, often termed «loess», can be traced along the southern edge of the old ice sheets from Europe to China.

So, within a relatively small area, the Denbies estate embraces a range of rock types, topographic aspects and microclimates, what French viticulturalists call «terroir», suitable for viticulture.

Figure 3 shows the location of the various vine varieties. Note that most have been planted in two locations, one on the chalk slopes, and a second on the lower alluvial soil of the flood plain of the River Mole. This cunning pla enables the winemakers to overcome the vagiaries of the English climate, to some degree at least, and thus to maintain the quality of wine over good and bad years.

When Adrian White purchased the Denbies estate I submitted to him a consulting report outlining the above facts, and jokingly suggested that he should have a –small– vineyard. The rest, as they say, is history. Now I can look out of my study window, admire the view, and sip its product. ■

References

CADMAN, R. (1993).–English Wine. Published by the English Wine Society. Marlow. 39 pp.

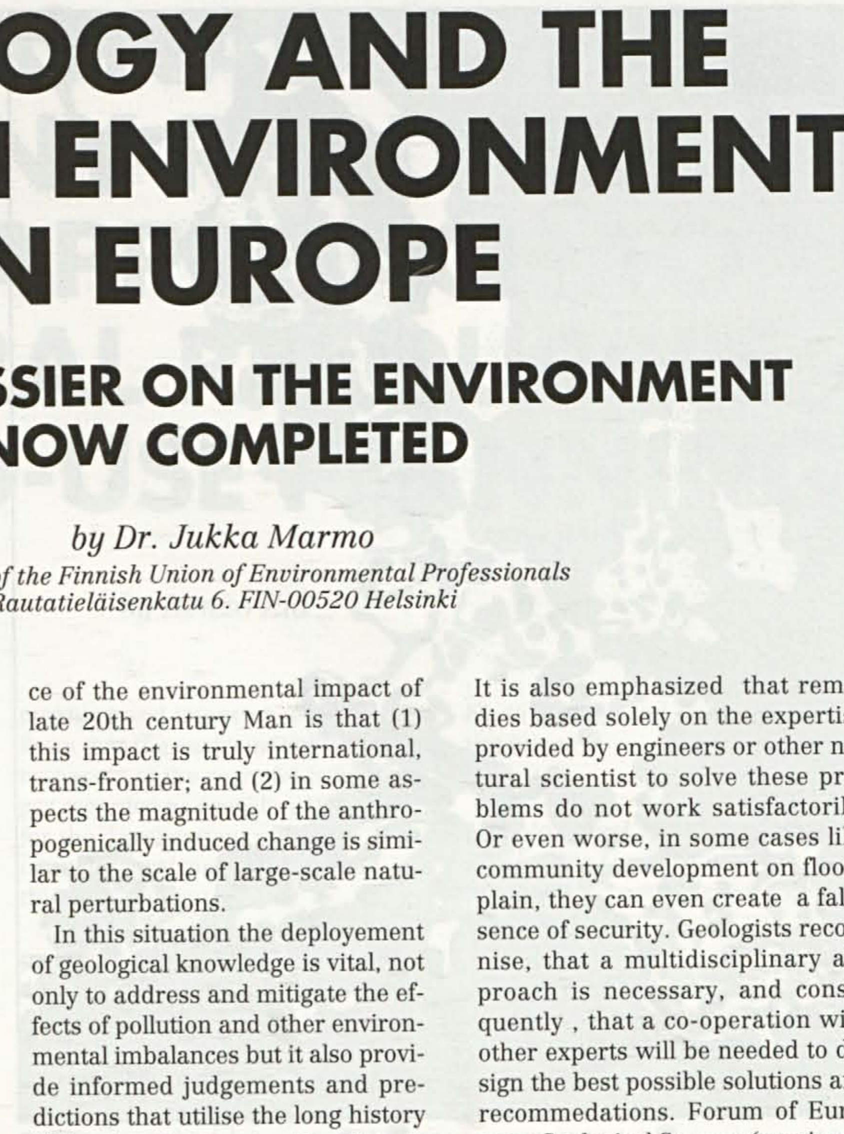
DEFOE, D. 1724-6. A Tour Through the Whole Island of Great Britain. Penguin Edn. 1971. 730 pp.

HANCOCK, J. H. and PRICE, M. (1990).–Real Chalk balances the water supply. Journal of Wine Research. Vol. 1. No. 1, pp. 45-60.

POMEROL, C. (Ed.) (1989).–Terroirs et Vins de France. 2nd Edition. English Translation by R. McCarta.

WALLACE, P. (1975).–The Geology of Wine. Proc. 24th Internat. Geol. Cong. Section 6. 359-365.

The main sources of geological information are the publications of the British Geological Survey, obtainable from HMSO, and available form all good bookshops.



GEOLOGY AND THE HUMAN ENVIRONMENT IN EUROPE

THE EFG DOSSIER ON THE ENVIRONMENT NOW COMPLETED

by Dr. Jukka Marmo

President of the Finnish Union of Environmental Professionals
Rautatieläisenkatu 6. FIN-00520 Helsinki

Abstract

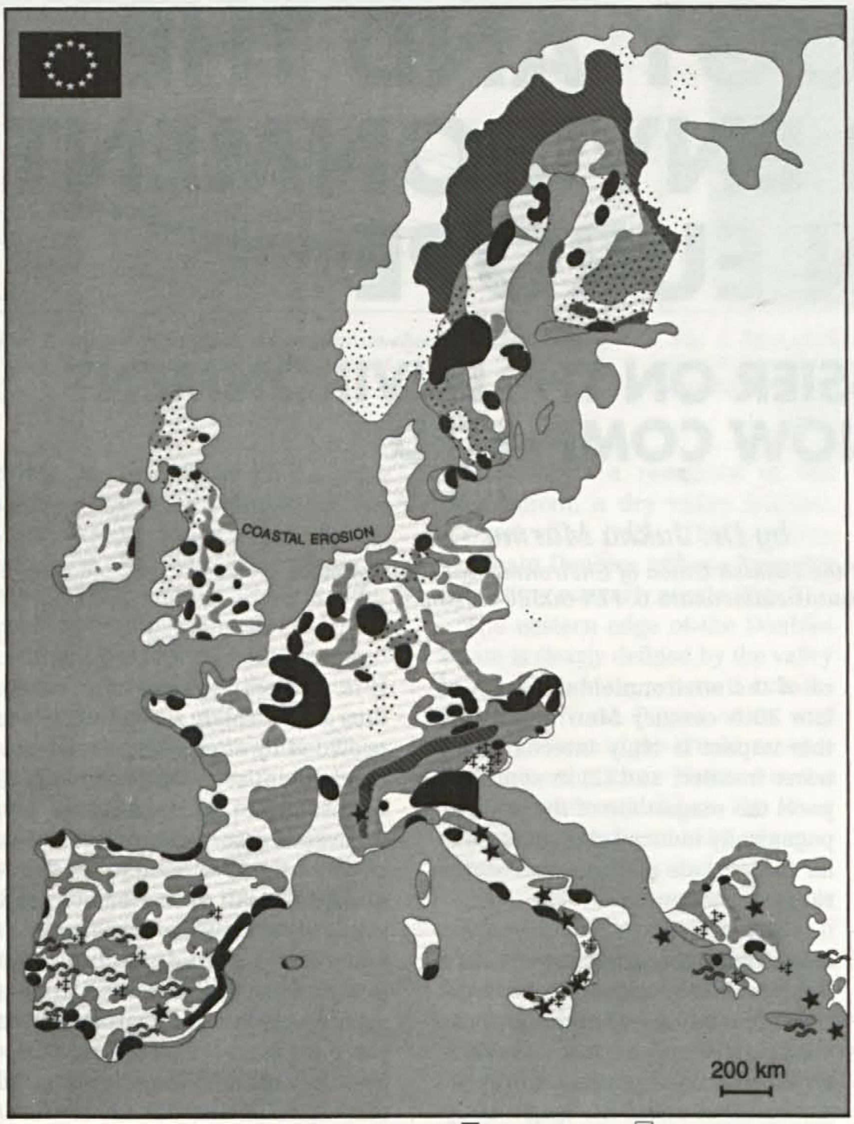
The text drafted by the EFG Environmental Working Group deals with the contribution of geology and geologists to the assessment of environmental problems in Europe and the need to approach them from a multi-disciplinary point of view. The text emphasises the need to employ geological professional and institutions in the preventive, protective and remedial measures within the framework of an active environmental protection yet to be in force in Europe.

In Europe, environmetal problems vary from country to country; the southern part of the continent is facing hazards of seismic origin, the middle part of Europe of floods and coastal erosion and in the north contamination of soil by acid rain is ubiquitious due to bedrock characteristics. Some of the problems are caused by Nature itself but some are manmade. However, many environmental concerns ultimately result from the combined effects of demographic pressures and the increasing technological demands of affluent societies. These are not new factors; human history is largely predicated upon such imperatives! However, the true significance of the environmental impact of late 20th century Man is that (1) this impact is truly international, trans-frontier; and (2) in some aspects the magnitude of the anthropogenically induced change is similar to the scale of large-scale natural perturbations.

In this situation the deployement of geological knowledge is vital, not only to address and mitigate the effects of pollution and other environmental imbalances but it also provide informed judgements and predictions that utilise the long history of local and planet-wide climatic and environmental changes documented in the rock record. A range of examples has been given in the dossier to underline the need for a coherent strategy to ensure that geological knowledge and expertise is appropriatly utilised in pan-European efforts to combat further environmental decline.

The document deals briefly with the main areas to focus on: geological hazards such as flooding, earthquakes, volcanic eruptions, coastal erosion and deposition, slope instability, water supply and quality, energy resources, waste disposal, contaminated land, urbanisation. In each area it is shown how geologists can contribute, or have been contributed to assessment of environmental problems. It is also emphasized that remedies based solely on the expertise provided by engineers or other natural scientist to solve these problems do not work satisfactorily. Or even worse, in some cases like community development on floodplain, they can even create a falce sence of security. Geologists recognise, that a multidisciplinary approach is necessary, and consequently , that a co-operation with other experts will be needed to design the best possible solutions and recommedations. Forum of European Geological Surveys (previously WEGS) and Eurogeosurveys have already laid much emphasis on environmental matters and will continue to do so. Acknowledged documents like «Geology and Environment in Western Europe» by WEGS has been published. Eurogeosurveys have recently established a base in Brussels and this arm is expected to get a better hold on decision making at the European level. Why then should the EFG try to reinvent the wheel?

It is the Working Group's view that the EFG and the Eurogeosurveys do not exist to compete, but complement each other. The surveys work on a national level and they are institutionalized to service society by providing relevant geological information on one hand, and



Main nature areas ▒ Including almost wild ▮ Rural areas ☐ Urban pressures ●
Pressures due to intensive agriculture or forestry ● Soil erosion ∔∔ High seismicity ★
Water resource problem ≈ Acid rain ⁛

A map showing some other major environmental problems in the E.U.Member Countries and Switzerland.Selected aspects of spatial development perspective are also show (modified from the E.U. Committee on Spatial Development. 1995)

to implement governmental policies with respect to their substance area, on the other hand. EFG plays a different role; it represents the profession and professional matters. Under her umbrella a great number of geologists working in industries and as independent consultants expect the federation to also promote their interest.

EFG concerns of quality matters, ethics, submitting political statements, preparing dossiers and having dialogues with decision makers and institutions are very important in the Federations efforts to generate new opportunities for professional geologists both within and outside Europe. Following these lines of policy it is the Working Group's view, that especially in the field of environmental geology, it is for the surveys to develop it as their core activity and in their partnership programmes. In business development the surveys should concentrate more in medium and long term activities of national significance. This is due to the fact that a survey as an accumulation of human and other resources can be regarded as superior to manage this business area in a cost- effective way, whereas in short term contracting private consultants can, without doubt, carry out the tasks with a high flexibility and optimum cost/ recovery ratio.

Policies on the environment must be based on the best possible scientific, technical and economic advice, and must involve thorough assessments of the risks, benefits and costs of options. In formulating such policies it is vital that the skills and perspectives of geologists should be fully deployed and utilised. Geological professionals and institutions can and must contribute significantly to preventive, protective and remedial measures within the framework of active environmental protection.

It is equally vital that policy-makers and environmental regulators across Europe should be more aware of the geoscientific perspectives of environmental issues and should be convinced of the need to translate the urgent requirements into concrete measures in order to ensure that Europe's environment is safe-guarded for future generations. EFG for her part is committed that this happens!

The EFG Environmental Working Group was set up by the Council in 1993 and was initially chaired by Gilbert Kelling of U.K. (GS) followed by Jukka Marmo of Finland (FUEP). other members of the WG included Detlev Doherr (Germany/BDG), Stavros Papastavrou (Greece/AGG), Antoine Bouvier (France/UFG) and Renzo Zia (Italy/ANGI). Active support was received from the Observer Countries by Andrzej Slaczka (Poland/PTG), Rudolf Onrasik (Slovakia/SAIG) and Johannes Stuijvenberg (Switzerland). Stephen Testa represented U.S.A. /AIPG

The Dossier is available in the EFG Paris office. ■

A REGIONAL LAW OF TUSCANY REQUIRES A NEW APPROACH TO NATURAL RESOURCES IN LAND-USE PLANNING

by Renzo Zia

Abstract

The author describes the importance of the law 5/95 of the Region of Tuscany. This piece of legislation provides a model for lad-use planning which is designed to control the development of the region within the environmental frame and which will improve the standard of living and geological safety of the current and future populations of this Italian region.

1. Introduction

On January 16th 1995, the Region of Tuscany passed the law number 5/95 entitled «Rules for the Government of Territory».

This law alters significantly the way in which land-use has so far been used from the urban point of view in Italy and in other European Countries.

The first article says that the development of Tuscany must aim at:

– securing for all citizens equal opportunities to improve their welfare.

– defending the right of the present and future generations to enjoy the natural resources of the region.

Both objectives have the same meaning and importance and it follows that the environment (i.e.»the resources of the region») is no longer regarded as providing the frame for the development of society, but is an integral part and an aim of this development.

Therefore, while urban planning presently pays attention to buildings, streets and factories, land-use panning in the future must now also consider the interactions between human activities and the natural resources of the region.

Protecting the environment does not simply require the authorities to respect and preserve these resources, but also t undertake an active policy of natural resource management.

Natural resources are limited and vulnerable. The fact that some of them such as air and water are renewable, neither increases their quantity nor !reduces their vulnerability.

Urban planning must pay special attention to them to ensure their rational and complete use now and in future.

The regional law 5/95 defines the natural resources as: «Air, water, soil, and the ecosystems of fauna and flora». These environments are attacked and transformed by society, but it is still possible to recover and protect them for the future.

2. Natural Resources and their Protection

2.1 Air

Air can very easily feel the effects of human activity and of the gaseous wastes connected with it. Sometimes air, which is odourless, is polluted by fuel burning to become «smog», which is poisonous and looks like mist or fog.

The connection between the chemical characteristics of air and human activities is clear an immediate.

Urban planning should consider the consequences of certain industrial activities on air. Such industries ought not be placed near towns even where they adopt appropriate measures to reduce their polluting effects.

2.2 Water

Once it reaches the ground, rainwater can either evaporate, be absorbed by soil or flow on the surface to eventually discharge to the sea.

Water gathers temporarily in soil

and can be drawn u by plants, which then return it back to the air through transpiration. When the soil is saturated, the surplus goes to a deeper level filling the pores and cracks of the rocks to become groundwater or underground water. Underground water can return to the surface through springs or artificial wells and can be developed a source of drinking water.

Surface water in rivers and lakes is the indispensable environment for the life of water dependent animals and plants. Changes in the quality or quantity (especially a reduction) of water have inevitable effects on the life of aquatic organisms. Moreover, surface water plays an important role in defining and characterising the landscape. Finally, surface water can be used for many purposes, such as irrigation, energy, industry, fish breeding and others. Moreover, it can be transformed into drinking water through appropriate treatments.

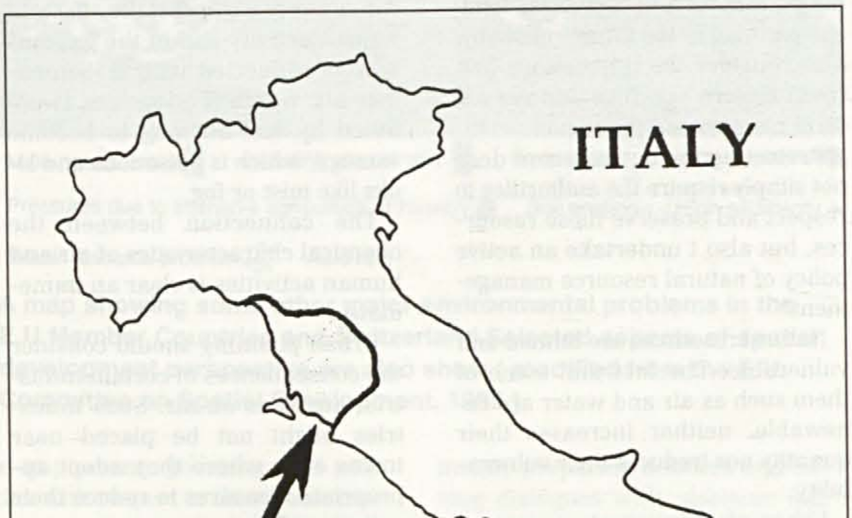
In the case of water, defending the rights of present and future generations is one of the most difficult duties. In fact this resource can very easily feel the negative effects of the present climate changes, which can even affect the quantity of available water.

Changes in the distribution of rains, especially in the annual distribution, and in evaporation, which is closely related to temperature, can reduce the quantity of infiltrating water that becomes groundwater and will materially alter the regime and flow of surface waters. Therefore, it is necessary with the assistance of hydrogeologists, to carefully manage all the destructive or damaging uses of water, resorting as much as possible to multiple and conjunctive uses of water.

2.3. Soil

The protection of the water resources is often !related to that of the management of soils, both in the agricultural sense and in the sense of land-use.

Soil in the agricultural sense is the base of life of the plants and, therefore, of agricultural and forestry activities.



Land-use results from human activities and the nature of industrial and agricultural developments determines the impact on the landscape.

While soil is a slowly renewable resource with the occurrence of favourable climatic, environmental and biological conditions, developed land is not renewable because of the long historical life of towns and connected utilities.

Developed land is a limited resource which needs to be protected. It is necessary that planning tries to use again areas already involved in urban development.

2.4. The Ecosystems of Flora and Fauna

The Ecosystems of flora and fauna are tightly related to each other and to the resources of air, water, soil (abiotic factors). In fact, flora and fauna are sensitive gauges of the natural ecosystems that require the preservation of the abiotic factor but also that human activity does not interfere in any way with the biotic factors.

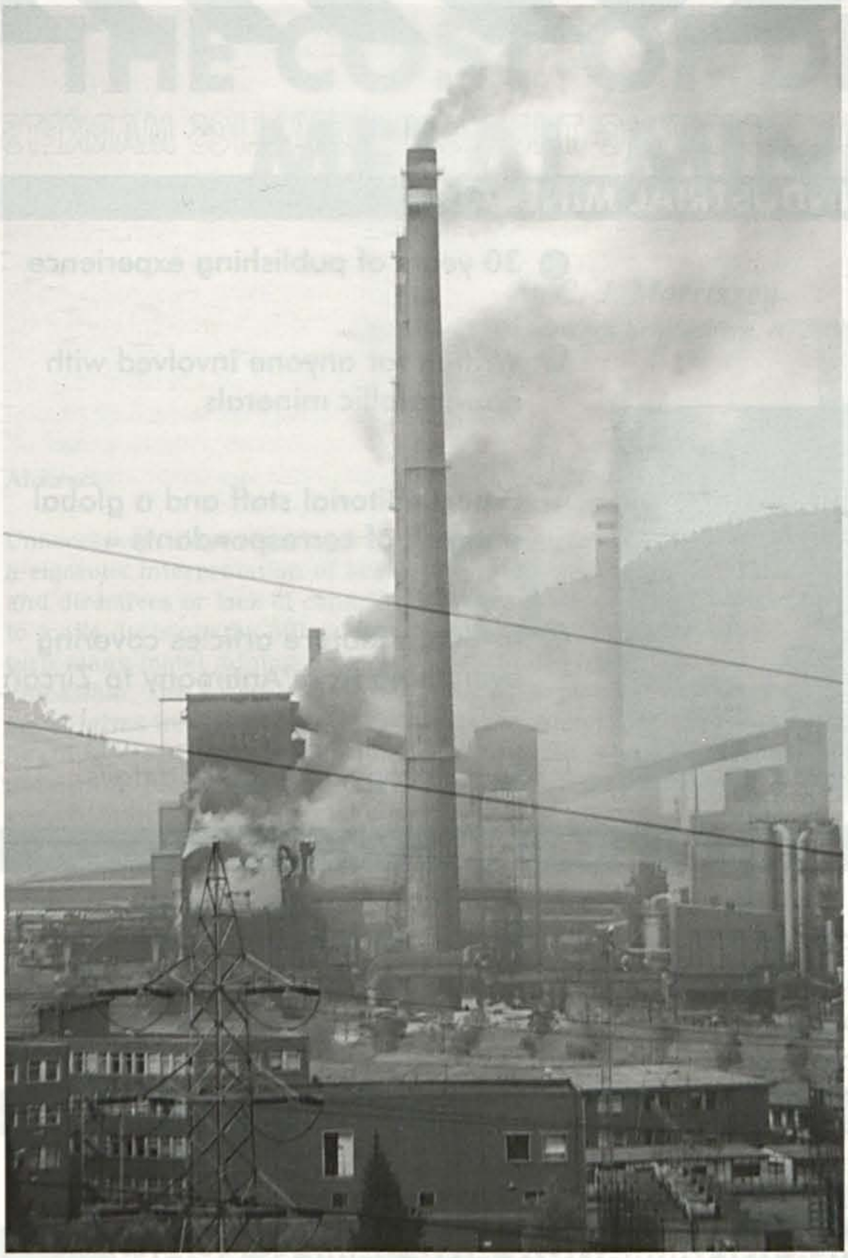
It is worth noticing that many human activities that have negative effects on the ecosystems of fauna and flora do not aim at that deliberately, but have related impacts which damage the natural environment.

To defend the natural ecosystems it is necessary to base urban planning on elements of knowledge and evaluation, so far disregarded, and so restore the natural integrity of sensitive habits such as wet-lands.

3. The right use of natural resources to prevent geological hazards.

Under the law 5/95, it is also clearly necessary to examine together he problems of resource management, protection of environment and urban and land-use planing.

Water and soil resources are subject to human activities which can,



not only reduce, the possibility of their development now and in the future, but also increase the dangers connected with them. It is crucial to reverse this situation to limit geological risk to exceptional events.

Surface water is readily impacted by changes imposed in the hydrographic system where urban development paid little attention to the natural environment.

The hydrological system, impacted by human activities is no longer able to drain the water from average storms which now result in flooding and erosion.

The absence of river and storm water control measures leads to mountain erosion and landslides. The lack of management of the hydrographic system produces also deep erosion of mountain sides, which often causes landslides.

Disafforestation, use of agricultural machines on slopes, abandonment of mountains and construction of roads in unsuitable areas, also contributes to erosion and landslides.

All these phenomena produce an increase in the solids load !of surface run-off and in the sedimentation on the plain, which in its turn reduces the available sections of watercourses and causes floods.

Underground water is exposed to the effects of uncontrolled groundwater extractions, which result in the impoverishment of this important groundwater resource. Related impacts include ground subsidence and the entry of sea water in coastal aquifers.

Underground and surface waters suffer the risk of pollution because of poorly located dumps, direct discharges of sewage, and the over application of fertilisers and pesticides in agriculture. Pollution of surface water easily extends to sea water where it heavily affects marine or estuary ecosystems.

Soil is damaged by excessive use and this can lead to it's complete destruction due to erosion or landslides, phenomena which usually derive from human activities.

The erosion by coastal currents is usually due to maritime constructions or the removal of sediments from watercourses.

Many landslides are related to the alteration in the equilibrium of hill and mountain sides due to expansion of towns and infrastructures.

Destruction of soil and its rock substratum is caused also by excavation, which can sometimes have tremendous effects on aquifers and soils. The magnitude of these potential impacts is often underestimated.

4. Conclusions

Natural resources must be correctly managed to avoid risks for people and their activities.

Only careful urban planning can save urban development from the hazards of flooding, landslides, pollution, fires and earthquakes or at least to reduce their consequences.

Such planning has to be founded on a systematic and through knowledge of the land in its geological, hyrogeological, hydraulic, agricultural and forestry aspects.

This is the reason why it is worth stressing the importance of the law number 5/95.

I hope that the principles which inspired will spread. ■

THE COST OF DELAY IN METAL MINING

by C. J. Morrissey
Chief Geologist, western hemisphere, RTZ-CRA Group

Abstract

Unnecessary delays resulting from a rigorous interpretation of laws and directives or lack of capacity to make decisions by officialdom turn many metal mining projects unfeasible. The author claims an equal-terms treatment for this type of projects, comprehensible permitting procedures and clear responsibility of officials taking key decisions.

Dr. Chris Morrissey, Chief Geologist, western hemisphere of the RTZ-CRA Group, originally a mining engineer and technical journalist, graduated in mining geology in 1970 from the Royal School of Mines in London. He joined the teaching staff there and also completed his PhD thesis before entering the mineral exploration profession in 1975, working in Ireland, Africa, North and South America. In recent years he has been Managing Director of exploration of the Europe region for RTZ which has discovered the Las Cruces base metal deposit in Spain.

This paper was presented in Ireland to a meeting of the Institution of Engineers of Ireland in November 1995 entitled "Regulatory and Planning Procedures in the Extractive Industries - The Real Cost".

The currency used throughout is Irish Punts (£IR).

£IR1 = US$1.60 = 1.2ECU = 7.9FFR.

Basic Truths

Some people would have you believe that mining is an optional perversion, something that should be unlearnt like nuclear fission, or consigned to places like the deep ocean or the asteroid belt. A variation on that theme is that the mineral resources of this planet are finite and should be left where they are to gratify our descendants or challenge their intellect.

In reality:

• The use we make of metals and minerals is one of the few things that sets us apart from ants and apes.

• The mineral resources of the deep ocean are very expensive to retrieve and process, beset by legal problems and by no means free from environmental liabilities. Extraterrestrial mining is just science fiction.

• There is no shortage of land-based mineral resources and human ingenuity is such that there never will be a shortage while there is a commercial incentive to go looking for them.

Figure 1 gives an indication of the scale of world demand for mined products. Figure 2 looks at the present and future demand for a single metal, copper. The projected figures are, of course, highly debatable but they do give some idea of the scale

WORLD MINE PRODUCTION IN A SINGLE YEAR (1993)

Coal	: 4.3 billion tonnes	
Iron ore	: 960 million tonnes	
Salt	: 176 million tonnes	
Phosphate	: 118 million tonnes	
Bauxite (Aluminium ore)	: 113 million tonnes	
METALS		
Copper	: 9.5 million tonnes	(Value ~ £IR15 billion)
Zinc	: 6.9 million tonnes	(Value ~ £IR4.2 billion)
Lead	: 2.7 million tonnes	(Value ~ £IR1.1 billion)

Figures from:
World Mineral Production 1989-93, Preliminary Statistics (British Geological Survey)

Figure 1.

WORLD POPULATION AND COPPER CONSUMPTION

YEAR 1990	Population (million)	Average Consumption (kg/head/year)	Gross Consumption (kilotonnes)	
Developed Countries	1,206	7.0	8,442	
Less Developed Countries (LDCs)	4,086	0.4	1,634	
			10,076	
YEAR 2050 (projected)				Increase on 1990
	Scenario 1 - Static Average Consumption			
Developed Countries	1,319	7.0	9,233	
Less Developed Countries	8,716	0.4	3,486	
			12,719	2,643
	Scenario 2 - Average LDC Consumption Doubled			
		7.0	9,233	
		0.8	6,972	
			16,205	6,129
	Scenario 3 - Average LDC Consumption 50% of that in Developed Countries			
		7.0	9,233	
		3.5	30,506	
			39,739	29,633

Notes: 1) Average copper consumption per head in high-income countries in 1990 ranged from about 13 kg in Japan to 3-4 kg in countries like Spain. In middle-income Latin America it was 0.8-1.6 kg; in India, China and most of Africa less than 0.5 kg.

2) The figures in the last column are a measure of the need for major new ore discoveries. One giant mine produces 250-600 kilotonnes of copper a year.

Figure 2.

of need for major new copper mines. A modest proportion of world demand is being met and will continue to be met by recycling, but nobody expects the need for new-mined copper or other metals to be significantly abated in that way. Note that consumption splits between developed and less developed countries, which should raise serious ethical questions about where mining activity should be concentrated if it is the unmitigated scourge that some people make out.

Similarly I question the ethical basis for objecting to mining as such.

- Metals and minerals are indispensable to nearly every form of human activity - construction, agriculture, transport, communications, medical care, sports - the list is almost endless.
- Everyone wants to be well-fed and well-housed, to get around and communicate, to be healthy and to enjoy their leisure.
- Metal usage tends to mirror the standard of living: raise that and you tend to increase the need for new mines (Figure 2).

Some more basic truths:

1. Mining is a business and can only make business sense in places where nature has concentrated metals and minerals to an exceptional extent. Some people talk as if mines were like factories, to put wherever it is most expedient socially and environmentally. They have to be in places where there are orebodies, which is often in scenic areas. The siting of mines often causes conflict with other opinions about how the land and the scenery should be used.

2. Discovering orebodies and making mines can be very expensive. For instance, the average cost of discovering a base metal orebody in Australia has been worked out as A$220 (£IR100) million. The typical discovering cost of an economic diamond deposit is about £IR150 million. The cost of developing a large copper mine often exceeds £IR300 million and can exceed £700 million.

3. Mines can bring many benefits to countries and to localities that host them - employment, infrastructure, persónal and public income, and sometimes improved post-mining amenities.

Competition for Mining Investment

Many countries around the world want the benefits that can come from mining and it is a curious paradox that while some are actually discouraging investment in mining, many more are clamouring for that investment to take place. (Some for that matter are doing both, apparently unaware of the deterrent effect of their legislation, regulatory arrangements and of their terms of trade for mineral rights).

No responsible mining company wants a free-for-all with environmental and social considerations thrown to the winds. Nobody wants dirty mines, filthy air or polluted waterways. No responsible government would encourage developments that bring disease and discomfort to their populations, their citizens and, in an increasingly democratic world, their electors. They want the benefits of mining, but want then to come from clean, well engineered and environmentally sensitive mines. All that is possible if they establish sensible and businesslike procedures for permitting and monitoring new mines.

It is not my purpose to point at anyone about the shortcomings of actual procedures. My message is tat if they are over-elaborate, excessively time consuming, or based on erroneous criteria they will run a great risk of driving investment away. That can happen readily with factories, the siting of which is far less constrained by tricks of nature. The materials, skills and infrastructure that are needed for a particular factory can generally be assembled at a number of alternative locations in different countries. Big mining companies may sometimes have some choice between orebodies that are ready for development in different countries. Smaller companies generally do not, and some of them are potentially the big employers

PARAMETERS OF NOTIONAL MINING OPERATION

Mining Resource	:	62 million tonnes averaging 10% Zn recoverable
Milling Rate	:	3 million tonnes a year over 20 years after tune-up
Zinc Price	:	55 cents per lb
Net Smelter Return	:	55% of contained metal value
Construction Cost	:	£IR120 million over two years
Operating Cost	:	£IR25 per tonne milled
Site Rehabilitation Cost	:	£IR20 million
Royalty Rate	:	4% of net smelter return from Production Year 7
Tax Rate	:	40% of net profit from Production Year 7

Figure 3.

and big wealth creators of the future.

Time Value of Money

Sticking to general principles, I will now illustrate the cost of delay in allowing a new mine to go ahead. The underlying concept is that time costs money in two ways, by depriving the investor of a return on money that has already been spent and by eroding the value of future income.

Consider an imaginary exploration programme that has led to a zinc discovery! amounting to, say, 62 million tonnes of ore at a recoverable grade of 10% zinc (Figure 3). Let's say the programme cost £IR30 million in today's terms, including the cost of drilling the deposit off. (That figure flatters my profession and is probably just a fraction of what has been spent in, for example, Ireland by exploration companies that didn't end up with an orebody). The next stage is a feasibility study, which in our imaginary case would take a year and cost £IR6 million. It concludes that the deposit would be worth mining and that the optimum mining rate would be 3 million tonnes a year with two-thirds of that in the first year. The construction cost of the mine is estimated at £IR120 million and total operating cost at £IR25 per tonne milled. I have assumed a highly mechanised underground.

In the build up to mining and during the life of the mine, environmental monitoring and remedial costs have been included in other costs but in the year after the mine stops production I have allowed £IR20million for site rehabilitation and other environmental costs.

Let's say there is going to be a tax and royalty holiday during the first five years of full production, thereafter a royalty of 4% of net revenue (net smelter return) and corporate income tax at 40% of net profit. I should say that my treatment of tax is very crude and you will appreciate that a project like this could fly high or fail to take off depending on the skill of the company in handling its business affairs. I am not going to specify whether the project is being financed by debt or equity, in other words whether cash surpluses in the early years would be used to pay off debts or reward shareholders.

Figure 4 is a simple cash-flow diagram for the whole duration of the project. In the diagram I have shown a five year delay between reaching a production decision and starting construction. Lets call that the permitting delay, though there could be other reasons. During the delay I have assumed that it would cost a £1 million a year to keep the project ticking over with a skeleton staff and to represent it at various hearings while keeping the company in good standing. In the early years here is no income so all the flows are negative. During the productive

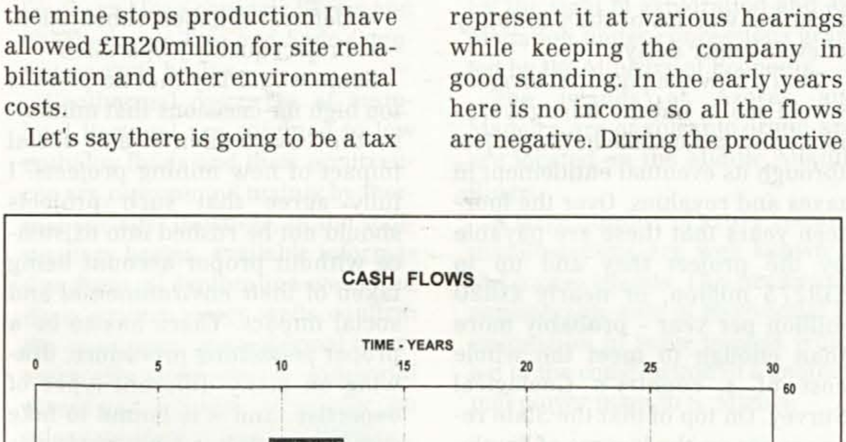


Figure 4.

years the positive flows represent operating profits that can be used to pay off debt, meet tax and royalty obligations and pay dividends.

Figure 5 shows how the net present value of the project and its internal rate of return vary with a permitting delay of between one and five years. In calculating the net present value I have used a discount rate of 10%. This is a common enough figure in our industry, even where the project is located in a stable country and is not considered very risky from a technical point of view. Higher discount rates would be appropriate if those conditions were not met.

EFFECTS OF DELAY ON PROJECT IRR AND NPV

	No Delay	YEARS OF DELAY 1	3	5
IRR (%)	17.0	16.0	14.2	12.6
NPV_{10} (£IR)	62.0	52.7	36.5	23.1
Loss of NPV (%)		15	41	63

Figure 5.

In NPV terms the project loses 42% of its value with a three year delay and 63% of its value with a five year delay. In parallel with that, the rate of return drops from a respectable 17% with o delay to a figure of 12.65% that could make the project look unattractive if there was something else making the potential investors edgy, for instance technical worries or the possibility of even longer delays.

That's how the potential investor would see it, but the host government also has a stake in the project through its eventual entitlement to taxes and royalties. Over the fourteen years that these are payable by the project they add up to £IR275 million, or nearly £IR20 million per year - probably more than enough to meet the whole cost of a country's Geological Survey. On top of that the State receives tax on the income of employees and, in various ways, on their purchases and transactions. There is also a multiplier effect through the creation of ancillary businesses and direct employment, so all in all the largest single beneficiary of a new mine could well be the public treasury.

Under the circumstance it does sometimes seem that officialdom takes too little account of the cost of delay. In summary, here are some of the effects that result from delay, with the general rule the longer the delay the higher the cost:

- Cancellation of relocation of real projects.
- De-motivation of investors in potential projects.
- Deferral of State income, direct and indirect.
- Deferral of job creation, direct and indirect.
- Deferral of import substitution.
- Project quality jeopardised.

Some would say that no price is too high for decisions that minimise the environmental and social impact of new mining projects. I fully agree that such projects should not be rushed into existence without proper account being taken of their environmental and social impact. There has to be a proper permitting procedure, drawing on many different types of expertise, and it is bound to take some time. What I am saying is that it is in the interest of the host country and the citizens, as much as it is in the interests of the investors, to ensure that the time does not drag on any longer than it absolutely has to.

That can happen by insisting on an unnecessarily rigorous interpretation of laws and directives, some of which may be framed in terms that are permissive of a fair amount of stupidity. There should not be double standards for mine developers and their opponents. Leaning over backwards to allow opponents a hearing is all very well, but I do think they should be required to stick to the point, to respect scientific truths and disciplines, and to behave as proponents of a point of view rather than as the sole possessors of righteousness. Performance against these conditions should have some bearing on their access to legal aid.

Delay can happen, too, if officialdom lacks the capacity to make decisions, perhaps because of the way it is structured or simply fails to get on with it. Permitting procedures can be complicated, with difficult issues at stake and many different regulatory bodies and interest groups entitled to a say. In that situation there is plenty of scope for 'buck-passing' and procrastination. To avoid that, the procedure needs to be clear cut, key officials need to have confidence in their decision-making powers and a willingness to use them, and their advisors must contribute to the process with a sense of urgency. (Placing imperatives like that on the legal profession is very difficult, especially when extra-territorial courts get involved, but where there's a will usually there's a way).

These are my personal views, and I put them forward as generalities. It is for you to judge how relevant they are to your own country. ■

PORTUGUESE GEOTHERMAL OPERATIONS: A REVIEW

by José Martins Carvalho
ACavaco Lda, Ave. Eng. Duarte Pacheco, 21. 1000 Lisbon, Portugal
Évora University, Largo dos Colegiais, 2. 7000 Évora, Portugal

Abstract

The geology of Portugal determines different conditions for geothermal energy occurrences. In the mainland, where crystalline rocks outcrop over 60% of the area, thermal waters are related with active faulting. Twenty seven springs have discharge temperatures between 25°C and 75°C and are used in balneotherapy. Two small, low enthalpy operations for direct use at existing spas are operating normally. In the sedimentary basins, particularly in the Lisbon basin where important heat consumers are located, Lower Cretaceous reservoirs with temperatures up to 50°C are adequate for small multipurpose geothermal operations. At the Air Force Hospital in Lisbon a 1,500 m geothermal well is producing hot tap water since 1992. In some volcanic islands of the Azores, the geological and market conditions allow high enthalpy electricity producing operations. In S. Miguel, the largest island, a small pilot plant operates since 1980. In 1994, a new binary power plant with a production capacity of 2 x 2.6 MW was installed.

Key words: Portugal, geothermal projects, direct use, electricity production, thermal springs, exploration.

1. Summary

In the mainland, the geology of Portugal shows three main geological units: (i) the ante-Mesozoic Hesperic Massif, part of the Hercynian basement, (ii) the Western and Southern Meso-cenozoic basins and (iii) the lower Tejo and Sado Ceno-Antropozoic basins.

Geothermal resources of mainland Portugal are confined to low enthalpy fluids and their occurrences are represented mainly by thermal springs. However, in the sedimentary basins, available information from oil exploration wells and deep ground water wells confirm the occurrence of geothermal reservoirs able to be used in industrial direct-use projects whenever an adequate market exists at surface.

The exploitation of discontinuous fissured geothermal reservoirs of the Hesperic Massif is mainly related with the spa business. Also, the bottled water industry utilises some hypo-saline waters discharging from quartzite reservoirs.

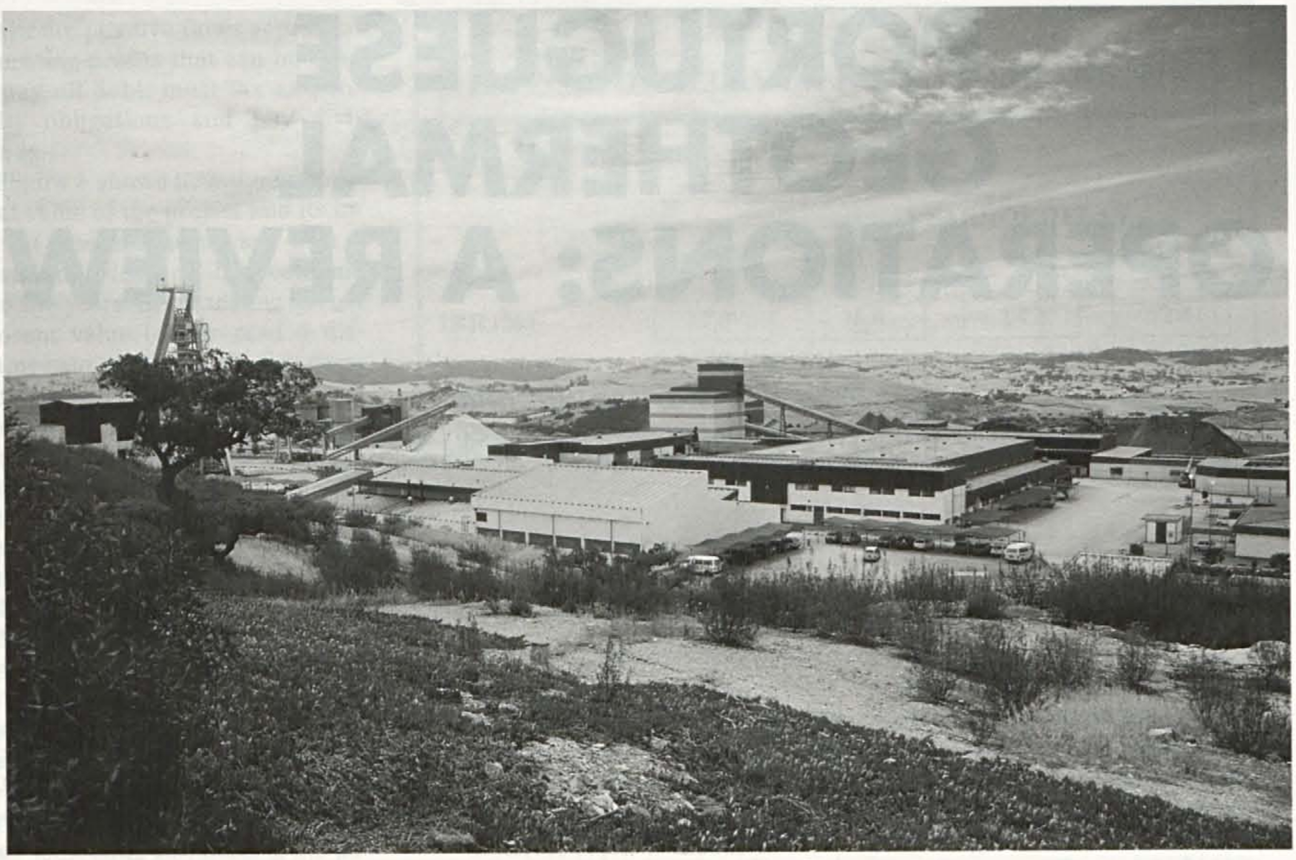
During the last twenty five years, and particularly after the middle 70´s, almost all the classical spring catchworks were replaced by drilled wells in an attempt to increase flows and temperature, and to prevent or remedy pollution and contamination. These works confirm that most of these mineral waters can be considered as geothermal resources where adequate heating energy demand is present. Furthermore, Portuguese law favours the promotion of these projects: according to 1990 legislation, geothermal resources are public domain but private bodies and municipalities can apply for the right of exploration and exploitation under concessions granted by the Ministry of Economy.

The islands of Azores and Madeira are of volcanic origin and are located on the Middle Atlantic Ridge.

A large number of active volcanic manifestations are well known in the Azores Islands. This justifies the considerable level of geothermal investigation in some islands which led to the construction of a geothermal power plant in S. Miguel.

2. Geothermal resources and proyects in the Hesperic Massif

It is clear from Cabral and Ribeiro (1989) that thermal anomalies follow axes trending NNE, NE and ENE along the main active faults. Ferreira et al (1984) discusses, in detail, the provenance of mineral waters with respect to geochemistry and regional and local tectonics. Natural discharge from pre-1970 spring catchment systems ranges from a few m^3/d to 800 m^3/d. In ge-



Neves-Corvo general view of the facilities.

neral, with new drilled wells, it has been possible to increase the former production. Almost all Portuguese thermal waters discharge from granite rocks of Hercynic age. Temperatures of mineral, thermal waters range from 15 to 75ºC. Distribution of high temperature springs seems related to active faulting, as referred above. However, typical cold mineral waters in a geological sense, are sometimes present a few kilometres away over the same structure. An example is the Régua-Verin fault where cold and hot mineral waters (15 to 75ºC) of the same chemical composition are located within 10 km distances.

The Hesperic Massif has three types of water: (i) hypo saline waters with TDS less than 150 mg/l and temperatures up to 28ºC, circulating mainly inside quartzite reservoirs, (ii) sulphurous waters with up to 1,000 mg/l and temperatures up to 62ºC, and (iii) carbonated waters with TDS up to 2,500 mg/l and temperatures up to 75ºC. Reported thermal waters present TDS ranging from 40 to 2,508 mg/l and pH from 5.4 to 9.5.

On a medium-term perspective, it is considered that geothermal fluids in the Hesperic Massif will only be used as low-enthalpy resources, even though data provided by geothermometers, suggest reservoir temperatures higher than 100ºC at several locations (Aires-Barros 1978, 1979 and 1981; Almeida 1979 and 1982; Johnston 1980). Ribeiro (1981) using Portuguese thermal waters found the correlation $T = 0.61t + 81.84$ between temperature at surface (t) and reservoir temperature (T).

Several constraints for direct-use geothermal energy are: (i) it seems clear that the available water for recharge does not allow the extraction of amounts of water much higher than the present exploitation systems without incurring severe environmental damage, (ii) low heating load and demand do not justify large investments and (iii) thermal bath localities are quite aware of its status and opinion makers claim that geothermal energy exploitation could be a danger for the future of the tourism and spa industries. Nevertheless, a few small geothermal operations are already in activity.

The most promising sites are located over the Regua-Verin active fault, namely Chaves and S.Pedro do Sul. Carvalho and Silva, (1988) and Carvalho, (1991) summarised and evaluated geothermal resource potential by following a modified Muffler and Cataldi (1978) approach. This methodology considers geothermal resources mainly dependent of the rate of ground water recharge to the hydrothermal circuits. In fact, the availability of water is a serious limitation for the utilisation of heat in geothermal fields of this type.

At Chaves, Northeast Portugal, a rhomb-shape graben, with an area of 18 km² (Cabral and Ribeiro (1988)), and with a basin-fill of at least 450 m, according to Carvàlho and Silva (1988), the municipal swimming pool geothermal project has been in normal operation since 1982, including space heating and hot tap water production. The geothermal fluid is pumped from a 150 m deep well at a temperature of 75°C. TDS is about 2,500 mg/l. This well, positioned about 200 m from the known thermal spring, was located and drilled in Silurian metasediments crossed by hydrothermal quartz veins. One other well was drilled for balneotherapy. During drilling with down-the-hole-hammer, air-lift yield reached 40 l/s. After completion, a final 72 hr pumping test, mesured a specific capacity of 11.3 l/s/m at, apparently, steady state. Thermometric logs to 150 m deep do not reveal an abnormal temperature gradient. Furthermore, a gradient inversion was found from 50 m to final depth. This work was expected to be followed by an operation, partially financed by the Demonstrations Projects of the European Community, which included the drilling of two new evaluation/production holes of up to 650 m depth designed to provide geothermal fluids to an hospital, some hotels and several public buildings in the town centre. That operation did not start due to funding difficulties. At present, energetic savings are about 100 toe (tons of oil equivalent); the new operation will allow as much as 3000 toe with an estimated pay-back of 3 years. It must be remembered that Chaves is a small town with 15,000 inhabitants where the heating season reaches 7 months. Meanwhile, a research project supported also by the European Community (Joule I Project) is underway to improve the conceptual model of the entire geothermal field. Partial interpretation of data was recently been made available (Andrade Afonso et al 1994a,b, Monteiro Santos et al 1994, Aires-Barros et al 1994). The meteoric origin for geothermal fluid seems confirmed as well as a recharge zone located on the eastern border of the graben. For the approved industrial multi-use cascade operation it is clear, by economical and technical reasons, that additional wells must be drilled where heat consumers are located (Carvalho and Silva (1988)).

S. Pedro do Sul, in central Portugal, is another interesting site (Carvalho (1994)). The site is located over the already referred Régua-Verin fault and the classical, archaic, spring arrangement discharges 10 l/s of 68 °C water from fractures in granite. TDS of the geothermal water is about 390 mg/l. This bath (Termas) is the most important in the country with about 15,000 registrations in 1992. There are several hotels which could be reasonable heat consumers. One km southwards, over the same fault, a small thermal spring (Vau) suggests that the geothermal field could be larger. Studies and work carried out over an area of 5 km2 around the existing thermal springs included: (i) geological mapping at 1/5,000 scale, and (ii) gravimetry and radiometry measurements each 100 m. These investigations, carried out in 1991, fully defined the structural blocks in the area. In a later stage, tactical prospecting at three selected areas (Vau, Termas and Várzea) included: (i) geological, 1/1,000 scale mapping, (ii) soil radon measurements (emanometry), (iii) Very Low Frequency measurements and (iv) resistivity profiling and vertical electrical soundings up to AB=2,400 m. These surveys fully delineated the Vau and Termas poles and provide evidence of hydrothermal circulation at Várzea, 1 km north of Termas. Two deviated 200 m cored wells were drilled in granites at Vau, in order to investigate low resistivity anomalies related to transversal faulting. The results were quite encouraging. The artesian flow reaches 3 l/s with a temperature of 69°C; on final pumping tests, 10 l/s were pumped with 5.2 m drawdown. Calculated transmissivity and storage are 107 m²/d and 0.00004 according to the Cooper-Jacob method. A 2 ha greenhouse, producing tropical fruits (mainly pineapple and banana), is installed on this site. Another deviated well, 236 m in length, drilled at Varzea was unsuccessful. Following these investigations, a multi-use cascade project including district heating and further applications in agriculture and fish-farming was included in the European Community 1994 Thermie program. The geothermal well, designed to be drilled up to 500 m depth, is currently drilling at 250 m (September 1996). Artesian flow is about 10 l/s; however, temperature is practically the same measured in the former shallow spring. Because of the mild climate, the first stage geothermal district heating operation will not exceed 150 toe. However, estimated payback is 5 years considering savings only on the district heating operation.

In 1989, at Carlão in north-western Portugal a small thermal spring (30°C and 0.5 l/s) was used to heat a 1,000 m2 greenhouse that produces out of season vegetables and melons for the local market. A three year payback was estimated by the owner. However the operation was discontinued in 1993 as the concessionaire was more interested on the spa business.

There are 27 known sites with local springs with temperatures higher than 25°C. For these sites, Carvalho, J M (1995) evaluated heating needs (existing or envisaged heating needs replaceable by geothermal resources in short-medium term) at 6,000 toe. For the same sites, available resources defined as the energy that can be replaced for heating, considering the measured yield and temperature, are about 7,000 toe. Thus, total energy savings are compatible with existing resources.

Several feasibility studies carried out in 1995 at several sites by CCE/ACAVACO, financed by the Thermie and Altener programmes, demonstrate that it is economically interesting to carry out several new direct use projects in these type of geothermal occurrences, Anon (1995).

However, development of geothermal resources in the Portuguese Hercynian Massif is limited by: (i)

Neves-Corvo. Underground workshop.

subsurface hydrogeology, (ii) heating demand, (iii) utilisation conflicts with spa and tourism industries, and (iv) financial problems. Nevertheless, the reported operations fully demonstrate that geothermal resources of the Hercynian Massif could be technically and economically developed for direct use, enhancing local and regional economies at a number of sites.

Considering recharge and reservoir characteristics, electricity production with binary power plants is not clearly conceivable in a medium term perspective. Further investigations (possibly combined with a hot-dry-rock program !!) could be advisable for a long term project. Low natural recharge for possible electricity production wells and scarce surface water resources for injection are major drawbacks for such programs.

3. Geothermal resources and proyects in the sedimentary basins

The general stratigraphy of the sedimentary basins is well known and its total thickness reaches about 5,000 m; it includes thick sedimentary strata of limestone and sandstone with sub volcanic intrusions, dikes and extensive lava flows and tuffs. The tectonic evolution was complex and includes the formation of NE trending basement graben structures and diapirism of lower Jurassic evaporites leading to severe deformation and structural complexity of the younger strata.

In a few thermal springs currently in use as spas, it is conceivable to develop small geothermal operations similar to those of the Hesperic Massif.

The average geothermal gradient measured in oil exploration and deep water wells range from 2.2°C/100 m to 3.6 °C/100 m over anomalous areas.

The estimates for the heat flow density have reached values around 80 mWm-2. Higher values of the heat flow densities seem associated with salt diapirs and/or basement highs or with the edges of the Lusitanian Graben.

The most promising low enthalpy reservoirs seem to be located (i) in lower Cretaceous sandstones (Aptian/Albian and Valanginian) and (ii) in Jurassic formations (Oxfordian and Calovian reef limestones and dolomites). On the average, in the Lisbon area, these strata are, respectively, within the range of wells of 1,500 m and 2,700 m depth and have temperatures ranging from 50 to 75°C (normal geothermal gradient). In this area, Aptian/Albian sandstones were drilled for water supply at depths up to 500 m and a geothermal well was drilled in 1987 at the Air Force Hospital. No attempts were made to reach the Jurassic formation at adequate depths.

The most favourable low enthalpy geothermal area in the sedimentary basins corresponds to the Greater Lisbon. In fact, in this area a potential market exists for the direct use of geothermal heat at various grades for industrial processes, residential and commercial usage and even agricultural applications.

The Geothermal Project of the Air Force Hospital in Lisbon is operating normally since the end of 1992. It is the first geothermal direct heat utilisation in the Lisbon sedimentary area and has been financed at 60% by the Valoren Programme. It is considered representative of further operations to be carried out in the Lisbon area. A 1,500 m deep single well, was drilled in 1987 and screened in the Aptian-Albian (Lower Cretaceous) siliceous sandstone. It has an exploitation yield of 18 m^3/hour with wellhead temperature of 50 °C. Static level is -4m and pumping level for 18 m3/hour is ca -170 m, the submersible pump being installed at -220 m. Bottom hole temperature is 53 °C and the transmissivity is ca 2 m^2/day. The reservoir could be considered as a leaky aquifer. Geothermal gradient is about 2.26 °C/100 m. At the time of construction, total dissolved solids (TDS) of the geothermal fluid was only 0.44 g/l. Surface installations were conceived in order to minimise interference with the existing equipment.

The geothermal fluid, after being pumped is treated: chlorination, removal of iron, manganese and sulphide and softening. Resulting water is potable according to national and European specifications. It is distributed directly all over the year as pressurised hot tap water and in the heating season in a small district heating network. At the end, cooled water from the heating process and/or treated geothermal water goes to a small cooling tower and is distributed as drinkable water. An adequate system monitors both reservoir and surface installation performance. This project is a good example of the rational utilisation of a natural resource: in fact total savings are the sum of the energetic economies with the production of drinkable water. The cost of the project was about 1.3 M US$. After four years of normal operation it is clear that the pay back time is about 10 years, considering all savings. Lately, an increase in the TDS of the geothermal fluid was reported. Investigations are in due course to determine the causes: failure of the casing or geochemical changes intra-reservoir.

The feasibility, at present stage, of carrying out geothermal operations on the Jurassic reservoirs is low due to (i) the geological risk, (ii) the probable high salinity of the fluid not allowing utilisation as drinking water, and (iii) the low heating demand on surface.

In the Tejo and Sado Ceno-Antropozoic basins there are excellent aquifers, with transmissivities up to 4,000 m^2/d and extraction capacities, per well, up to 100 l/s. However, water temperature of this system does not exceed 32 °C, restricting its ability only to water supply and very low temperature geothermal applications. A few operations with geothermal heat pumps for greenhouses and domestic purposes are known. However, present economical conditions do not favour the spread of this kind of technology in Portugal.

4. High enthalpy geothermal resources and projects in Azores

According to Forjaz, V. H. (1994), central and western Azores islands are over the so called Azores micro plate. This micro plate is cut by several fractures coming from the Middle Oceanic Ridge. These structures cross S. Miguel island and some of them continue to the East creating the Azores-Gibraltar megafracture. The geothermal conditions in S. Miguel are promising and, furthermore, S. Miguel is the larger and most populated island of the Azores, having an electrical consumption up to 24 MW.

During 1972, Dalhousie University (Canada) drilled an investigation well at the Ribeira Grande tectonic valley, on the northern flank of the Água de Pau volcano. The occurrence of steam determined the conclusion of the drilling works at 1,000 m.

In 1976, started the Azores Geothermal Project, an exploration and exploitation programme including geophysical and geochemical exploration, geothermometric drilling and evaluation/production wells up to 1,500 m. Five wells were drilled at Ribeira Grande, on the lower flancs of the Agua de Pau volcano. They revealed the existence of a 225-235°C, liquid dominated Na Cl (8g/l), Huttrer(1995). This programme made possible the installation, in 1980, of the 3 MW, Pilot Power Plant of Pico Vermelho, fueled by the steam produced by well PV-1. The Pico Vermelho Power Plant runs regularly with a capacity of 0.6 MW but suffers from severe encrustation problems in the geothermal well. Servicing is required every month. Technical, political and financing difficulties did not enable the completion of the project to the power plant full capacity.

The existing industrial binary fluid power plant, located close to the Fogo caldera, is operating since 1994. Four geothermal wells were drilled up to 2,000 m at Cachaço-Lombadas, a geothermal area adjacent to Ribeira Grande. The reservoir is formed by pillow lavas from the Água de Pau volcano and the cap rock includes tuffs, lahar, ignimbrites, trachytes and basalt of the same volcanic structure. Average temperature of the reservoir is 240 °C at 1,200 m, the wellhead temperature being 200 °C. Production per well is about 120 ton/h (CL-2, the better well, flows 152 ton/h with a steam flow of 39 t/h and an enthalpy of 1,300 kJ/kg). The installed capacity in two binary fluid Ormat groups is about 5 MW resulting from wells CL1 and CL2. The planned total capacity including total production of the four wells is 12 MW, about 60-65 % of the power demand of S. Miguel.

The future of this geothermal operation as well as others at Terceira and Faial-Pico islands, where geothermal feasibility studies were already carried out, are dependent on the future evolution of the oil price and from European and local policies to support renewable energy.

There is no evidence of geothermal potential at the Madeira Island, except for a site in the vicinity of Funchal, the capital (Forjaz, V. H. (1994)). ■

5. References

AIRES-BARROS, L. (1978).– Aproveitamentos Geotérmicos. Considerações Gerais. A Exploração das Altas e Baixas Entalpias no Território Português. Boletim de Minas, V. 15. Lisboa.

AIRES-BARROS, L. (1979).–Termometria Geoquímica. Princípios Gerais. Aplicações Geotérmicas a Casos Portugueses. Com. Serv. Geol. Portugal, Tomo LXIV. Lisboa.

AIRES-BARROS, L. (1981).–Sobre as Potencialidades em Geocalor de Alguns Polos Geotérmicos do Continente Português. Boletim de Minas, V. 18 (2). Lisboa.

AIRES-BARROS, L., R. C. GRAÇA and J. M. MARQUES (1994).–The Low Temperature Geothermal System of Chaves: a Geochemical approach (Portugal).Geothermics 94 in Europe, Document BRGM n.° 230, Éditions BRGM, Orléans.

ANDRADE AFONSO, A. R., MONTEIRO SANTOS, F. A. and MENDES VICTOR, L. A. (1994).–The Resistivity Method in the Evaluation of Geothermal Resources-Application to Chaves Geothermal Field (Portugal). Geothermics 94 in Europe, Document BRGM n.° 230, Éditions BRGM, Orléans.

ANDRADE AFONSO, A. R., RIO, M. I., SANTOS, F. A. and MENDES VICTOR, L. A. (1994).–The Application of Self Potential method to a Low Enthalpy Geothermal Field (Chaves, Portugal). Geothermics 94 in Europe, Document BRGM n.° 230, Éditions BRGM, Orléans.

ANON (1995).–Acção OPET G16-Recursos Geotérmicos Portugueses de Baixa Entalpia. Acavaco Lisboa.

CABRAL, J. and RIBEIRO, A. (1989).–Carta Neotectónica de Portugal. Serviços Geológicos de Portugal. Lisboa.

CARVALHO, J. M. (1988).–Polos Geotérmicos de Trás os Montes. Recursos e Metodologias de Desenvolvimento. Anais da UTAD, Vol. 2. Vila Real.

CARVALHO, J. M. and SILVA, L. F. (1991).–Ressources Geothermiques de Basse Temperature du Portugal. Potentiel de Devellopement. Cours International de Formation à la Geothermie Appliquée. Institut Français de l'Energie. Paris.

CARVALHO, J. M. (1994).–Geothermal Resources Exploration in the Hercynian Basement, S. Pedro do Sul; Portugal, Geothermics 94 in Europe, Document BRGM n.° 230, Éditions BRGM, Orléans.

CARVALHO, J. M. (1995).–Low Temperature Geothermal Reservoirs in the Portuguese Hercynian Massif. Proceedings of the World Geothermal Congress 95, vol 2, pag 1343-1347.

FERREIRA, M. P., CARVALHO, J. M. and MENDONÇA, J. L. (1984).–Águas Minerais na Zona Centro Ibérica-(Sector de Portugal): Metodologia, Tipologias. I Congreso Español de Geologia. Ass Geol Españoles. Madrid.

FORJAZ, V. H. (1994).–Central Geotérmica Industrial da Ribeira Grande, Lagoa do Fogo, S. Miguel, Açores, Portugal. SOGEO S.A. Ponta Delgada.

HUTTRER, G. W. (1995)._The Status of World Geothermal Power Production. Proceedings of the World Geothermal Congress 95, vol. 1, pag 3-14.

JOHNSTON, D. A. (1980).–Geothermal Resources in Portugal and The Azores. (first draft) U. S. Geological Survey. Menlo Park. California.

MOITINHO ALMEIDA, F. (1979).–Termómetros Hidrogeotérmicos Aplicados a Águas de Portugal. Res das comunicações. 1.° Encontro de Geociências. Lisboa.

MOITINHO ALMEIDA, F. (1982).–Novos Dados Geotermométricos sobre Águas de Chaves e S. Pedro do Sul. Com. Ser. Geol. Portugal. Tomo LXVIII, fasc. 2. Lisboa.

MONTEIRO SANTOS, F. A., ANDRADE AFONSO, A. R., DUPIS, A. and MENDES VICTOR, L. A. (1994).–Joint Inversion of AMT DC Data-Application to Chaves Geothermal Field (Portugal). Geothermics 94 in Europe, Document BRGM n.° 230, Éditions BRGM, Orléans.

MUFLER and CATALDI (1978).–Methods for Regional Assessment of Geothermal Resources. Geothermics, Vol. 7. Pergamon Press. New York.

RIBEIRO, A. and MOITINHO DE ALMEIDA, F. (1981).–Geotermia de Baixa Entalpia em Portugal Continental. Geonovas, Rev. da Assoc. Port. de Geol. V. 1 n.° 2. Lisboa.

THE EFG PROPOSES AN EUROPEAN DIRECTIVE ON GEOLOGICAL-GEOTECHNICAL STUDIES

by EurGeol Luis Suárez[1]

Lawyer, Master in Engineering Geology UCM
Chairman of the EFG Engineering Geology Working Group

Abstract

The EFG Engineering Geology Working Group, composed by Mr. L. Suarez (Chairman. Spain), Mr. R. Fox (UK), Mr. V. Illiceto (Italy) and Mrs. M. Hara Alexiadou (Greece), is drafting an Engineering Geology Dossier which includes a proposal for an European Directive on geological-geotechnical studies for private and public works.

Such text, included below, will be presented to the relevant authorities of the EU Commission and Parliament.

The WG welcomes suggestions and ideas from all interested readers with regards to the proposal.

Introduction

Today Society tends more and more to precise the definitions of the roles and competencies within the working world. This is caused by several reasons amongst other: technological progress, relation with environment, discovery of all the known land as recipient of all the human action.

All these factors had also an important relevance in the rapid evolution that Earth Sciences had experienced.

Technological progress has allowed the expansion and enlargement of the knowledge of the planet. Among the responsible of this new frontiers we can include the massive application of geophysical, geochemical and geotechnical methods, both in continents and in oceans, but also the exploration of the space and the assembly of information coming from satellite research. If one takes into consideration, for example, relation with the environment, it can be perceived a radical change because subjects, once considered only scientific, have become today of general interest.

The conscience that land has limited dimensions, leads to dramatic consequences when one tries to introduce landuse planning lines which take into consideration the roles of agriculture, industry, transport, towns as well as mining exploitations, discharges, etc..

Earth Sciences, and Geology in particular, are found in the first line face to face to these subjects. The need to find an adequate technological answer, able to face big and small environmental, land use or civil engineering subjects, has resulted in the rapid progress of this sector of the Geology known by different names: Applied Geology, Technical Geology, Engineering Geology, etc.

The main fields of activity of Engineering Geology are:

– The acquisition of geological, hydrogeological, geophysical, geochemical and geotechnical knowledge for the execution of engineering works. The use of geological research will be a function of the dimensions of the work and of the characteristics of the site.

– The evaluation of the incidence of the works on the land, taking into account eventual geological hazards on environment.

– The evaluation of the level of safety of the intervention with time. This last aspect reviews, in perspective, the modifications that could be produced upon the land.

All EU countries have produced, even though with different degrees, laws and regulations that take into consideration the competencies of the Geological Engineer (GE).

It is obvious that the benefits will be much more important if the GE is called in during the preliminary phases of the works, when the basic lines of the project are designed, as well as during the main parts of the project itself, during its execution and approval.

But another point must not be forgotten due to its social weight

[1] Ilustre Colegio Oficial de Geólogos. Avenida Reina Victoria, 8, 28003 Madrid. Tel: 34 1 5532403. Fax: 34 1 5330343 email icog@telprof.eurociber.es.

Mechanical precut machine. Detail of cutting saw Tunnels under El Pardo mountain. Madrid. (Spain).

and importance. It's the economics aspect that the GE is able to materialise with a reduction of the costs of the work, as one can notice if one contemplates the cost progression of works started from the beginning without or with limited geological knowledge: the progression becomes exponential due to unexpected and to the geological hazards involved.

In human life the risk factor must be considered as a natural component, however, many risks are classified as so, due to the ignorance of the geological factor or processes that should have been neutralised with an adequate prevention.

In medicine, it is said that it will be impossible to face many illness if people is not subjected to prevention and to a hygienical feeding behaviour.

Our society will never be able to use at its best the most advanced techniques (Geophysical and geotechnical research methods, etc.), used by the GE, if it does not understand the need to deal with the subjects of environment, land use etc., with the optics of prevention.

An example serves for all: in countries with the strong seismicity only prevention is able to save human lives, because on the framework of prevention they have developed the study of the seismic zones, para-seismic engineering, civil protection, etc.

One last consideration is dedicated to refute the idea that the GE is restricted to be nep-ful only in big projects.

Once more it will be adequate to refer to the similarities with medicine, as in the past there has been a preference for big hospitals, whereas now the role of smaller institutions such as Day Hospitals, first aids, etc. is widely recognised.

Two are the benefits of this trend:

- a reduction in costs of sanitary institutions
- a wider diffusion of the methods of the base medicine

All this is applicable also in Engineering Geology.

Diagnosis of the current situation

In many places of the EU severe damages, incidents and even accidents resulting in high budget deviation in infrastructural works due, among other reasons, to the absence or low profile of the geological/geotechnical studies of these works in the preliminary study phase, preliminary project and project phases, as well as in the construction phase.

An improvement in the quantity and quality of the geological/geotechnical studies of the infraestructural works contracted by the EU member countries has been detected in recent times, although there is a great diversity in the qualitative and quantitative exigencies of the geological/geotechnical studies in the member states, a diversity also noticed in the different sectors contracting infraestructural works in each member country: roads, hydraulic works, railways, buildings, ...

The bidding and contracting criteria of the geological/geotechnical studies, should be more clear to avoid any kind of lack of transparency in the bidding approval.

In that sense, the Reforms Departments of the building companies, find the proper environment to secure new work units not contemplated due to non existent or inadequate geological/geotechnical study.

In many countries of the EU, it is not legally compulsory to carry out geological/geotechnical studies for the foundation of buildings.

Contracting public or private projects, prone to have geological/geotechnical incidents or accidents or to produce great budgetary deviations over the approved bid budget, should not be carried out unless a preliminary study and evaluation of the geological/geotechnical conditions of the bearing grounds and the surrounding terrain that could affect the work, building or infrastructure has been performed.

Proposal

It is recommended to prepare a draft of a project of EU Directive that collecting the diagnosis of the current situation, adopts, based in the legislative system used in the European Directive on the Evaluation of the Environmental Impact of certain public and private works, the adequate legislative articles, to implement the need of compulsory geological/geotechnical studies of works, buildings and infrastructures, following the draft directive included below.

Draft proposal of an European directive on geological-geotechnical studies on private and public works

The Council of the European Communities, in view of the Treaty instituted by the EU and in particular the articles..., in view of the proposal of the Commission, in view of the resolution of the European Parliament, seen the resolution of the Economic and Social Committee.

Considering that the European Union programmes in the subject of works, buildings and infrastructures point that...

Considering that the great disparity in the legislation and standards in force in the different member States, in the subject of geological/geotechnical studies in public and private works, might create unpaired concurrence conditions, and have in this way an indirect effect upon the functioning of the European Union; thus making convenient to proceed to approximate the legislation as foresighted in the article nº 100 of the Treaty.

Considering besides, that it seems necessary to carry out one of the objectives of the European Union in the field of the works, buildings and infrastructures.

Considering that necessary powers of action to this effect have not been previewed in the Treaty, thus being necessary to refer to the Article nº 235 of the Treaty.

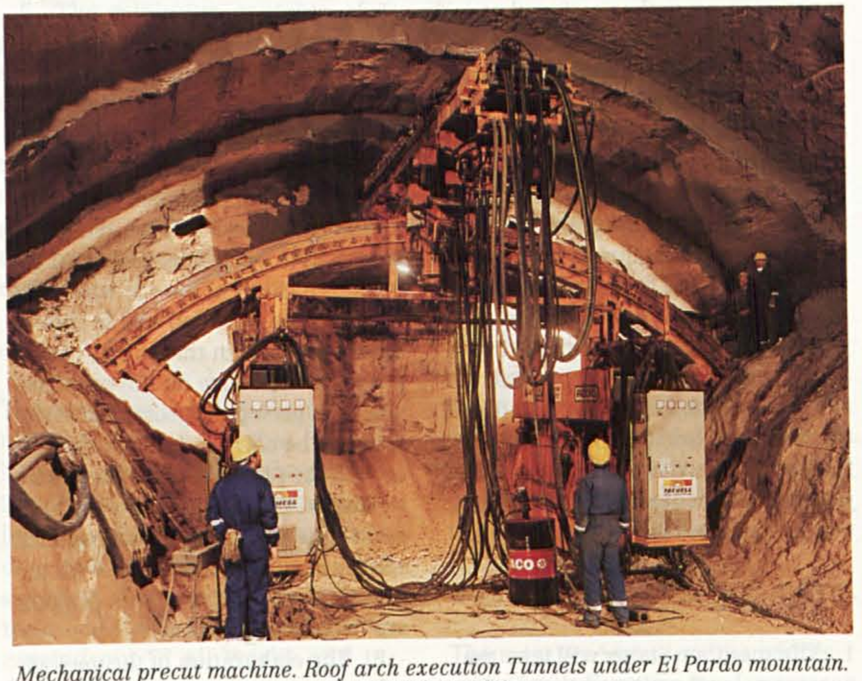
Considering that the main principles of the geological/geotechnical studies should be introduced, in order to base an develop public and private projects susceptible to possible geological/geotechnical accidents or incidents or to produce main financial deviations upon the contracted budget.

Considering that the bidding and contracting of private and public projects susceptible to possible geological/geotechnical accidents or incidents or to produce main financial deviations upon the contracted budget should not be carried out unless a previous evaluation and study of the geological/geotechnical conditions of the supporting terrain that might affect the work, building or infrastructure; that such geological/geotechnical studies should be carried out on the basis of an adequate information, provided by the designer of the work.

Considering that it seem necessary that the main principles of the geological/geotechnical studies of public and private projects susceptible to possible geological/geotechnical accidents or incidents or to produce main financial deviations upon the contracted budget, should be harmonised in particular with regards to those projects that should be based on geological/geotechnical studies, designers main obligations, and the content of the studies.

Considering that certain types of projects are susceptible to possible geological/geotechnical accidents or incidents or to produce main financial deviations upon the contracted budget, so such projects should be subjected to previous geological/geotechnical studies.

Considering the importance of the inter exchange of the geological/geotechnical information between the different Ministries and General



Mechanical precut machine. Roof arch execution Tunnels under El Pardo mountain. Madrid. (Spain).

Directorates of the Administrations of the member States.

Approves the following directive

Article 1

1. This directive will be applied to the geological/geotechnical studies of public or private projects of works, buildings and infrastructures susceptible to possible geological/geotechnical accidents or incidents or to produce main financial deviations upon the contracted budget.

2. Unless incompatible with the nature of the works, the project of the work, building or infrastructure should be based on a geological/geotechnical study of the terrain on which the work will be built and surrounding areas that might have an effect on it.

3. In the sense of the following directive the following definitions apply:

Project of work, building and infrastructure: The execution of the works of construction of works, buildings and infrastructures.

Work master: the author of a request for an authorisation for a private work or the public authority that takes the initiative to start a project. Work master has a double meaning, depending if it refers to the constructor of the promoter, owner of the concession or authorisation that is the civil responsible of the works.

Authorisation: decision of the corresponding authority or authorities conferring the work master the right to carry out the project.

4. The corresponding authority or authorities will be those designated by the member States to carry out the tasks deriving from this directive.

5. This directive will not be applied to projects adopted in particular by national specific legislative act, but the objectives pursued by the directive and in special the information distribution, will be subjected to the contents of the legislative procedure.

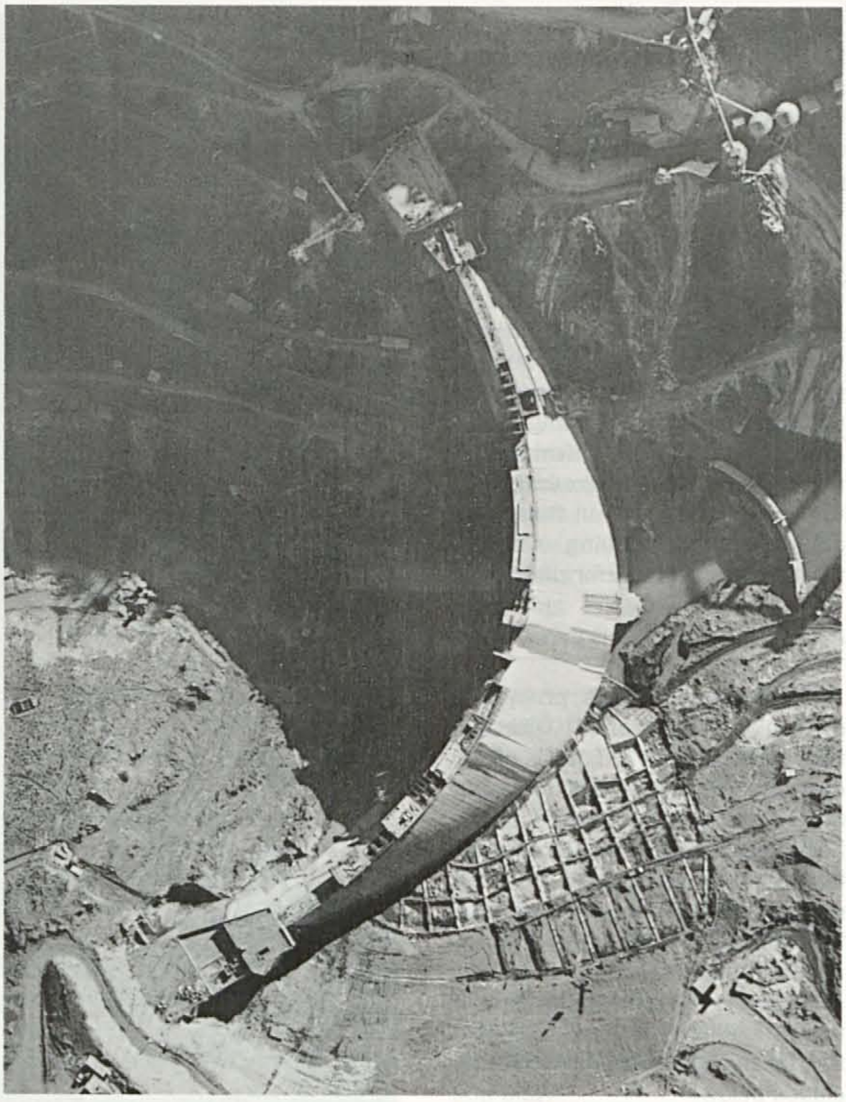
Article 2

1. The member States will take the necessary legal action so that at the moment to confer the authorisation to contract, the projects of works and infrastructures, considering its nature, dimension and location, should be subjected to a previous geological/geotechnical study of the site where the work will be executed and in the surrounding terrain that might have a potential incidence on the proposed site. This geological/geotechnical studies will be carried out in accordance with the pre-projects of the works, buildings and infrastructures, defined by the work master, unless such studies result incompatible with the nature of the project. This projects are defined in article 4.

2. The elaboration of the geological/geotechnical studies might be integrated in the existing procedures to authorise a project of works, buildings and infrastructures in the member States or, if non existing, in other procedures or the procedure established to reach the aims of this directive.

Article 3

The geological/geotechnical studies of projects of works and infrastructures, identify, discover and evaluate properly, depending on each individual case and in accordance with articles 4 to 8, the geological/geotechnical parameters of a project of works, buildings or infrastructure.



Aerial view of an are daw.

Article 4

1. The projects of works, buildings or infrastructures included in Annex 1, will carry out a geological/geotechnical study of the site where the work will be carried out and the surrounding areas that might have influence on it.

2. All those projects not included in Annex 1 will carry out a geological/geotechnical study following articles 5 to 7, only when the member States consider that its characteristics demand it.

Article 5

1. In case a project, according to article 4, should carry out a geological/geotechnical study following articles 5 to 7, the member States will take the necessary actions to ensure that the work master provides in an adequate manner, the information specified in point 2 of this article 3 if:

a) The member States consider that such information are adequate for the specific characteristics of a project and of the geological parameters that might be affected.

b) The member States consider that they can reasonable demand from the work master to supply such data considering the available knowledge and geological/geotechnical methodologies.

2. The information to be supplied by the work master should content, as a minimum, according to paragraph 1:

– Description of the preliminary project, with information on the location, conception and dimensions, as well as a description of the physical characteristics of the whole project and the demands, in land use terms during the construction and operation phases.

– Description of the main alternative solutions examined by the work master with an indication of the main reason to adopt them or effect upon the geological environment.

– Description of the geotechnical parameters at project level, that the designer considers necessary for an adequate execution of the project.

– Necessary data to identify and evaluate the main effects that the project might have on the geological environment and the demands that this should guarantee to the work or infrastructure.

– Summary of the information content in the aforesaid sections.

3. In accordance with the budgetary allowance of the works, a percentage of the global budget will be dedicated to the geological/geotechnical study.

According to the complexity of the project and the geological nature of the site, a variable percentage between 0,5 and 4% of the original budget of the work, building or infrastructure, will be dedicated to the geological/geotechnical study of the work, building or infrastructure.

4. Once defined the budgetary allowances and defined at a preliminary project level the structural requirements of the work, building or infrastructure, and according to the funds allocated in the previous section, a geological/geotechnical study previous to the execution of the construction project will be contracted to a consulting company, independent from the construction project, being then used in the construction project the resulting geotechnical parameters.

5. The minimum contents of a geological/geotechnical study will be that expressed in the Annex 2 of this directive.

6. When considered necessary, the member States will favour that the authorities having adequate geological/geotechnical information will provide it to the work master.

Article 6

The member States will take the necessary actions so that the authorities responsible of the project, in view of its specific responsibility in geological/geotechnical studies, will take the adequate measures so that the geological/geotechnical studies will be effectively carried out in all works and infrastructures.

Article 7

The information received according to articles 5 and 6, should be taken in consideration in the frame of the authorisation procedure.

Article 8

1. The member States and the Commission will exchange information on the experience acquired with the application of this directive.

2. In particular, the member States will indicate the Commission the criteria and/or exigences fixed in its case on the selection of the projects, according to article 4.2 and the types of projects subjected to studies, according to articles 5 to 7, in application of article 4.2.

3. Five years after this directive has been notified, the Commission will send to the Assembly and the Council, a comprehensive report on its application and effectiveness. This report will be drafted on the basis of the mentioned inter exchange of information.

4. On the basis of such exchange of information, the Commission will submit to the Council supplementary actions, if needed, in order to apply this directive co-ordinately.

Article 9

1. The member States will take the necessary actions to fulfil this directive in three years from its publication.

2. The member States will notify the Commission the text of the legal national dispositions adopted in the field regulated by this directive.

Article 10

The dispositions of this directive do not prejudge the faculty of the member States to establish more strict regulations with regards to the field of application and the methods of the geological/geotechnical studies in works and infrastructures.

Article 11

The member States are the addresses of this directive. ■

ROCKFALL SIMULATION AND HAZARD MAPPING BASED ON DIGITAL TERRAIN MODEL (DTM)

by Bernhard Krummenacher and Hans-Rudolf Keusen
GEOTEST AG Zollikofen (Switzerland)

Introduction

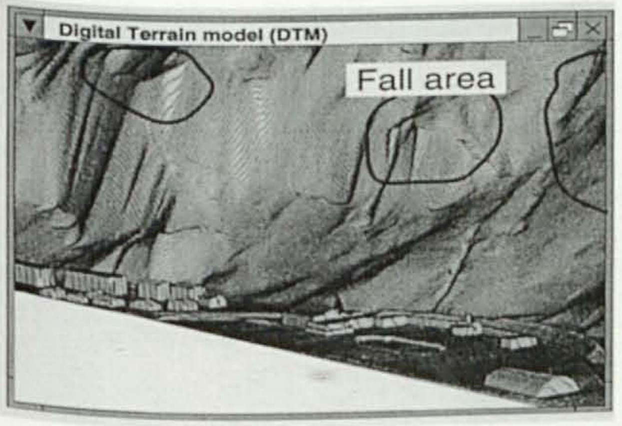
The last 3 years have brought a rapid development in computer techniques. On one hand the calculating speed and storage capacity, on the other a price collapse. Together, they allow expanded possibilities in the three-dimensional modelling of natural processes and events. In Switzerland the fortunate survey maps on a 1:25,000 scale are available in digitalised form (DTM 25). With the aid of the three-dimensional modelling of rockfalls, it is possible to locate danger areas and list them for planning future buildings.

Data bases for the modelling of the rockfall process

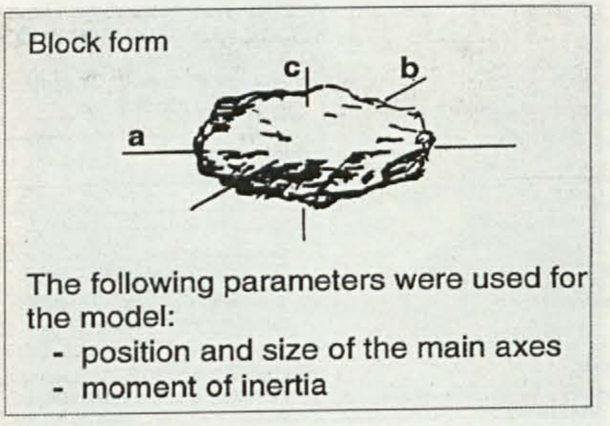
The most important base for the simulation is an exact digital terrain model (Slide 1). After processing the basic data with the Geographic Information System ArcInfo (Function Topogrid), a raster-terrain model with a spatial resolution of 10 x 10 m can be generated.

The possible rockfall areas are digitally or photogrammetrically determined.

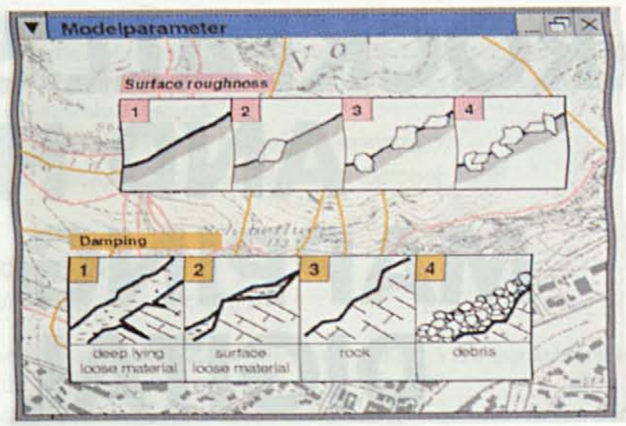
The behaviour of the rockfall is mainly influenced by 3 - parameters: the surface roughness, the damping due to the immediate ground surface, and the constitution of the wood. The surface roughness falls into one of 4 classes, where the size of the surface components is also considered. Similarly, the damping characteristics are classified according to one of 4 classes. Field areas with the same parameters (roughness and damping) are mapped and digitalised (Slide 2). The information concerning the wood is either taken from existing forestry sources, or gathered by random sampling. The numbers and diameters of the trunks are the essential factors.



Digital Terrain Model.



Blockform.



Surface roughness.

The rockfall simulation model

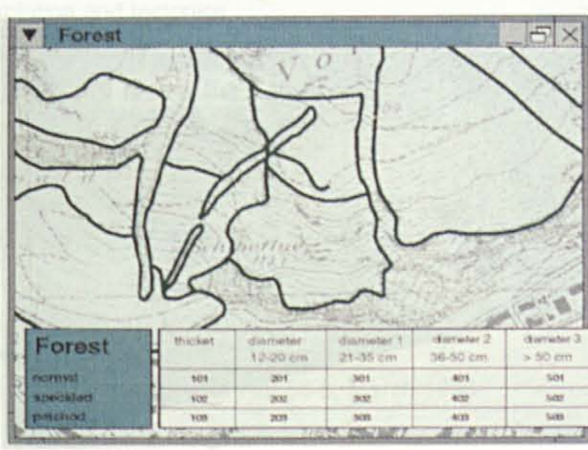
The model calculates rockfall trajectories of blocks and stones along digitalised ground profiles, as well as on three-dimensional spatial models. Within defined limits, starting points of blocks and stones in a determined density can be generated. The programme then calculates the rolling and bounding of them according to physical laws. The contact reactions of the blocks with the underground and tree trunks, steer the rock flow and thus the resulting trajectory.

The following criteria are taken into account:

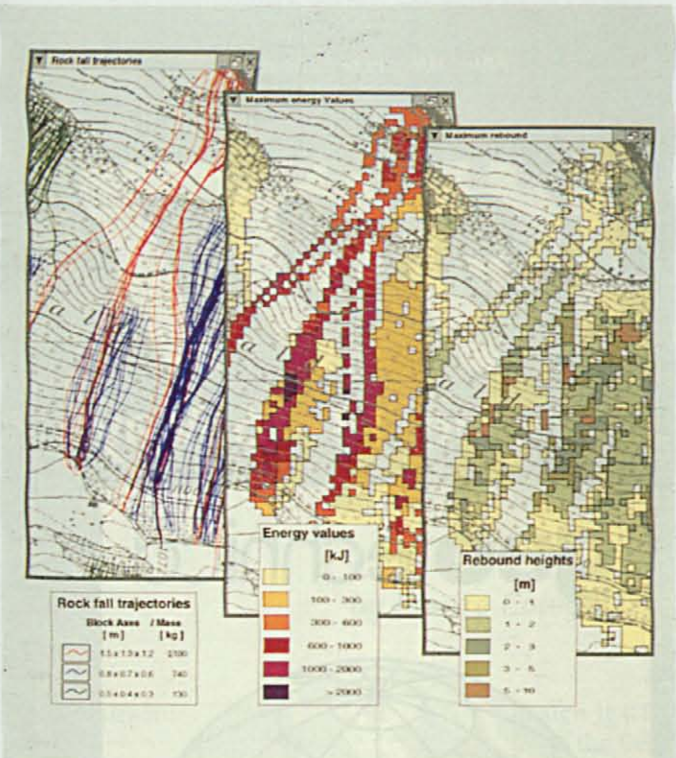
– the shape of the blocks, assessed according to the 3 main axes and various rounding factors for calculating mass, moment of inertia and leverage;

– the plastic deformation of the underground to calculate energy loss and change in direction;

– the constitution and development of the wood, to determine the braking effect. The contact height with the trees, crash speed and average trunk diameter are taken into consideration. Thus, all effects, from the elas-



Wood constituents.



Three-dimensional broken stones analyse.

tic yielding of small trunks, to the destruction of large trees can be simulated. The data density for the 'in' and 'out' parameters depends on the size of the area, or on the aim of the investigation.

Preparation of danger-information environment maps

Applying the DTM25 the Canton Bern will have at its disposal models of dangerous areas covering rockfalls, mud slides and avalanches.

The potential conflict areas (covering slips, ground collapse and avalanches) are being determined by analyses of aerial photographs, by study of geological maps etc. are then being digitalised. These risk areas will be assigned definite damage factors (digital defined buildings and roads) included in the geographical information system and conflict areas defined. The defining of these areas with the simulation programme will include not only the objects concerned, but also relevant event trajectories. The data will be available for further statistical evaluation, for example, to building insurers. ■

Section Danger-Information map Canton Bern 1:25,000.

References

GSTEIGER, P. (1989).– Steinschlag - Wald - Relief, Empirische Grundlagen zur Steinschlag-simulation. Diplomarbeit am Geographischen Institut der Universität Bern.

KRUMMENACHER, B. (1995).–«Modellierung der Wirkungsräume von Erd- und Felsbewegungen mit Hilfe geographischer Informatiossysteme (GIS)», in Schweizerische Zeitschrift für Forstwesen 146. Jg Nr. 9, September 1995, 741 - 761.

ZINGGELER, A., KRUMMENACHER, B., KIENHOLZ, H. (1990).– Steinschlagsimulation in Gebirgswäldern». Fachtagung der Schweizerischen Geomorphologischen Gesellschaft, Fribourg, 22./23. Juni 1990, in Berichte und Forschungen Geographisches Institut Fribourg / CH, Vol. 3: 61-70 (1991).

IDEAS FOR THE FUTURE OF THE INSTITUTO TECNOLÓGICO GEOMINERO DE ESPAÑA (ITGE)

by Ilustre Colegio Oficial de Geólogos de España

Abstract

A proposal is made on the future aims and objectives of the Spanish ITG, a public research organisation with similar functions to other European Geological Surveys which is now facing a major re-structuring after being transferred from the Ministry of Industry and Energy to the newly created Ministry of Environment.

1. *A change of image*

The ITGE needs a change of image to reinforce its leading role as a public entity of the Central State Administration in the earth sciences sector.

One of the first measures to underline the necessary change of image is to adequate its current denomination to one more in accordance with its own reality. The ICOG proposes one simple, direct and rooted in its own tradition: *Instituto Geológico de España (IGE)* (Spanish Geological Institute). This new name, aside from representing the continuity of the most formal elements of the institution, allows to recover the surname which traditionally most people have used to design it ("El Geológico"), and reflects the Geological adjective, common to 13 of the 15th geological surveys of the European Union (see Table n.º 1).

Such image change should also include several basic aspects:

- A new stage in the relations of the Institute with earth sciences scientific and professional groups, with permanent and close contacts.
- Close up and opening to Society's real problems, with presence in the media, development of a publications, diffusion and training policy.
- Increasing internal democracy, participation and co-responsibility mechanisms following other public research organisations where responsibilities are assigned periodically with a higher participation from the staff (elections, participation in committees, councils, etc.). All these aspects should be compiled in new Institute by-laws.

2. *A political-administrative change*

The ICOG valorises positively the new administrative dependency of the Institute, after the creation of the Ministry of Environment. Most of the functions that should and could be developed by the organism are within the scope of the new Ministry.

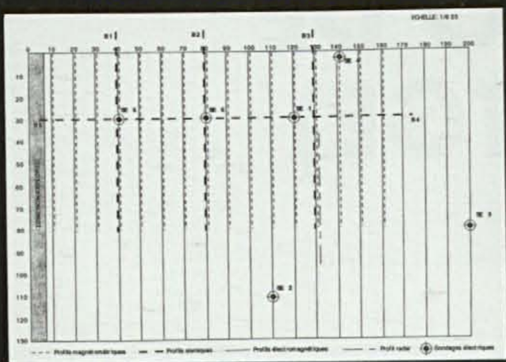
The double dependence, organic from the Secretary of State of Water and Coasts, and functional from the Secretary General of Environment, not being the only possible solution, seems to guarantee the polyvalence of its missions, in accordance with the internal plurality of the Institute.

In spite of which, this new political-administrative frame should not ignore the following needs:

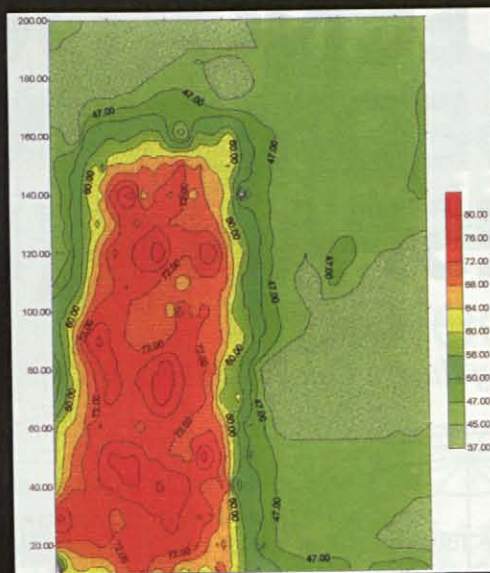
- Reinforce ITGE's presence within the State of Autonomies, preferably in those Autonomic Government lacking geological corps, and collaborating with those which already have autonomic geological surveys.
- The importance of the institute as a public service should be secured and increased. In this sense, it is necessary to assure its public financial support via the General Budget of the State and at noteworthy levels much higher than current levels and in parallel with the multiple requests made to the institution from other departments due to the general societarian interest in receiving every day more information on the problems and solutions of environment.

Etudes de Sites - Décharges Sauvages
Prospection Géophysique Multiméthode

Plan de position des travaux réalisés

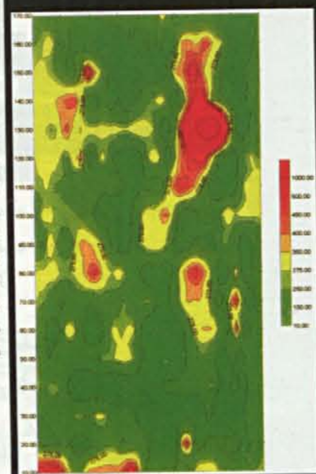


Recherche des contours



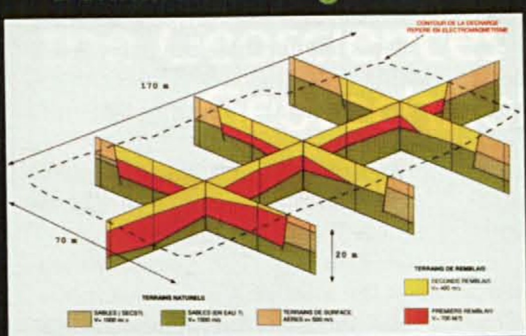
ELECTROMAGNETISME

Recherche d'anomalies métalliques



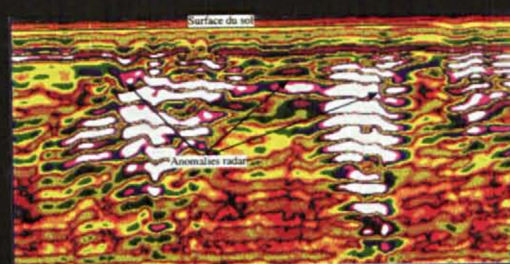
MAGNETISME

Définition de la géométrie



SISMIQUE REFRACTION - ELECTRIQUE

Identification des anomalies



RADAR GEOLOGIQUE

HISTORIQUE

- Deux principales phases de remplissage.
- Présence d'anomalies magnétiques en rapport avec des fûts.
- Recouvrement actuel par une couche de terre naturelle.

GEOMETRIE

- Surface de la décharge : 10 000 m^2.
- Volume de l'ancienne sablière : 100 000 m^3.
- Exploitation en trois phases juxtaposées.
- Fond de fouille limité par le niveau de la nappe phréatique (8, 10, 12 mètres).

INTERET DE LA GEOPHYSIQUE

- Moyens d'investigation légers et discrets.
- Méthodes de surface non destructives : réduction des risques.
- Meilleure connaissance du site et implantation optimale des sondages et prélèvements de contrôle.
- Optimisation des budgets de reconnaissance.

CARACTERISTICAS DE LOS DIFERENTES SERVICIOS GEOLOGICOS DE LA U.E.

PAIS	Creación	Denominación	Departamento Ministerial	Población (x 10[6])	Personal Fijo	Pers./Pobl. (x 10[5] hab.)
Alemania	1850	Bundesanstalt für Geowissenschaften und Rohstoffe	Economía	79.50	876 [1] 2735[2]	1.10 3.44
Austria	1849	Geologische Bundesanstalt	Investigación y Ciencia	7.71	86	1.11
Bélgica	1896	Geologische Dienst Service Géologique	Economía	9.95	30	0.30
Dinamarca	1888	Geologiske Undersogelse	Medio Ambiente	5.14	220	4.28
España	1849	Instituto Tecnológico Geominero de España	Medio Ambiente	36.95	324	0.87
Finlandia	1885	Geologian Turkimuskeskus	Industria y Comercio	4.98	740	14.86
Francia	1959	Bureau de Recherches Géologiques et Miniéres	Ind. y Desarrollo Territorial	56.60	1528	2.70
Gran Bretaña	1835	Geological Survey	Ofic. Ciencia y Tecnología	55.49	865	1.55
Grecia	1952	Institut of Geology and Mineral Exploration	Industria y Energía	10.12	1160	11.46
Irlanda	1845	Geological Survey	Energía	3.50	49	1.40
Italia	1867	Servizio Geologico	Medio Ambiente	56.40	120	0.21
Luxemburgo	1936	Service Géologique	Obras Públicas	0.38	4	1.05
Países Bajos	1903	Rijks Geologische Dienst	Economía	14.89	219	1.47
Portugal	1858	Serviços Geologicos	Industria y Energía	10.25	82	0.80
Suecia	1858	Geologiska Undersokning	Industria	8.56	205	2.39

[1] Dato referido al BGR Federal
[2] Cifra que abarca el BGR Federal y el de los «Landers»

Table n.° 1.

• This new administrative dependence should not forget other departments whose competencies might need the services of the Institute. In particular the exploration of mineral resources should count with the collaboration of the Institute and the Ministry of Industry and Energy, aside from the role that Autonomic Governments and private sector might have. This point is perfectly framed within a policy of cost reduction and increased synergy within the State Administration.

• The R&D character of the Institute should be maintained and its structures modified for an efficient participation in National R&D programs. In this sense an effort should be made so that the management of projects whose funds come from such programs approximates to other Public Research Organisms.

3. *A change in functions*

It seem obvious that there is a need to re-orientate the functions of the Institute, aside from those assigned by former laws that should continue to develop.

The basic functions of the Institute should centre in three main fields, similarly to the rest of European Geological Surveys, regardless of their administrative dependence:

- Environment.
- Natural Resources.
- Hidrogeology.

covering specially the infrastructural fields of those activities (see Table n.° 2).

The changes in functions proposed are of four types:

A. Management support functions

A.1. In State public domains

• Underground hydraulic public domain (aquifers).

• Substrate (mineral resources, mineral and spring waters, underground space).

• State protected land (National Parks and other).

A.2. Public domains of other administrations

• Activities in co-ordination with Autonomic Communities and Local

CAMPOS DE ACTUACIÓN DESARROLLADOS POR LOS DIFERENTES SERVICIOS GEOLÓGICOS DE LA U.E.

PAÍS	COMPETENCIAS						
	Cartograf.[1]	Geolog.Marina	M.Ambiente	Hidrogeología	Geofísica	R.Minerales	Geotecnia
Alemania	70 %[2]	- "Ocean Drilling Program"	- Invent.suelos - Emisión gases - Contam.industr. - Normat.Vert.Ind. - Est."barreras" geol. - Reutiliz.resid. - Fenóm.Chernobil - Resid.Radiactivos - Riesgos Naturales - Proy.Internac.	0	- Estr.Corteza - Terremotos	- Au, Pt, lignitos - Est.metalogén. - Prospecc.petról. - Geotermismo - Estudios económ.	- Labores subt.
Austria	10 %		- Verted. y Escombr. - Resid.Radiactivos - Riesgos Naturales	0	0	- Min.no metálicos - R.Constr.	0
Bélgica			- Verted. y Escombr. - Resid.Radiactivos - Riesgos Naturales	0	0		0
Dinamarca			- 30 % de su activid. - Contam.agrícola - Sond.Inyecc.Ag.Res. - Cambio climático - Verted. y Escombr. - Resid.Radiactivos - Riesgos Naturales	- Dptº.Hidrogeol.	0	- Min.no metálicos	0
España	90 %	- Proy.FOMAR (1/200.000)	- Orden.sect.minero - Recup.costas - Recup.escombreras - Riesgos Naturales	- Dptº.Hidrogeol. - Model.matemat. - Control acuíf. - Recarga acuíf. - Aguas termomin.	0	- PES (Plan Expl.Sist.) - Inv.R.Ornamentales - Inv.R. y M.Industr. - "Panorama Minero" - Rec.Geotermicos - Gasif.carbón - Caract.huecos R.E.	- Geot.carbón - Proy.con UE
Finlandia	20 %		- Carto. elem.pesados - Cambio climático - Verted. y Escombr. - Resid.Radiactivos - Riesgos Naturales	- Dptº.Hidrogeol.	- Interpr.geol. - Detecc.fract. - Estr.Corteza - Terremotos	- Dep.gravas y arenas - Inv.R.Constr. - Inv.Turberas	- Almacen.peligr.
Francia	75 %		- Medio urb. - Contam.hídrica - Estudios erosión - Proc.biotecnol. - Verted. y Escombr. - Resid.Radiactivos - Riesgos Naturales - Proy.Internac.	- Dptº.Hidrogeol. - Est.fracturación - Circul.fluidos - Software sondeos - Hidroq.Med.Urb - Hidroq.Med.Ind.	0	- Progr.Expl.Min. (SYNERGIS,GDM) - Invent.R.Min. - Geotermismo	- Proy.Metro - Planif.Urb. - Caract.suelos - Zonac.suelos
Gran Bretaña	80 %[3]	- 314 Hojas a 1/250.00 - Cont.metales pesados	- Carto. elem.pesados - Medio urb. - Emisión gases - Contam.agrícola - Resid.Radiactivos - Movilid.acuosa RN. - Mapas radiom. - Caract.granitos - Verted. y Escombr. - Riesgos Naturales - Proy.Internac.	- Dptº.Hidrogeol. - Hidroq.Med.Urb - Hidroq.Med.Ind.	- Anal.estruct. - Observatorio Magnet.Terr. - Estr.Corteza - Terremotos	- Dep.gravas y arenas - 150.000 análisis - Pt y Au - Est.metalogén. - "Min.Yearbook" - "Direct.Mines"	0
Grecia			- Carto. elem.pesados - Invent.suelos - Estudios erosión - Verted. y Escombr. - Resid.Radiactivos - Riesgos Naturales	- Dptº.Hidrogeol.	0	- Carbones - Mármoles - Viabilidad	- Proy.constr.
Irlanda	20 %		- Verted. y Escombr. - Resid.Radiactivos - Riesgos Naturales	0	0	- Min.no metál. - R.Constr.	0
Italia	10 %		- Carto. elem.pesados - Estudios erosión - Verted. y Escombr. - Resid.Radiactivos - Riesgos Naturales	- Dptº.Hidrogeol.	0	- R.Ornamentales - R.Constr.	0
Luxemburgo			- Verted. y Escombr. - Resid.Radiactivos - Riesgos Naturales	0	0	- Min.no metálicos - R.Constr.	0
Países Bajos	30 %	- Condiciones costeras - Tendido cables y oleoductos	- Verted. y Escombr. - Resid.Radiactivos - Riesgos Naturales	0	0	- Dep.gravas y arenas - Invent.arcillas - Gasif.carbón	- "Polders"
Portugal	65 %		- Verted. y Escombr. - Resid.Radiactivos - Riesgos Naturales	- Dptº.Hidrogeol.	0	- Dep.gravas y arenas - R.Ornamentales	0
Suecia		- Tendido cables y oleoductos	- Carto. elem.pesados - Invent.suelos - Emisión gases - Mapas vulnerab. - Verted. y Escombr. - Resid.Radiactivos - Riesgos Naturales - Cambio climát.	- Dptº.Hidrogeol.	- Discont.rocas - Observatorio Magnet.Terr.	- Dep.gravas y arenas - Inv.R.Constr.	- Mapas varios: Acces.territ. Usos milit. Excav.terr.

1.- A E:1/ 50.000
2.- A E:1/100.000
3.- A E:1/ 65.000

Table n.º 2.

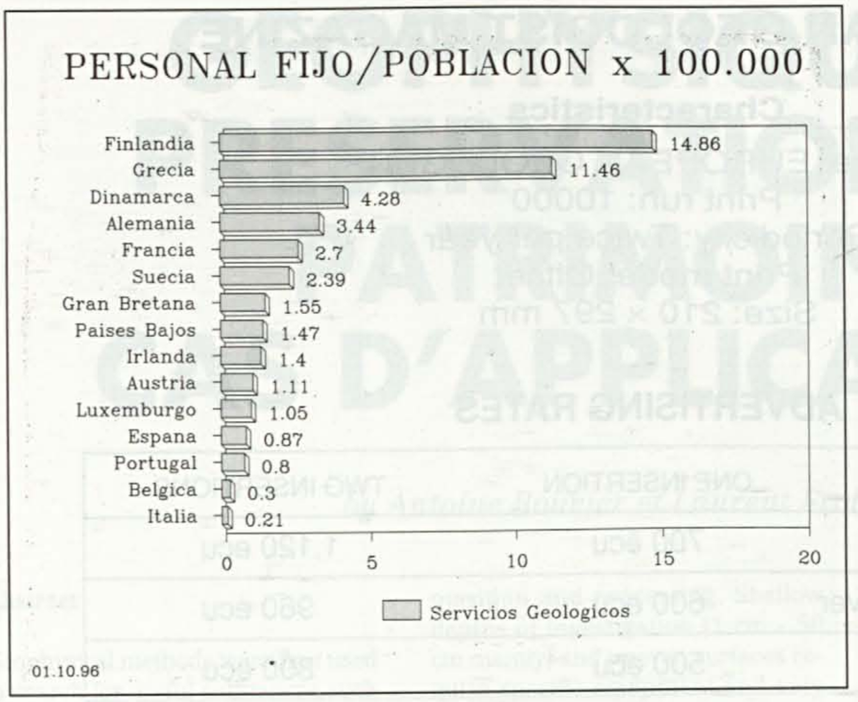


Table n.º 3.

Administrations (under agreement or request).

• Derived from legal links.

A.3. Private domain

• Activities in co-ordination with any administration oprivate agent (under agreement or request).

• Derived from legal links.

B. Research and Development functions

• Participation in national or autonomic R&D plans.

• Participation in special programs (Antarctic Research, etc.).

• Development of specific plans and programs (Natural Hazards Prevention Plan, Geological Mapping 1:25 000, National Aggregates Plan, National Plan of Industrial Minerals and Rocks, etc.).

• Development of concerted plans (Environmental Thematic mapping).

C. Diffusion and divulgative functions

• Geological Museum (new designation).

• Periodical and special publications.

• Data banks, Documentation centre, etc.

• Other activities (training, conferences).

D. International relationships

• International projects.

• Eurogeosurveys.

• Foregs.

• Co-operation with earth sciences scientific and professional societies.

E. Support to the national earth sciences scientific community functions

• National Geological Commission.

• Institutional co-operation with scientific societies.

• Institutional co-operation with professional associations.

• Investment related to the organisation of Scientific activities (symposium, courses, congresses, etc.)

4. A cultural and organisation change

As important as all above are changes related to the internal culture and the organisation structure.

It will be necessary to:

• Involve the staff in a "Common Project".

• Transmit to the staff that the Institute is a public service and that they work for Society.

• Professionalize the administrative career, avoiding personal and convenience treatments.

• Motivated and fair retributive criteria, based in professional competence and efficiency in fulfilling the aims and services.

• Implement participate and information systems, from above to below and inversely, in order to increase confidence in management and in the work done.

• Incorporation of all the temporary employees developing continual work in the Institute in the permanent staff of the organisms, in order to adequate the staff to the functions and real needs of the Institute, and reach the geological survey staff/population rates of other European countries such as France, UK or Germany (see Table n.º 3.

• Homogenisation of the Institute staff within the functionaries frame.

• Adequate the structure of the Institute to the real distribution of the professional which integrate its staff. ■

EUROPEAN GEOLOGIST MAGAZINE

Characteristics

Name: EUROPEAN GEOLOGIST
Print run: 10000
Periodicity: Twice per year
Print mode: Offset
Size: 210 × 297 mm

ADVERTISING RATES

INSERTIONS	ONE INSERTION	TWO INSERTIONS
Outside back cover	700 ecu	1.120 ecu
Inside front and back cover	600 ecu	960 ecu
Full page (colour)	500 ecu	800 ecu
Half page (colour)	250 ecu	400 ecu
Quarter page (colour)	150 ecu	240 ecu
Full page (b&w)	250 ecu	400 ecu
Half page (b&w)	125 ecu	200 ecu
Quarter page (b&w)	75 ecu	120 ecu
Preferential location	20 % plus	
Advertising Article	20 % plus	

EUROPEAN GEOLOGIST MAGAZINE ADVERTISEMENT ORDER FORM
(* delete as appropriate)

Please reserve a: quarter/ half/full page advertisement *

The advertisement will be black & white/ colour *

in the following issues of European Geologist:

June97/ Dec97/ June98/ Dec98 *

Advertisement material is enclosed/ will follow/ other * (please state) ....

....

....

....

Return to Manuel Regueiro, European Geologist Magazine, European Federation of Geologists. ICOG, Av. Reina Victoria 8, 28003 Madrid, Spain, or fax to 34 1 5330343 (Tel. 34 1 3495778)

GEOPHYSIQUE ET PRESERVATION DU PATRIMOINE CAS D'APPLICATION

by Antoine Bouvier et Laurent Frobert

Abstract

Geophysical methods were first used to search for useful substances such as metallic orebodies, fresh water, oil and construction materials or to investigate characteristics of the subsoil prior to the building of engineering structures: dams, tunnels, railway lines, harbours etc...

Fifteen years ago, environmental surveys using applied geophysical techniques (electrical, magnetism, seismic refraction) were rare and were mainly prompted by accidental pollutions: seawater intrusion and potash tip leaching or assessments of industrial noises (vibrations) affecting buildings and understructures.

Within the last five years, environmental protection laws and the inventory of polluted sites in France (from domestic dumps to gas factories and hydrocarbon storage facilities) have led to a surge in electrical, electromagnetic and magnetic surveys for delineating polluted zones and possibly characterising the polluting source.

Recently, geophysical techniques have been used for the preservation of Historical Monuments (Heritage Protection). The problems are essentially related to decaying stones caused by iron bar and joggle oxidation and also weathering agents.

Techniques must be non-destructive and equipment light and sophisticated to allow in situ data acquisition and processing. Shallow depths of investigation (1 cm - 50 cm mainly) and uneven surfaces require specific equipment and very accurate positioning of the survey profiles.

This paper will describe results obtained at four different sites where geophysical surveys contribute to the protection of historical heritage.

The first two cases deal with the detection of metallic reinforcement elements in statues erected on the Reims cathedral and on the calvary of Plougastel-Daoulas (France).

The last two ones study dissolution phenomena on the stone surface of both Carmona Necropolis (Spain) and Tours cathedral (France).

Magnetism, resistivity and electromagnetism (Radar) surveys have produced effective results at low cost.

Introduction

L'utilisation des méthodes géophysiques a concerné tout d'abord la recherche de substances utiles: minerais, pétrole, eau douce, matériaux de construction...ou encore l'étude du sous-sol pour les travaux de génie civil: construction de barrages, de tunnels, d'immeubles, aménagements portuaires...

Il y a une quinzaine d'années, les études géophysiques liées à l'environnement s.l. étaient exceptionnelles et consistaient principalement à délimiter les pollutions accidentelles de la nappe phréatique par le sel, en zone littorale ou à proximité des terrils de potasse ou encore à évaluer le taux de nuisance d'une source vibratoire (foreuse, dameuse ou engin de chantier) sur l'habitat proche.

Depuis moins de 5 ans, les lois sur la protection de l'environnement et l'inventaire des sites pollués en France: anciennes décharges, usines désaffectées (gaz, produits chimiques), zones d'infiltration accidentelle de substances polluantes (dépôts d'hydrocarbures)... ont permis aux méthodes électriques, électromagnétiques et magnétiques de contribuer à la localisation et à la caractérisation des sources polluantes.

Plus récemment, les méthodes géophysiques ont été mises en oeuvre dans le cadre de la Protection du Patrimoine et des Monuments Historiques.

Les problèmes posés concernent essentiellement l'état de la pierre: degré de fissuration et/ou d'altération, présence éventuelle d'agrafes de renforcement, de goujons en fer ou laiton...

Les techniques utilisées doivent être non destructives et relativement légères pour permettre une reconnaissance «in situ» ; de plus, la faible profondeur d'investigation requise (1 centimètre à cinquantaine de centimètres tout au plus), nécessite des appareillages de mesure adaptés et un positionnement précis des mesures.

Quatre exemples d'application des méthodes géophysiques à l'étude de l'état de la pierre sont présentés ci-aprés. Les deux premiers* (concernent la détection des éléments métalliques de renforcement existant d'une part au niveau de la statue d'Abraham sur la façade Ouest de la cathédrale de Reims, d'autre part, à hauteur du statuaire du calcaire de Plougastel-Daoulas (Finistére Sud).

Les deux demiers intéressent les phénomènes de dissolution observés à la surface de la pierre sur le site de Carmona (Espagne) et sur la cathédrale de Tours (France).

Etude des statues

Nombre de statues ornant les monuments historiques en France ont souffert à la fois des outrages du temps (climat et pollution) et des conflits armés.

La réparation de ces domrnages a consisté le plus souvent en un réagréage à l'aide de goujons métalliques et de mortiers de nature plus ou moins élaborée selon l'époque de la restauration. Lorsque les goujons sont en laiton, en cuivre ou en bronze, leur oxydation et corrosion ne provoquent pas usuellement de dégradation sensible de la pierre.

Par contre, l'oxydation (rouille) des éléments ferreux (clous, agrafes et fers de fixation) contribue fortement à la fissuration et à l'éclatement de la pierre.

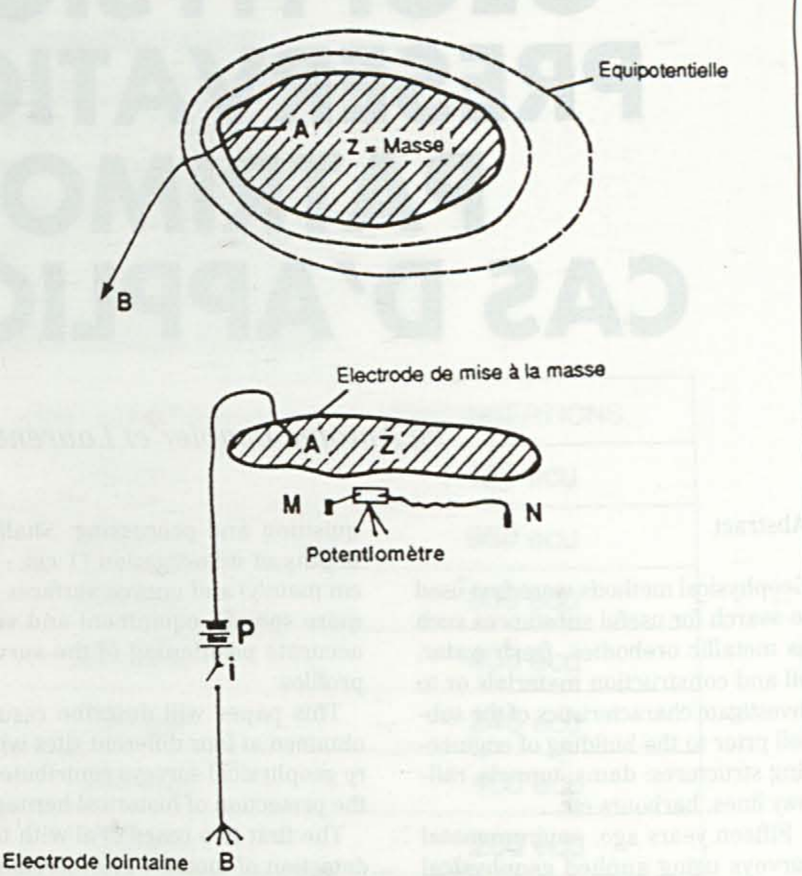
La localisation de ces éléments cachés ou partiellement visibles au sein de la pierre est devenue une nécessité pour traiter en priorité les zones menacées de dégradation rapide.

1) Statue d'Abraham (cathédrale de Reims)

Les méthodes potentielles habituellement mises en oeuvre pour la prospection minière: méthodes électrique de mise à la masse et électromagnétique, le procédé SLINGRAM, sont adaptées à la reconnaissance - à une autre échelle - des structures conductrices (métaux) au sein d'un ensemble résistant constitué par la pierre: calcaire ou ciment.

* Travaux réalisés pour le compte du Cercle des Partenaires du patrimoine.

SCHEMA DE MISE A LA MASSE Figure 1



1.1. Méthode dite de «mise à la masse» (figure 1)

Cette méthode consiste à envoyer du courant dans un amas conducteur Z (un fer de fixation ici) dont tous les éléments sont alors portés à des valeurs de potentiel identiques.

A l'extérieur de la «masse» conductrice, dans les terrains encaissants (la pierre, ici) le potentiel chute rapidement. Il en résulte que la surface extérieure de l'amas conducteur est sensiblement une surface équipotentielle.

En pratique, on injecte un courant I (centiampères) entre un fer apparent (électrode A) et une électrode située à l'infini (notée B), localisée à l'échelle de l'étude, à une centaine de mètres de A ; l'on mesure alors la différence de potentiel (V(mv) entre une électrode fixe notée M, fichée dans la pierre par un fer et une électrode mobile, N, appliquée sur la pierre. Cette demière était constituée par une pastille de chlorure d'argent, identique à celles utilisées pour l'obtention d'un électrocardiogramme.

Les mesures de potentiel et d'intensité du courant d'injection en une série de points bien repérés permettent le calcul de la résistivité apparente (a qui dépend de la position et de la géométrie du quadripole ABMN:

$$\rho a = \frac{\Delta V}{I} \frac{2\pi}{\frac{1}{MA} - \frac{1}{NA}}$$

Résultats

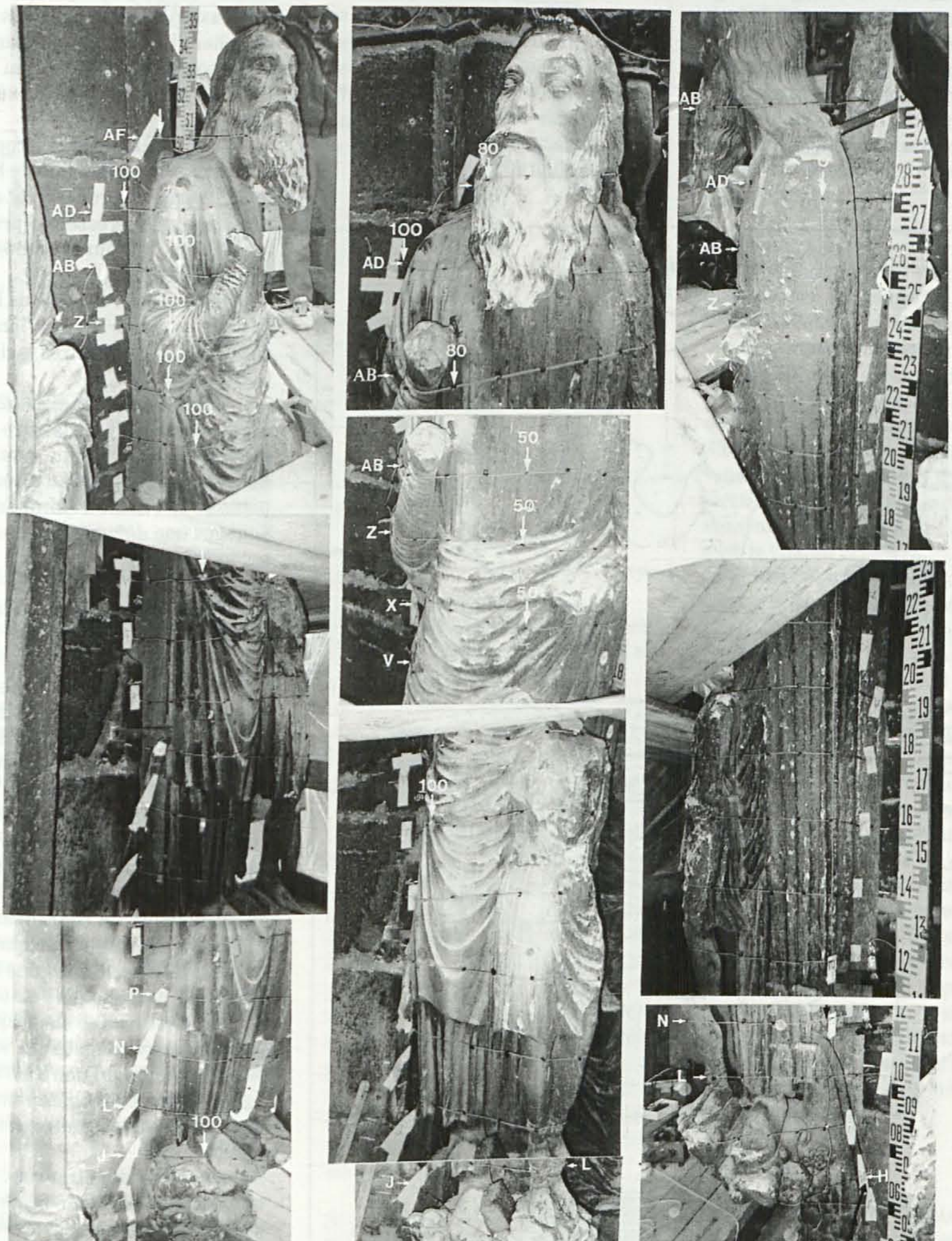
182 points de mesure sont distribués le long de 15 profils horizontaux, parallèles et distants de 20 cm

STATUE D'ABRAHAM

MISE A LA MASSE

Figure 2

Position des points de mesure (points noir)



entre eux. Sur chaque profil, les mesures, au pas de 10 cm, sont numérotées de l'extérieur vers l'intérieur à partir d'un zéro représenté par un fil vertical orange. La ligne de mesures 100 est matérialisée par du papier «scotch» vert.

Le courant était injecté dans la partie horizontale de l'agrafe du support inférieur, côté extérieur gauche de la statue (figure 2).

Le report sur carte du rapport (V/1 mesuré en chaque point autorise le tracé d'une carte de potentiel dont l'allure refléte la forme de l'amas conducteur.

La carte de potentiel, figure 3, correspond à une représentation sur plan des différents profils de mesure (AF à D) et permet de visualiser la décroissance du champ électrique à partir de l'attache métallique, lieu d'injection du courant, situé au niveau du profil N, point 20.

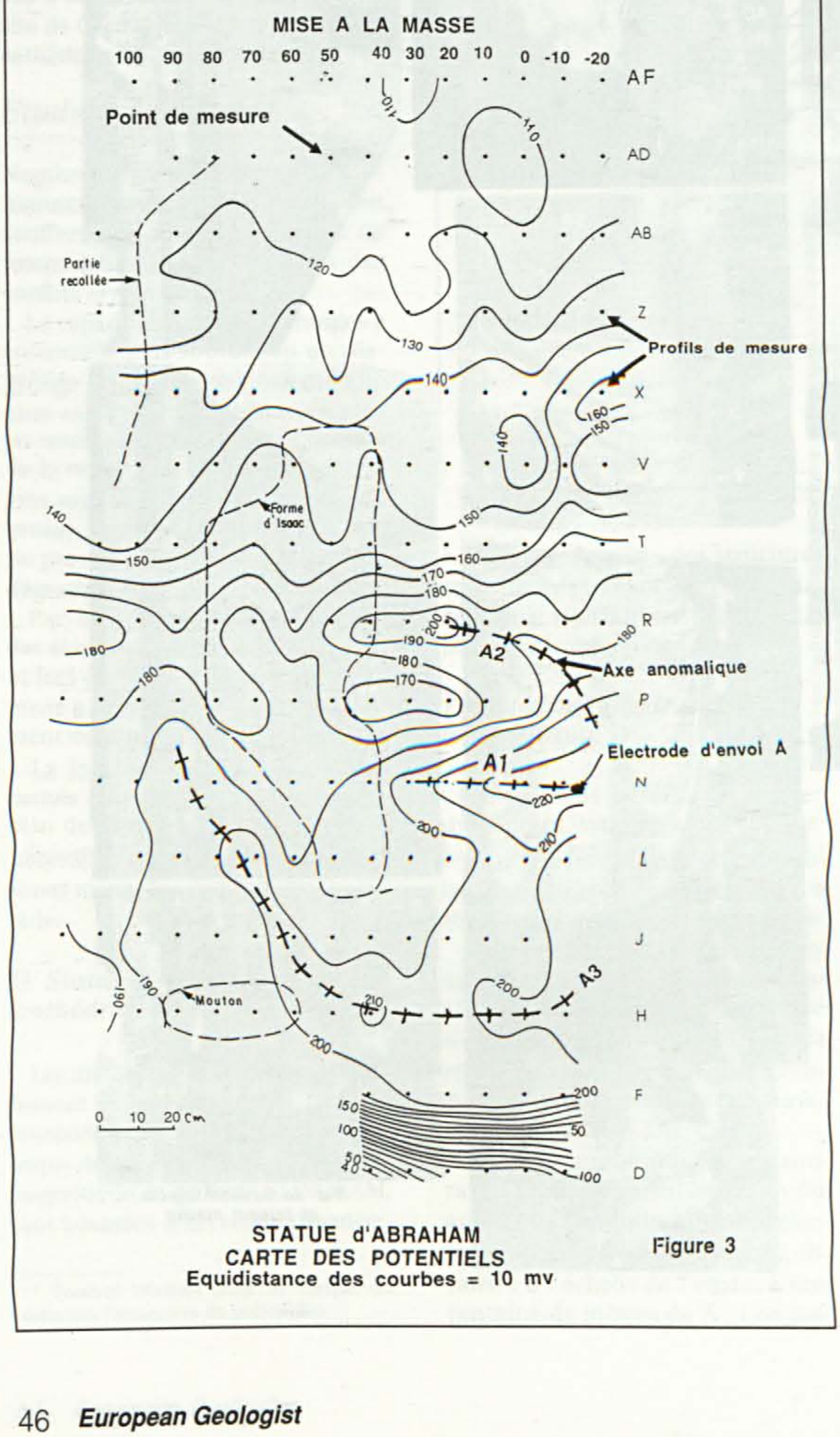


Figure 3

Trois axes Al, A2, A3, de moindre décroissance du potentiel apparaissent:

– l'axe Al, qui suit le profil N, entre l'électrode A et le point A30,

– l'axe A2, de tracé moins assuré, reliant le diverticule dessiné par l'équipotentielle 180 mv au point R20, de potentiel plus élevé: 200 mv.

– l'axe A3, pouvant être connectè à la branche descendante de l'agrafe au niveau du profil H; cet axe se prolonge et intéresse les profils J (point 60), L (points 70-80) et N (points 80-90).

Al matérialise l'avancée de l'agrafe dans la pierre sur une longucur d'environ 35 centimètres (points - 1 0 à 25 du profil N).

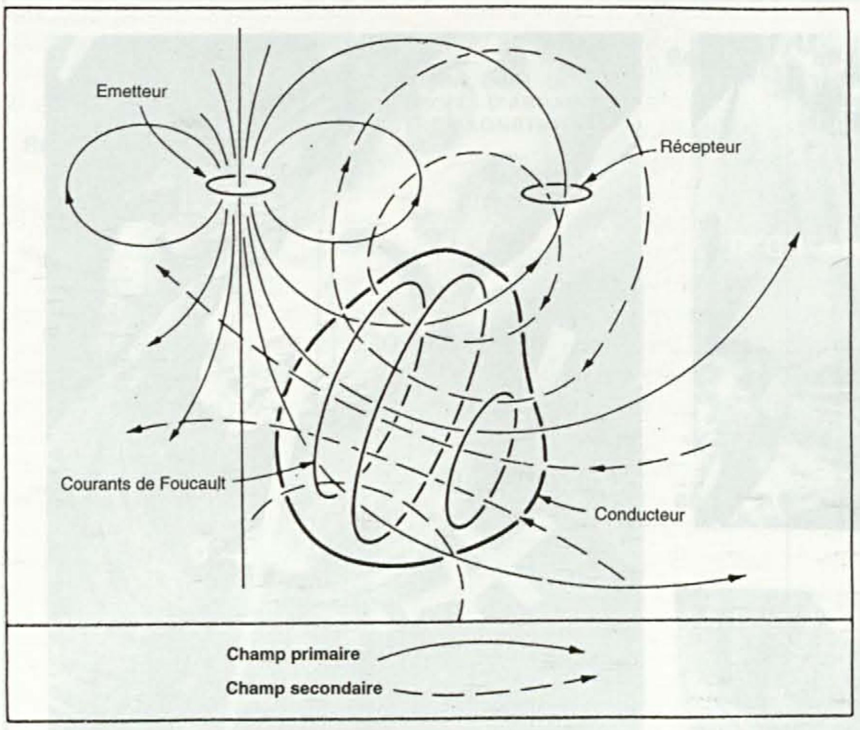
La signification des axes A2 et A3 est ambigüe: soit l'existence d'une zone fissurée et humide, soit l'effet de la « topographie » au niveau des pieds et de l'habit d'Abraham provoquant une déformation des équipotentielles.

1.2. Méthode électromagnétique - procédé SLINGRAM

Le procédé SLINGRAM couramment utilisé en prospection minière a été utilisé pour localiser la présence de corps métalliques enrobés dans 30 à 40 centimètres de pierre. Le procédé est sensible à la fois à la conductivité électrique et à la perméabilité magnétique du métal.

Le principe de mesure est le suivant (figure 4): un courant alternatif de fréquence F = quelques centaines d'Hz circule dans une bobine émettrice ; il crée dans l'air (et dans la pierre, résistant électrique) un champ électro-magnétique sinusoïdal dit « champ primaire » (HP). Les lignes de force du champ magnétique sont celles, classiques, d'un dipôle.

– une bobine réceptrice, coplanaire avec l'émetteur et de même géométrie, permet la mesure du champ primaire dans l'air. Ce champ primaire est en phase avec le courant primaire. Si un objet métallique, conducteur, est situé à proximité de ce dispositif, à une distance inférieure ou égale à 2 ou 3 fois



PROCEDE SLINGRAM

Figure 4

la distance émetteur-récepteur, il sera le siége de courants induits créés par les variations de flux du champ primaire.

La bobine réceptrice mesurera le champ total HT = HP + HS.

Puisque seule la valeur du champ secondaire conceme la cible conductrice, le champ primaire sera compensé grâce à un dispositif électronique approprié.

Le champ secondaire est en général déphasé par rapport au champ primaire. Pour un conducteur métallique qui présente une susceptibilité magnétique importante (fer ou acier), le champ secondaire comporte une composante en phase avec le champ primaire et une composante en quadrature. Après compensation du champ primaire dans l'air, la cible peut donc être détectée soit par l'anomalie de la partie réelle (en phase), soit par l'anomalie de la partie imaginaire (en quadrature).

Le dispositif de mesure «miniaturisé» consistait en une bobine émettrice et une bobine réceptrice, coplanaires et espacées de 6 à 24 centimètres (r); la distance, (d), de l'appareillage de mesure à la cible était égale à 8 centimètres.

Résultats

Pour étudier l'extension éventuelle dans le bras droit d'Abraham d'un goujon « affleurant » au niveau de sa main, cinq profils ont été réalisés: quatre sont perpendiculaires à l'allongement du bras, le cinquième (BD) relie main et coude, figure 5.

Les profils perpendiculaires BD5 à BD25, figure 6, indiquent que l'influence du goujon se fait sentir jusqu'au profil BD15 inclus, l'anomalie conductrice caractéristique ayant une amplitude voisine de 8 %. L'anomalie a disparu à hauteur du profil BD25. Le long du bras, le profil BD, confirme la grande sensibilité de la réponse électromagnétique dont l'amplitude est supérieure à 30 %. Les mesures, au pas de 2,5 centimètres, permettent d'attribuer au goujon une longueur d'environ 20 centimètres.

2) Statuaire du calvaire de Plougastel-Daoulas

Le calvaire de Plougastel-Daoulas (1602-1604) a été endommagé en Septembre 1944 par des tirs d'artillerie puis restauré à l'aide de goujons en bronze ou en fer enrobés dans du ciment à prise lente.

Deux méthodes géophysiques: l'une électromagnétique, à l'aidc d'un détecteur de métaux, l'autre magnétique (magnétomètre à protons) ont permis de réaliser le repérage des éléments ferreux au sein de la kersantite.

2.1. Méthode électromagnétique - détecteur de métaux (Scope 990)

Une bobine émettrice opérant à fréquence voisine de 20 Khz, dans la gamme des émetteurs VLF et une bobine de réception sont logées toutes deux dans un disque de détection de 20 centimètres de diamètre.

Lorsque le détecteur passe audessus d'un objet métallique conducteur, la bobine réceptrice est sensible à la création d'un champ électromagnétique secondaire, généralement en quadrature de phase avec le champ primaire.

Le détecteur émet alors un signal sonore accompagné d'une déviation d'aiguille sur un «vu-mètre», à partir d'une position zéro de «reset».

Dans le cas d'un métal non ferreux (bronze, laiton ou cuivre), *l'anomalie de conductivité* affecte la partie imaginaire du champ magnétique total; le champ secondaire est en quadrature avec le champ primaire. Le détecteur émet un son aigu tandis que l'aiguille du «vu-mètre» se déplace vers la droite.

Une cible en fer represente une *anomalie de susceptibilité magnétique* qui affecte la partie réelle du champ total; le champ secondaire est en phase ou en opposition de phase avec le champ primaire.

Le son émis par le détecteur est grave, l'aiguille du «vu-mètre» se déplace vers la gauche.

Résultats

Au niveau du Christ en croix, figure 7a, le détecteur a révélé la présence de métal non ferreux au niveau de l'aine gauche, dans les deux bras, les deux mains et au niveau de la commissure gauche de la lèvre supérieure.

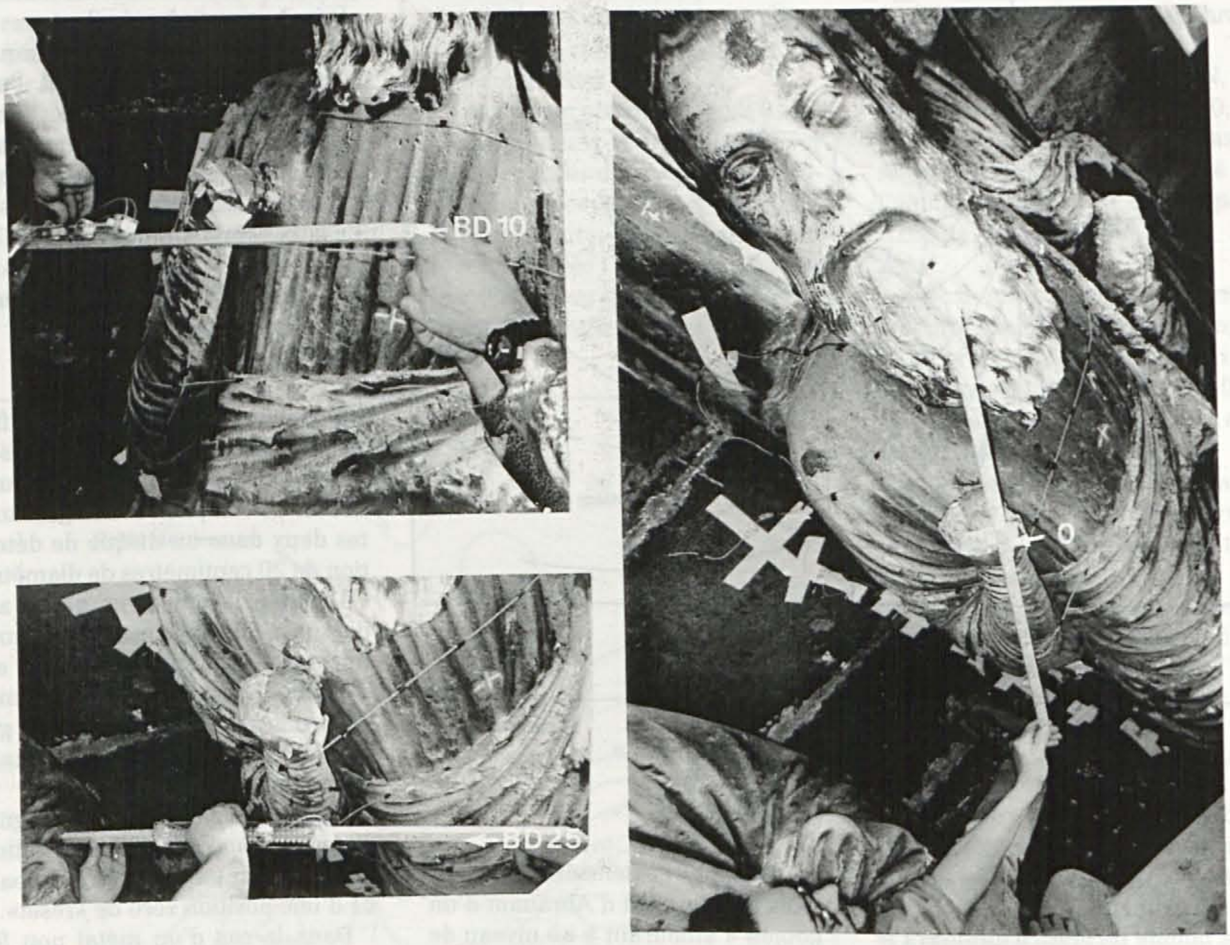


Schéma de positionnement
(Vue latérale de l'intérieur au 1/10)

POSITION DES PROFILS DE MESURES EM SUR LE BRAS DROIT D'ABRAHAM Figure 5

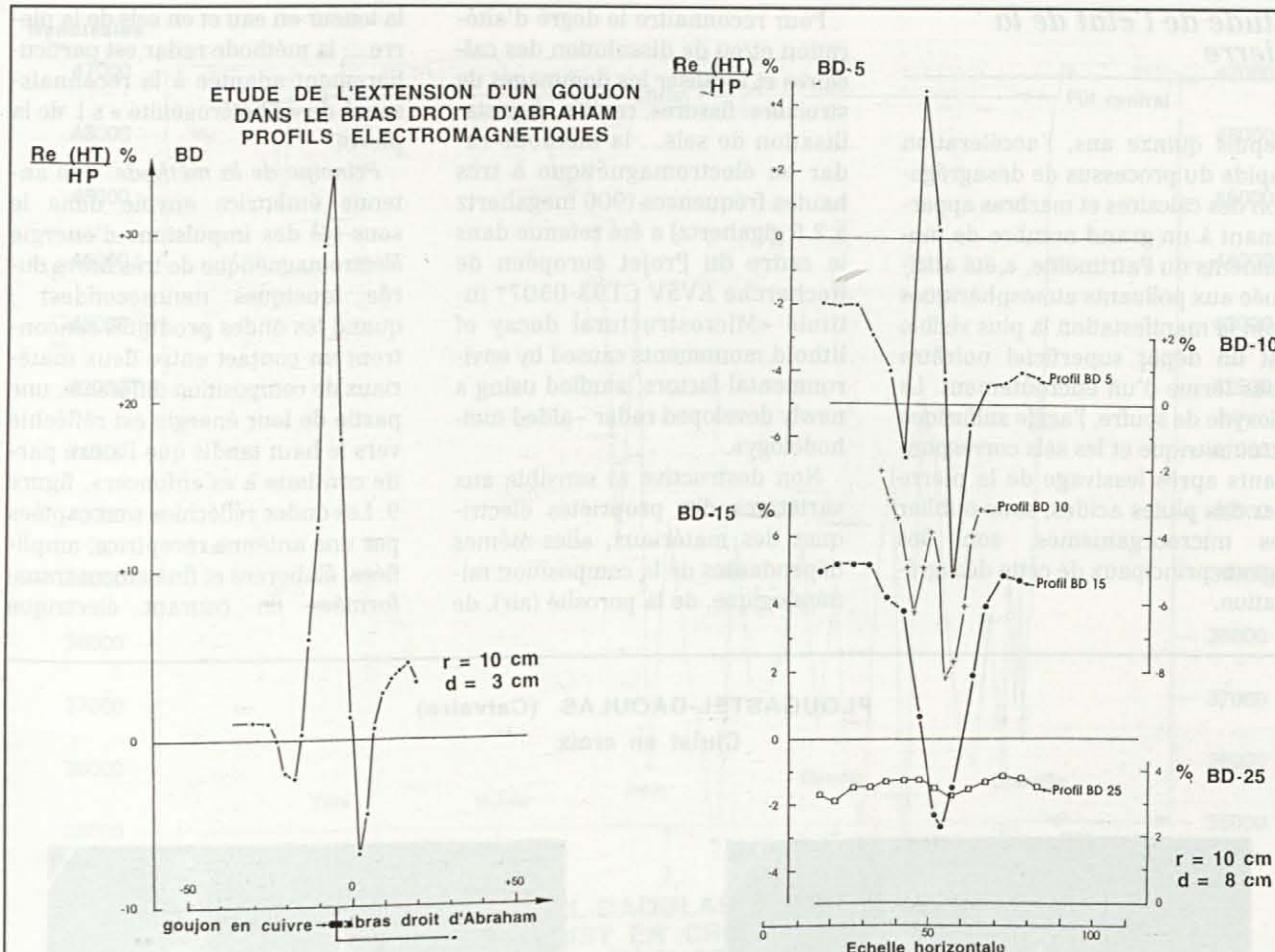


Figure 6

Le bronze est aussi détecté dans le fût de la croix. Le fer est présent dans les deux jambes, à hauteur des genoux et des chevilles (marqué en rouge).

2.2. Méthode magnétique-magnétomètre à protons «Envi-Mag»

Le magnétomètre à précession nucléaire mesure la valeur du champ magnétique total à partir de la fréquence de précession libre des protons (noyaux d'hydrogène) qui ont été polarisés dans une direction approximativement perpendiculaire au champ terrestre.

Lorsque l'on supprime brusquement le champ de polarisation, les protons précessionnent comme une toupie, le champ magnétique terrestre remplaçant la force de précession qui correspond à la pesanteur, dans le cas de la toupie.

Le proton précessionne avec une vitesse angulaire (qui est proportionnelle à l'intensité F du champ magnétique, ce qui donne:

$$\omega = \gamma pF$$

γp est une constante qui représente le rapport gyromagnétique du proton, c'est à dire le rapport de son moment magnétique à son moment cinétique. On obtient le champ magnétique à partir de la relation:

$$F = \omega/\gamma p = 2\ \pi/\gamma p \text{ avec } 2\ \pi/\gamma p = 23{,}4874 \text{ nanotesla/Hz}$$

La source de protons est une bouteille (censeur) remplie d'un liquide organique riche en hydrogéne (méthanol ou benzéne ...). Le champ de polarisation (50 à 100 oersteds) est créé par un courant continu passant dans une bobine placée autour de la bouteille. Lorsque le courant est brusquement interrompu dans le solénoïde, la précession du proton autour du champ magnétique terrestre est mise en évidence par une deuxième bobine, sous la forme d'une tension transitoire induite, modulée par la fréquence de précession qui est alors mesurée.

Résultats

Les mesures ont été réalisées en continu le long de profils bien repérés sur les statues.

Le profil réalisé dans l'allongement du corps du christ en croix (figures 7b et 8) confirme bien la nature ferreuse des éléments métalliques décelés au détecteur, à hauteur des genoux et des chevilles; il semble accréditer l'hypothèse d'une armature métallique en fer continue entre la taille et les chevilles (points 3 à 5), siège d'une anomalie magnétique intense (> 8000 nanoteslas).

Etude de l'etat de la pierre

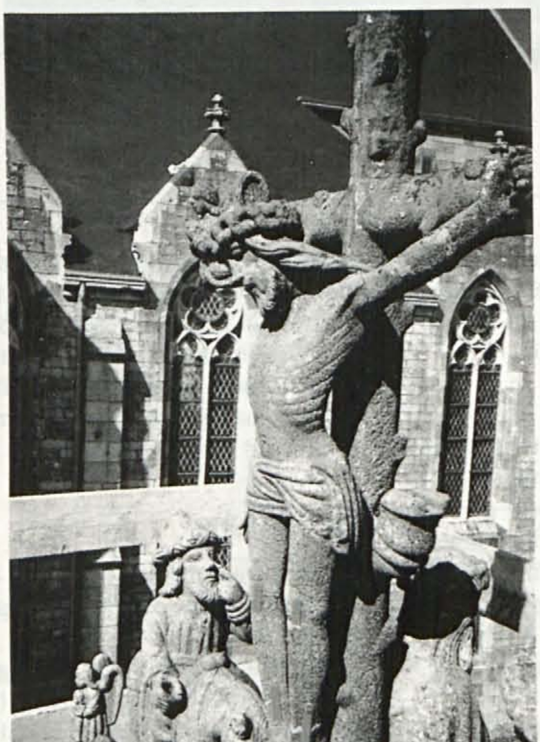
Depuis quinze ans, l'accélération rapide du processus de désagrégation des calcaires et marbres appartenant à un grand nombre de monuments du Patrimoine, a été attribuée aux polluants atmosphériques dont la manifestation la plus visible est un dépôt superficiel noirâtre sous forme d'un encroûtement. Le dioxyde de soufre, l'acide sulfurique et/ou nitrique et les sels correspondants après lessivage de la pierre par des pluies acides, sans oublier les microorganismes, sont les agents principaux de cette désagrégation.

Pour reconnaitre le degré d'altération et/ou de dissolution des calcaires et localiser les dommages de structure: fissures, cavités, recristallisation de sels... la méthode radar ou électromagnétique à très hautes fréquences (900 megahertz à 2.5 gigahertz) a été retenue dans le cadre du Projet européen de Recherche EV5V CT93-0307* intitulé «Microstructural decay of lithoïd monuments caused by environmental factors, studied using a newly developed radar - aided methodology».

Non destructive et sensible aux variations des propriétés électriques des matériaux, elles-mêmes dépendantes de la composition minéralogique, de la porosité (air), de la teneur en eau et en sels de la pierre..., la méthode radar est particulièrement adaptée à la reconnaissance de « l'hétérogénité » s.l. de la pierre.

Principe de la méthode: une antenne émettrice envoie dans le sous-sol des impulsions d'énergie électromagnétique de très brève durée (quelques nanosecondes) ; quand les ondes produites rencontrent un contact entre deux matériaux de composition différente, une partie de leur énergie est réfléchie vers le haut tandis que l'autre partie continue à «s'enfoncer», figure 9. Les ondes réfléchies sont captées par une antenne réceptrice, amplifiées, élaborées et finalement transformées en courant électrique

PLOUGASTEL-DAOULAS (Calvaire)
Christ en croix

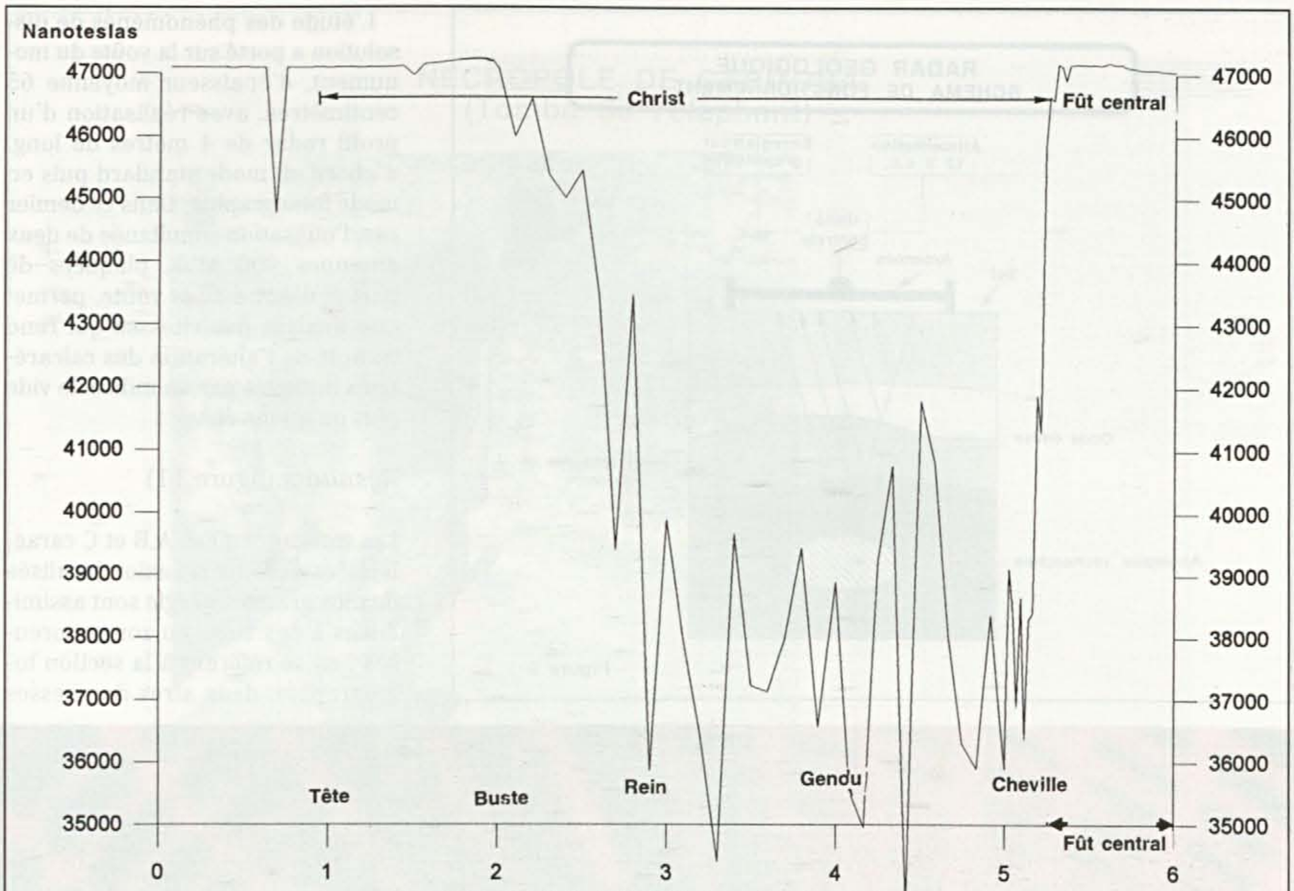


Détecteur de métaux
Résultats : non ferreux en ocre
ferreux en rouge

Figure 7 a

Profil magnétique

Figure 7 b



PLOUGASTEL-DAOULAS (Calvaire)
CHRIST EN CROIX
PROFIL MAGNETIQUE

Figure 8

transmis aux stylets d'un enregistreur graphique à carte électrosensible ou à un enregistreur magnétique pour l'édition de documents en couleur.

Les antennes émettrice et réceptrice sont placées dans un meme boîtier (antenne 900 Mhz, par exemple) ou dans deux boîtiers accolés (antennes 2.5 Gigahz).

Pendant la prospection, les antennes sont déplacées le long de profils recoupant les objectifs de la recherche.

Le faisceau d'émission du radar géologique est un cône qui part du centre du couple émetteur-récepteur et qui a une ouverture d'environ 90°.

L'enregistreur graphique du radar géologique (SIR10) produit, en temps réel, un radargramme ou section continue du sous-sol sur laquelle l'abscisse correspond aux distances le long du parcours des antennes et l'ordonnée, au temps allerretour employé par les ondes pour atteindre les objectifs et revenir.

Le temps est compté en nanosecondes car les ondes radar se propagent à des vitesses voisines de celle de la lumière.

L'angle de réflexion des ondes enregistrées étant pratiquement nul, l'équation fondamentale de la méthode est: $P = Vt/2$ avec:

- P profondeur en métres des contacts et autres objectifs,
- V vitesse moyenne en m/ns des ondes dans les terrains recouvrant les contacts et autres objectifs,
- t temps double ou durée de l'aller-retour des ondes réfléchies. C'est le temps lu sur le radargramme.

Le temps qui correspond à toute la largeur du papier d'enregistrement, ou temps d'investigation TI, est choisi par l'opérateur en fonction de la profondeur des objectifs à atteindre. Les ondes qui arrivent après ce temps TI ne sont pas prises en considération.

Deux exemples illustrent l'apport du radar géologique à l'étude de l'état de la pierre.

Le premier intéresse la Nécropole romaine de Carmona, située à une trentaine de kilomètres à l'Est de Séville, le deuxième, la cathédrale de Tours, à 250 kilomètres au Sud de Paris.

1 - Nécropole de Carmona

Au niveau de la structure dénommée «Tumba del Elefante», creusée dans des calcarenites, la circulation des eaux météoriques a entrainé une altération différentielle de la pierre et en particulier du ciment de consolídation des éléments calcaires en autorisant la prolifération de lichens nitrophiles (figure 10).

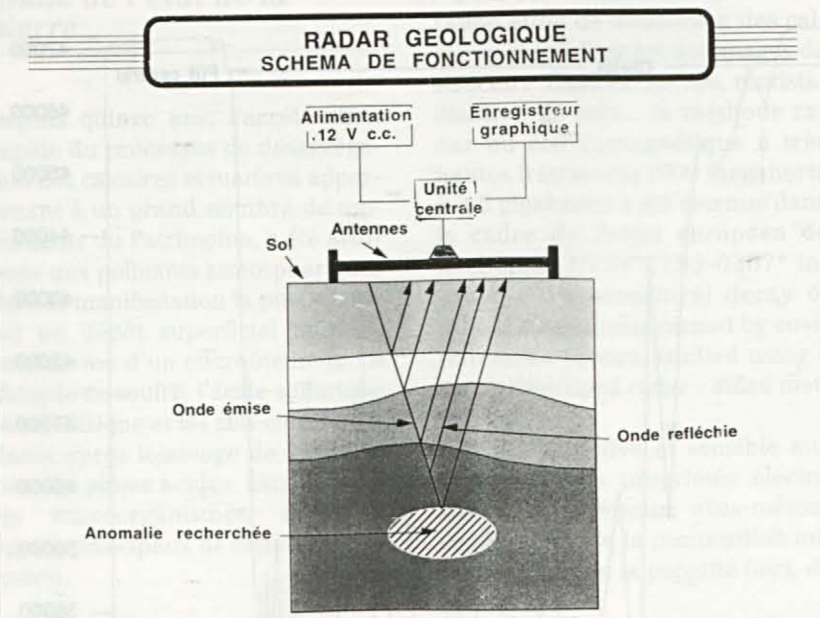


Figure 9

L'étude des phénoménes de dissolution a porté sur la voûte du monument, d'épaisseur moyenne 65 centimètres, avee réalisation d'un profil radar de 4 mètres de long, d'abord en mode standard puis en mode tomographie. Dans ce demier cas, l'utilisation simultanée de deux antennes 900 Mhz, plaquées de part et d'autre de la voûte, permet une analyse des vitesses qui rend compte de l'altération des calcarénites marquée par un indice de vide plus ou moins élevé.

Résultats (figure 11)

Les trois anomalies A,B et C caractérisées par une réflexion localisée de plus grande énergie sont assimilables à des vides ou zones poreuses ; en se référant à la section tomographie, deux aires de vitesses

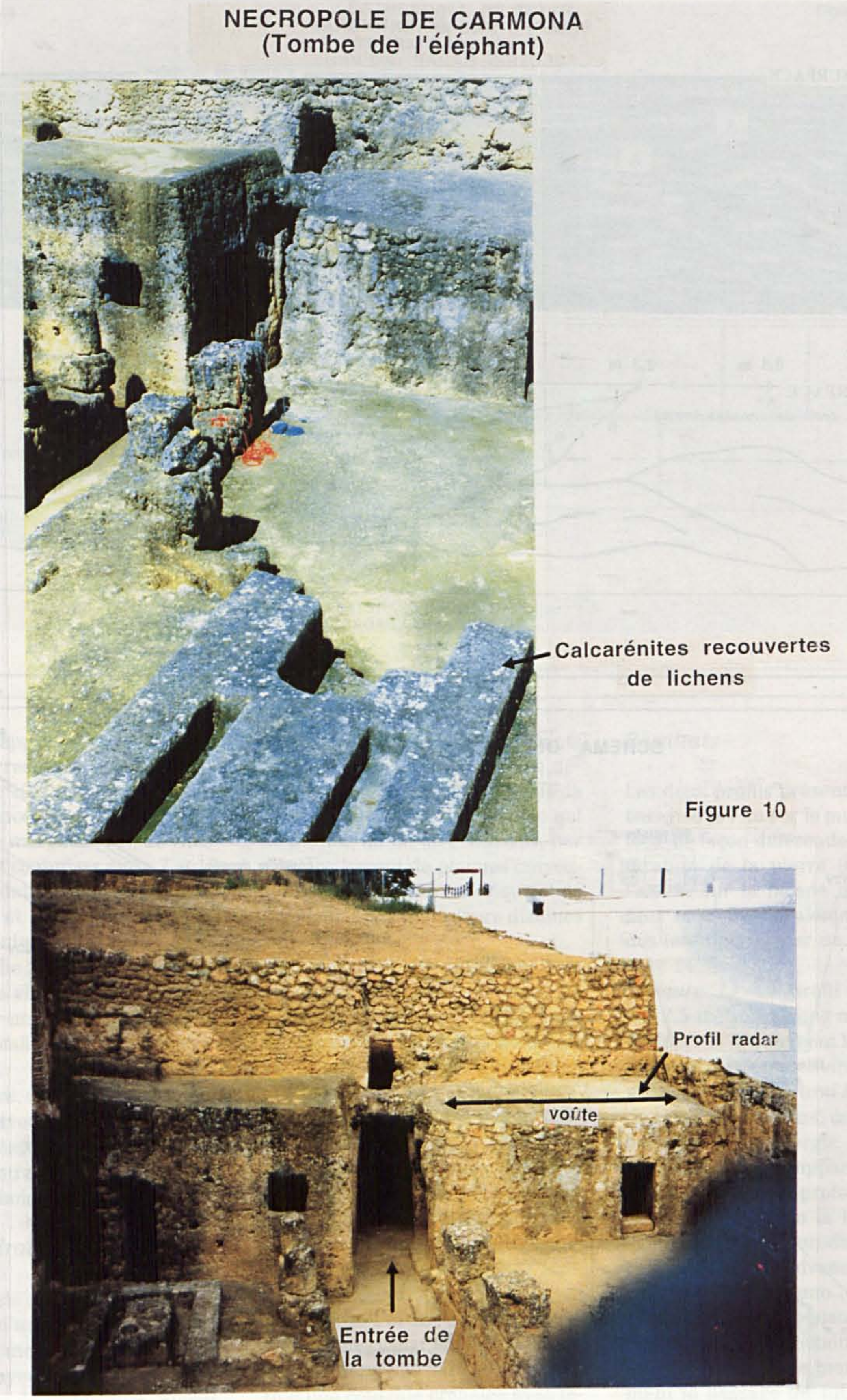

NECROPOLE DE CARMONA
(Tombe de l'éléphant)
Calcarénites recouvertes de lichens
Profil radar
voûte
Entrée de la tombe

Figure 10

Figure 11

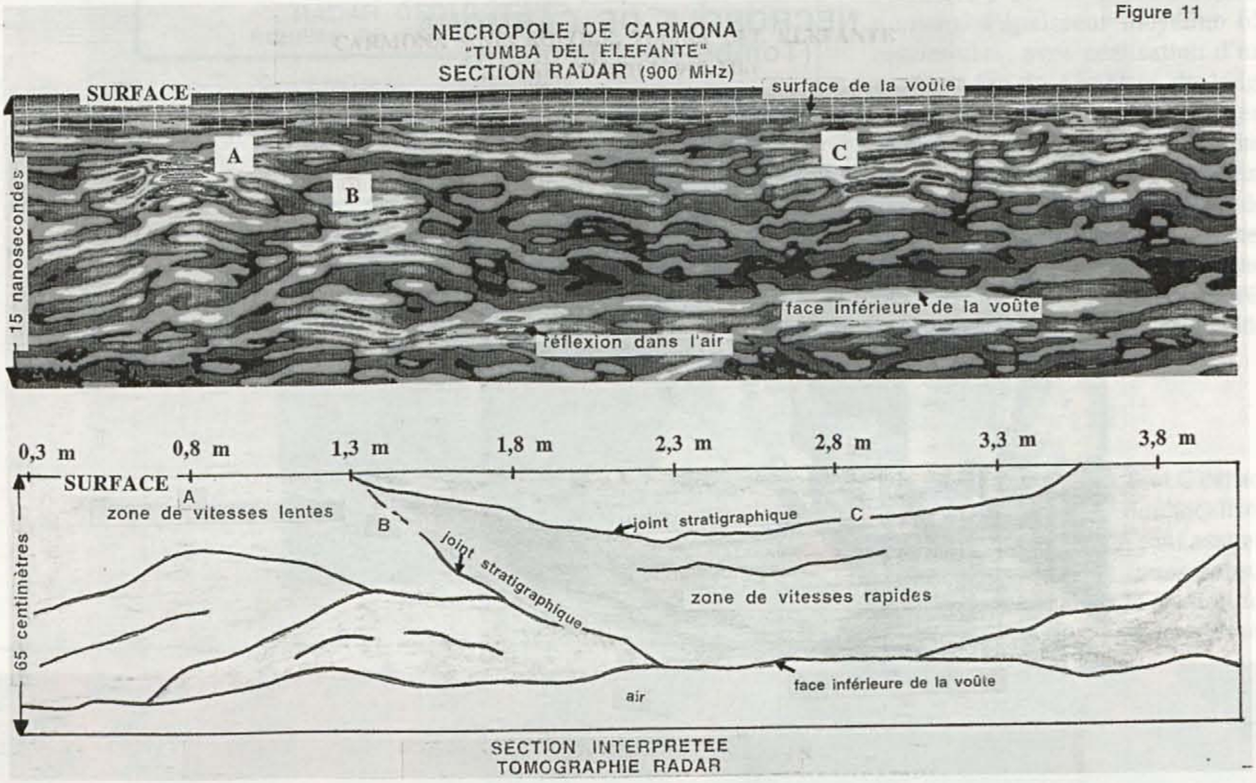
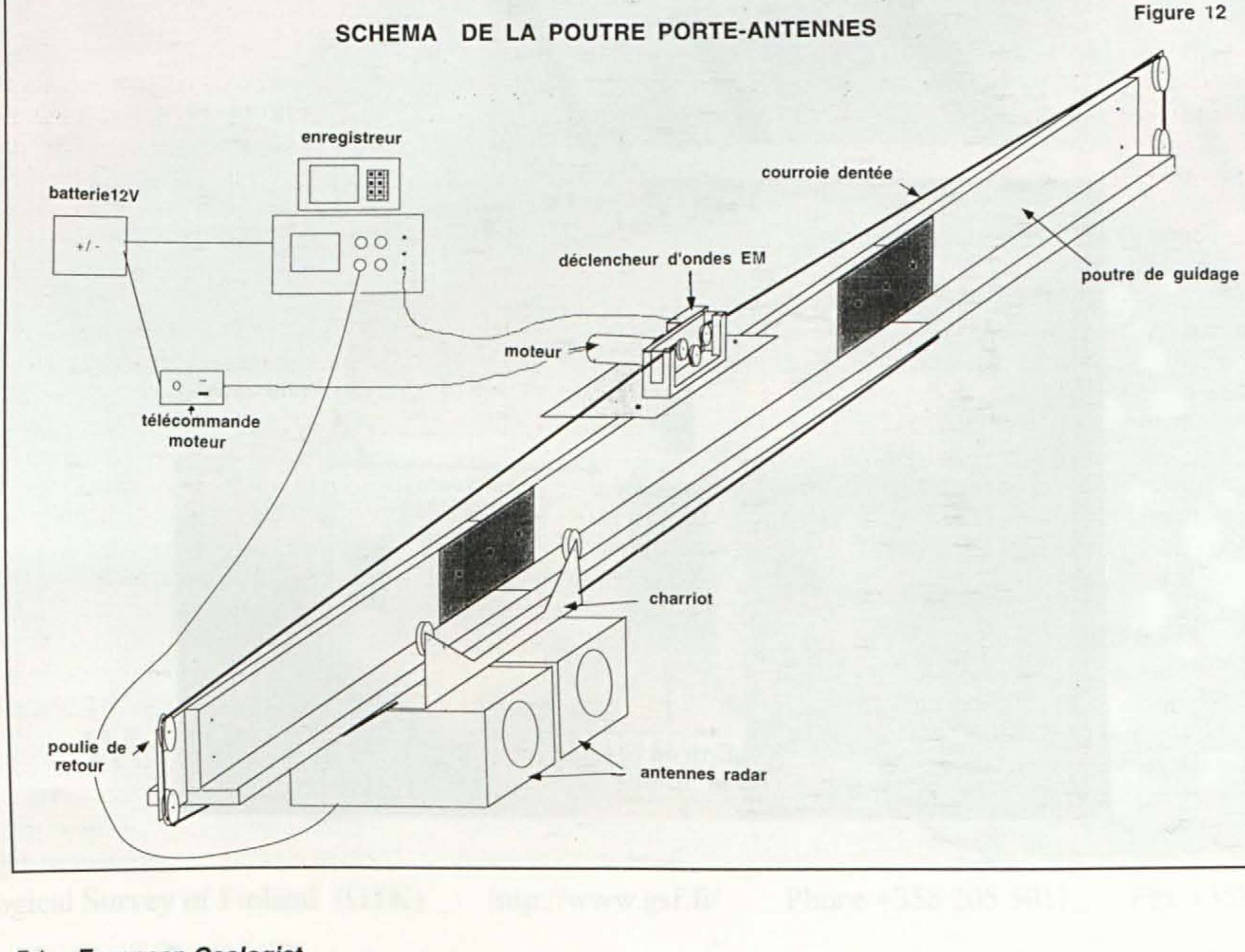
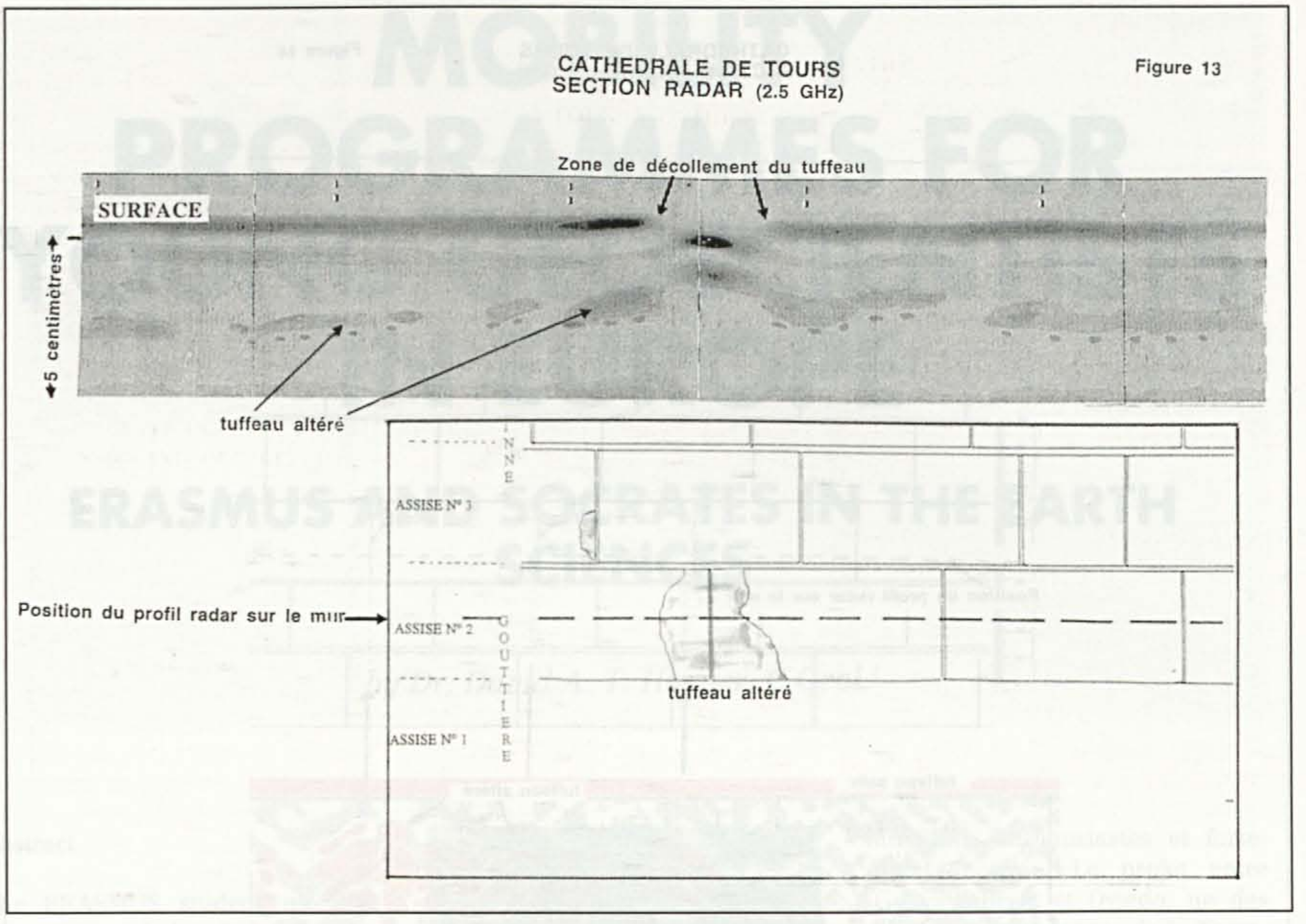


Figure 12





differentes apparaissent: l'une, centrale (I) correspondant à des vitesses rapides: 10 à 13 cm/ns attestant de la présence de vides de dissolution, l'autre marginale (II), de vitesses lentes et comprises entre 7 et 10 cm/ns rendant compte de zones compactes et peu altérées au sein des calcarénites.

L'anomalie A qui appartient au domaine de vitesses lentes ne peut représenter un vide. Il s'agirait d'un élément métallique de renforcement de la voûte.

Par contre, les anomalies B et C coïncident avec des secteurs de gradient de vitesses et représentent des joints de stratification et/ou des contacts lithologiques.

2 - Cathédrale de Tours

La cathédrale de Tours est construite à l'aide d'une pierre tendre, poreuse et blanche apparentée à un calcaire crayeux avec restes de bryozoaires et de mollusques, appelé tuffeau.

L'humidité mêlée aux polluants atmosphériques provoque une désagrégation lente mais sûre de la partie superficielle de la pierre qui se traduit, en fin de processus, par un décollement de plaques crayeuses d'épaisseur centimétrique et de longueur égale à plusieurs dizaines de centimètres.

La propension au delitement de la pierre était jusqu'ici reconnue en utilisant un marteau en bois frappant les murs extérieurs de la cathédrale mais le procédé était quelque peu destructif.

Une reconnaissance par méthode radar devait pallier cet inconvénient et confirmer la très haute résolution des antennes 2.5 gigahz pour distinguer toute «anomalie» dans les 10 premiers centimètres de tuffeau.

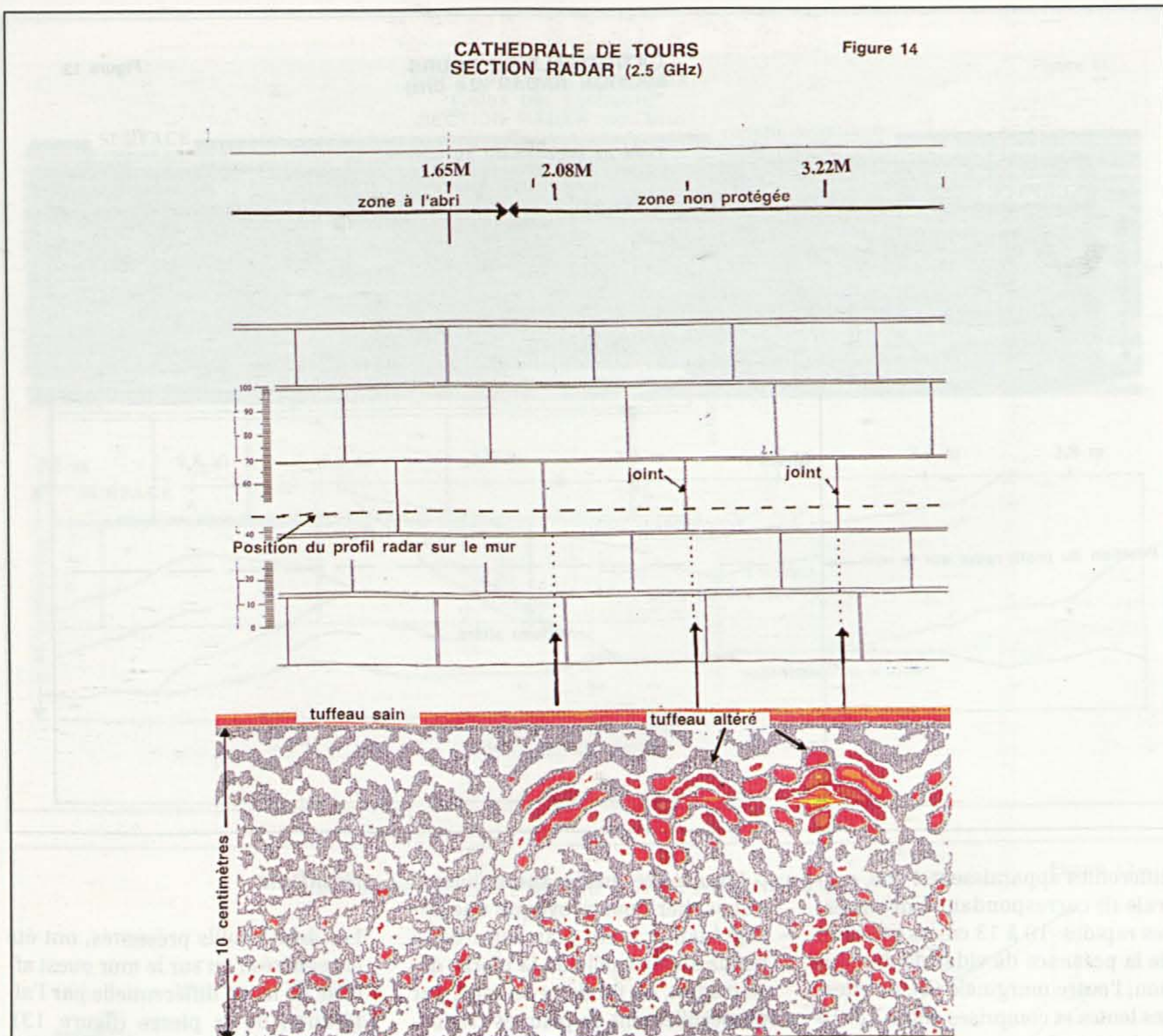
Pour atteindre une résolution spatiale de l'ordre du centimètre, les antennes radar ont été fixées sur un chariot mobile par l'intermédiaire d'une courroie crenelée avec télécommande (figure 12).

Résultats

Les deux profils présentés, ont été enregistrés l'un sur le mur ouest affecté de façon différentielle par l'altération de la pierre (figure 13), l'autre, sur la façade nord, où le mur se trouve localement à l'abri des intempéries par un auvent, figure 14.

Figure 13.–Le profil enregistré sur 2,5 mètres de long met bien en évidence le décollement local du tuffeau, sur 20 cm environ, provoquant un véritable trou à la surface de la pierre. Plus bas, un réflecteur de plus faible énergie et plus ou moins discontinu apparaît à environ 2,5 - 3 cm de profondeur. Cet horizon représente la limite inférieure de l'altération du tuffeau et coïncide avec un niveau poreux et humide, siège d'une dissolution plus active des carbonates.

Figure 14.–La section radar est intéressante car elle montre clairement le passage du tuffeau altéré par infiltration d'eau le long de



joints entre les blocs de pierre, à la pierre saine, protégée par l'auvent.

Il est dès lors facile de réaliser la cartographie des zones altérées ou en voie d'altération pour un traitement spécifique.

Conclusion

La pollution sous toutes ses formes - pollution atmosphérique, pollution des eaux - est une cause majeure de l'altération des monuments.

Parmi les expérimentations qui visent à localiser les zones altérées et à évaluer les mécanismes de dégradation des matériaux, notamment des pierres, les méthodes géophysiques non destructives et de coût moderé: électriques, magnétiques et électromagnétiques, trouvent un champ d'application de plus en plus large.

Pour le seul repérage rapide d'éléments métalliques au sein de la pierre, l'utilisation d'un détecteur de métaux et d'un magnétomètre à protons est adaptée (cas du calvaire de Plougastel-Daoulas).

Pour une évaluation des volumes, la méthode radar et certaines méthodes électriques: mise à la masse, panneau électrique, sont à préconiser (étude des cathédrales de Reims et Tours).

D'autres méthodes comme la gammagraphie, la thermographie infra-rouge ou la tomographie électromagnétique peuvent être localement mises en oeuvre avec succès.

Le développement des études pour la préservation du Patrimoine doit conduire à la construction d'appareillages géophysiques spécifiques, affranchis au mieux des « bruits industriels » et de faible encombrement, pour étudier avec la même résolution l'état du drapé de Moïse à Reims et celui des avant-corps du château de Versailles. ■

Références

A. BOUVIER.–*Rapports géophysiques CGG sur la cathédrale de Reims, le château de Versailles, le calvaire de Plougastel-Daoulas.* 1995-1996 (documents internes).

MOBILITY PROGRAMMES FOR YOUNG GEOSCIENTISTS IN EUROPE

ERASMUS AND SOCRATES IN THE EARTH SCIENCES

by Dr. David A. T. Harper, C.Geol.[1]

Abstract

The ERASMUS student mobility programme is helping create a new generation of European geologists. The programme offers opportunities to study and carry out field mapping project in partner universities across the EU and in EFTA countries. The mix of culture, language, new courses and, of course, unfamiliar geology has generated a greater awareness of the European dimension of the science amongst enthusiastic and highly motivate students. The scheme between Galway, Brest and Oviedo, one of the first in the Earth Sciences, has proved popular and successful and plans to expand under the succeeding SOCRATES programme are advanced.

Résumé

Le programme de mobilité étudiante ERASMUS aide à créer une nouvelle génération de géologues européens. Le programme offre des opportunités pour étudier et réaliser des prjets de cartographie de terrain avec des universités partenaires dans toute l 'Union Européenne et les pays de l 'AELE. Le mélange de culture, de langue, de nouveaux cours et, bien sûr, de géologie nouvelle a produit une plus grande prise e conscience de la dimension européenne de la Science parmi des étudiants enthousiastes et fortement motivés. Le projet entre Galway, Brest et Oviedo, un des premiers en Sciences de la Terre, s 'est avéré populaire et couronné de succes et des projets de s'étendre au futur programme SOCRATES sont avancés.

Resumen

El programa de movilidad estudiantil ERASMUS está ayudando a producir una nueva generación de geólogos europeos. El programa ofrece oportunidades para estudiar y realizar proyectos de cartografía del campo en universidades asociadas en todos los países de la CE y de la AELC. La mezcla de cultura, lenguaje, cursos nuevos, y, naturalmente, geología desconocida ha generado un conciencia de la dimensión europea de la ciencia entre estudiantes entusiastas y muy motivados. El plan, entre Galway, Brest y Oviedo, es uno de los primeros en tratar las ciencias de la tierra. Ha resultado popular y exitoso y ya hay un gran número de actividades programadas en relación con el próximo programa SOCRATES.

Erasmus of Rotterdam. Portrait by Quentin Massys of Antwerp. Galleria Nazionale d'Arte Antica, Palazzo Corsini, Rome. Photo: Alinari-Anderson.

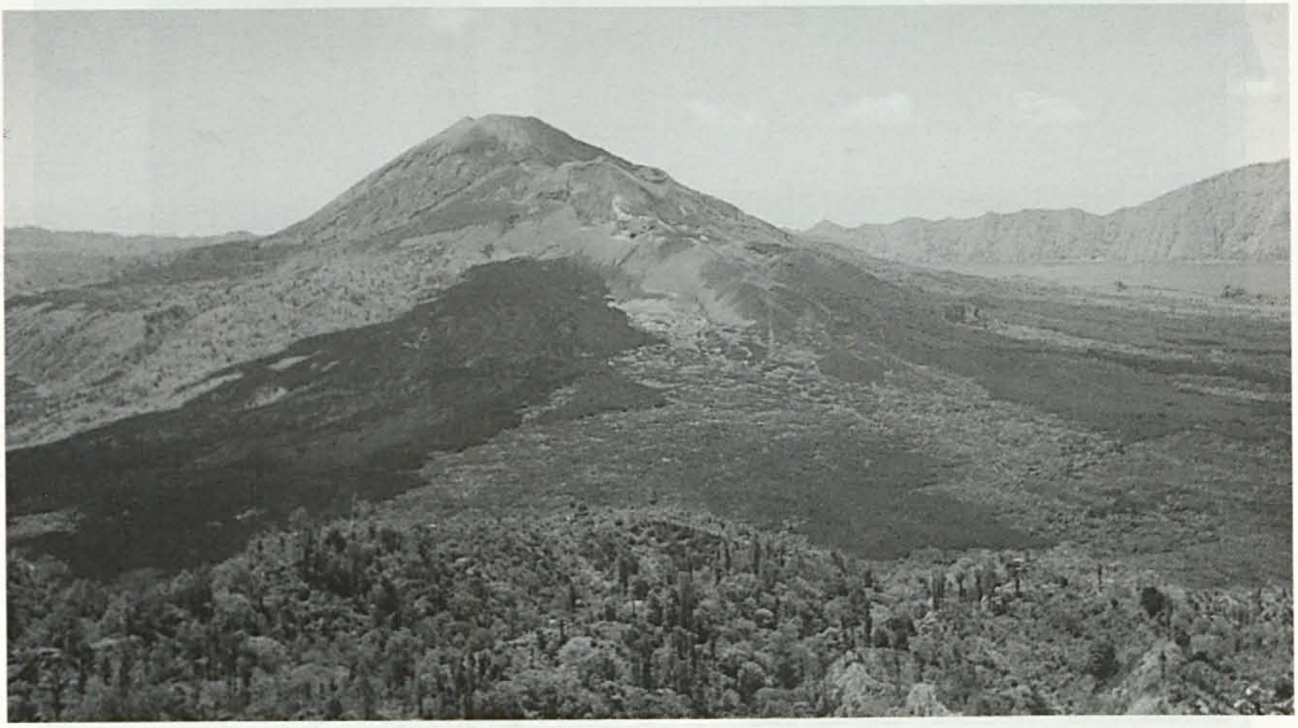
[1] Department of Geology. University College. Galway. Freland.

Desiderius Erasmus of Rotterdam (1466-1536) was arguably the best known of the Mediaeval scholars. He was n acknowledged writer, translator and humanist and in his restless journeys across Europe, in search of ancient manuscripts, Erasmus spread the flames of the Renaissance from the cradles of enlightenment around the Mediterranean to the perceived darkness of Northern Europe. His humanism and translation of the New Testament paved the way for the Reformation. It is highly appropriate that his name and his likeness, based on Holbein's portraits, should dignify the first student mobility programme sponsored by the European Community.

The European Community Action Scheme for the Mobility of University Students (ERASMUS) was formally established in 1987 by Council Decision; the function of the program is to promote student mobility within the European Community and to encourage greater co-operation between its Higher Education Institutions. The student mobility programmes offer university students a chance to undertake a substantial period of study (minimum 3 months) in another European Union member state or EFTA country, fully recognised by the home institution as an integral part of their degree. The programme offers ideal training for earth scientists, allowing the! mix of academic and vocational components of the course to be extended to research and teaching experienced during short periods abroad in unfamiliar settings.

The scheme initiated in 1987 between the universities in Galway and Brest, was one of the first Erasmus exchanges of students ad staff in the earth sciences. In 1989 Oviedo joined the system and currently co-ordinates the project. All three institutes are situated on both the margins of Europe and their own countries. Initially the exchange involved a six-month period abroad. The first three months, from July - September, are spent field mapping in the host country. All three partners could offer a wide variety of projects in varied geological terrains: in the West of Ireland - Precambrian metamorphics and Caledonian granites of the Connemara Massif or the Lower Palaeozoic volcanics and fossiliferous sediments of the South Mayo Trough; in France - Palaeozoic rocks of the Armorican Massif or the Mesozoic and Cenozoic rocks of the Western Alps and in Spain - the Palaeozoic rocks of the Asturian and Cantabrian mountains. A range of Caledonide, Variscide and Alpine terrains is covered by the partner

Precambrian cratons and the Phanerozoic orogenic belts of Europe; the peripheral positions of Brest, Galway and Oviedo are indicated in contrasting geological terrains (modified from various sources).



countries. Many of the field areas are remote forcing the students to communicate in the host language. The mapping project is written up as a short thesis in either the home or host language, with a lengthy abstract in the host language, and is usually examined by staff from the home department.

Then onto the host institution, either Coláiste na hOllscoille Gaillimh (Galway, Ireland), Université de Bretagne Occidentale (Brest, France) or Universidad de Oviedo (Oviedo, Spain) for a Winter Semester of courses together with language tuition and further field trips. Similar an equivalent modules to those at the home institution are followed abroad and examinations are held in all three departments at the end of the semester before the students return home. The value of modules and marks has been established through the European Credit Transfer Scheme (ECTS) and may simply be plugged into spreadsheets in the home institute. Both the courses studied abroad and the thesis are integral, examineable parts of the degree programme in all three institutes.

To date over fifty students have participated in the programme from all three countries and several have continued postgraduate studies in host institutions. The exchange has generated cohorts of more motivated, confident and in some cases better educated students with a greater awareness of both European culture and geology. Teaching programmes have benefited from the exchange of ideas, material and techniques between staff, and the structure of the exchange and its components continue to be modified in response to student needs ad developments in all three institutes. A greater European dimension is evident in some courses such as the Regional Geology and Tectonics modules. In Galway both the Department and the College have derived considerable advantages from the cultural mix provided by visiting students and their staff. The exchange has undoubtedly created a very important window on Europe otherwise unavailable in the more peripheral regions of the EU.

The new SOCRATES programme approved by the Ministers of the 12 European Union Countries in June 1994 will supersede ERASMUS and is intended to ensure the continuation of the Community action already undertaken under ERASMUS (and other related programmes); the new programme guarantees a rationalisation of the various activities of ERASMUS (and others schemes), as well as the other budget headings available for co-operation in education. More staff exchanges and intensive courses are envisaged and joint curriculum development will be encouraged. The scheme allows for an expansion of networks but bilateral agreements between exchange partners will ensure equable student numbers are exchanged. Although Galway will have additional arrangements with the University of Mainz, our system as a whole, under SOCRATES, is set to expand to include British, German, Italian and Portuguese geology departments. The period of the exchange will be extended to cover the entire academic session prior to final year and students can elect to remain in the host country to complete Summer mapping projects before returning home.

This new generation of highly-motivated European geologists is better equipped to handle the global dimension of the subject and will be in the queue for further professional European qualifications. ■

COMENTARIOS ACERCA DE LA LEGISLACION COMUNITARIA Y ESPAÑOLA REFERENTE A AGUAS MINERALES

por A. F. Castro Gámez

Abstract

The author makes a succinct revision of the dispersed regulations in the matter of mineral waters that conducts to the conclusion that a revision of the common legislation is convenient in order to guaranty and unify criteria of quality and the protection of a resource of considerable economic importance.

Introducción

Durante los últimos años se ha producido un desarrollo casi espectacular de la industria envasadora de aguas minerales en España. Este desarrollo viene impulsado, de una parte por los inferiores niveles de consumo existentes en relación con el resto de la Comunidad, y de otra por las situaciones coyunturales que suelen afectar al sector, tales como los periodos de sequía, sin mencionar factores sociológicos de más difícil interpretación.

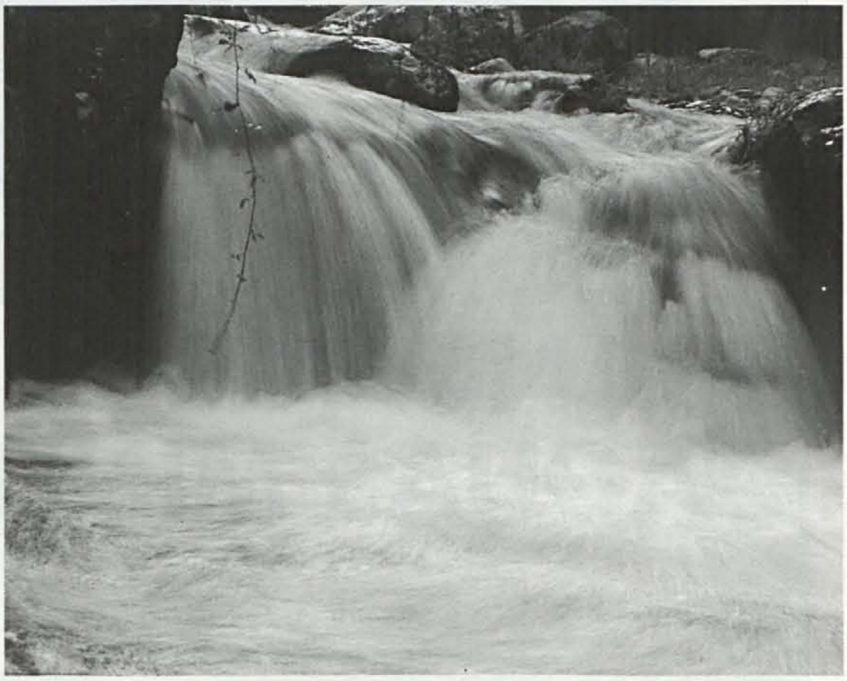
No hay que olvidar que existen unas 700 plantas en Europa generando más de 45.000 empleos directos con una producción que sobrepasa los 24.000 millones de litros, lo que da idea del volumen de negocio de un sector que tuvo en España durante el año 1994 tasas de crecimiento superiores al 10%.

Todo ello parece augurar un futuro optimista para los hidrogeólogos, aunque la disparidad legislativa aún presente en la actualidad, a pesar de existir una norma con fines unificadores –Directiva 80/777/CE–, crea una cierta confusión en lo que se refiere a los requisitos para la tramitación de los expedientes de declaración de la condición mineral de las aguas.

Marco legislativo

La Directiva 80/777/CE relativa a la aproximación de las legislaciones de los Estados miembros sobre explotación y comercialización de aguas minerales naturales, tuvo por objeto la unificación de las legislaciones nacionales y/o regionales en dicha materia. Su transposición al Derecho español se realizó mediante el Real Decreto 1164/1991, Reglamentación Técnico-Sanitaria para la elaboración, circulación y comercio de aguas de bebida envasadas, que vino, en opinión de unos a completar lo dispuesto en la Ley 22/1973 de Minas y el Real Decreto 2857/1978, Reglamento General para el Régimen de la Minería, y a enturbiar la situación anterior en opinión de otros. De hecho, esta norma obliga de forma expresa a la realización del correspondiente estudio hidrogeológico (Anexo I de la citada directiva y Anexo II del Real Decreto 1164/1991), aunque en la definición de su contenido se aprecia un cierto distanciamiento entre el formulismo legal y la realidad científico-técnica. Así se exige la determinación de una serie de parámetros que pueden resultar excesivos en muchos casos (radiactividad, isótopos de Oxígeno e Hidrógeno, ...) frente a una escasa definición en otros casos (estratigrafía del yacimiento hidrológico, origen y naturaleza del terreno, ...) que sin embargo no incluye otros datos como el inventario de focos potencialmente contaminantes o los parámetros hidráulicos que definen el acuífero, que, entre otros, resultan evidentemente necesarios para la localización y protección del recurso (basta pensar en las inversiones que conlleva la instalación de una planta envasadora y las consecuencias de la aparición de la contaminación o de la merma en los caudales de explotación).

A partir del mencionado marco legislativo se produce durante estos últimos años un desarrollo de la normativa sectorial por parte de las diferentes Comunidades Autónomas españolas que añaden nuevas componentes de incertidumbre al proceso de declaración. Así, la Comunidad Gallega promulga la Ley 5/1995 en la que se regulan, además de las aguas minerales y de manantial, las termales y los establecimientos balnearios. En síntesis, dicha Ley se ajusta a lo dispuesto en la Directiva, pero incorporando y definiendo la figura del perímetro de protección en base al concepto de tiempo de tránsito (no hay que olvidar que la Directiva no contempla la definición del perímetro en sí, sino textualmente "las medidas de protección del manantial y zona circundante contra la contaminación") y que, además, grada la superficie protegida en tres zonas de restricción máxima, media y mínima, exigiendo que el titular disponga de la propiedad de los terrenos que comprenden la zona de máxima restricción, lo que, al margen de otras consideraciones legales, parece lógico con objeto de evitar los algo más que posibles conflictos jurídico-administrativos en esa zona. A su vez establece la necesidad de informe vinculante por parte de la administración hidráulica, pero sólo para el caso de las aguas de manantial, lo que tampoco deja de suscitar controversia, así por ejemplo el Decreto 307/1994 de la Generalidad de Cataluña no confiere carácter vinculante a dicho informe. Lo cierto es que, independientemente del carácter del informe en cuestión, debe de tenerse en cuenta el criterio del organismo hidráulico competente que en definitiva deberá ser el encargado de la planificación del recurso en la cuenca correspondiente. De hecho, la normativa catalana indica que las limitaciones derivadas del establecimiento de los perímetros de protección no afectarán a la planificación hidráulica, sin perjuicio de las indemnizaciones que sean procedentes. Quizá fuese más lógico exigir ese carácter vinculante y/o la realización de un balance hidráulico lo más detallado posible del acuífero en cuestión (es decir, hacer realmente efectivo el principio de la



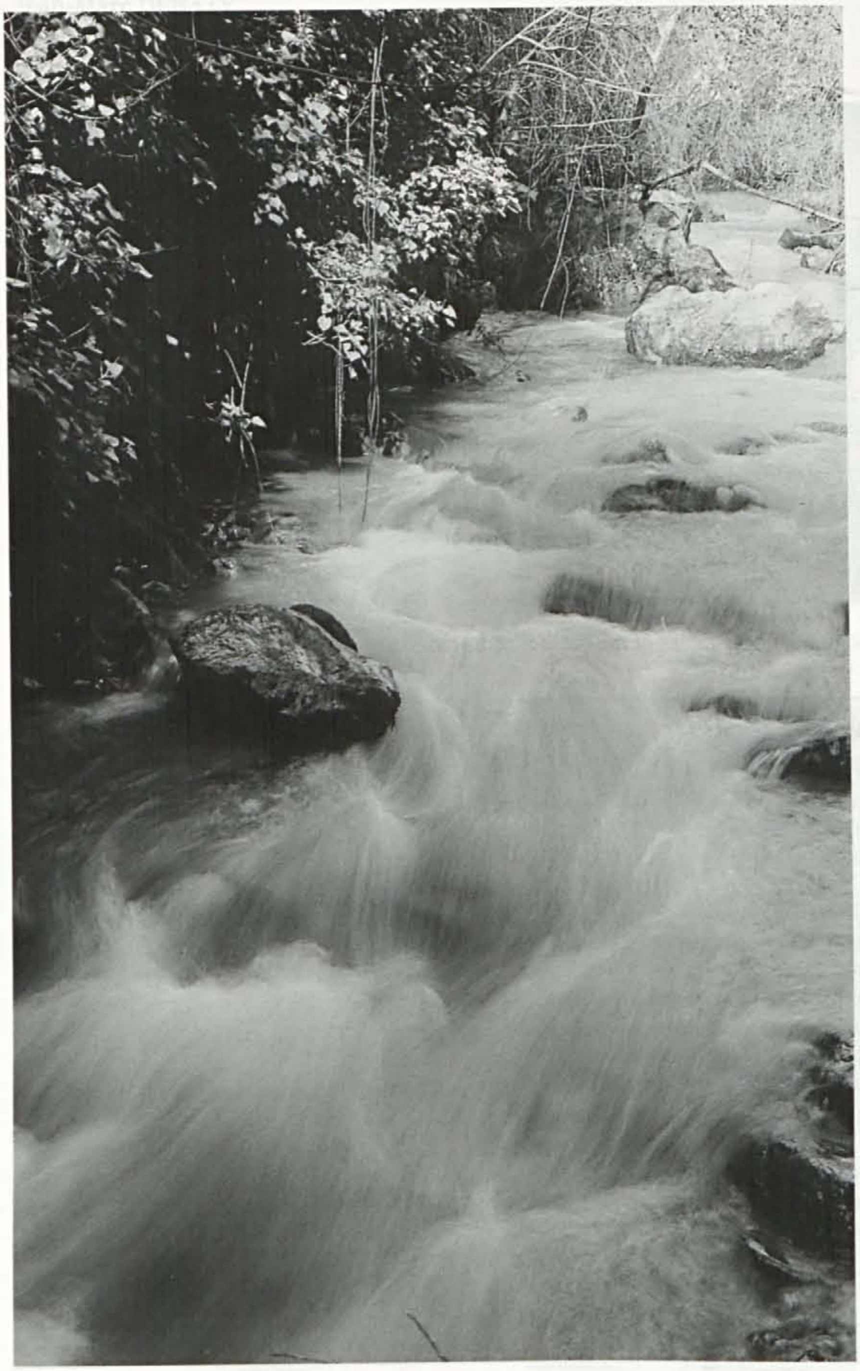
unidad del recurso frecuentemente no respetado en el caso de las aguas minerales).

Por su parte, la Comunidad de Castilla-La Mancha, tras un tortuoso proceso de gestación, se dota del marco legal correspondiente mediante la Ley 8/1990 de Aguas Minerales y Termales (en donde se incluyen los establecimientos balnearios todavía regulados en la mayor parte de España por el Decreto-Ley 743/1928) y el Decreto 4/1995 por el que se aprueba su Reglamento. Esta Ley exige la presentación del estudio hidrogeológico, así como "la protección del acuífero frente a la contaminación" mediante la definición del correspondiente perímetro de protección y, lo que es llamativo, la necesaria incorporación al expediente de un informe del organismo administrativo competente en materia hidráulica en relación a otros posibles aprovechamientos, obligando a que, en la posible resolución administrativa el caudal máximo de explotación no sea superior al marcado por el organismo de cuenca, lo que de manera implícita supone la realización del balance arriba mencionado. No hay que olvidar que una de las causas más frecuentes de cancelación de expedientes de declaración de la condición mineral de las aguas tiene su origen en la oposición manifestada por otros usuarios del recurso.

En suma, existe una poco precisa legislación a nivel comunitario, y lo que es peor, a nivel regional en algunos estados miembros, como es el caso de España, agravada con una normativa que puede resultar ambigua en lo que se refiere a los estudios hidrogeológicos. Dos consideraciones más, han pasado 16 años desde que se publicó la ya muy mencionada Directiva y los avances en hidrogeología pueden calificarse de muy importantes –y es que las ciencias avanzan una barbaridad– y, por otra parte, el primero de Enero de 1996 se instauró la llamada Marca Comunitaria, que otorga un derecho exclusivo frente a terceros en los quince Estados miembros, lo que conlleva, en buena lógica, un muy riguroso proceso de control de calidad que, para el caso que nos ocupa, debería reflejarse en una mayor definición de la normativa reguladora de los estudios hidrogeológicos.

Problemática administrativa - Planteamiento hidrogeológico

Ya se ha apuntado sintéticamente la posible problemática a considerar en relación a la Administración hidráulica, por lo que parece lógico completar el tan traído y llevado estudio hidrogeológico con el balance del sistema (inventario de puntos de agua, caudales explotados, recursos renovables y reservas) así como un inventario de focos potencialmente contaminantes (otro frecuente motivo de cancelación-caducidad es la "súbita" aparición de la tan temida como frecuente contaminación). El propio estudio hidrogeológico podría y debería incluir la definición del perímetro de protección (que en gran parte de la normativa se pospone a la tramitación del expediente de aprovechamiento posterior al de declaración) puesto que, entre otras cosas, ese debe ser al menos uno de sus objetivos fundamentales (la protección del recurso). Cuestión muy distinta es la del mecanismo administrativo, nacional o regional, que haga realmente operativa esa zona de protección, probablemente su zonación en función de criterios como el de tiempo de tránsito, poder autodepurador del terreno, perdurabilidad de los contaminantes, etc. pueden ayudar en parte a resolver el problema (en España, los perímetros de protección de aguas minerales quedan definidos por cuadrículas mineras –una cuadrícula tiene una superficie aproximada de 30 Ha– de lo que se deriva un frecuente sobredimensionamiento, que unido a la falta de zonación en el mismo compromete seriamente su operatividad). La elaboración de una marco legislativo común lo suficientemente preciso en lo que refiere a los estudios hidrogeológicos parece ser una de las pocas alternativas posibles en lo que, hoy por hoy, constituye una productiva fuente de litigios jurídicos y administrativos.



Conclusiones

Parece evidente que se hace necesaria una actualización del marco legislativo comunitario en materia de aguas minerales, y muy especialmente en lo que se refiere a la normativa a aplicar en los estudios hidrogeológicos. Dentro de éstos, parece que la definición del perímetro de protección y su zonación mediante varios criterios, y muy especialmente el de tiempo de tránsito, constituye una de las pocas opciones con base técnica suficiente para poner fin a una situación que hoy día se presenta imprecisa y, por añadidura, no exenta de conflictividad. ■

Bibliografía

ITGE. (1991).–Guía Metodológica para la Elaboración de Perímetros de Protección de Captaciones de Aguas Subterráneas.

ITGE. (1992).–Jornadas de Aguas Minerales y Mineromedicinales en España.

LALLEMAND-BARRES, A. (1989).–Guide Methodologique d'etablissement des périmetres de protection des captages d'eau souterraine. Ed. BRGE. Orleans.

LLAMAS, R. (1991).–Consideraciones sobre la normativa española en materia de aguas envasadas. *Tecnología del Agua*, n.º 79.

European Geologists Page

The European Geologist magazine is very proud to open this new section to share news and information of the whereabouts of our principal readers : European Geologists. Please feel free to send in anything worth including such as jobs offers, professional news, companies news, personal news, notes on interesting voyages, geological jokes. We hope to see this page thriving with whatever you want to share with your magazine.

News from EurGeol

Paul Maliphant new professional venture. EurGeol n.º 56 Paul C. Maliphant MSc, C. Geol., F.G.S. has recently joined the Cambrian Group based in Usk, Gwent, Wales, UK on 1st April 1996 as Operations Director of the newly formed Cambrian Geotechnical.

The new company will take over the Geotechnical activities of Cambrian Consultants with the aim of expanding into the geotechnical and geo-environmental consultancy market.

Paul can be contacted on: Tel: +(44)-1291-673022 Fax: +(44)-1291-673023 Modem: +(44)-1291-673024 E-mail : mayfield@cambrian.u-net.com Compuserve : 100136,1765.

We wish Paul all the luck in his new responsibility

Geological quizs

Some photographic examples of the geological origin of life

Livermore Labs Discover New Element

The heaviest element known to science was discovered today by physicists at Lawrence Livermore National Laboratories.

The element tentatively named *Administratium*, has no protons or electrons and thus has an atomic number of 0. However it does have one neutron, 125 assistant neutrons, 75 vice-neutrons, and 111 assistant vice-neutrons giving-it an atomic mass of 312.These 312 particles are held together in a nucleus by a force that involves the continuos exchange of meso-like particles, called morons.

Since it has no electrons, *Administratium* is inert. However, it can be detected chemically, since it impedes every reaction with which it comes into contact. According to the discoverers (now employed by the EU) a minute amount of *Administratium* caused one reaction to take over four days to complete, when it normally would occur in less than one second.

Administratium has a normal life of approximately three years at which time it does not actually decay, but, instead, undergoes a reorganisation in which the assistant neutrons, vice-neutrons and assistant vice-neutrons exchange places. Some studies have shown that the atomic weight actually increases after each reorganisation.

Research at other laboratories indicate that *Administratium* occurs naturally in the atmosphere. It tends to concentrate at certain points, such as government agencies, large computer or aerospace corporations, and universities, and can actually be found in the newest, best-maintained buildings.

Scientists point out that *Administratium* is known to be toxic at any level of concentration and can easily destroy any productive reaction where it is allowed to accumulate. Frantic attempts are being made to determine how *Administratium* can be controlled to prevent irreversible damage, but results to date are not promising, since attempts to control it simply cause more *Administratium* to be created.

Reprinted from Blue Notes, the newsletter of the San Francisco Personal Computer Users Group.

MEMBER ASSOCIATIONS

BELGIUM

* UNION BELGO-LUXEMBOURGEOISE DES GEOLOGUES (UBLG)

President: Jacques Vercruysse
13 rue Jenner
B-1040 BRUXELLES (BELGIUM)
Tel: 32 2 627 04 18 Fax: 32 2 647 73 59

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

Jean-Marc DEBATY
prof: Petrofina Dpt Health, Safety, Env. & Quality
rue de l'industrie, 52
1040 Bruxelles (BELGIUM)
Tel: 32 2 288 91 05 Fax: 32 2 288 33 34

Jacques VERCRUYSSE
prof: Envico
Generaal de Wittelaan 9/3
B-2800 Mechelen
Tel: 32 15 28 19 64 Fax: 32 15 28 19 70

Meeting at Burlington House

FINLAND

* FINNISH UNION OF ENVIRONMENTAL PROFESSIONALS (FUEP)
  President: Jukka Marmo
  Akavatalo, Rautatieläisenkatu 6
  SF-00520 HELSINKI (FINLAND)
  Tel: 358 0 150 23 76 Fax: 358 0 14 26 04

Karita ÅKER
prof: Soil & Water Iltd
Itålahdenkatu 2
FIN-00210 HELSINKI (FINLAND/FINLANDE/FINLANDIA)
Tel: 358 0 68 26 61 Fax: 358 0682 66 00

Jukka MARMO
prof: Geological Survey of Finland
Betonimiehenkuja 4
SF-02150 ESPOO (FINLAND)
Tel: 358 2 05 50 11 Fax: 358 205 50 12 e-mail: jukka.marmo@gsf.fi

FRANCE

* UNION FRANCAISE DES GEOLOGUES (UFG)
  President: Jean-Michel Quenardel
  Maison de la Géologie, 77 rue Claude Bernard
  F-75005 PARIS (FRANCE)
  Tel: 33 1 47 07 91 95 (tuesday, wenesday, thursday; mardi, mercredi, jeudi)
  Fax: 33 1 47 07 91 93

Jean-Michel QUENARDEL
prof: Université de Paris-Sud
Labo géologie Struct. et App., Bât. 504
F-91405 Orsay cedex (FRANCE)
Tel: 33 1 69 41 67 53 Fax: 33 1 69 41 83 69

Antoine BOUVIER
prof: CGC
1 rue Léon Migaux
F-91341 Massy cedex (FRANCE)
Tel: 33 1 64 47 36 72 Fax: 33 1 64 47 39 86 e-mail: francis. brvere@qm.cgg.com

GERMANY

* BERUFSVERBRAND DEUTSCHER GEOLOGEN, GEOPHYSIKER UND MINERALOGEN EV (BDG)
  President: Detlev Doherr
  Wissenschaftzentrum, Ahrstrasse 45
  D-5300 BONN 2 BAD GODESBERG (GERMANY)
  Tel: 49 228 30 22 63 Fax: 49 228 30 22 70

  (Please direct all communication for the German delegates to the BDG office in Bonn)

Detlev DOHERR
prof: Fachhochschule Offenburg
Badstr, 24
D-77652 Offenburg (GERMANY)
Tel: 49 781 205 281 Fax: 49 781 205 333
E-mail: doherr @ fh-offenburg. de
Internet: http: // www fh-offenburg. de /

Martin FLECKENSTEIN
prof: BEB Erdgas und Erdö/Gwbh
Riethorst 12
D-30659 Hannover (GERMANY)
Tel: 49 511 641 22 87
Fax: 49 511 641 123 08

XXX EFG Council Meeting. Maison de la Géologie. París. 1995.

GREECE

* ASSOCIATION of GREEK GEOLOGISTS (AGG)

President: Stavros Papastavrou
Didotou 26
10680 - ATHENS (GREECE)
Tel: 30 1 36 05 579 Fax: 30 1 36 05 436

Stavros PAPASTAVROU
prof: I.G.M.E., Dpt. Econ. Geol.
Messoghion 57
G-11527 ATHENS (GREECE)
Tel: 30 1 77 155 61 Fax: 30 1 77 522 11

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

IRELAND

* IRISH ASSOCIATION FOR ECONOMIC GEOLOGY (IAEG)

President: Kerr Anderson

Gareth Ll. JONES
prof: Conodate International Ltd.
Parkview House Beech Hill O. C., Clonskeagh
DUBLIN 4 (IRELAND)
Tel: 353 1 269 84 64 Fax: 353 1 260 16 35
e-mail: csa @ iol. ie Compuserve: 100302, 1100

Christian SCHAFFALITZKY
prof: CSA Ltd
Parkview House Beech Hill Office Campus
Clonskeagh
Dublin 4 (IRELAND)
Tel: 353 1 269 4077 Fax: 353 1 269 4424
e-mail: csa @ iol. ie Compuserve: 100302, 1100

ITALY

* CONSIGLIO NAZIONALE DEI GEOLOGI ITALIANI (CNGI)
  President: Pietro De Paola
  Via Vittoria Colonna, 40
  I-00193 ROMA (ITALY)
  Tel: 39 6 68 80 77 36/39 68 80 77 37 Fax: 39 6 68 80 77 42

* ASSOCIAZIONE NAZIONALE FRA I GEOLOGI ITALIANI (ANGI)
  President: Floriano Villa
  Via C. Battisti n.° 4
  I-20122 MILANO (ITALY)
  Tel: 39 2 551 28 42 Fax: 39 2 760 071 82

DELEGATES

Pietro DE PAOLA (ONG)
prof: Consiglio Nazionale dei Geologi (CNGI)
Via Vittoria Colonna, 40
I-00193 ROMA (ITALY)
Tel: 39 6 68 80 77 36 / 39 68 80 77 37
Fax: 39 6 68 80 77 42

(Please, note preference for correspondence to be faxed)
(De préférence la correspondance sera télécopiée)

Renzo ZIA
dom: Via Cavallotti, 18
I-55048 TORRE DEL LAGO PUCCINI LUCCA (ITALY)
Tel & Fax: 39 5 84 34 17 95

OBSERVERS

Vittorio ILICETO
prof: Consiglio Nazionale dei Geologi (CNGI)
Via Vittoria Colonna, 40
I-00193 ROMA (ITALY)
Tel: 39 6 68 80 77 36 / 39 68 80 77 37 Fax: 39 6 68 80 77 42

Floriano VILLA
prof: Associazione Nazionale fra i Geologi Italiani (ANGI)
Via C. Battisti n.° 4
I-20122 MILANO (ITALY)
Tel: 39 2 551 28 42 Fax: 39 2 76 00 71 82

Award of the tittle of European Geologist to Gerard Clement Past President of the EFG.

NETHERLANDS

* KONINKLIJK NEDERLANDS GEOLOGISH MIJNBOUWKUNDIG GENOOTSCHAP (KNGMG)

President: Salomon Kroonenberg
Postbus 157
2000 AD HAARLEM (HOLLAND)
Tel: 31 23 5300300 or 31 15 2786025
Fax: 31 23 535 16 14 or 31 15 278 11 89

Prof. Dr. Salomon B. KROONENBERG
Faculty of Mining & Petroleum Engineering
Delft University of Technology
Mijnbouwstraat, 120
2628 RX Delft (NETHERLAND)
Tel: 31 152 78 60 25
Fax: 31 152 78 11 89
e-mail s.b.kroonenberg@mp.tudelft.nl

A. B. Phil WESTERHOF
prof: Int. Inst. Aerospace Survey & Earth Sciences
Kanaalweg 3
NL-2628 EB DELFT (HOLLAND)
Tel: 31 15 748 847/748 809
Fax: 31 15 623 961
e-mail Westerhf@itcdelft.itc.nl

PORTUGAL

* ASSOCIAÇÃO PORTUGUESA DE GEÓLOGOS (APG)

President: Joachim Renato Araújo
Apartado 2109 P-1103 LISBOA (PORTUGAL)
Tel: 351 1 346 39 15
Fax: 351 1 342 46 09

Pedro Artur NOGUEIRA DE CARVALHO
prof: SOMINCOR, Mina Neves-Corvo
Sta. Bárbara dos Padrões
7780 CASTRO VERDE (PORTUGAL)
Tel: 351 86 68 000
Fax: 351 86 68 250/351 86 68 289

Joào M. M. TELO PACHECO
prof: GPEP
Rua Vale do Pereiro, 4
1200 Lisboa (PORTUGAL)
Tel: 351 1 388 35 41 Fax: 351 1 388 27 75
e-mail: JPP@ip.pt

SPAIN

* ASOCIACION DE GEOLOGOS ESPAÑOLES (AGE)

President: Luis Suárez Ordóñez
Avenida Reina Victoria, 8, 4.º B
E-28003 MADRID (SPAIN)
Tel: 34 1 553 24 03 Fax: 34 1 533 03 43

* ILUSTRE COLEGIO OFICIAL DE GEOLOGOS (ICOG)
President: Luis Suárez Ordóñez
Avenida Reina Victoria, 8, 4.º B
E-28003 MADRID (SPAIN)
Tel: 34 1 553 24 03
Fax: 34 1 533 03 43
e-mail: icog@telprof.eurociber.es
web: http://www.telprof.es/icog

Luis SUAREZ ORDOÑEZ
prof: RENFE, Jefe de Geotecnia
Estación de Chamartín, Caracola 22 Prolongación del Andén 1
Tel: 34 1 314 29 14
Fax: 34 1 323 20 93/94

Manuel REGUEIRO Y GONZÁLEZ-BARROS
prof: ITGE, Mineral Resources Division
Ríos Rosas, 23, 28003 Madrid
Tel. 34 1 349 57 78 Fax: 34 1 442 62 16
Dpt. Cristalografía y Mineralogía
Facultad de Ciencias Geológicas
Ciudad Universitaria
28040 MADRID (ESPAÑA)
Tel: 34 1 3944868 Fax: 34 1 3944872 e-mail eurgeomr@eucmax.sim.ucm.es

SWEDEN

* SVERIGES NATURVETAREFÖRBUND (SN)/GEOLOGSEKTIONEN
President: Christer Åkerman
Box 760, S-13124 NACKA (SWEDEN)
Tel: 46 8 466 24 80 Fax: 46 8 466 24 04

Christer ÅKERMAN
prof: Sveriges Geologiska Undersökning (SGU), Box 670,
S-75128 UPPSALA (SWEDEN)
Tel: 46 18 17 93 18 Fax: 46 18 17 92 10 e-mail: chaakc@sgu.se

Gunnar HULTQUIST
prof: Ålandsdal
S-740 20 BRUNNA (SWEDEN)
Tel: 46 18 39 21 38 Fax: 46 18 39 21 38 e-mail: 101 92 22 007@infral.se

UNITED KINGDOM

* GEOLOGICAL SOCIETY (GS)
President: Richard Hardman
Burlington House, Picadilly
LONDON W1V 0JU (UK)
Tel: 44 1 714 34 99 44 Fax: 44 1 714 39 89 75 http: //www.geolsoc.org.uk/

Richard A. FOX
prof: Land Search & Exploration Dept.
Ready Mixed Concrete (UK) Ltd., RMC House, High Street
FELTHAM, MIDDLESEX TW 13 4HA (UK)
Tel: 44 1 932 56 88 33 Telex: 935547 RMC G
Fax: 44 1 817 51 00 06

Richard SELLEY
prof: Department of Geology
Royal School of Mines. Imperial College
Prince consort Rd.
London SW7 2 BP (UNITED KINGDOM)
Tel: 44 1 7 159 46 425 Fax: 44 1 7 159 46 464

Gunnar Hultquists hands over the Presidential hammer and bell to Manuel Regueiro Haarlem. 1996. XXXI EFG Council Meeting.

OTHER COUNTRIES

OBSERVERS

BULGARIA

* Kiril ANGUELOV
prof: University of Mining & Geology
SOFIA 1100
BULGARIA/BULGARIA/BULGARIE
Tel: 359 26 25 81 (ext 377) Fax: 359 2 62 10 42 or 359 2 77 63 38

CANADA

* ASSOCIATION PROFESSIONNELLE DES GEOLOGUES ET DES GEOPHYSICIENS DU QUEBEC
2093, 7ème rue, Val-d'Or
Québec J9P 6P6 (CANADA)
Tel: 1 819 874 1293 Fax: 1 819 874 5264

Neville-Warren CLOUTIER
419 boul. Saint Joseph Ouest
Outremont, Québec H2V 2P3 (CANADA)
Tel: 1 514 279 0730 Fax: 1 514 279 7139 e-mail: nevillew@login.nct

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

Gordon D. WILLIAMS
Tel/Fax: (403) 247-3225 e-mail: williago@cuug.ab.ca

CZECH REPUBLIC

* CZECH ASSOCIATION OF ENGINEERING GEOLOGISTS (CAIG)
* CZECH ASSOCIATION OF HYDROGEOLOGISTS (CAH)

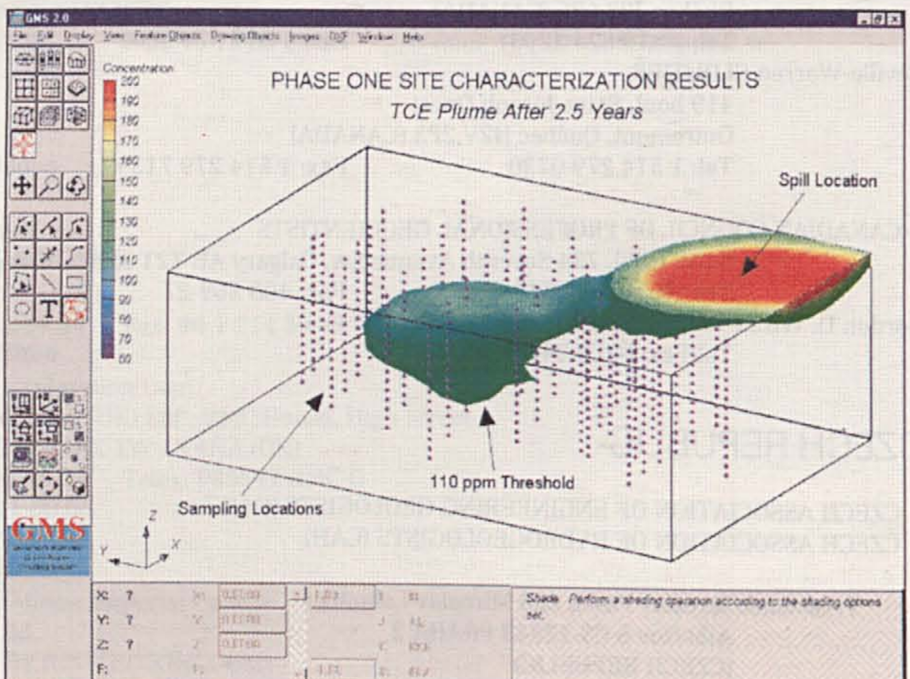
Presidents: Jaroslav Pasek and Miroslav Lobontka
Albertov 6 CS-12843 PRAHA 2
(CZECH REPUBLIC)
Tel: 42 2 29 75 41

Jaroslav PASEK
prof: Department of Hydrogeology & Engineering Geology
Faculty of Sciences, Charles university, Albertov 6
CS-12843 PRAHA 2 (CZECH REPUBLIC)
Tel: 42 2 29 75 41

DENMARK

Svend STOUGE
prof.: Dansk Geologisk Forenig (Danish Geological Society)
Øster Volgade 5-7
1350 København (DENMARK)
Tel: 45 33 13 50 01 Fax: (Danish Geological Society) 45 31 19 68 68
e-mail: st010@mmdgu.dgu.dk

Marianne VASARD NIELSEN
prof: The Danish Geological Society
Dansk Geologisk Forening
Elstedvaenge 27
8520 Lystrup (DENMARK)
Tel: 45 86 22 24 33 Fax: 45 86 74 24 33 e-mail: mvn.pka@po.ia.dk



HUNGARY

* MAGYARHONI FOLDTANI TARSULAT (MFT) (Hungarian Geological Society)
  President: István Bérczi
  prof: Universytet Jagiellonski
  Fö u. 68
  1027 Budapest (HUNGARY)
  Tel: 36 1 201 91 29 Fax: 36 1 156 12 15

István BÉRCZI
prof: MOL, Exploration and production Division
Batthyony út 45
H- 1039 Budapest (HUNGARY)
Tel: 36 1 180 0122 Fax: 36 1 180 2145 e-mail: iberczi@molkummi.datanet.hu

POLAND

* POLSKIE TOWARZYSTWO GEOLOGICZNE
  President: Andrzej Slaczka
  prof: Universytet Jagiellonski
  Jagiellonian University, Institut of Geological Sciences
  Oleandry 2a
  30-063 Kraków (POLAND)
  Tel/Fax: 48 12 33 22 70 e-mail: slaczka@ing.uj.edu.pl

RUSSIA

R. VOLKOV: Executive Secretary
USSR National Comittee of Geologists
Pyzhevky 7
109017 Moscow Zh - 17 (RUSSIA)
Tel: 7 095 231 75 00 Fax: 7 095 230 21 79 / 7 059 233 55 90

SLOVAKIA

* UNION OF SLOVAKIAN GEOLOGICAL ASSOCIATIONS (UGAS)
  President: Rudolf Ondrasik

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

SWITZERLAND

* SWISS GROUP OF ENGINEERING GEOLOGISTS (SGEG)
  President: Peter Haldimann
  Bühlstrasse 33
  CH-8700 Küsnacht (SWITZERLAND)
  Tel: + 41 1 341 25 00 Fax: + 41 1 341 25 70

EFG delegate: Johannes van STUIJVENBERG
prof: Umweltgeologe
Berstrasse 34
3072 OSTERMUNDIGEN (SWITZERLAND)
Tel: 41 31 931 16 57 Fax: 41 31 931 34 79

* SWISS SOCIETY OF HYDROGEOLOGY (SSH)
President: Federico Matousek
Matousek, Baumann & Niggli AG
Mäderstrasse 8
CH-5401 Baden (SWITZERLAND)
Tel: 41 56 222 09 45 Fax: 41 56 221 50 45

EFG delegate: Johannes van STUIJVENBERG
prof: Umweltgeologe
Berstrasse 34
3072 OSTERMUNDIGEN (SWITZERLAND)
Tel: 41 31 931 16 57 Fax: 41 31 931 34 79

Other contact in Switzerland
Jean F. SCHNEIDER
prof: ETH Hönggerberg
8093 ZÜRICH (SWITZERLAND)
Tel: 41 1 633 25 21 / 41 1 633 27 42 (secretariat) Fax: 41 1 633 11 08

USA

* AMERICAN INSTITUTE OF PROFESSIONAL GEOLOGISTS (AIPG)
National headquarters
7828 Vance Drive, Suite 103,
Arvada, Colorado 80003
Tel: 1 303 431 0831 Fax: 1 303 431 1332 e-mail: aipg@ix.netcom.com

Russell G. SLAYBACK
prof: Leggette Brashears Graham Inc
dom: 4 Increase Lane
Greens farms. CT 06436
Tel: 1 203 452 3100 Fax: 1 203 452 3111

William KNIGHT
prof: AIPG
Tel: 1 303 431 0831 Fax: 1 303 431 13 32
dom: 9721 West 87th Avenue
Arvada, Colorado 80005 (USA)
Tel: 1 303 424 4063

Robert FONT
prof: President, Geoscience data Management
dom: P/O Box 795151
Dallas Texas USA 75379
Tel et Fax: 1 214 516 47 25 e-mail: 72263.1036@compuservc.com

PARIS OFFICE:

Jean-Claude VIDAL (Assistant-Secretary)
prof: UFG, Maison de la Géologie
77 rue Claude Bernard
F-75005 PARIS (FRANCE/FRANCIA)
Tel: 33 1 47 07 91 95 (tuesday, wenesday, thursday 9 h-17 h GMT)
Fax: 33 1 47 07 91 93

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

Dr. Jose Carvalho. Member
Sondageus E Fundacôes 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
Blackhall Clane,
co Kildare (IRELAND)
Tel: 353 45 68868 Fax: 353 45 68934

Richard A. Fox
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
prof: Instituto Tecnológico Geominero de España
C/ Ríos Rosas, n.º 23
28003 Madrid (SPAIN)
Tel: 34 1 3495788 Fax: 34 1 4426216

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

MEMBER ORGANIZATIONS OF THE EFG

Member Countries and Organizations		Date of Inauguration	Logo
Belgium and Luxembourg			
UBLG	Union Belgo-Luxembourgeoise des Géologues, 13 rue Jenner, B-1040 Bruxelles, Belgium (Belgique)	1980	
Federal Republic of Germany			
BDG	Bundesverband Deutscher Geologen, Ahrstrasse 45, 5300 Bonn 2, FRG (Alemagne)	1984	
Finland			
FUEP	Finnish Union of Environmental Professionals Akavatalo, Rautatieläisenkatu 6, SF-00520 Helsinki, Finland (Finlande)	1995	FUEP
France			
UFG	Union Française des Géologues, Maison de la Géologie, 77 rue Claude-Bernard, F-75005 Paris, France	1965	
Greece			
AGG	Association of Greek Geologists Didotov 26, 10680 Athens (Greece)	1965	AGG
Ireland			
IAEG	Irish Association for Economic Geologists, c/o Geological Survey of Ireland, Beggars Bush, Dublin, Republic of Ireland (Irlande)	1973	
Italy			
ANGI	Associazione Nazionale fra i Geologi Italiani, Via C. Battisa no 4, I-20122 Milano, Italy (Italie)	1948	ANGI
CNGI	Consiglio Nazionale dei Geologi, 22 via della Conciliazione, I-00193 Roma, Italy (Italie)	1966	CNGI
Netherlands			
KNGMG	Royal Geological and Mining Society of the Netherlands Postbus 157, 2000 AD HAARLEM (Netherlands)	1912	
Portugal			
APG	Associaçao Portuguesa de Geologos, Apartado 2109, P-1103 Lisboa cedex, Portugal	1976	
Spain			
AGE	Asociación de Geólogos Españoles, Reina Victoria, 8-4.º B, 28003 Madrid (Spain)	1965	AGE
ICOG	Ilustre Colegio Oficial de Geólogos Reina Victoria, 8-4.º B, 28003 Madrid (Spain)	1979	
Sweden			
SN	Sveriges Naturvetareforbund (Geology Section), Box 760, S-13124 Nacka, Sweden (Suède)	1971	
United Kingdom			
GS	Geological Society, Burlington House, Piccadilly, London WIV OJU, UK (Angleterre)	1807	

EUROTITLES

by EurGeol José Manuel Baltuille[1] and EurGeol Manuel Regueiro[2]
[1]Chairman of the Spanish Vetting Committee, member of the EFG Registration Committee and past-President of the ICOG
[2]President of the EFG, member of the Spanish Vetting Committee and Secretary of the ICOG

Abstract

The authors review and compare the characteristics, advantages and requisites of different professional eurotitles for several professions and the current situation of this system of professional certification now developing in Europe.

Introduction

The Spanish Vetting Committee (Comisión Nacional de Evaluación, CNE) in Art.2 of its Statutes, aproved by the EFG Council, states:

"The CNE represents the only national body in charge of the reception, study and evaluation of the applications to obtain the title of European Geologist from the Registration Committe of the European Geologists of the European Federation of Geologists (EFG)."

thus, it has recently organised in Madrid, a roundtable on Eurotitlesin order to know the opinion and experience of other professional groups and the Spanish Administration about this type of titles and their future.

The subject is partially connected with the problem of free movement of professional within the EU, defined by the European Directive 89/48 of 21/12/1988.

This paper summarises the main results of the roundtable.

The European Chemist (EurChem)

The European Communities Chemistry Council (ECCC), representing 200,000 professionals, defined in 1992 the title of European Chemist (EurChem) as a "honorific title conferring those who hold it a professional prestige within the institutions and allows a de facto recognition of the corresponding professional qualification."

The title is the best presentation card for a chemist in the international environment and will facilitate his movement within the EU member states.

In fact several multinational companies are already recommending their chemists to apply for the title of EurChem.

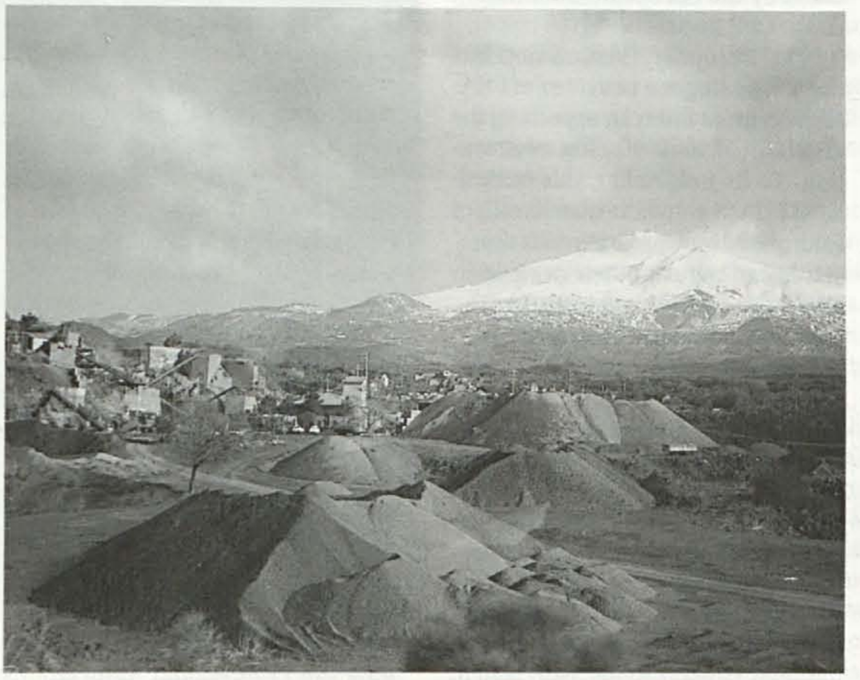
In order to obtain the title the following requisites are needed:

- To be a member of the any European institution incorporated to the Council of Chemist of the EU.
- A minimum of 8 years between academic studies and professional experience. Such experience should be validated by referees.
- Possessing one of the academic titles of "Category A" (those allowing a direct access to doctorate).

The current number of EurChem in Europe are about 300, of those 90 are Spanish. Average professional experience of the applications received is about 15 years.

The European Engineer (EurIng)

The institution co-ordinating engineers s.l. in Europe in the European Federation of National Associations of Engineers (FEANI), an institution created in 1957 which represents 1,500,000 engineers from 27 European countries, both of long



Cantera de basalto, ETNA.

COMPARISON BETWEEN THE DIFFERENT EUROTITLES

	EurGeol	EurChem	EurIng	EurPhys	EurBiol
Organisation and Headquarters	European Federation of Geologists (EFG) Paris	European Communities Chemistry Council (ECCC) London	Fédération Européene d'Associations Nationales d'Ingenieurs (FEANI) Paris	European Register of Physicists (ERP) Geneve	European Communities Biologists Association (ECBA) Namur
Represented professionals	65 000	200 000	1 500 000	75 000	100 000
Geographical Environment	All European countries	All EU countries	All European countries	All European countries	All EU countries
Age of the title	1994	1992	1987	1995	1994
Total n° of Eurotitles	110	300	20 000	100	76
Spanish Eurotitles	6	90	1 200	1	6
Accredited experience (years)	8	8	7	7	8
Validity period (years)	3	5	5	5	5
European Evaluation organisms	Registration Committee	European Chemists Registration Board (ECRB)	European Monitoring Committee (EMC)	European Regional Monitoring Committee (ERMC)	European Biologist Registration Committee (EBRC)
National Vetting Committees	National Vetting Commission	Evaluation Jury	National Accreditation Committee	National Vetting Committee	National Vetting Committee

cycle and short cycle (5 and 3 years respectively).

The title of European Engineer (EurIng) was established by FEANI for those member engineers who:

- Studied a minimum of 3 or 5 years (short cycle engineer or long cycle engineer) in one of the Universities approved by FEANI.
- Possesses a total of 7 years adding academic education and professional experience, having a minimum of 2 years of engineering professional experience.

The title has been accepted very successfully in Nordic and Anglo-Saxon countries and less enthusiastically in Mediterranean countries.

The interest of the EU for this title is clearly reflected in the resolution taken by the European Commission (D.O . CEE 26/09/1994) :

"The European Commission has been following the activities of FEANI with great interest, especially the creation of their EurIng registration. To its judgement, this initiative of FEANI constitutes an excellent example of how professionals themselves can regulate their profession at an european level, and can be used as a model for other professional groups of the technical and scientific sector such as the chemists and the physicists.

The registration of FEANI is based on the diversity of existing engineering educations in the Community and can be adapted to the modifications introduced at anational level. The applications procedures are also a good example of howEuropean and national organizations can benefit from their experience.

Although the EurIng title can not be consider as a title according to letter a) ofarticle 1 of Directive 89/ 48/ CEE of the Council, December 21 1988, relativeto a a general system of recognition of higher education titles sanctioningprofessional educations of a minimal duration of three years, it can be an aid to the national competent authorities when examiningapplications for recognition of conformity according to article 3 of the mentioned Directive. The inscription in FEANI 's registration, certifies that, with independence of the duration and content of their basic formation, the engineer has certain level of professional competence, endorsed by their national and europeans colleagues. Taking into consideration thatthe jurisprudence of the Tribunal of Justice *compells the member State to consider the professional experience adquired after obtainingthe title* when recognising it, the Commission considers that, *under normal circumstances, those engineers that have obtaining the EurIng title should not be subjected to a period of adaptation or to an examination,mentioned in article 4 of Directive 89/ 48/ CEE.*"

The EurIng register has already admitted 20,000 engineers, of which 1,200 are Spanish.

The European Biologist (EurBiol)

In 1994 the European Communities Biologists Association (ECBA), grouping the Professional Associations of 15 member states and about 100,000 biologists, approves the title of European Biologists (EurBiol) which is implemented next year.

Requisites to fulfil by biologists requesting the title are:

- Belonging to one of the member Associations of the Association of Biologists of the European Communities.
- A minimum of 8 years between academic formation and professional experience according to the following formula:

3U + 2 (U and/or T and/or E) + 3E

U = University studies
T = Specialisation
E = Professional experience

Although the title has been enforced a short period, there are already 76 EurBiol in the EU, of these 6 are Spanish.

The European Physicist(EurPhys)

The Title of European Physicist has been very recently created by the European Society of Physicist, which groups around 75,000 physicists.

The title is very recent so in 1995, 100 titles has been awarded but only one Spanish.

The European Geologist (EurGeol)

The Title of European Geologist was defined by the Council of the EFG in 1988, but was officially launched in

1994 when the first 9 titles were awarded.

The European Federation of Geologists, is an umbrella organisation representing 13countries andaround 65,000 geologists.

The title has been defined as *"a professional title that represents a guarantee of quality of service in the different specialities of the practice of Geology"*.

In order to obtain the title the following EFG compulsory regulations should be fulfille:

• Possessing a Geology title legally recognised in the country of origin.

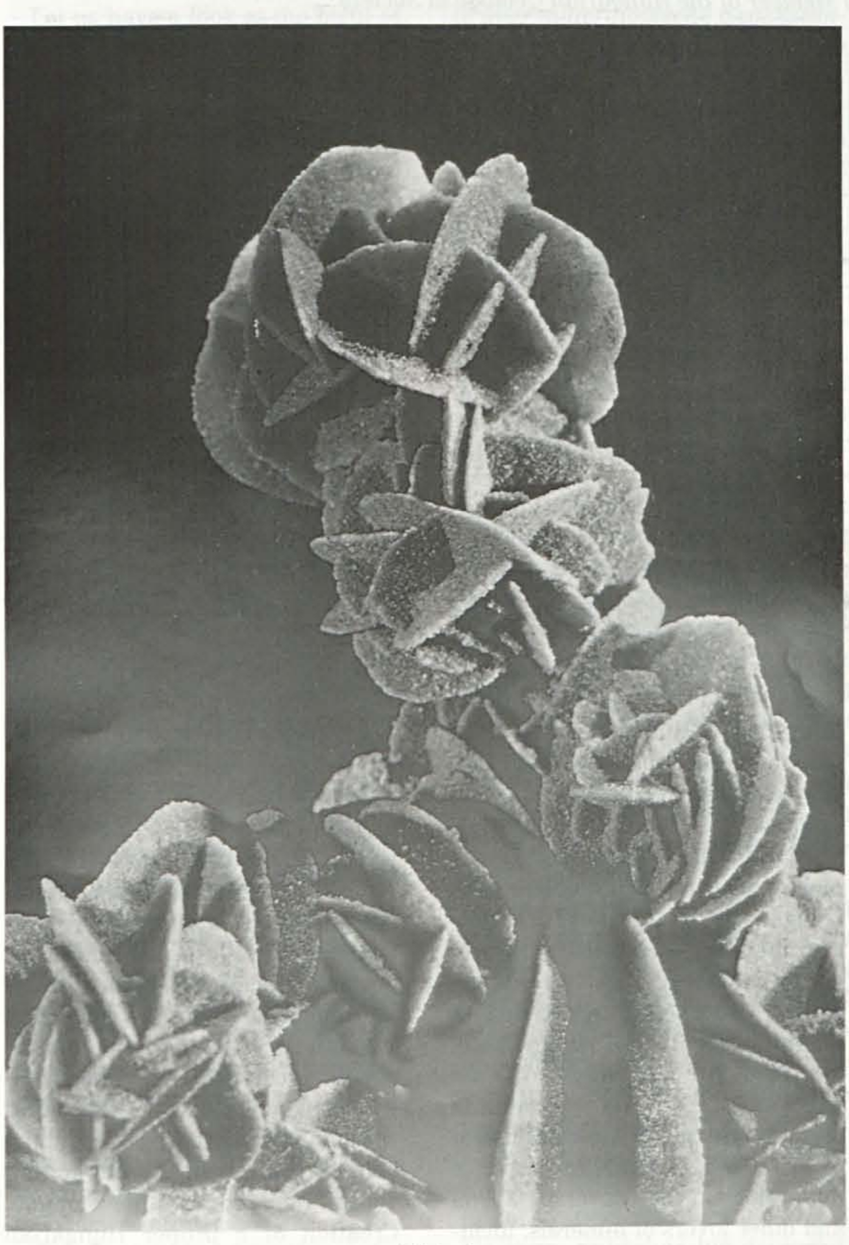
• A minimum of 8 years between academic knowledge and professional experience, which should be fulfilled in the following way :

1. A minimum of 4 years of academic studies in geology

2. Prove 4 years of professional experience (or 1 of specialisation and 3 of professional experience).

3. Those professionals from a EFG country member where the career of geology is finished in 3 years, they will be requested 6 years of proved professional experience.

• To be an activemember of the Association



Rosa del desierto.

• To pay the title fees.

• Fulfil the Code of Professional Conduct of the EFG.

Currently the total number of EurGeol is about 110, of which 6 are Spanish.

Conclusions

From the aforesaid it can be deducted that:

1. Academic titles do not imply professional competence.

To this regard the European Communities Biologists Association (ECBA) considers that an academic title *implies the acquisition of the basic knowledge required in the corresponding science,* whereas the professional title *implies that the bearer has completed a period of professional experience, during which he has used the theoretical knowledge acquired in subjects related with that science.*

In summary, the academic formation is based in the acquisition of specific knowledge, whereas the professional formation implies experience, ability and competence in solving the different practical problems faced.

2.-It is necessary to develop the possibilities existing under the resolution of the European Commission (DO CEE 26/09/94), in order to obtain the same recognition for other pan European professional organisations (EFG, ECCC, ECBA) as that obtained by FEANI.

3.-The EFG should design, together with other geoscientists, a common strategy towards the industrial world and the various administrations, in order to publicise and enforce everything related to Eurotitles.

4.-In as much as we are able to interest the private companies about the advantages and need of the Eurotitles , these will reach an adequate level of recognition and will be taken into account by companies when recruiting staffor allow a true free movement of professionals in the EU by national administrations. ■

SCIENTIFIC SOCIETIES IN THE EIGHTEENTH AND EARLY NINETEENTH CENTURIES IN HUNGARY

by Dr. Gabor CSIKY
Honorary Member of the Hungarian Geological Society

With the end of the Turkish Wars in 1699, Hungary became a part of the Austrian Empire. The Hungarian reform movement, starting in 1825 was determined by this political/historical fact and as such strongly influenced the political, economic, and cultural life of the country. Fundamental principles leading to the renewal of the society were proclaimed: rescission of the feudal privileges, acceleration of bourgeois development and, as a consequence of national independence, industrialisation. Foundation of nation-wide institutions, such as the Society for the Protection of the National Industry (Iparvedegylet), and a steamship line (Dunagözhajozasi Tarsasag), and public projects such as regulation of river ways, the construction of the first permanent bridge over the Danube connecting Buda to Pest, indicated the progress the economy. In culture, the national education came into prominence. National Institutions such as the Hungarian Academy of Sciences (1825, the Kisfaludy Society of Literature (Kisfaludy Tarsasag, 1836) and the National Theatre (1837) were established. The first Congress of the Hungarian Physicians and Naturalists (Magyar Orvosok es Termeszetvizsgalok Vandorgyülese, 1840), the Hungarian Society of Natural Sciences (Magyar Termeszettudomanyi Tarsulat, 1841), and finally, the Hungarian Geological Society (Magyarhoni Földtani Tarsulat, 1848) were launched in the spirit of this cultural movement.

Ambitions to organise scientific societies, however, appeared as early as the eighteenth century. In the age of "Enlightenment" many scientists became aware of the advantage of organising societies, compared to working individually. A number of Hungarian scientists, who had been educated abroad, gained experience in the scientific societies of western countries. These countries developed under more peaceful conditions than Hungary did in the 16-17th centuries, therefore their scientific movements, and those f Germany in particular, had a significant impact on scientific activity in Hungary. Note, that the first president of the «Societät für die gesammte Mineralogie zu Jena», established in 1797 by J. G. Lenz, professor of mineralogy at the University f Jena and other lovers of minerals, including J. W. Goethe, was a Hungarian aristocrat, Count Domokos Teleki from Transylvania.

The intention and ambition of Hungarian physicians and naturalists to establish a scientific society emerged at the beginning of the eighteenth century, together with the idea of the foundation of an academy of sciences. Attempts of this kind, however, remained only plans, or aborted in the short run. A typical initiative was that of Pal Kitaibel, an outstanding naturalist who proposed the establishment of a "Hungarian Society of Natural Economic and Medical Sciences". The proposal (Plan für eine "Ungarische Gesellschaft ür Naturkunde, Ökonomie und Medizin») had been submitted to the government in Vienna in 1802, but was rejected. Due to the negativity of the Court and the Hungarian aristocracy, all these attempts were predestined to failure. An additional obstacle was the lack of an adequate Hungarian scientific language. The official language of ceremony and science was Latin. The scientists could debate with one another in Latin or in German, but could not communicate with the public that spoke only its mother tongue. Creation of a proper Hungarian scientific language was necessary for the renewal of national self-determination and of the Hungarian language itself.

These were achieved during the reform period. Count Istvan Szechenyi founded the Society of Hungarian Scientists (Magyar Tudos Tarsasag) in 1825, the predecessor of the Academy of Sciences. Having been accepted in literature, the Hungarian language now took its position in the world of science as well. By raising the idea of independence and bourgeois development with a comprehensive national programme, the reform movement created a favourable climate to realise Kitaibel's proposal.

Let us have a look at the birth of mineralogy and geology in eighteenth century Hungary. The century of "Enlightenment" was the century of natural sciences as well. Development of capitalist production created an active demand for indispensable mineral resources, the exploration of which required the solution of several technical and scientific problems. This challenge was addressed to the disciplines of mining and metallurgy, pioneering the technical and scientific development. The first institutes of higher education on technical disciplines were founded in this field. Subjects like mechanics, geodesy, physics, chemistry and mineralogy were taught here at a higher level and with laboratory training. The Mining Academy of Selmecbanya (Banska Stiavnica, Slovaia), founded by Queen Maria Theresia in 1763, played an outstanding role in the development of natural sciences in Hungary. It was the starting point of the development of Hungarian geology (at that time mainly mineralogy).

The first department of the Selmecbanya Mining Academy was the chair of metallurgy, chemistry, and mineralogy. It was the first place in Hungary, where mineralogy and chemistry were in the curriculum. In this way, these subjects gained independence from mining and metallurgy, respectively, as their auxiliary sciences.

The first works of the Hungarian geological literature were published in the same period. Several scientists, naturalists or mineralogists visited mines in the country, collecting minerals, rocks, and fossils, to satisfy the practical and scientific requirements of mining and education. Based on their observations, knowledge, and experience, they wrote books on descriptive, topographical mineralogy including:

"Mineralogia Magni Principatus Transilvaniae (Claudiopoli 1767)" by Professor Janos Fridvaldszky (1730-1784); *"Beytrag zur Mineralgeschichte von Siebenbürgen* (Nürnberg 1780)" by J. E. Fichtel (1732-1795), ministerial counsellor; *"Briefe über mineralogische Gegenstände auf seiner Reise durch das Temeswarer Banat, Siebenbürgen, Ober- und Nieder-Ungarn* (Frankfurt u. Leipzig 1774)" by Ignac Born (1742-!1791), the eminent scientist of the time; *"Mineralgeschichte der Goldbergwerke in dem Vöröspataker Gebirge bei Abrudbanya* (Leipzig 1789)" by F. I. Müller (1742-1825), mining engineer, discoverer of the element tellurium, chief of mining in Transylvania; *"Magyar Mineralogia azaz a kövek s ertzek tudomanya* (Kolozsvar 1786)" by Ferenc Benko (1745-1816), professor of natural history; *"Magyar Mineralogia avagy az Asvanyokrol szolo Tudomany* (Komarom 191)" by Samuel Zay, a physician; *"Versuch eines topographisch-mineralogischen Handbuches von Ungarn* (Oedenburg 1817)" by Professor Andras Kereszteły Zipser (1783-1864); *"Ungarns Mineralreich orycto-geognostisch un topographisch dargestellt* (Pest 1820)" by Jozsef Jonas (1787-1821), mineralogist.

These contributions mark the first stage (from 1767 to 1825) of the history of mineralogy and geology in Hungary. The science of geology in Europe developed as a respectable discipline from A. Werner's geognosy in the first half of the nineteenth century. The first geological society was established in 1807 in England, where W. Smith, the «father of stratigraphy», being ahead of his time, publishes his geological map of England and Wales in 1815. The struggle between plutonists and neptunists abated, and Ch. Lyell's «Principles of Geology» (1830-1833) championed the doctrine of uniformitarianism, which gradually displaced Cuvier's catastrophism. The second geological society, the «Société Géologique de France» was established in 1830 in Paris, taking the Geological Society of London as a model.

As mentioned earlier, the Hungarian Academy of Sciences was established by Count I. Szechenyi in 1825. At the beginning it was rather a philosophical society, quite like the model of the European academies, the Académie Française, founded in 1635. Though the Section of Mathematics and Natural Sciences was formed in 1832, it did not include any professional natural scientist. At last, in the proposal of Ferenc Bene, professor of medicine, the Congress of the Hungarian Physicians and Naturalists was formed in 1840. His motin was stimulated, on one hand by social demand, and by foreign examples on the other. The Congress of German Physicians and Naturalists had been organised in 1822 by L. Oken, and nine years later a similar movement was launched in England. The Hungarian ne was the third of this kind in Europe.

The first Assembly of the Congress of Hungarian Physicians and Naturalists was held in Pest, on the 28th of May, 1841. The Assembly adopted the proposal of Pal Bugat, professor of medicine, aiming at the foundation of the Hungarian Society of Natural Sciences.

Natural sciences started to attract more and more attention and gained popularity. By that time the Mining Academy of Selmecbanya, well-known all over Europe, had released generations of mining engineers and geologists. It provided the personal background to establish the third geological society of Europe in January 1848, a couple of months earlier than the foundation of the German Geological Society. ■

REGULATION OF PROFESSIONAL GEOLOGISTS AND MUTUAL RECOGNITION OF QUALIFICATONS DIRECTIVE OF THE EUROPEAN UNION

by EurGeol Richard Fox

1. Introduction

The single common market within the European Community was envisaged in the Treaty of Rome which established the EEC in 1957 (DTI 1992). The completion of the Single Market as "an area without internal frontiers in which the free movement of goods, persons, services and capital is ensured", was finalised in 1992.

Directive 89/48/EEC was the First General Directive on the Mutual Recognition of Professional Qualifications, and it was programmed to be implemented by the E.U. States on the 4th January 1991. However, information available from the Authorities indicated that only the Irish Republic, UK, Denmark, Portugal, Spain, Italy and Luxembourg had put regulations in place by the end of August 1992. France and Germany are implementing profession by profession; in the case of Germany, by Region (ie. Land Authority) also.

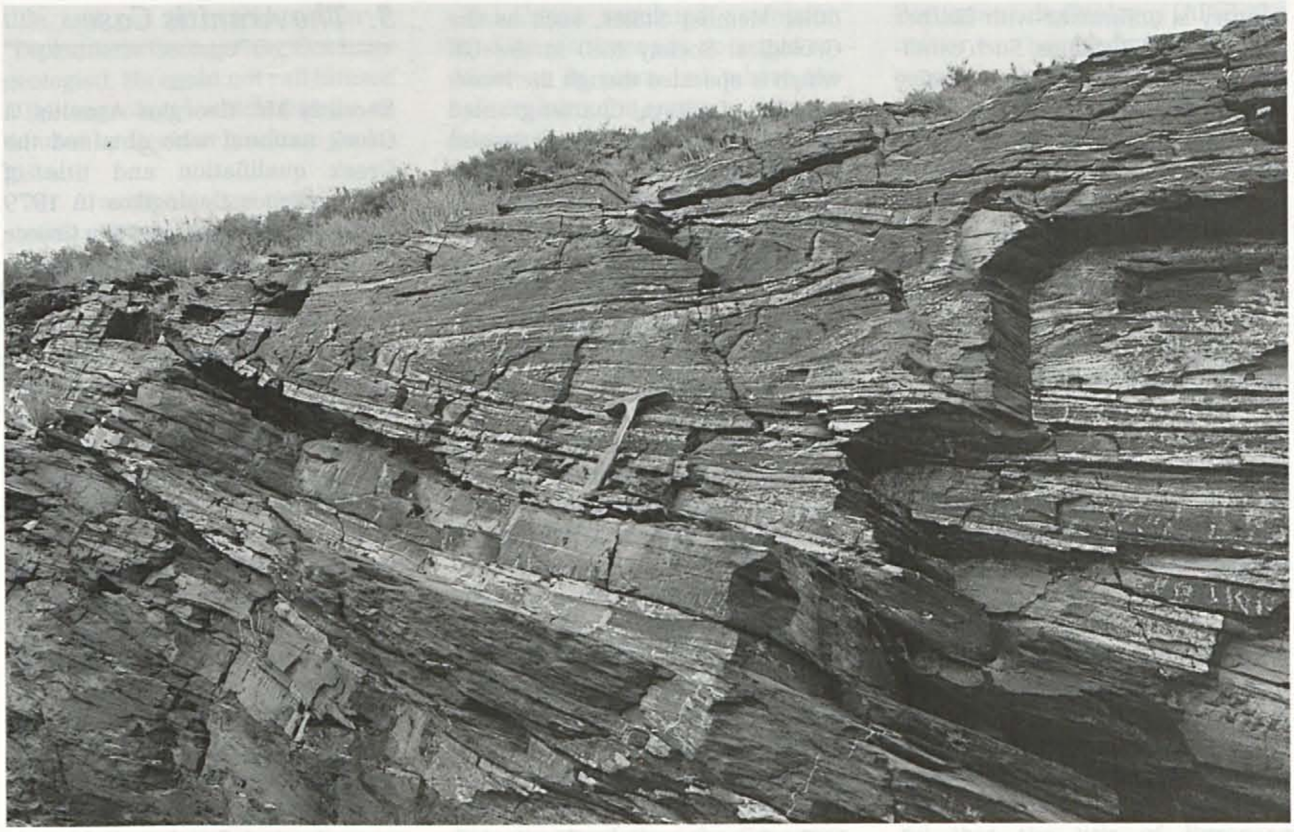
These safeguards are briefly as follows

(a) If the length of education and training of a professional geologist from their Member State of origin is shorter than that required in the Country to which they wish to move, then the geologist may be required to produce evidence of up to 4 years experience as a qualified geologist in another EU Country in addition to their education and training. This ensures that any short-fall in the length of training is made good by professional experience, thus bringing the person concerned up to an equivalent level of expertise.

(b) If there is a substantial difference in the content of education and training of the geologist between the two EU States, then in those cases the incoming geologist may be required to undergo a procedure designed to ensure that they have acquired the extra knowledge needed to be a fully effective geologist. This might comprise an examination (known as an "aptitude" test) or a period of assessed supervised practice (known as the "adaption" period) not exceeding 3 years in the country concerned.

For a professional geologist from one Member state to have their qualifications recognised in another Member state where the profession is *regulated*, it is necessary to first consult the list of designated authorities (ie. The bodies responsible for receiving applications to practice in other Member States) where it is planned to seek work.

In the UK the Department of Trade and Industry (DTI) is responsible for ensuring the consistent application of the Directive across a wide range of professionals, and under the European Communities Act 1972 (S.I.1991 No.824) the regulations of the Directive have been implemented, with the Geological Society appointed as the `designated` professional body to regulate professional geologists. It is, nevertheless, the responsibility of the Geological Society to consider appli-



cations and interpret the regulations on behalf of the DTI.

In the last 4 years there have been a considerable number of successful applications from geologists in Member States of Continental Europe that have applied to the Geological Society for recognition of their qualifications, and have become Fellows and Chartered Geologists of the Society, enabling them to practice in the U.K.

In Spain there have also been some successful acceptances of applications to the Ilustre Colegio de Geologos from geologists outside that Country to enable them to comply with the regulatory arrangements in Spain.

2. Progress on Implementation of the Directive

There are a variety of ways in which professional geologists may wish to work in other Member States. They may wish to *seek employment* elsewhere in the Community; they may wish to set up business themselves in another State, or they may wish to *offer services* to a number of different States from their home base. In each of these cases the Directive should help by enabling their professional qualifications to be recognised elsewhere in the Community.

At the present time it is accepted that the system of mutual recognition of qualifications for professional and academic purposes within the EU is far from complete. Although the objective in securing the freedom of all EU citizens to work, to offer services and to study in all EU Member States remains a key one, progress towards this goal has been recorded as slow (DTI Pers.Comm.1994). Currently the European Commission are attempting to identify the reasons for this slow progress and are looking for suggestions from the Member States on how these difficulties may be overcome.

In the professional sphere, any geologist obtaining one or more qualifications in a particular country entitling them to practise a specific profession in that (host) country can, without difficulty, use those qualifications to enter that profession in the country concerned. However, any geologist wishing to enter the profession in another (migrant) country will in most cases find themselves in one of two situations, as follows:-

(i) De Jure professional recognition

In this case authorisation to work in a specific profession in a particular country is, by right, legally subject to the possession of one or more relevant diplomas issued in that country. In this case, the host country assesses how far qualifications obtained abroad correspond to those required at home and, if they are not considered equivalent, the candidate is required to repeat all or part of his/her training.

(ii) De facto professional recognition

In this case, the actual situation is that the geological profession is not regulated in the host country. The person concerned faces a different problem, namely that the host country is unfamiliar with his/her "foreign" qualifications. Such candidates are at a disadvantage relative to their competitors who have been trained in the host country. This handicap can only be reduced by improving information on exiting national training to set the basis in each Member State for the professional recognition of the various diplomas awarded throughout the Community which qualify the holder for the same profession.

In Italy where geologists are licensed through the Ordine Nazionale dei Geologi (ONGI), some of the problems of the Directive were highlighted at a Conference in Pesaro, Italy in 1993 (Cedeschini). The regulation of geologists, as with other professionals in Italy, is carried out by the Ordine, and the latter is classified as a professional organisation with genuine "public body" status, vested with real powers, but also restricted in their aims and initiatives which it can impose.

This is in contrast to the other geological professional associations in other Member States, such as the Geological Society (GS) in the UK which is operated though the incorporation of a Royal Charter granted in 1824, the Union Francoise Geologues (UFG) in France which is authorised to practice through the French Home Ministry, and the Irish Association for Economic Geology (IAEG) in Ireland is administered by Trustees of the Association.

The Italian "Ordine" together with the Spanish, Illustre Colegio, operate within the legal frameworks set down by their Governments and are concerned that any freedom of movement according to the Directive on Mutual Recognition must take into account the legal and administrative instruments that exist in those countries. There is, therefore, a continuing debate relating to the conflicts between Community Directives on the one hand and the provisions contained in the national laws of individual Member States which could cause difficulties in the free movement of geologists from Member States outside Italy (Cedeschini 1993).

3. The Aranitis Case

Recently Mr. Georgios Aranitis, a Greek national who obtained the Greek qualifiation and title of Ptichiouschos Geologikos in 1979 and worked as a geologist in Greece until 1990, when he went to work in Germany (Clarke 1995). He found that his work permit classified him as "assistant non-qualified geologist", and so he requested recognition of his Greek qualification under Directive 89/48/EEC.

The Senatsverwaltung ruled that Mr. Aranitis could not invoke Directive 89/48 because it covered only regulated professions and geology was not regulated by law. Furthermore, Mr. Aranitis`s Greek degree in geology was not comparable with the German degree, which required the submission of a dissertation, and there was, in any case, no provision under the Directive for Mr. Aranitis to make up a qualitative academic deficit through his professional experience.

Thus, he could only use his Greek

title and put in brackets after it "Diplomierte Geologe" (ie. Graduate geologist). He could not call himself "Diplomgeologe" which was the title used by German graduate geologists.

Mr. Aranitis objected to the ruling stating:- Article 7(1) of the Directive, requiring Member States to allow access to their professional title for appropriately qualified migrants, should have direct effect since the Directive had not been implemented in Germany in respect of geologists. Furthermore, the profession was regulated "de facto" because virtually all Germans occupying the type of post he wanted were "Diplomgeologe" to the extent that in practice there was no scope for exercising the profession without that title.

Finally, the Verwaltungsgericht rejected Mr. Aranitis objection on the grounds that:-

- Aranitis's (dissertationsless) degree was not comparable to a German degree,
- it was not proved that geology was a regulated profession,
- the Directive was not directly applicable,
- the title "Diplomgeologe" was not a professional title, as described in Article 7(1) of the Directive but an academic title as described in Article 7(2). Mr. Aranitis was only entitled to use it in the Greek form.

Mr. Aranitis appealed against this decision to the Obervaltungsgericht (Court of Appeal) in Germany and the latter stated the following:-

- The Directive might have direct effect in respect of geologists if they were regulated,
- nonetheless, there appeared to be no regulation in Germany corresponding to that described in Article 1(d) of the Directive concerning the profession of geologists,
- the description of professional title in Article 7(1) might relate to the academic title if there was no other professional title and if only applicants with the academic title exercised the profession.

The European Court of Justice (ECJ) in Luxembourg was asked to rule on two matters -

(a) Can a regulated profession exist where there are no actual regulations in place but where the only training for access to the profession consists of at least four and a half years higher education leading to a qualification, in consequence of which all professionals in the field and all applicants on the job market are those with that qualification?

(b) If the answer to (a) is affirmative, then should the academic title Diplom- (here Geologe) be considered to be also the professional title described in Article 7(1) where there is no other professional or protected title in existence for the profession?

On the 26th October 1995 the ECJ ruled on the Aranitis case (Case C-164(94), and after careful consideration of the types of "Regulation" operating in the Country, it was concluded that the geological profession is not regulated according to the situations covered by the Directive, and thus the Case was dismissed.

4. Other Cases

In early 1995 the Union Belgo-Luxembourgeoise des Geologues (UBLG) based in Brussels reported that one of their members who was a European Geologist (P. Lobi) had seen the Title of European Geologist as a way of achieving cross-border acceptance of his qualifications and enabling him to sign official geological documents in different European Countries especially in the U.K. and Portugal where his Company, the Spadel Group, operates water-bottling factories.

Some difficulties arose where 2 technical reports (geophysics, drilling investigations and pumping tests) relating to "natural mineral water" required an official signature before being sent to the Instituto Geologico e Mineiro (Ministerio de Industrio e Engergia). The signature of Eur.Geol.P.Jobi was at first not recognised by the Instituto Geologica e Mineiro, but with assistance from the Associacao Portuguesa de Geologos (APG), the matter was resolved and the signed reports were able to assist the progress of the development of the new water sources.

5. The Future

Recently Commissioner Mario Monti was reported as saying that the EU Directive on the recognition of diplomas has helped some 11,000 people (6,000 from the UK) to find work in another Member State. Many of these were teachers. It was, nevertheless, accepted that implementation by several Member States continued to be slow, and the European Federation of Geologists (EFG) is attempting to monitor cases where geologists may find difficulties in gaining acceptance of their professional qualifications.

Member States are seen as endeavouring to maintain their autonomy, but the Federation are hopeful that the title of European Geologist awarded by the EFG after a period of 8 years education and training will go some way towards assisting in the free movement of geologists between Member States in the future. ■

References

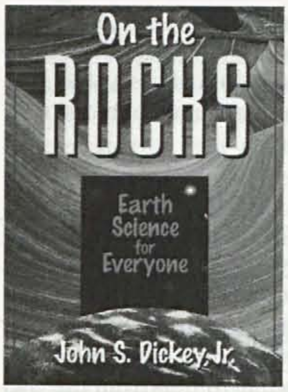
EEC (1989).–First General Directive on the Mutual Recognition of Professional Qualifications (89/48/EEC) Brussels, Belgium.

CEDESCHINI (1992).–First National Conference on the state of professional geology. Pesaro, Italy. 23-24th October. Ordine Nationale dei Geologi, Rome, Italy.

CLARK (1995).–Correspondence with Carol Clark, UK Co-ordinator (Directive 89/48/EEC), Brussels, Belgium.

COURT OF JUSTICE (1995).–Opinion of Advocate General. Leger on the Georgios Aranitis v Land Berlin Case C-164/94. Court of Justice of the European Communities. 26th October 1995.

D.T.I. (1994).–Europe, Open for Professions-UK Implementation, Department of Trade and Industry, London. Fourth edition March 1994.



On the Rocks. Earth Science for Everyone

John S. Dickey, Jr
Published by: John Wiley & Sons, Inc
Publication date: 1996
ISBN: 0-471-13234-9
List Price : $16.95 USA
252 pp

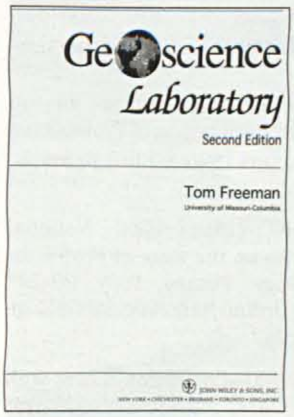
Realising the immensity of the unknown, but at the same time displaying in a simple way the basics of the earth science knowledge through an historical and entertaining review from atoms to stars, is the objective of this book. It intends to bring science to non-scientists to change their way of understanding the reality of the world where we all live.

A remarkable achievement from a Dean of Sciences, Mathematics and Engineering at the Trinity University in San Antonio, Texas, who recognises that the book is addressed to the dilettante rather than the serious student probably because through his historical review of the science milestones, the reader can realise that the most important Earth Science advances are due to a myriad of scientific dilettantes.

The text has been drafted in a very easy-to-read mode for most readers, and includes not only the everyday lives of the scientists who had a main role in the scientific discoveries described, but also poetic briefings and anecdotes that enhance its readability and makes this whistle-stop tour (in geological terms) through the genesis and other events that have taken place on Earth and in some of its accompanying solar system colleagues, an agreeable and brief excursion.

The book has twelve chapters which cover most of the rocky sciences generally included under the umbrella of Geology: the origin and genesis of Earth, geochemistry, mineralogy, petrology, geomorphology, stratigraphy, structural geology, plate tectonics, mineral resources, and planetology, but does not cover biological oriented geosciences such as palaeontology.

The book ends with the hope that soon man will be able to convert all his incredible geological knowledge into something useful for Earth inhabitants. Also that uniquely compared to other sciences, geology will be used to predict and avoid the numerous geological hazards that today, in the dawn of the 21st Century, still cause thousand of casualties and innumerable pains to some of our Blue Planet's dwellers.



Geoscience Laboratory

Second Edition
Tom Freeman
Published by: John Wiley & Sons, Inc
Publication date: 1996
ISBN: 0-471-14266-2
List Price: $19.99 USA
230 pp

Teaching geology is now easier thanks to this well organised Laboratory book, ideal to explain North American first grade university students of Geology and related disciplines (Geography, Engineering, Biology, etc.) the main issues of Earth Science.

The book has 19 chapters covering Mineralogy, Petrology, Mapping, Geomorphology, Geotectonics, Physical Geography, and Palaeontology.

Handy for the teacher also, as it includes pre-elaborated questionnaires on the corresponding chapters, so evaluation is quite straightforward.

A small plastic stereoscope allow students to observe relief in the many stereoscopic photographic pairs included in each chapter, which enhance the practicality of the volume.

Clear tables, diagrams and graphics guide the students through the various aspects of geological and geographical sciences.

The book has a clear North American bias, but its a great guideline for a possible similar text at an European or national level.

ETHICS IN THE GEOSCIENCES GEOLOGICAL SOCIETY OF AMERICA PRESIDENTIAL CONFERENCE

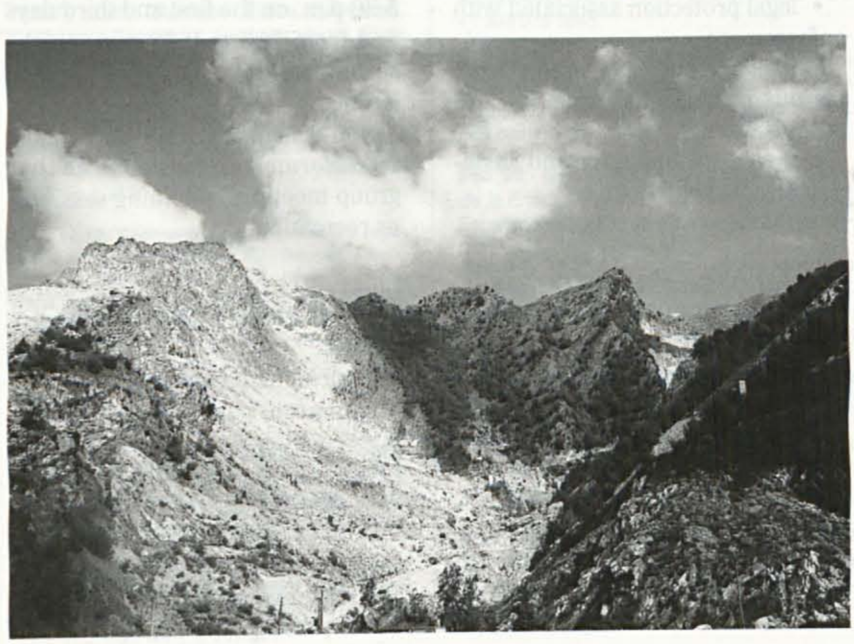
A Geological Society of America Presidential Conference, «Ethics in the Geosciences,» will be held July 16-21, 1997, at the Resort at the Mountain, Welches, Oregon, on the flanks of Mount Hood. Cosponsors are GSA and the American Association of Petroleum Geologists.

Purpose and Goals:

Unethical conduct and practices are increasing within the geoscience and other scientific communities. Such unethical practices include, but are not limited to, falsification of data, deliberate misrepresentation of qualifications and/or professional registrations, plagiarism, and wilful misrepresentation of scientific knowledge in research or to accommodate a client or legal position.

This conference will assemble an interdisciplinary group of participants who will serve as catalysts within the geosciences community in the promotion of ethical behaviour. The conference topic is an issue that geoscientists need to address and debate in order to create an effective interface between geology and the public. (Indeed, a requirement for a Presidential Conference is that topics must focus on the interface between geology and the public.)

GSA Presidential Conferences operate under Penrose Conference guidelines. The presentation format includes keynote addresses, panel discussions, ad hoc working groups, and poster sessions. As an exception to the Penrose format, participants are allowed and encouraged to disseminate information after the conference.



The primary goals of the 1997 conference are :

1. To promote a dialogue within the geosciences community on ethical issues that are not currently a part of the geoscientist's typical education or professional experience; and

2. To develop a framework for

assembly and dissemination of information on ethical issues within the geoscience community.

Discussions will focus on:

- identification of the types of ethical systems;
- cultural controls on ethical behaviour (conflict of ethical systems);
- case histories of ethics violations or perceived violations;
- professional certification, licensing, registration, and enforcement as applied to an ethical framework;
- legal protection associated with enforcement;
- existing codes of ethics from various professional societies and organisations;
- means of instilling and fostering ethical behaviour.

Conference Participants

The conference will be limited to 100 participants. Of this number, about 75% will be geoscientists, and the balance (including most invited key participants) will include social scientists, political scientists, attorneys, judges, planners, and journalists.

Participants will represent the academic, governmental, and industrial sectors.

Participants should share a primary interest in identifying areas in need of ethical standards and should have the ability or position to effectively disseminate and implement concepts that evolve from the conference.

Conference Schedule

Technical sessions will be held each morning from 8:00 a.m. until noon beginning on July 17. In addition, technical presentations and/or discussions will be held from 1:30 to 5:30 p.m. on the first and third days and from 700 to 9:30 p.m. on the second and fourth days of the conference.

Non-scheduled times will allow for informal discussions, ad hoc group meetings, planning sessions, or recreation.

Conference Convenors

The principal convenor is David Stephenson, past president of GSA (1994-1995), South Pass Resources, Inc., 11259 E. Via Linda, Suite 100-949, Scottsdale, AZ 85259; (602) 948-7171, fax 602-948-7205, E-mail: sprigeo@aol.com.

The co-principal convenor is Pete Rose, president of the Division of Professional Affairs, American Association of Petroleum Geologists, 711 West 14th St., Austin, TX 78701; (512) 480-9970, fax 512-473-2240, E-mail: prrose@onr.com.

Co-convenors of the conference are Richard Grauch, U.S. Geological Survey, M.S. 973, Denver Federal Center, P.O. Box 25046, Denver, CO 80225;(303) 236-5551, fax 303-236-3200, E-mail: rgrauch@ helios.cr.usgs.gov;and Tom Holzer, U.S. Geological Survey, M.S. 977, 345 Middlefield Road, Menlo Park, CA 94025; (415) 329-5637, fax 415-329-5163, E-mail:tholzer@isdmnl.wr.usgs.gov.

Applications

Persons interested in participating in this conference should submit a letter of application that includes a statement of interest in the conference topic, a confirmation that attendance would be for the full duration of the conference, and the subject of any proposed poster presentation.

Deadline for applications is February 15, 1997. Send letters of application to Heidi Horten, South Pass Resources Inc., 11259 E. Via Linda, Suite 100-949, Scottsdale, AZ 85259.

The conference fee, which includes lodging, food, and transportation to and from the Portland airport, is expected to be approximately $725.

Direct inquiries and questions to any of the convenors at the above addresses. ■

Invitations to participate will be mailed by March 15,1997.

Pat Chenworth - Administrative Secretary
pchenwor@geosociety.org
Geological Society Of America
3300 Penrose Place
Boulder, CO 80301 USA
Phone: (303) 447-2020 x131
FAX: (303) 447-1133
GSA WWW Home Pagettp://www.aescon.com/geosociety/index.html.

GEO CALENDAR

1996

Nov. 18-20. *International Conference on «Trends in the development of geotechnics».* Belgrade, Yugoslavia. Faculty of Mining and Geology, geotechnical department, Dusina 7, 11000 Beograd, Yugoslavia. Tel: 381 11 33 88 33, ext. 150. Fax: 381 11 33 5539.

Nov. 19-22. *TEM 96-TECMA 96.* Semana Internacional de Urbanismo y Medio Ambiente. Madrid, España.

Nov. 20-21. *Colloque International. La Géologie appliquée au sevice des collectivités locales et de l'aménagement de territoire.* Rabat, Maroc. Secrétariat du Colloque de gëologie appliquée c/o Aziz Hafdi, Division géologie de l'Ingénieur. Direction de la géologie. Ministère de l'Energie et des Mines. B.P. 6208, Rabat Instituts, Maroc. Fax: (212) (01) 77 79 43. Tel: (212) (07) 77 77 75.

Nov. 25-29. *III Congreso Nacional del Medio Ambiente.* Madrid. Secretaría Técnica del Congreso. TILESA. c/ Londres, 17. Tel: (91) 361 26 00. Fax: (91) 355 92 08. 28028 Madrid, España.

Nov. 27-29. *Nickel'96, Conference,* Kalgoorlie. Details: Conventions Department, The Australasian Institute of Mining and Metallurgy, P.O. Box 660, Carlton South, Victoria 3053, Australia. Tel: +61 3 9662 3166; Fax: +61 3 9662 3662.

Nov 30 - Dec 2. *VIETSTONE.* Feria del Sector de la Piedra Natural, Maquinaria y Afines. Ho Chi Min City, Vietnam.

Nov-Dec. *Travaux des PICG.* Paris, France. J.Rey, Lab. de géologie sédimentaire et paléontologie, Univ. Paul Sabatier, 39 allées Jules Guesde, 31062 Toulouse Cedex, France. Tél. 33/61 53 02 35. Fax: 33/62 26 71 40.

Dec. 1-3. *Southern African Minerals, conference (on non-metallic minerals),* Durban. Conference Department, Industrial Minerals, Park House, Park Terrace, Worcester park, Surrey, KT4 7HY, U.K. Tel: +44 171 827 5202. Fax: +44 181 335 3994.

Dec. 2-3. *Extinctions.* Paris, France. E. Buffetaut, Lab. Paléontologie des Vertébrés, 4 pl. Jussieu, 75252 Paris Cedex 05, France. Tél. 33/1 44 27 35 14.

Dec. 2-3. *GCSM'96. Global Conference on Small/Medium Scale Mining,* Calcutta. (Small Mining International, Canada; Intermediate technology, UK.) Contact: Prof. A.K. Ghose, Convenor, GCSM'96. The National Institute of Small Mines (NISM), 6A, Dhakuria Station Lane, Calcutta 700 031, India. Tel/Fax: +91 33 473 9542.

Dec. 2-4. *Curso de Homologación de especialistas en control de calidad de balasto.* Director: Luis Suárez. Ilustre Colegio Oficial de Geólogos de España. Tel: 34 1 5532403, Fax: 34 1 5330343. E-mail icog@telprof.eurociber.es. *Homologation course for ballast quality control specialists.* Director: Luis Suárez. ICOG. Tel: 34 1 5532403. Fax: 34 1 5330343. E-mail icog@telprof.eurociber.es.

Dec. 3-6. *OSEA'96: 11th Offshore South East Asia, Conference & exhibition.* Singapour. Will Martin, Overseas exhibition Services Ltd, 11, Manchester Square, London W1M5AB, G.-B. Tél. 44/171 486 1951. Fax: 44/171 486 8773.

Dec. 3-6. *Northwest Mining Association's International Exposition,* Spokane. Details: Northwest Mining Association, 10 N. Post St, Suite 414, Spokane, Washington 99201-0772. U.S.A. Tel: +1509 624 1158. Fax: +1 509 623 124.

Dec. 3-6. *Remade Lands, international conference on the remediation and management of degraded lands,* Hong Kong. Conference Secretariat, Department of Biology, Hong Kong Baptist University, Kowloon Tong, Hong Kong. Tel: +852 2339 7050. Fax: +852 2336 1400. E-mail: ICDLM@HKBU.EDU.HK

Dec. 4-6. *Resources'96. Convention,* Adelaide. Details: Staffords Conference Management, 1st Floor, 128 Fullarton Road, Norwood, South Australia 5067. Tel: +61 8 364 1005.Fax: +61 8 332 8810.

Dec. 8-9. *Western Investment in Mining Conference,* San Francisco. Details: International Investment Conferences, Inc., 9100 S. Dadeland Blvd., Miami, Florida 33156, U.S.A. Tel: +1 305 670 1963. Fax: +1 305 670 0971.

Dec. 9-11. *Explosives in the Service of Man, symposium* (marking the centenary of Alfred Nobel's death), Glansgow. Elaine wellingham, Conference Secretariat, Field end House, Bude Close, Nailsea, Bristol, BS19 2FQ U.K. Tel: & Fax: +44 1275 853311.

Dec. 9-13. *American Geophysical Union.* Fall Meeting Dept,AGU, 2000 Florida Avenue, NW Washington, DC 20009, USA. Tel: +1202 462 6900. Fax: +1202 328 0566.

Dec. 11-12. *Sédimentologie de la matiére organique.* Paris, France. F. Baudin, Lab. Stratigraphie, tour 15-16, 4 pl. Jussieu, 75252 Paris Cedex 05, France. Tél. 33/1 44 27 49 57. Fax: 33/1 44 27 38 31.

1997

Jan. *Drought, groundwater pollution and management.* Dindigul, Inde. Managing director, Tamibnadu water supply and drainage board, TWAD House, Chepauk, Madras 600005,Inde.

Jan. 7-10. *5th Annual Clean Coal Technology Conference,* Tampa, FL. Contact: Faith Cline, US Dept. of Energy; Tel: 202 586 7920, World wide web http://www.fe.doe.gov.

Jan. 13-17. *Tailings and Mine Waste'97.* Ft. Collins, CO. Contact: Linda Hinshaw, Dept. of Civil Engrng.,CSU, Ft. Collins, CO 80523-1372. Tel: 970-491-6081. Fax: 970-491-3584., e-mail lhinshaw@vines.colostate.edu.

Jan. 28-29. *Mudrocks at the Basin Scale: Properties, Controls and Behaviour.* Burlington House. Petroleum Group. Andy Aplin, University of Newcastle. Tel: 0191 222 6426. Fax: 0191 261 1182. e-mail: A.C.Aplin@Newcastle.ac.uk.

Feb. 2-5. *Explosives and Blasting Technique, International Society of Explosives Engineers conference,* Las Vegas. International Society of Explosives Engineers, 29100 Aurora Road, Cleveland, Ohio 44139-1800, U.S.A. Tel: +1 216 349 4004. Fax: +1 216 349 3788.

Feb. 4-7. *R'97. Recuperación, reciclaje, reintegración.* Ginebra, Suiza. Tel: +41 1 385 29 29. Fax: +41 1 385 26 53.

Feb. 9-13. *Global Exploitation of Heap Leachable Gold Deposits, symposium,* Orlando, Florida. Don Hausen, 17167 Woodside Drive, Salt Lake City, Utah 84124, U.S.A. Tel: +1 801 277 0883. Fax: +1 801 277 0612.

Feb. 11-13. *The Western Powder Show Fairplex Exposition Complex,* Pomona, California. Contact: Patty Yagl or Don Olstinske at Advanstar Expositions. Tel: +(216) 891 2706. Fax: +(216) 891 2741.

Feb. 20-22. *Safety in Mines Research Institutes, conference,* New Delhi. Prof. B.B. Dhar, Chairman, Organising Committee, Central Mining research Institute, Barwa Road, Dhanbad, 826001, Bihar, India. Tel: +91 326 202 326. Fax: +91 326 202 429. e-mail: director @csmri.ren.nic.in

Feb. 23-27. *Comminution Practices, symposium,* Denver. S.K. Kawatra, Dept. of Engineering, Michigan Tech University, 1400 Townsend Drive, Houghton, MI 49931 1295, U.S.A. Fax: +1 906 487 2934. e-mail: skkawatr@mtu.edu.

Feb. 24-27. *SME Annual Meeting & Exhibit,* Denver. Society for Mining, Metallurgy and Exploration, P.O. Box 625002. Littleton, CO 80162 5002, U.S.A. Tel: +1 303 973 9550. Fax: +1 303 979 3845.

Feb. 25-26. *The Oil & Gas Habitats of the South Atlantic Region.* Burlington House. Petroleum Group. Nick Cameron, Imperial College. e-mail: nick.cameron@ic.ac.uk.

Feb. 26 - Mar. 1. *ECOMED-POLLUTEC. Salón de la Energía y el Medio Ambiente.* Barcelona, España. Tel: 93-233 22 99. Fax: 93- 233 23 46.

Mar. 4-7. *TERRATEC. Salón de los Mercados del Medio Ambiente.* Leipzig, Alemania. Tel: (0341) 768 0. Fax: (0341) 678 82 92.

Mar. 8-13. *3e Colloque de stratigraphie et de paléogéographie de l'Atlantique sud et 13e Colloque african de micropaléontologie.* Yaoundé, Cameroun. Société national des hydrocarbures, Comité d'organisation des Colloques, BP 955, Yaoundé, Cameroun. Fax: nº(237) 20 46 51.

Mar. 9-12. *Prospector and Developers International Convention and Exhibition,* Toronto. PDAC, 34 King St, 9th Floor, Toronto, Canada M5C 2X8. Tel: +1 416 362 1969. Fax: +1 416 362 0101.

Mar. 10-14. *Geofluids II* - Belfast (Waterfront Hall Conference Centre). Petroleum Group. John parnell et al, University of Belfast. e-mail: geofluids@qub.ac.ak.

Mar.16-18. *Indian Industrial Minerals,* Taj Palace, New Dehli, India. Contact: Sharon Thomas, IMIL Marketing Dept., Park House, 3 Park Terrace, Worcester Park, Surrey KT4 7HY, UK. Tel: +44 (0) 171 827 9977. Fax: +44 (0) 181 337 8943.

Mar. 16-19. *Bauxite and Alumina,* The Sheraton Balharbour, Miami, USA. Contact: Sharon Thomas, IMIL Marketing Dept., Park House, 3 Park Terrace, Worcester Park, Surrey KT4 7HY, UK. Tel: +44 (0) 171 827 9977. Fax: +44 (0) 181 337 8943.

Mar. 17-21. *L'Aprés Charbon-After Coal Mining.* Lille, Northern France. Convenor: Prof. Francis Meilliez, Université des Sciencies et Technologies de Lille, UFR de sciencies de la Terre, 59655 Villeneuve d'Ascq Cedex, France. Tel: 00 33 20 43 4113. Fax: 00 33 20 33 77 66. E-mail: francis.meilliez@univ.lill

Mar. 18-21. *3rd ERS Symposium.* Florence, Italy. European Space Agency. OEE Mission Management Office. Headquarters 8,10 rue Mario Nikis, 75738 Paris Cedex 15. Tel: +33/1/53 69 - 72 85.Fax: +33/ 1/ 53 69- 76 74. Via Galileo Galilei-CP 64, 00044 Frascati, Italy. Tel: +39/6/94180-360. Fax: +39/6/94180-362.

Mar. 19-21. *MINOREX'97.* Mr. John Lane. - TURRET GROUP PCL. 171 High Street. Rickmansworth. Herts WD3 1SN, Inglaterra.

Mar. 19-22. *TAU EXPO'97. Exhibición Internacional de Servicios y Tecnologías para el Medio Ambiente.* Milán, Italia. Tel: (02) 31 23 258. Fax: (02) 42 36 919.

Mar. 21-27. *AM/FM International Annual Conference,* AM/FM International, San Antonio, Texas. Contact: Paula Delie, 303-337-0513.

Apr. 4-6. *ASPRS/ACSM Annual Convention,* ASPRS, ACSM, Seattle, Washington. Contact: 301-493-0200.

Apr. 6-9. *6th Conf. Sinkholes, Eng. and Env. Impact Karst.* Springfield, MO, USA. B.F. Beck, P.E. LaMoreaux and Ass., Inc., P.O. Box 4578, Oak Ridge, TN 37831-4578. Tel: (423) 483 7483. E-mail: prelaor@use.usit.net.

Apr. 20-22. *Processing for Profit.* Industrial Minerals Information Ltd. Marriott Hotel, New Orleans, USA. Contact: Sharon Thomas, Industrial Minerals, Park House, Park Terrace, Worcester Park, Surrey KT4 7HY. Fax: 44 (0) 181 337 8943.

Apr. 22-27. *INTERMAT '97. Exposición Internacional de Equipos y Técnicas para Obras Públicas y Construcción,* Feria Paris-Villepinte. France. PromoSalons. Diego de León, 44.28003 Madrid. Tel: 34 1 4428622.

Apr. 24-30. *Paleocene-Eocene Boundary Events in Time and Space.* GSA Penrose Conferences. Alburquerque, New Mexico, U.S.A. Co- Conveners: William Berggren. Woods Hole Oceanographic Institution; Spencer Lucas, New Mexico Museum of Natural History. Marie-Pierre Aubry Universite Montpellier II. Lower Stott University of Southe California. And: James Zachos University of California Santa Cruz, CA. Application deadline: December 1, 1996. Send applications to Spencer Lucas New Mexico Museum of Natural History 1801 Mountain Road NW Alburquerque NM 87104 USA. E-mail: lucas@darwin.nmmnh-abq.mus.nm.

Apr. 27-29. *Petroleum Group Biennial Meeting.* Field Reactivation for the 21st Century-Bath. Petroleum Group. Steve Daines, Conoco (UK) Ltd. Tel: 01224 205000. Fax: 01224 205204.

May. 5-10. *European Coal Conference 97.* Izmir, Turkey. Covenor: Dokuz Eylül University, Faculty of Engineering, Dept. of Geology, 35100 Bornova-Ismir, Turkey. Tel: (90) 232 3882919. Fax: (90) 232 3738289.

May. 13-16. *GEOTECHNICA. International Trade Fair and Congress for the Geosciences and Geotechnology.* Cologne Germany. *Feria Internacional Monográfica y Congreso de Geociencias y Geotécnicas.* Feria de Colonia. Alemania. KölnMesse. Messeplatz,1. Postfach 50679. Köln . Tel: (49) 221/821-0 Fax: (49) 221/821-3415

May. 19-21. *Ottawa'97, Réunion annuelle de l'Association gëologique et de l'Association minéralogique de Canada.* Ottawa, Canada. Commission géologique du Canada, piéce 757, 601 rue Booth, Ottawa, Canada Ontario K1A OE8. Tél. 1/613 947 76 49. Fax: 1/613 947 76 50. E-mail: ottawa97@emr.Ca.

May. 24-26. *HILLHEAD'97. Exposición y Demostración de Equipos y Maquinaria para Canteras.* Buxton (Inglaterra). Mr. Roger Allen. Exhibition Organiser Hillhead'97. 7 Regent Street. Nothingham NG1 5BY. Inglaterra.

May. 31-Jun 6. *IV Conferencia Internacional sobre Drenajes Acidos de Rocas.* Vancouver, Canadá. Venue West Conference Services. Ms. Peggy Shepard. 645, The Landing, 375 Water Street. Vancouver, B.C. Canada V6B 5C6. Fax: (604) 681 - 2503.

Jun. 8-10. *European Minerals.* IMIL. Arts Hotel, Barcelona, Spain. Contact: Sharon Thomas, Industrial Minerals, Park House, Park Terrace. Worcester Park, Surrey KT4 7HY. Fax: +44 (0) 181 337 8943.

Jun. 15-21. *Clay Confernce,* Ottawa, Canada. (J.B. Percival, Geological Survey of Canada, 601 Booth St. Ottawa, Ontario, K1A 0E8. Tel: 613/992 4496. Fax: 613/943 1286.E-mail: percival@gsc.emr.ca).

Jun. 16-17. *Biostratigraphy in Production & Development Geology*-Aberdeen University. Petroleum Group. Mike Simmons, University of Aberdeen. Tel: 01224 273438. Fax: 01224 272785.

Jun. 16-20. *IRF XIIIth World Meeting.* Toronto, Canada. c/o Ministry of Transportation 1201 Wilson Avenue. Downsview (Ontario) (Canada M3M 138). Tel: 416 2355107. Fax: 416 235 5151.

Jun. 23-26. *Symposium international sur la géologie de l'ingenieur et de l'environnement.* Athènes. Grèce. IAEG. «Athenes 97». P.O. Box 19 140 GR . 11 710 Athènes, Grèce. Fax: 301/924 25 70.

Jun. 24-26. *HILLHEAD '97.* Buxton. UK. R. Allen. Quarry Management. 7 Regent Street. Nothingham NG1 5BY. UK. Tel: 44 115 9411315. Fax: 44 115 948 4035.

July 10-12. *European Palaentological Association, 2º Congrès européen de Paléontologie: climates past, present and future.* Vienne, Autriche. L. Grauvogel-Stamm, Institut de Géologie, 1, rue Blessing, 67084 Strasbourg Cedex, France. Tél. 33/88 35 85 70. Fax: 33/88 36 72 35.

July 14-17. *I Congreso Paraguayo de Ingeniería Geotécnica.* Asunción, Paraguay. S.P.G. Att: Ing. Miguel Stanickevsky, Presidente. I. CO-PAINGE, Ave. España 919, Casilla de Correo 336, Asunción, Paraguay. Fax: 595 (21) 80 592.

July 22-25. *AIR FILTRATION & PURIFICATION ASIA'97.* Conferencia y exposición sobre productos y tecnología para mejorar la calidad del aire. Singapur.

July. 28-Aug. 1. *GeoSciEd II.* Second International Conference on Geoscience Education. University of Hawaï.Hilo; Hawaï. Contact: M. Frank Watt Ireton, GeoSciEd II Registration, Education & Research Directorate, American Geophysical Union, 2000 Florida Avenue, NW, Washington, DC 20009. E-mail: fireton@agu. org.

Aug. 10-17. *12º Congrès International de spéléologie et 6º Colloque d'hydrologie en pays calcaire et en milieu fissuré.* La Chaux-de-Fonds (Neuchatel). Suisse. Sublime, Case postale 4093. CH- 2304. La Chaux-de-Fonds. Suisse. E-mail: congress.uis97@chyn.unine.ch.

Aug. 15-17. *6th Conference on «Limestone Hydrology and fissured Aquifers».* La Chaux-de-Fonds (Switzerland). Organised within the framework of the 12th International Congress of Speleology. Prof. F. Zwahlen, Hydrogeology Centre, Rue Emile Argand 11, CH-2007 NeuchaTel: Tel: 0041/38/23 26 00. Fax: 0041/38/23 26 01. E-mail: darko. semic @ chyn. unine. ch, Address internet: http.// www.unine.ch/UIS 97/.

Aug. 18-29. *29th General Assembly of the International Association of seismology andphysics of the Earth's Interior.* Thessalonique, Gréce. 29th IASPEI general assembly geophysical laboratory, University, GR- 54006, Thessaloniki, Grèce. Tél.30/31 998 526.Fax: 30/31 998 528. E-mail: iaspei@olymp.ccf.auth.gr.

Aug 28 - Sep 3. *AIG IVth international Conference on Geomorphlogy.* Bologne, Italie. Paolo Forti, Planning Congressi, via Crociali 2, I -40138 Bologne, Italie. Fax: 1939/51309477.

Sept. 1-5. *International Symposium on Geology and Environment.* Istanbul, Turkey. Secretary GEOENV'97. P.K. 464 Yenisehir, 06444 Ankara, Turkey. Tel: 90-3124343601. Fax: 90-3124342388. e-mail: degan @ jco. hun.edu tr.

Sept. 2-6. *Symposium Int. on geosciencie and environmental protection.* Istanbul, Turquie. T. Cebi, Int. symposium geosciencie, PK 464 06 424 Kizilay-Ankara, Turquie. Tél. 90/312 432 30 85. Fax: 90/434 23 88. E-mail: jdogan @et.cc.hun.edu.tr

Sept. 6-12. *14th International Congress of the ISSMFE.* Hamburg, Germany.Scientific organization: XIV ICSMFE 97, Deutsche Gesellschaft für Geotechnik e.v. Hohenzollernstr. 52, D45128 Essen.Tel: 201/78 27 23 et 201/77 08 21. Fax: 201/78 27 43. Organizing Committee: XIV ICSMFE 97, c/o CPO Hanser Service, B.P. 1221, D-22882 Hamburg-BarsbütTel: Tel: 40/670 88 20. Fax: 40/670 32 83.

Sept. 7-10. *AAPG - International Conference and exhibition.* Vienne, Autriche. AAPG. Convention Dept., Box 979, Tulsa, OK 74101, USA. Tél. 1/918 560 26 79. Fax: 1/918 560 26 84.

Sept. 10-15. *New Mexico Faults and Subsurface Fluid Flow: Fundamentals and Applications to Hidrogeology and Petroleum Geology.* Conveners: Laurel B. Goodwin, New Mexico Institute of Mining and Technology. William C. Haneberg, New Mexico Bureau of Mines and Mineral Resources. J. Casey Moore, University of California, Santa Cruz. And, Peter S. Mozley, New Mexico Institute of Mining and Technology. Application deadline: March 1, 1997. Send applicatios to William C. Haneberg, New Mexico Bureau of Mines and Mineral Resources, 2808 Central Avenue SE, Alburquerque, NM 87106, USA. E-mail: haneberg@nmt.edu.

Sept. 21-26. *XX Congreso Internacional de Procesos de Minerales.* Aachen, Alemania. GDMB, Gesellschaft Deutscher Metalhütten, und Bergleute e.V. P.O. Box 10 54. D-38668 Clausthal, Zellerfeld, Alemania.

Sept. 21-27. *Groundwater in the urban environment.* Nottingham, G.B. Stephen Foster (BGS), c/o Conference Nottingham, 309 Haydn Road, Nottingham NG5 1DG, G.-B. Tél. (44-115) 985 65 45. Fax: (44-115) 985 66 12.

Sept. 23-28. *Tectonics of Continental Interiors.* Brian Head Resort. Utah (near Cedar City). Conveners: Michael W. Hamburger, Indiana University. Stephen Marshak, University of Illinois. And, Ben A van der Pluljm, University of Michigan. Application deadline: February 15, 1997. Send applications to Michaek W. Hamburger, Dpt. of Geological Sciences, Indiana University, Bloomington, IN 47405, USA. E-mail: hamburg@indiana.edu Lois Elms

Sept. 29 - Oct. 3. *7º Conference Internationale «Espace Souterrain. Villes intérieures de demain».* Montréal, Québec, Canada. Organizing Committee, 303 Notre-Dame St. E. 5º floor Montreal, Quebec, Canada H 2Y 3Y8. Ph.:(514) 872-8343. Fax: (514) 872-0024. E-mail: 7e Confso @ odysee. net / 7e confso.

Oct. 5-8. *Chinese Minerals/Fluorspar.* IMIL. Hilton Hotel, Shanghai, China. Contact: Sharon Thomas, Industrial Minerals, Park House, Park Terrace, Worcester Park, Surrey KT4 7HY. Fax: +44 (0) 181 337 8943.

Oct. 14-18. *XVII Congreso Mundial de Minería y XII Convención de Ingenieros de Minas.* Acapulco, México. Asociación de Ingenieros de Minas, Metalurgistas y Geólogos de México, A.C. Att. Srta Blanca Laura de Ochoa, c/ Jaime Torres Bodet, 176 (antes Ciprés), Col. Santa María La Ribera, Deleg. Cuauhtemoc, CP 06400 México D.F.

Oct. 20-23. *Geological Society of America,* ann. mtg., Salt Lake City. (Becky Martin, GSA Meetings Department, Box 9140, Boulder, Colo.80301-9140. Tel: 303/447 2020, ext. 164.Fax: 303/447 1133.

Oct. 15-16. *Like-Time Environmental Management of UK Offshore Oil and Gas Operations-* Burlington House. Petroleum Group. Colin Macduff-Duncan, Esso Exploration & Production UKLtd. Tel: 01372222567. Fax: 01372223469. email;collin.r.macduffduncan@exxon.sprin.com.

Oct-Nov. *North American IM Annual Meeting.* IMIL.USA. Sharon Thomas, Park House, Park Terrace, Worcester Park, Surrey KT4 7HY. Fax: +44 (0) 181 337 8943.

Nov. *Industrial Minerals Forum & Annual Dinner.* IMIL. London, UK. Contact: Sharon Thomas, Park House, Park Terrace, Worcester Park, Surrey KT4 7HY. Fax: +44 (0) 181 337 8943.

Nov. 2-7. *Ninth International Conference of the International Association for Computer methods and advances in Geomechanics.* Wuhan, China. Prof. Jian-Xin Yuan, Chairman of IACMAG 97, Institute of Rock and Soil Mechanics, The Chinese Academy of Sciences, Wuhan 430 071, China. Tel: (86) (27) 788 1776. Fax: (86) (27) 786 2413.

Nov. 11-14. *IV Simposio Nacional sobre Taludes y Laderas Inestables.* Granada, España. Universidad de Granada y Universitat Politècnica de Catalunya. Joaquín Pérez Romero, Dpt. de Ingeniería Civil, E.T.S. Ingenieros de Caminos, Canales y Puertos. Universidad de Granada, Colegio Máximo Cartuja, 18071 Granada. Tel: 958- 24 61 38. E-mail: joperez@platon.ugr.es. Jordi Corominas, Dpt. Ingeniería del Terreno, E.T.S. Ingenieros de Caminos, Canales y Puertos. c/ Gran Capitán s/n. Edificio D-2. 08034 Barcelona. Tel: 93- 401 68 66. Fax: 93- 401 65 04. E-mail: corominas@ctseccpb.upc.es.

1998

Mar.-Apr. Spring. *2nd International Symposium on water resources in karstic formations.* Kermanshah, I.R. of Iran. A. Afrasiabían, P.O. Box 15875-3584 Tehran, I.R. of Iran. Tel: +98 21 7520474. Fax: +98 21 7533186.

Mar.30-Apr. 5. *BAUMA'98. XXV Edición del Salón Mundial de Maquinaria para Obras Públicas y Materiales de Construcción.* Munich, Alemania. Messe München GmbH. Messegelände. D-80325 München, Alemania.

Apr. 13-17. *15th International Sedimentological Congress.* Alicante. Spain. 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 Ordóñez. Chairman. Ph: 34 65903552 Fax: 34 65903552. e-mail: ctierra@vm.cpd.ua.es

Jun. 7-9. *International Congress on «Underground Construction in modern infrastructure».* Underground construction 98, c/o Congrex (Sweden) AB. P.O. Box 5619, S-114 86 Stockholm, Sweden. Tel: +46 8 612 69 00. Fax: +46 8 612 62 92. E-mail: Congrex @ congrex. se, Internet: http: //www.congrex.se.

Jun. 29-July 18. *International Platinum Symposium.* IAGOD/CODMUR, Johannesburg, South Africa. (C.A. Lee, Box 68108, Bryanston 2021, South Africa. Tel: 2711/4112253. Fax: 2711/6923693).

Aug. 9-15. *International Mineralogical Association,* mtg., Toronto.(A.J. Naldrett, Dept. of Geology, University of Toronto, Toronto, M5S 3B1. Tel: 416/978 3030. Fax: 416/978 3938. E-mail: ima98@quartz.geology.uturonto.ca).

Aug. 20-26. *16 Congrés mondial de Sciencie du sol.* Monpellier, France. CNEARC, 16 Congrés mondial de Sciencie du sol, 11 01 avenue, d'Agropolis, B.P. 50 98, 34033 Motpellier Cedex, France. Tél. 33/67 61 70 23. Fax: 33/67 41 02 32.

Sept. 1-10. *XXI Congreso Mundial de Carreteras de la AIPCR.* Kuala Lumpur, Malasia. AIPCR. La Grande Arche, Paroi Nord, Niveau 1. La Défense. 92055 Paris La Défense. Cedex 04 (Francia). Tel: +33 1/47 96 81. Fax: +33 1/49 00 02 02.

Please send meeting notice three months before publication date to: *The Editor,* EFG, ICOG, Av. Reina Victoria 8, 28003 Madrid, Spain, Tel: 34-1-3495778, Fax: 34-1-4426216. Include date, title, sponsor, place of meeting and telephone number for information.

From 20 to 24 October 1997, and organised by the Ilustre Colegio Oficial de Geólogos de España.

Course on Engineering Geology of Lineal Infrastructures

Highways • Railways • Channels • Airports • Gas-ducts

Following its continual training policy, the Ilustre Colegio Oficial de Geólogos de España (ICOG) organises from 20 to 24th October 1997 a Course on Engineering Geology of Lineal Infrastructures, dedicated to geological and geotechnical studies of roads, highways, railways, channels, airports, gas-ducts, etc.

The course will have morning general and theoretical sessions and the explanations of practical cases in evening sessions.

One day will be dedicated to European lineal infrastructures. Thus the ICOG invites European Geologists with experience in this type of works to contact the director of the course in order to program their possible participation in the course. The ICOG will provide a certain number of scholarships for EurGeol's and EFG members. If you are interested please contact Luis Suarez at the ICOG. Tel: 34 1 5532403. Fax: 34 1 5330343. E-mail icog@telprof.eurociber.es.

EUROPEAN GEOLOGIST ARTICLES

The EFG need 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. Articles submitted on diskette along with a hard copy are appreciated. The Editor uses DOS, WordPerfect 5.1, 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 six weeks preceding month of issue.

Acceptable languages will be Spanish, English and French, although for the sake of uniformity it would be desirable to have them in English.

To ease the editorial work some simple guidelines are included:

1.–File on IBM formatted disk (in Wordperfect and ASCII format) or Mac, as well as a good «top» copy/printout. Submissions should be 1000 to 2000 words in length.

2.–Format:

Margins:	Right and left margins 2,5 cm Top margin 2,5 cm Bottom margin 3,5 cm
Title:	Times Roman (or similar) font, bold, capitals, point size 12, centred on line 2 blank lines Name/s of author/s 3 blank lines
Subtitles:	Times Roman (or similar) font, bold, lower case, point size 12, left aligned. 1 blank line
Text:	Times Roman (or similar), point size 12 single line spacing left aligned no indentation at start of paragraph blank line between paragraphs
Page numbers:	Please write page numbers in pencil only.
Diagrams and Tables:	Paste into text or provide separately at correct size.
Photographs:	Provide preferably slides. The magazine will be published in B&W but front page will be in colour, so one original will be selected from the presented works in each issue.

References:

Citation in the text - e.g. ...as discussed recently (Green, 1993)
...as discussed recently by Green (1993)

Churchward, P.E. and Rosenbaum, J.B. 1963. Sources and recovery methods for rhenium. *Report of Investigations, United States Bureau of Mines*, Nº 6246.

Ho, C.S. and Lee, C.N. 1963. *Economic Minerals of Taiwan.* (Taipei: Geological Survey of Taiwan).

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
  - Public Works
  - Hydrogeology

Publications

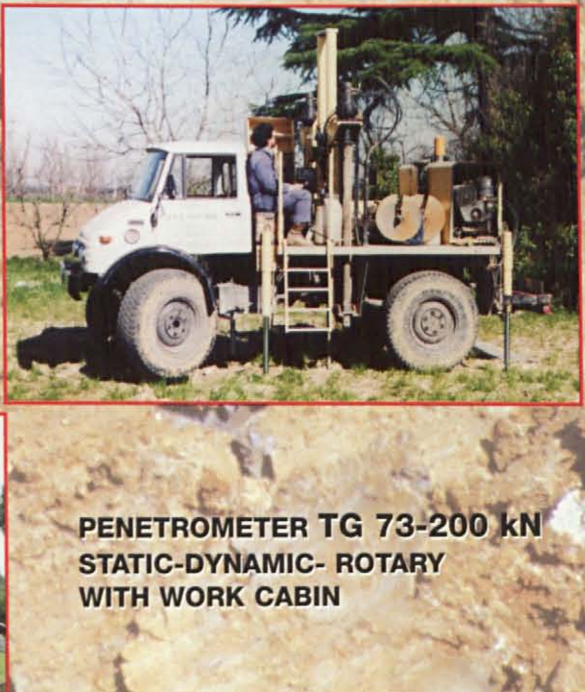
Geo Calendar

◄ 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. MR. MASSIMO CONTINI SALES MANAGER DISTRIBUTORS AND AGENTS WANTED

EUROPEAN GEOLOGIST ARTICLES

The EFG need 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. Articles submitted on diskette along with a hard copy are appreciated. The Editor uses DOS, WordPerfect 5.1, 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 six weeks preceding month of issue.

Acceptable languages will be Spanish, English and French, although for the sake of uniformity it would be desirable to have them in English.

To ease the editorial work some simple guidelines are included:

1.–File on IBM formatted disk (in Wordperfect and ASCII format) or Mac, as well as a good «top» copy/printout. Submissions should be 1000 to 2000 words in length.

2.–Format:

Margins:	Right and left margins 2,5 cm Top margin 2,5 cm Bottom margin 3,5 cm
Title:	Times Roman (or similar) font, bold, capitals, point size 12, centred on line 2 blank lines Name/s of author/s 3 blank lines
Subtitles:	Times Roman (or similar) font, bold, lower case, point size 12, left aligned. 1 blank line
Text:	Times Roman (or similar), point size 12 single line spacing left aligned no indentation at start of paragraph blank line between paragraphs
Page numbers:	Please write page numbers in pencil only.
Diagrams and Tables:	Paste into text or provide separately at correct size.
Photographs:	Provide preferably slides. The magazine will be published in B&W but front page will be in colour, so one original will be selected from the presented works in each issue.

References:

Citation in the text - e.g. ...as discussed recently (Green, 1993)
...as discussed recently by Green (1993)

Churchward, P.E. and Rosenbaum, J.B. 1963. Sources and recovery methods for rhenium. *Report of Investigations, United States Bureau of Mines*, Nº 6246.

Ho, C.S. and Lee, C.N. 1963. *Economic Minerals of Taiwan*. (Taipei: Geological Survey of Taiwan).

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
  - Public Works
  - Hydrogeology

Publications

Geo Calendar

◄ **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. MR. 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 born 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 Kingdom (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 Brussels.

The geologists of the Federal Republic of Germany (B.D.G.) became members of the F.E.G. in 1985, Ireland (I.A.E.G.) in 1988, Finland (F.U.G.) and Sweden (S.N.) in 1989, Greece (A.G.G.) and The Netherlands (K.N.G.M.G.) in 1993.

The E.F.G. currently represents some 65.000 geologists from 13 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.