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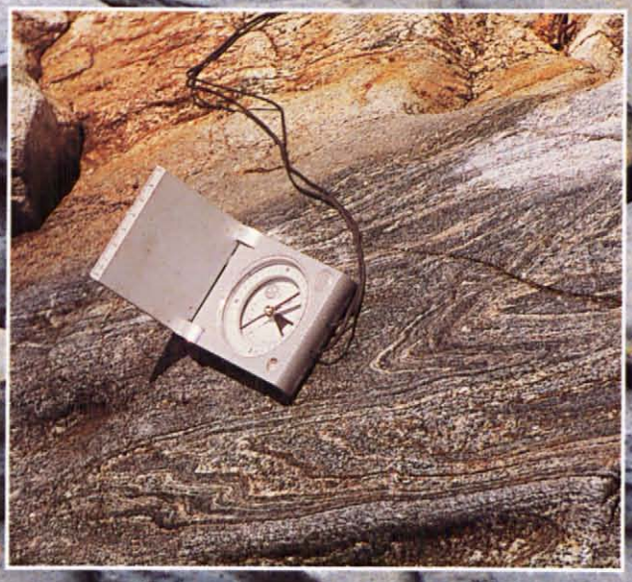
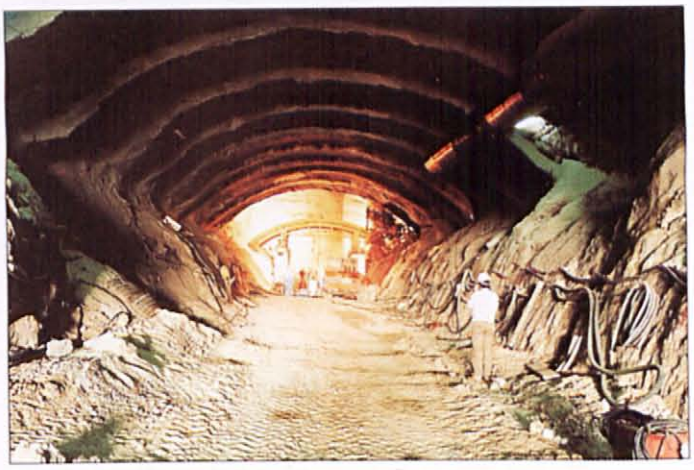


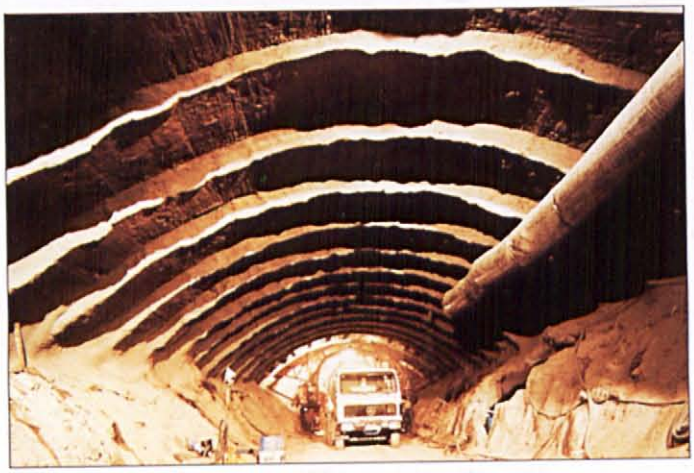
ENVIRONMENTAL GRAVEL EXTRACTION IN LIMBURG

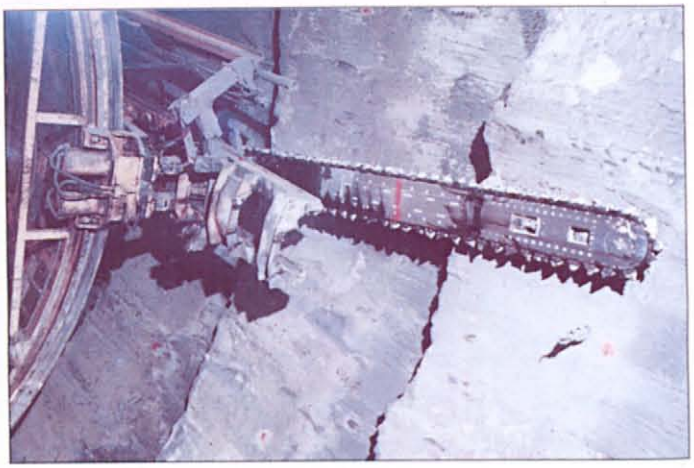
THE MONT TERRI UNDERGROUND ROCK LABORATORY

GEOSCIENTISTS CAN LOOK GOOD IN SWIMWEAR, TOO

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







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Unemployment is the main concern of the European Union. The very recent summit devoted to the subject, proves a will from most members to implement active policies to change the situation. Only Spain was not ready to meet the deadline challenge to reduce its level of unemployment, but at the same time its Government has announced an employment plan to be agreed with social agents.

Unemployment seems to result from technical development that reduces workforce need and from social wants and wants not that promotes the need of new professions and the decay on the necessity of others. But there is no doubt that some unemployment results from the fact that graduates are not prepared in accordance with market needs.

Such is the case of geologists, which hold the sad record of an average 21,5% unemployment rate, considering only EFG members.

But we are in a free market, and an excess of offer (more than 4415 graduates per year) for a potential demand of around 1500 geological jobs in the EFG area, not only produces a theoretical annual unemployment rate of more than 2915 unemployed geologists per year but also a downslide trend in wages, specially for the first job.

What can the European Federation of Geologists do about it?

It seems that actions should be required in several fronts:

1.- The Academia approach

Reduction of the output. This is only possible by a reduction on the number of faculties. As this obviously is a national ministerial decision, is far from the reach of the EFG. An example of that, was the closure of Faculties of Geology in the Netherlands.

Change in career curricula. Very difficult, as academic instances usually drive in their own mood and generally ignore the voice of professional associations.

2.- The Educational approach

Promoting post graduated courses to specialise geologists on those subjects demanded by Society. Search, locate and cover professional niches (environment, waste disposal, geological hazards) not assigned to any professional in particular. Some EFG members are already developing this type of plan.

3.- The Employment service

The EFG has set up a system called Eurogeojobs, in order to channel possible job offers from all over Europe to our members.

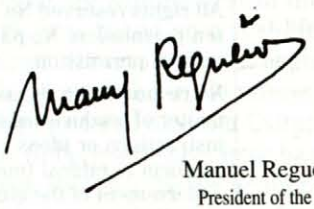
This last approach needs the collaboration, for the mutual benefit, of all employing organisations and EFG member associations.

In our global market, employment is a wandering market. Today here tomorrow there. Today employment for geoscientists is not in Europe. Thousands of job offers are now coming via internet from the USA, South America, Australia and the Far East.

If you are a geologist without an employment in Europe today, you should be ready to meet the personal challenge of going to work abroad. There are plenty of opportunities outside Europe, both for Spanish speaking and English speaking geologists.

The EU plan will not be effective immediately, so, if you donít want to wait, and are ready to acquire the enormous experience that an overseas job will bring to your life, breath deeply and take your chance.

I did it many years ago, and it did work.



Manuel Regueiro
President of the EFG

CONTENTS

GEOSCIENTISTS CAN LOOK GOOD IN SWIMWEAR, TOO

by Ted Nields

Geological Society Burlington House, Picadilly. London. UK*

Why do people take an instant dislike to me?" someone once asked Spike Milligan. "Saves time" he replied.

It is a sad fact that most people make their minds up about others very quickly. Stereotyping is easy and comfortable. Stereotypes confirm one's prejudices about the world. They save time. They are also, as Stephen Jay Gould reminds us, "untrue, but culturally powerful".

This essay is about the culturally powerful stereotypes of scientists in recent Hollywood films and the fundamental changes that those stereotypes are undergoing; with geoscientists leading the way. These changes are culturally significant, I believe, because they mark a changing attitude to science among the wider public.

In drama, time is of the essence. Which is why, among countless other romantic heroes, Tamino falls in love in act one scene one of Die Zauberflte upon seeing a miniature portrait. Love at first sight saves time.

The characters of time-constrained dramas like TV shows, plays and films have to become established quickly with the audience. If they did not, there would be no time for the plot. Most people are interested in plot. Only the novel and perhaps the painted portrait regularly provide for in-depth character analysis. Even then, popular novels ñ the sort with the author's name bigger than the title - tend not to mess about with such refinements.

Dante's Peak. Universal International Pictures - Ben Glass.

Quick, easy images are also the stuff of TV news, advertising and public relations. Stories have to be tellable in quick, simple images. Advertisers have 30 seconds to associate their product with the sorts of stereotype characters with whom their target audience wishes, they hope, to be associated. The cynics in public relations (and that's everybody, I am afraid) will often say that effective PR is a matter of getting people to believe one lie instead of another.

When we look to Hollywood for portrayals of scientists, we are seeing a reflection of what Hollywood writers believe will be a stereotype that most of the audience will recognise. From the point of view of those interested in improving the image of science and scientists, progress would consist of a change in this stereotype exchanging an old lie for a new, more favourable one.

Geoscientists have been in there from the start of this process. The sexy, dashing whip-wielding archaeologist Indiana Jones, played by Harrison Ford in a series of films beginning with Raiders of the Lost Ark, was based on a real-life character. He was palaeontologist Roy Chapman Andrews, discoverer of the inaptly named dinosaur Oviraptor in the Gobi Desert. (Oviraptor has since been shown to be the mother of the eggs beside which she was fossilised,

* Reprinted from Geoscientist with authorisation of the Geological Society.

Dante's Peak. Universal International Pictures - Ben Glass.

supposedly in the act of nest-robbery. She is now proof of maternal behaviour in dinosaurs.)

Indiana Jones was an unusual film character, portraying the academic as action-man. Hitherto, we were much more familiar with the egghead scientist or not - as an arrogant, unworldly, occasionally megalomaniac obsessive with a beautiful daughter (to provide romantic interest for the hero action-man). This ancient dramatic tableau can be traced back to The Tempest and probably beyond. But with Indiana Jones we saw the beginning of a reaction against this creaky old cut-out.

This could merely reflect audience fatigue with cliché. Nevertheless, cliché has never caused anyone to lose money in the past. Increasing audience sophistication is, though, part of the equation.

The last five years have seen an avalanche of big Hollywood movies with geological themes. Steven Spielberg's sequel to Jurassic Park has already sent box-office records tumbling. A few weeks ago, the second volcano disaster movie of the

year, simply entitled Volcano, opened in Tinseltown. And before that piece of unlikely eruptive mayhem, we saw the release of Dante's Peak, starring the current James Bond, Pierce Brosnan, as hero-geologist. This film, and the Jurassic Park duology (which I guess should be the word for a series that's one short of a trilogy) merit greater attention.

These films are aimed at the general cinema-going public and have a combined world-wide audience of billions. They all contain images of scientists in general, and geologists in particular. I believe this makes them very significant indicators of public perception, for the following reason.

If screen scientists appear too different from an acceptable stereotype, then the character will not convince a general audience. However, to put up an out-and-out cliché would be a disaster in all but the most outrageous spoof. The screenwriter's challenge is to take recognisable character traits that would be cliché elsewhere, and transplant them onto figures in the plot who would not normally be expected to display those traits. Think, for example, about the original effect achieved by combining moral emptiness, extreme violence and high intelligence in Hannibal 'the cannibal' Lektor; or by making an academic the action-hero, as in Raiders and sequels.

Films like Jurassic Park and Dante's Peak are very encouraging for geologists precisely because of the new set of characteristics that have been grafted on to them in this manner.

Spielberg's blockbuster Jurassic Park (the biggest-grossing film ever until it was overtaken this year by its sequel The Lost World) presents us with three scientists: Jeff Goldblum's theoretical mathematician, Sam Neil's vertebrate palaeontologist and Laura Derne's palaeobotanist. For the benefit of the two readers who have not seen this film, the crucial facts to know are these.

Billionaire megalo Attenborough has found a way of resurrecting dinosaurs by cloning the DNA preserved in their blood. This blood is extracted from the bodies of mosquitoes fossilised in amber. He has since populated a Pacific island with his creations, and plans to open it as a theme park. The scientists are called in to give the project their backing. Now for the sub-plot.

Sam Neil and Laura Derne's characters have been stepping out together for some time. But woe! Neil is frightened of commitment to all except his work (familiar stereotype here) and he finds the company of children, not to mention the possibility of fathering them, difficult. This slushy rider to the main story tells how Sam Neil comes to enjoy the company of Attenborough's niece and nephew on their disastrous tour of the island. Hence, he becomes reconciled with the hitherto terrifying thought of marrying a palaeobotanist.

All the main scientist characters in this picture come over well. Derne is strong-willed, independent, feminist and sexy. She is everything, in fact, because she also wants marriage and kids. Neil is dedicated - a bit too dedicated C but also an intuitive person, a superb communicator, and above all, knowledgeable about dinosaurs. Goldblum is nervous, twitchy, eccentric, weird, roguish and cool. He flirts with Derne, who despite being strong-willed independent and feminist, responds well to his quirky advances.

If these characters sound a bit too good to be true, you are right. But remember the cynic's view of public relations. As a lie, this one is certainly better for scientists than the old one. These characters may have failings, but they are not numerous and do not include arrogance, selfishness, greed or malevolence. Instead, those traits are reserved for the Attenborough character, the aggrieved computer nerd on his staff, and the accountant.

I have not seen a showing of this film when the sight of the accountant being eaten by T. rex did not get a cheer. Nobody is sympathetic to the nerd because he is a fat, ugly, two-timing, lazy slime-ball. Moreover, in what we may take as evidence of a reaction against the idols of the 1980s, Attenborough's self-made billionaire finds little favour.

Dante's Peak. Universal International Pictures - Ben Glass.

Of course, Attenborough's character has some other scientists who are on his side, notably his employees. The whitecoats working in the dinosaur hatchery show the applied aspect of the film's theoretical basis. These folk are actually reconstructing dino-DNA and hatching the critters out in glass incubators.

This was an interesting side issue for the portrayal of science. Perhaps I imagine it, but every time I watch this scene, I get the impression that Attenborough's technicians are all oriental. Was Spielberg falling victim to another cliché, namely that oriental scientists merely apply the discoveries of the West? That Oriental science is not characterised by original thought or wider insight? That the East can only perform mechanical repetition?

I am sure the right-on Mr Spielberg would be horrified at the idea. One has to be close to a subject to be sensitive to malevolent stereotyping; but one can be too sensitive. The jury is still out - which makes a good excuse to watch it again.

Saviour-scientists appeared in this year's best volcano movie, Dante's Peak (Universal Pictures). But this film not only had a volcano

Dante's Peak. Universal International Pictures - Ben Glass.

and lots of geologists: it had scientific credentials to match.

This was just as well, because the script was not up to much. In classic Jaws format, the film opens with a cosy community about to get the shock of its life from the Force of Nature on its doorstep, in this case, a large, hitherto dormant volcano in the Cascade Mountains of the western USA. The vested interests of business and the local council, with the exception of the feisty single mum Mayoress (and there's an unlikely combination of characteristics), conspire to prevent the right action being taken until it's too late.

Coming to the rescue is USGS geologist Harry Dalton (Pierce Brosnan). At this point you will understand why Mayoress (Linda Hamilton) has to be single. Dalton/Brosnan has been sent to conduct a preliminary evaluation. Intuition, with which he is well endowed, quickly tells him that the time for surveys is past and action is needed. He is about to arrange an evacuation of Cosytown USA when his boss arrives. His boss, Paul Dreyfus (Charles Hallahan), is thoughtful and cautious. He is also fat, ugly and old.

The boss is distressed to find that his impetuous subordinate is about to panic the natives on nothing more than the evidence of his senses and a few asphyxiated squirrels. A bad experience years ago when he too was young and impetuous (but not, we suspect, as handsome as Mr Brosnan), urges him to caution. He is right, of course; but Brosnan is righter.

The drama unfolds as you would expect. Brosnan is vindicated. The citizens are evacuated (though only just). Poor old Paul, despite being man enough to admit his error, pays the ultimate penalty, as is dramatically right. Brosnan and Mayoress survive and C well, all ends as it should.

This is a very encouraging film for geoscientists. The young, pretty, student-like whizz-kids who work for crusty, overweight Paul have the computers, the technology, and the theory in their heads (always quoting papers and their authors). Paul's trouble is being too tied up with protocol, procedures, hardware and software. He isn't in touch with the Earth. But he is honest. He is neither evil nor incompetent. And he admits his mistake manfully.

Brosnan is quick, because he is intuitive. He uses his senses. He tastes things. He feels for the flora and fauna. These empathic traits are the anti-cliché devices that the scriptwriters have attached to him. He is also terrifically handsome. Handsome, athletic scientists are a novelty. Think of Brian Donlevy in the Quatermass films. (Incidentally, Professor Quatermass is an example of yet another stereotype, the saviour-scientist as frightening but wonderful Prospero-type wizard, a type exemplified by William Hartnell as the first Dr Who in the cult BBC TV series from the sixties.)

The science press paid more attention to Dante's Peak than it usually does to motion pictures, because the film's publicity concentrated on its scientific credentials. The film had three volcanological consultants: Drs Jack Lockwood, David Harlow and Norman MacLeod. They did not prevent some unlikely and inaccurate things. The production of copious lava, not a present-day characteristic of Cascade eruptions, is one; though there is evidence of ancient lavas in the Cascades. The scene where Brosnan drives a landcruiser across a lava flow lasts far too long to be credible. The volcanic ash looks more like the stuffing of jiffybags than the fine grey flour I had to scrape out of every orifice when I visited Washington State just after the Mount St Helens eruption.

But this carping misses the point; and not just because the film was, as promised, remarkably faithful to geological reality. The special effects, particularly the rolling pyroclastic clouds (based on the real-life films of the late Maurice and Katia Krafft) were wonderful. Most of the science press's reviews entirely missed the fact that Dante's Peak is the latest in a series of films in which scientists are breaking free of their mad, bad image. The reasons for this phenomenon are not hard to find.

The public has become better informed about science than it was. One of the results is an increasing awareness of the difference between science and technology. Tampering With Nature has always been the main theme in science fiction where the scientist has played the villain. As we move towards the next century, the public is shifting its view. Scientists can be cool and brilliant. They can be intuitive about Nature. They can be in touch with their feelings, and brim-full of what has become known as "emotional intelligence". The villains are now much more likely to be those, like the mo-

ney-mad, or power-mad, or the plain unthinking white-coated automatons hatching dinosaurs in Jurassic Park, who thoughtlessly apply science. The heat seems to have come off those who are merely curious about Nature's workings.

This explains why geoscientists are in the vanguard of this new trend. Geoscientists can more easily be cast as sensitive seers than can, say, physicists, chemists or geneticists. Moreover, by being associated with the open air and fieldwork, they can take on some of the characteristics usually associated with roughie-toughie types like oilmen and lumberjacks. Crusty old Paul Dreyfus, given a hard hat and a set of coveralls, would look like every Louisiana toolpusher I've ever met. There has been one example of scientist as villain in a recent Hollywood product. I should like to include him, because I do not believe he invalidates my central thesis.

Tim Burton's Mars Attacks! is an outrageous spoof: an 'Ed Wood'-style, pseudo B-movie sci-fi thriller. The only difference is that Mars Attacks! was made with huge amounts of money, high production values, and talent.

In this tale, which went down better in Europe than in the US, gum-card cartoon aliens invade the earth with malice aforethought. Pierce Brosnan (again) plays a scientist, but one who this time is a bad-guy. But if you look closely, you will see that this character is not a baddy because he is a scientist. Instead, Burton allows him to fulfil the role of the complacent, well-meaning liberal intellectual who counsels caution and peace.

Audiences are famously reactionary. Everyone just knows that the military chief, played by Rod Steiger, is right to urge the President to nuke 'em, and nuke 'em now. Brosnan's scientist does not appeal to stereotypical distrust of science. He appeals to an even deeper misgiving in the American psyche - distrust of fancy-talking intellectual pinkos. Some of them are bound to be scientists; but not all intellectuals are scientists. So Mars Attacks! is not an attack upon scientists per se.

The battle for the rehabilitation of science in the public mind is not over by a long way. But these new fictional representations of science and its practitioners are showing us, I believe, that it has moved into a distinctly new phase. We are moving into a world where Brosnan can be believable as a volcanologist and palaeobotanists can be as alluring as Laura Derne.

About ten years ago I wrote a piece for New Scientist about an advertising campaign for mineral water. It featured a husband who grows suspicious of his wife when she starts spouting geological information at the dinner table. He wonders whether the "handsome young mineralogist" that she had met on the beach in the South of France might have been interested in more than her wind-surfing technique.

Perhaps that was the beginning. Perhaps, as I predicted then, the era has now come when the public can accept as perfectly natural what we in the field have known for years. As well as being interesting and useful people, geoscientists look good in swimwear too.

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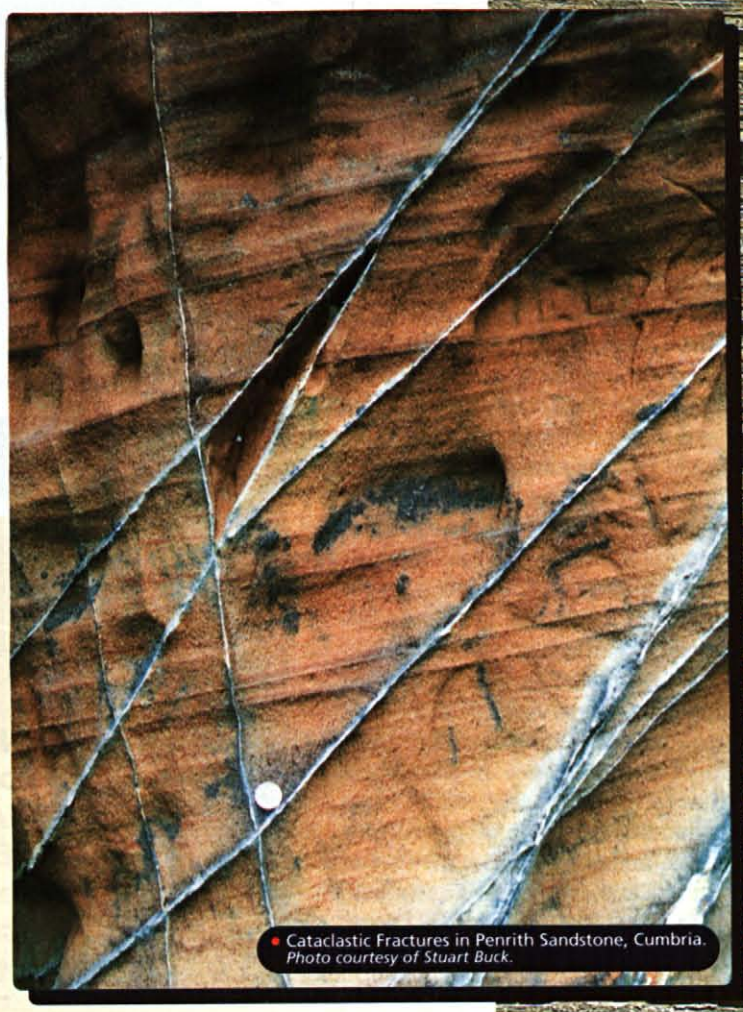

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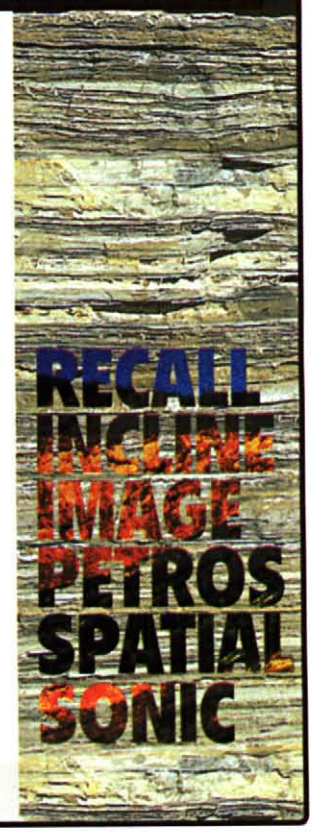

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THE 21ST CENTURY PETROLEUM CONSULTANT; A MASTER OF MULTIPLE TRADES

*by Robert G. Font**
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Abstract

With the approach of the 21st century, we must examine various key questions pertinent to the future success of independent petroleum consultants. What tools and techniques will be necessary in order to maintain a competitive edge? What formal education, special training and specific credentials will be needed to operate efficiently? What management and business strategies will become essential to ensure profitability? What emerging technologies will impact our careers? The following discussion is intended as a survey of the tools, skills, techniques, education, and credentials which, in the writerís perception, will become crucial to the success of petroleum geologists in the new century.

Resumen

Con el próximo advenimiento del siglo 21, debemos examinar diversas preguntas clave para el éxito futuro de los geólogos consultores independientes del petróleo. ¿Qué herramientas y técnicas serán necesarias para mantener un perfil competitivo? ¿Qué educación formal, formación específica y acreditaciones específicas serán necesarias para operar con eficacia? ¿Qué estrategias de gestión y de negocio serán fundamentales para asegurar la rentabilidad? ¿Qué tecnologías emergentes tendrán impacto sobre nuestras carreras? La discusión que sigue pretende ser una revisión de las herramientas, conocimientos, técnicas, educación y acreditaciones que en opinión del autor serán fundamentales para el éxito de los geólogos del petróleo en el nuevo siglo.

Résumé

Avec le 21me siècle qui approche, nous devons examiner différentes questions «cle» qui conditionnent le succès futur des géologues consultants, indépendants, du secteur pétrolier. ¿Quels outils et quelles techniques seront nécessaires pour conserver une coudée d'avance dans la compétition? ¿Quelle éducation formelle, formation spécifique et titres particuliers seront requis pour travailler efficacement? ¿Quelles stratégies du point de vue gestion et aussi commercial seront essentielles pour garantir un profit? ¿Quelles technologies naissantes vont conditionner nos métiers? Le débat qui suit a pour objet l'étude des outils, des compétences, des techniques, de l'enseignement et des titres qui, selon l'auteur, vont devenir fondamentaux pour le succès des géologues du pétrole, à l'aube du 21me siècle.

The Computer - A Basic Tool

If there is one tool that will be essential for all of us to master in the new century, since it is changing the way we do business, it is undoubtedly *the computer*. Whether a workstation or a PC, being able to utilize computer applications and being proficient in general computer usage is rapidly becoming an every day necessity for independent contractors and consultants. Regardless of the application, such as working on a reservoir simulation-geostatistical analysis project, handling seismic records for a 3-D or 4-D study, performing a basin modeling/back stripping analysis,

* Reprinted from The Professional Geologist (AIPG).

modeling gravity and magnetic anomalies over potential structure or stratigraphic traps, running an exploration economics and risk analysis program, browsing the Internet for critical information, sending e-mail messages to colleagues around the world, running a log analysis program, or simply generating contour maps, the computer is an essential tool for us to work with. There are a variety of software programs available today, ranging in price from less than one hundred to a few thousand dollars, that handle almost any application one may be interested in. The point is simply this: *The software is out there for us to use and to help us operate more efficiently.*

Computers are also becoming a necessary tool for us to find, locate and manage data of interest. The National Geoscience Data Repository System is an excellent example of what the future may hold for finding and locating critical data (Merrill, Milling and Breed, 1996). Sponsored by the AGI and supported by the DOE as well as private industry, the NGDRS is envisioned to be a system of dispersed, independent data centers that are joined electronically. Private companies are willing to donate millions of miles of seismic data, well logs, boxes, cuttings, cores and other assorted geoscience data. Presently, studies are underway to establish an organization to this system, develop a directory of public and private data centers, and determine the best manner to document what data exists and where it is located. Once the repository becomes a functional reality, participating companies and individuals will be able to select a geographical area of interest from a world map, on-screen, and either view or download a list of all data storage facilities within the selected region. The user will then be able to specify the data of interest, determine its location and arrange for its acquisition. It is expected that the NGDRS will become an integral tool for domestic independents and, possibly, for geoscientists worldwide.

The role of the computer in data management is rapidly evolving. As geoscience professionals in the oil and gas industry, we are users of vast quantities of technical information (Font, 1996a and 1996b). Many of us dream of the day when we can see all of our data on the computer screen and retrieve instantaneously, in a format that will be of optimum benefit to us in our daily tasks. Thus, the selection of the appropriate data base is essential. There are many excellent products available for potential use, both commercial and proprietary. The Association of Record Managers and Administrators publishes a reference (Phillips and Tarrant, 1996) containing about 100 records management software programs, many of which can be adapted to suit the needs of the petroleum industry. The data management that we dream of is, therefore, within our reach.

In short, in addition to allowing one of the quickest and most effective ways in which to process analyze and manage data, computers also provide one of the fastest and more desirable ways for us to communicate. We will need the computer for business survival.

Necessary Skills and Education

New skills are becoming necessary for us to master to supplement our traditional base. This topic and the future of petroleum geology in general are issues of current concern among professionals in both industry and academia. There appears to be a consensus regarding various specific and necessary skills (Clifton and Ashley, 1994; Wantland, 1996; Berendson, 1996). These include:

* *The ability to quantitatively describe rock units and represent their data statistically for scaling purposes.*

* *The need to integrate geological, geophysical and geochemical data, along with petrophysical, and engineering parameters.*

* *Exposure to and experience with field geology and outcrop studies to allow the visualization and interpretation of subsurface sedimentary architectures in three dimensions.*

* *The understanding of the economics of the petroleum industry, as well as the relation between tectonics and sedimentation.*

* The capability to work both as an individual and as a team member, contributing specific problem-solving skills.

* An understanding of the history and culture of other nations, and a working ability in foreign languages (if working internationally).

Environmental Awareness

Environmental regulations will continue to impact our work as independent petroleum consultants and oil and gas operators in the 21st century. In fact, the enactment of more stringent environmental laws should be expected in the near future (Marler, 1994; Holliday, 1995; McFaddin, 1996). Simply stated, if we are not presently familiar with the significance and impact of environmental laws such as RCRA, CWA, SDWA, CERCLA, CAA, TSCA and others, we will have to correct that problem or pay the price. *As independent petroleum consultants and oil and gas operators, we can not afford to be ignorant of these environmental laws.* Thus, environmental education must become part of the training for these individuals in the 21st century.

Techniques

The geoscientist of the 21st century will be compelled to understand, if not master, a number of different techniques based on the rapid pace of technological advances (Clifton and Ashley, 1994; Durham, 1996; Anderson, 1996). Among the new tools that impact our competitiveness as consultants and contractors are:

* *Advances in petrophysical tools (such as MRIL, FMI).*

* *Progress in drilling technology (i.e., horizontal drilling, deep-water drilling).*

** Advances in seismic technology (4D, Coherence, etc.).*

** Improvements in core imaging.*

** Strides in field-automated computer applications (such as log and pore system analysis).*

** Increasing understanding of reservoir geohistory and sedimentary controls on PVT.*

** Advances in remote sensing techniques (i.e., GPR, GPS, NMR, SRM).*

** Mathematical techniques (chaos, fractal geometry, fuzzy logic, etc.).*

Credentials

Registration of geoscientists is sweeping the nation. Currently, twenty-six states are known to have laws relating directly to the practice of geology and about a dozen more states are working to achieve registration. «Registration» mainly concerns those of our colleagues who practice in fields which are interpreted as having a direct impact on the «general public» and, in most cases, exempts petroleum geoscientists working in private industry. However, it is felt that «registration» will become increasingly important, if not vital, to all of us in the oil and gas industry in the near future. Plainly expressed, those that register will obtain credentials that may be viewed as «expert status» by courts of law. Undoubtedly, future actions by petroleum geoscientists will be challenged in the courts. If nothing else, petroleum geoscientists will find it advantageous, if not necessary, to acquire these credentials to be considered professionally competent and qualified to testify as an «expert witnesses». Petroleum geoscientists who choose not to register may become increasingly vulnerable.

«Certification» by organizations such as AIPG will become crucial to consultants and contractors, even if «registered». «Registration» is instituted for the protection of the general public, and not for the benefit of the professional practitioner. Thus, organizations such as AIPG will be needed to provide support and backing to its members when the need arises, to stay abreast of all issues which may affect our professional practice, and to act quickly and in unison to counteract unfounded and irrational attacks on our profession and industry. *In summary, both «registration» and «certification» will be desirable credentials for us to have in the new century.*

Flexibility and Adaptability-What's Ahead?

The most critical qualities the 21st century geoscientists must possess involve the ability to be flexible and adapt to a changing environment. As new opportunities arise (and as others «dry up»), we must be in a position to take advantage of the new. These novel chances may require us to «shift gears» and utilize our experience and expertise in the pursuit of new challenges. As companies continue to reorganize and seek more cost effective ways in which to operate, in order to stay competitive, new «consultants» will develop. Thus, opportunities in our industry will continue. *With a solid technical background, good business sense, impeccable ethics, a positive attitude, a good network of industry contacts and the willingness to learn and evolve, the 21st century domestic independent has a bright future ahead.*

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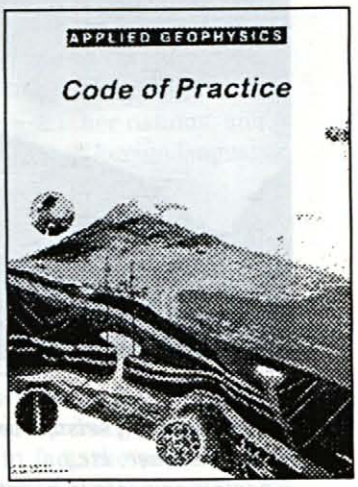

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THE CANADIAN COUNCIL OF PROFESSIONAL GEOSCIENTISTS

by Gordon D. Williams
Ph.D., CPG, PG, REM, EurGeol
Canadian Council of Professional Geoscientists - Implementation Task Force

Abstract

For several years, professional associations that licence (register) geoscientists in Canada have recognised that a national organisation was needed to fulfil a threefold purpose: 1) act as a forum through which common issues could be addressed; 2) help co-ordinate standards and other activities affecting professional geoscientists in Canada; and 3) represent Canadian geoscientists nationally and internationally.

Until about ten years ago - when the need was less pressing - only two jurisdictions, Alberta and the Northwest Territories had legislation in place to license geoscientists. British Columbia, Newfoundland and Saskatchewan have since been added to the list of provinces that require geoscience licensure, and Manitoba, Ontario, Nova Scotia and New Brunswick currently are at various stages of implementing their own requirements. At present, all the professional associations that licence geoscientists also licence engineers under a single combined engineering and geoscience act of their provincial or territorial legislature.

National coordination for the engineering professions has been provided by the Canadian Council of Professional Engineers (CCPE) since the 1930s. To meet the needs for a parallel national organization in the geosciences, the Canadian Council of Professional Geoscientists/ Conseil canadien des géoscientifiques professionnels (CCPG) was established in March, 1997, with the active assistance of the CCPE. A federally chartered not-for-profit corporation headquartered in Calgary, Alberta, the CCPG will become fully functional on January 1, 1998. It is a completely independent entity whose members are those provincial and territorial associations that license or certify geoscientists under right-to-practice or right-to-title legislation, or are working towards licensure or certification.

Resumen

Durante muchos años, las asociaciones profesionales que certifican a los geocientíficos en Canadá han reconocido que era necesaria una organización para cumplir tres objetivos: 1) actuar como foro para discutir temas de interés común; 2) ayudar a coordinar las normas y otras actividades que afectan a los geocientíficos en Canadá; y 3) representar a los geocientíficos canadienses nacional e internacionalmente.

Hasta hace sólo diez años, cuando la necesidad no era tan urgente, tan sólo dos jurisdicciones, Alberta y los Territorios del Noroeste disponían de legislación para la certificación de profesionales. Desde entonces se han incorporado a la lista de provincias que exigen la certificación de profesionales Columbia, Newfoundland y Saskatchewan y Manitoba, Ontario, Nova Scotia y New Brunswick están actualmente en diferentes fases de implementar sus propios requisitos. Actualmente todas las asociaciones profesionales que certifican geocientíficos también lo hacen con los ingenieros bajo una sola ley en su provincia o territorio aplicable a ingenieros y geocientíficos.

La coordinación nacional de los ingenieros la lleva a cabo desde los años 30 el Consejo Canadiense de Ingenieros Profesionales (CCIP). Para cubrir las necesidades de una organización paralela en las Ciencias de la Tierra se estableció en marzo de 1997, el Consejo Canadiense de Geocientíficos Profesionales (CCGP) con la colaboración del CCIP. El CCGP, una corporación federal sin ánimo de lucro con sede en Cagliary (Alberta) estará en pleno funcionamiento el próximo 1 de Enero de 1998. Es una entidad completamente independiente cuyos miembros son asocia-

ciones territoriales que certifican geocientíficos bajo la legislación del derecho al ejercicio profesional o están trabajando para conseguir la certificación profesional.

Résumé

Depuis plusieurs années, les Associations professionnelles qui «certifient» les Géoscientifiques au Canada ont reconnu la nécessité d'un Organisme au plan national, pour atteindre trois objectifs: 1) agir comme une tribune (forum) par l'intermédiaire de laquelle les sujets d'intérêt commun seraient discutés; 2) aider à la coordination et à la définition de standards et autres activités concernant les Géo-scientifiques professionnels au Canada; et 3) représenter les Geo-scientifiques canadiens à la fois sur le plan national et international.

Jusqu'à une dizaine d'années, –lorsque le besoin s'en faisait moins sentir–, deux juridictions seulement, en Alberta et dans les Territoires du Nord-Ouest, possédaient une législation reconnaissant les Géo-scientifiques. La Colombie britannique, le Newfoundland et le Saskatchewan ont depuis rejoint la liste des Provinces du Manitoba, de l'Ontario, de la Nouvelle Ecosse et du Nouveau Brunswick sont actuellement en train de mettre en oeuvre, à différents niveaux, leur propre législation (exigences). Aujourd'hui, l'ensemble des Associations professionneles qui reconnaissent les Géos-cientifiques certifient aussi les ingénieurs à partir d'une même loi (provinciale ou territoriale) applicable aussi bien aux ingénieurs qu'aux Géo-scientifiques.

Depuis les années 1930, une coordination nationale pour les métiers d'ingénieur a été mise en oeuvre par le Conseil Canadien des Ingénieurs Professionnels (CCPE). Parce que l'existence d'un Organisme national équivalent dans le domaine des Géosciences est nécessaire, le Conseil canadien des Géo-scientifiques professionnels (CCPG) a été créé en Mars 1997 avec le soutien actif du CCPE. Le CCPG, organisme enregistré au niveau fédéral, but non lucratif, dont le siège est situé à Calgary, Alberta, sera pleinement opérationnel à partir du 1er Janvier 1998. Il représente une entité totalement indépendante dont les membres sont les Associations provinciales et territoriales qui reconnaissent et certifient les Géo-scientifiques au niveau du droit d'exercer ou droit au titre, ou qui travaillent á la reconnaissance ou la certification des Géo-scientifiques professionnels.

Current Status of Licensure in Canada

More than 5,000 geoscientists are now licensed as Professional Geoscientists (P.Geo.), Professional Geologists (P.Geol.) or Professional Geophysicists (P.Geoph.) under combined engineering and geoscience right-to-practice legislation in Alberta, British Columbia, Newfoundland, Northwest Territories and Saskatchewan. Over the next few years, approximately 10,000 geoscientists will be licensed in Canada as the remaining jurisdictions enact similar legislation. The status in the remaining provinces and territories is as follows:

- In Nova Scotia, a bill to establish the Association of Professional Engineers and Geoscientists of Nova Scotia was introduced in the legislature in 1996, but was subsequently withdrawn because of difficulties between engineers and architects in defining certain areas of overlapping professional practice. Geoscientists have now formed the Association of Professional Geoscientists of Nova Scotia to work with the Association of Professional Engineers of Nova Scotia to ensure that combined engineering and geoscience legislation is enacted as soon as possible.
- In Manitoba, a new act to create a combined Association of Professional Engineers and Geoscientists of Manitoba is the result of several years of intense effort on the part of geoscientists and engineers in that province. The act was scheduled for introduction at the fall, 1997, sitting of the legislature but, because that sitting was cancelled, it will probably appear on the spring, 1998, agenda.
- In Ontario, the Association of Geoscientists of Ontario has been working with Professional Engineers Ontario to revise that province's current engineering act to incorporate geoscientists. A draft of the new act could be in the legislature by early 1998.
- In New Brunswick, a joint task force of the Association of Professional Geologists of New Brunswick and the Association of Professional Engineers of New Brunswick (APENB) recommended joint licensure under a combined act. The task force report was accepted by both organizations and a new engineering and geoscience act is currently being developed. The new act is scheduled to be presented for approval at APENB's next annual meeting in February, 1998.
- Geoscientists in Québec have been seeking professional licensure or certification for almost 30 years but the body responsible for licensing engineers in Québec - the Ordre des ingénieurs du Québec - has not been sympathetic towards combined licensure. The geoscientistsí organization, the Association Professionnelles des Géologues et Géophysiciens du Québec (APGGQ) have therefore approached the provincial government directly to provide right-to-title certification. The Office des Professions du Québec recommended several years ago that a new Ordre be created for geoscientists and given exclusive right to use specified titles under existing legislation. Unfortunately, the legislation, as it relates to geoscientists, has yet to be proclaimed by the government despite continuing efforts on the part of the APGGQ to encourage them to proceed.
- The number of geoscientists practising in Yukon and Prince Edward Island is very small. As licensure of geoscientists spreads to more of the other provinces, the en-

gineering associations in these jurisdictions may well recommend including geoscientists in their acts.

Organization of CCPG

The CCPG is an umbrella organization that exists solely to serve its constituent geoscience associations, with no power of compulsion over its members or their existing statutory authority. Individual professionals will not be members of CCPG nor will CCPG licence or certify individual professionals. Professional geoscientists will belong to their provincial or territorial associations which, in turn, will hold membership in CCPG.

Figure 1 illustrates the current membership of CCPG and, for comparison, CCPE. Most of the constituent association members are common to both CCPG and CCPE or will be when current legislative activity is completed. In the future, geoscientists and engineers will undoubtedly be better served by having a single combined national organization.

The CCPG Implementation Task Force was formed by CCPE in January, 1996, to establish the CCPG within two years. The Task Force has accomplished its objectives and is currently functioning as the interim CCPG Board of Directors until it is discharged at the end of 1997 and the officially constituted Board assumes control. The initial Board of Directors, representing the charter members of CCPG, comprises:

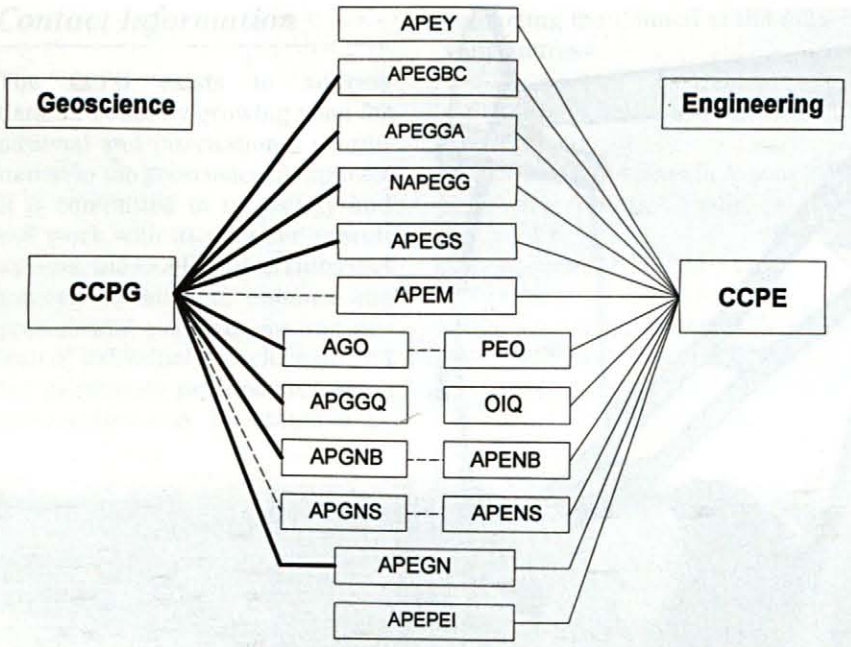


Figure 1: relationship of provincial constituents associations (member organizations) to the Canadian Council of Professional Geoscientists (CGPG)and the Canadian Council of Professional Engineers (CCPE). Solid heavy and light lines indicate membership in CCPG and CCPE respectively. Dashed lines indicate combined engineering and geoscience acts in the legislative process or under development.

APEY- Association of Professional Engineers of the Yukon
APEGBC- Association of Professional Engineers and Geoscientists of the Province of British Columbia
APEGGA- Association of Professional Engineers, Geologists and Geophysicists of Alberta
NAPEGG- Association of Professional Engineers, Geologists and Geophysicists of the Northwest Territories
APEGS- Association of Professional Engineers and Geoscientists of Saskatchewan
APEM- Association of Professional Engineers of the Province of Manitoba
AGO - Association of Geoscientist of Ontario
PEO- Professional Engineers of Ontario
APGGQ- Association of Professional Geologists and Geophysicists of Québec
OIQ- Ordre des ingénieurs du Québec
APGNB- Association of Professional Geologists of New Brunswick
APENB- Association of Professional Engineers of New Brunswick
APGNS- Association of Professional Geoscientists of Nova Scotia
APENS- Association of Professional Engineers of Nova Scotia
APEGN- Association of Professional Engineers and Geoscientists of Newfoundland
APEPEI- Association of Professional Engineers of the Province of Prince Edward Island.

Michel Bouchard, Ph.D.	APGGQ (Québec)
Timothy Canam, P.Geol.	NAPEGG (Northwest Territories)
Bob Leech, M.Eng.Sc.	AGO (Ontario)
Hugh Miller, Ph.D., P.Geo.	APEGN (Newfoundland)
Philip Reeves, P.Geo., P.Eng.	APEGS (Saskatchewan)
Linda Thorstad, P.Geo.	APEGBC (British Columbia)
Reg Wilson	APGNB (New Brunswick)
Gordon Williams, Ph.D., P.Geol.	APEGGA (Alberta)

CCPG Objectives

The purpose of CCPG is to assist its member associations by providing a national focus for their activities and concerns. The principal objectives of the CCPG, as listed in its letters patent, are to:

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

a) coordinating, correlating and standardizing their activities, particularly in the areas of registration of geoscientists, mobility of registered practitioners and interprovincial practice;

b) promoting and maintaining high standards in the geoscience professions;

c) developing effective human resources policies and promoting the professional, social and economic welfare of members of the geoscience professions;

d) promoting a knowledge and appreciation of geoscience and the geoscience professions, and enhancing the usefulness of the professions to the public;

e) promoting the advancement of geoscience and related education;

f) generally carrying out their various objectives and functions;

- act on behalf of, and to present the views of, its constituent associations and organizations in matters that are national or international in scope, including international registration or certification of geoscientists and reciprocal practice;
- act in respect of other matters of Canada-wide or international nature concerning the geoscience professions, either alone or together with other bodies.

Geoscientists, perhaps more so than some other professionals, often practice outside the jurisdiction in which they are licensed. Increasingly, their practice spans more than one province or territory, and many individuals work internationally. CCPG will work toward facilitating the mobility of professional geoscientists within Canada by encouraging its member associations to make transferring registration from one jurisdiction to another as easy as possible. A related objective is to develop arrangements whereby geoscientists will be able to practice outside their 'home' province or territory for specified short periods without having to become licensed in each jurisdiction.

The development of reciprocal relationships with licensing or certifying organizations elsewhere in North America and beyond is an explicit objective of the CCPG. In this regard, contact has been made with the American Institute of Professional Geologists, the National Association of State Boards of Geology, the European Federation of Geologists and the Geological Society in Great Britain. Contacts with the Australasian Institute of Mining and Metallurgy and the Consejo Profesional de Ciencias Geologicas of Argentina are being developed.

The Canadian Geoscience Standards Board

Compatible academic and experience requirements for licensure are prerequisites to easy mobility of professionals, within Canada and elsewhere. To assist its member associations in developing and maintaining such standards, the CCPG has established the Canadian Geoscience Standards Board (CGSB). Composed of representatives of each member association of CCPG, and chaired by Dr. Philippe Erdmer of the University of Alberta, the CGSB has held two meetings and will meet once again before the end of 1997. Its mandate is to:

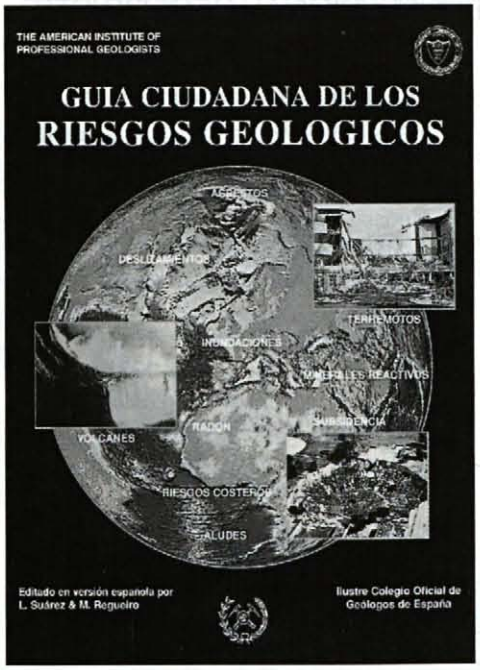
- provide guidance to the constituent associations of CCPG on matters relating to professional qualifications and practice.
- publish and periodically update national guidelines and examination syllabi in the geosciences for use by the constituent associations.
- develop methods of assessing the extent to which Canadian geoscience degree programs meet or exceed educational standards acceptable for licensure as a geoscientist in Canada and to publish a list of geoscience programs which it considers meet or exceed those standards.
- conduct research into foreign geoscience programs to determine the extent to which such programs may satisfy all or some of the academic requirements for licensure in the constituent associations.
- ascertain the equivalency of accreditation programs in other countries, recommend mutual recognition agreements with foreign organizations and to monitor the activities of those organizations with which mutual recognition agreements have been signed.

The first priority of the CGSB is to ensure that academic and other standards adopted by the member associations of CCPG are sufficiently compatible so that the transfer of membership between jurisdictions by individual geoscientists is not impeded.

Contact Information

The CCPG exists to address Canada's rapidly growing need for national and international coordination in the geoscience disciplines. It is committed to inclusivity and will work with its member organizations, the CCPE, universities and learned societies to enhance the professional qualifications and stature of individual geoscientists and the geoscience professions. More information may be obtained by contacting the Council at the following address:

Canadian Council of Professional Geoscientists
Suite 1600, 734 Seventh Avenue SW
Calgary, Alberta, Canada
T2P 3P8
Telephone: (403) 232-8511
Facsimile: (403) 269-2787
E-mail: gordonw@cadvision.com
Internet: http://www.ccpg.ca
(Under construction, available January 1, 1998)



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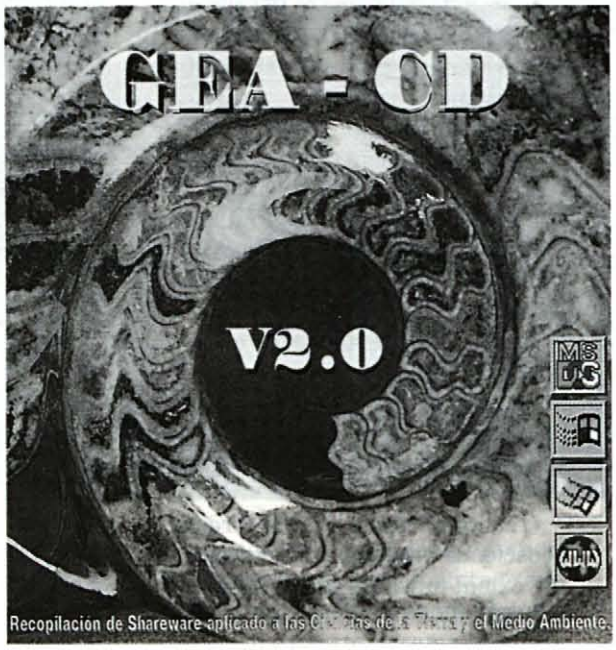

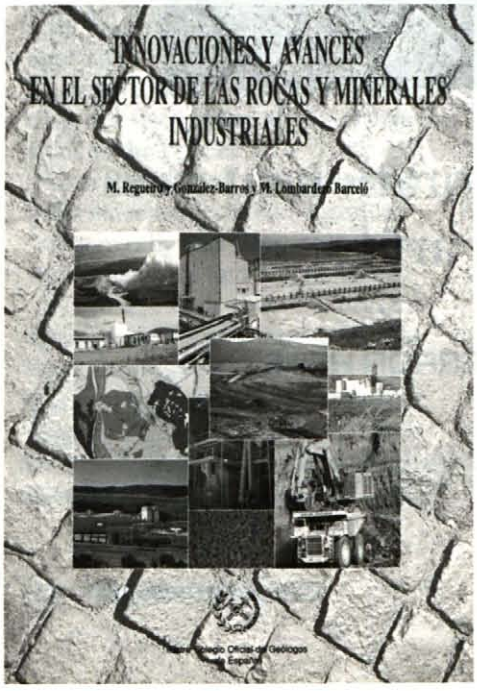

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VOICE IN THE WILDERNESS

Ian Plimer, Professor of Geology at the University of Melbourne, is the Society's newest Honorary Fellow. His citation quoted the courageous stand against Creation "Science" which he has undertaken at considerable personal cost. He talks to Ted Nield about his experiences, up to and since the recent much-publicised court case.

TN– Professor Plimer - congratulations. How would you define creation "science", and what made you take such a strong public stance against it?

PP– Creation "science" is the unsubstantiated dogma of a narrow fundamentalist religious cult who will stop at nothing to hijack the education system. This was already happening in the US and I did not want the same to occur in Australia. These were dangerous times of "political correctness". All ideas were deemed of equal value. In Queensland, an education minister ruled that creation "science" could be taught. It was entering schools by stealth, was aired at school camps and presented by school visitors.

I have devoted my life to geology, both in industry and education. My field of ore deposit geology is essentially applied common-sense, and it is impossible for any geologist to entertain ideas such as the Great Flood or a 6000 year-old Earth, in even the most advanced state of inebriation. Both ideas are central tenets of creation "science". I could see that a well-organised, liberally funded creationist movement was a force of darkness cleverly using "science" and religious fear and omitting logic, ethics and Christianity.

General knowledge about geology is close to zero and this was being exploited by a fundamentalist religious cult. As holder of one of Australia's Chairs in geology, I had to take a public stand. From the start, it was clear that it would be a long hard row to hoe, and controversial.

TN– What sorts of arguments did you have to face?

PP– They were not arguments - they were defamatory ad hominem attacks. In response to a 1986 article of mine in Australian Geologist, a creationist medical practitioner wrote: "There is just so much error in the article it would take dozens of pages to refute reasoned scientific argumentation is virtually non-existent". He went on to accuse me of a "tragic misuse of authority and influence". Presumably, a professor of geology misuses his authority by writing against the geological basis of creationism in a professional newsletter.

My contact with creationism accelerated. I underwent a frontal lobotomy reading all available creationist literature. My public lectures ascended to Orwellian dimensions. A 1988 debate with Dr Duane Gish, the US Creationist guru, resulted in hate mail, death threats, defamatory pamphlets and an organised campaign to have me dismissed from my Chair. Teenage thought-police taped my every word. Stacked audiences chanted when I spoke. Children whose age was not yet in double figures informed me that my science was wrong.

Vexatious mail was sorted by my extremely patient and supportive secretary. It was easy to identify. Wrongly addressed, the random use of capitals, lack of any date or signature, numerous spelling errors, Biblical references (commonly wrong), obsession with Satan and their vicious hatred, all supported the suggestion that the followers of creationism are simple, ill-educated folk.

The most memorable of these letters (undated, unsigned) read: "Dear Sir, Drop dead." The most interesting threat came in a long letter from the American creationist lawyer Wendall Bird. My reply included the sentence "I presume your English and punctuation errors were deliberate". Of course there were neither - but a new version arrived a month or so later riddled with them. The hilarity of such moments lightened the battle - and supportive letters far outweighed the hate-mail.

I have been painted as an atheist, a God-hater, an agent of Satan, and compared with the Nazis. I am a non-theist, but I am sympathetic to the social value of religion in society. I came to know theologians who not only support my actions but argue there is no theological basis for creationism. Some high Anglicans and Jesuits argue that creationism is anti-Christian! There was clearly a unity between science and some quarters of the church, and I fostered this, as I became interested in why some scientists and some Christians embrace creationism, and why creationism seemed to be a blight of the New World.

TN– You say that Creationism is bad science and bad religion. What do you mean by that?

PP– Creationists believe that the first 11 chapters of genesis provide an accurate history of our planet. This is a religious belief and cannot, unlike science, be challenged by evidence. I believe this view belittles epistemology, theological scholarship, the Bible's spiritual revelation, its poetical and allegorical richness and its undeniable historical contribution. How can we accept the

Bible as the literal inerrant word? Which Bible? Which translation? Why out of 5,700 million humans should fundamentalist Christians have favoured-creed status with God? Which God?

Science explains the world around us, whereas religion is an attempt to come to terms with being human. This is the wonderful, exciting unity of science and theology. There is a great human need for spirituality; but mainstream churches have lost contact with their flocks. To fill the spiritual gap there has been a great rise in charismatic fundamentalist and Pentecostal churches, cults, new-age ideology and irrationality.

For thousands of years religions, cults and despots have exploited fear of the unknown. But science thrives on the unknown and expands into the uncharted future. Creationism is a contraction into the theocratic, pre-scientific world of three centuries ago.

TN– Most people would say that - but they wouldn't mortgage their houses to fight creationism like you have done.

Why not ignore these bizarre folk to practise their beliefs in privacy? Does it matter?

PP– It does.

The scientific chronicle of Planet Earth is underpinned by evidence, for all to see and challenge. As evidence accumulates, the chronicle is refined and modified. This is the healthy unfinished business of science. Because of constant testing, any dogma, mistake or fraud is ultimately uncovered and their perpetrators dismissed and discredited.

There have been many investigations into the "science" of creationism. All have shown it to be misquoted, misleading, deceptive, fraudulent or concocted. Not one scientific claim of creationists has withstood scrutiny. Many creationist leaders with scientific qualifications have been involved with scientific fraud for decades. Yet they continue their work unabated.

The creationist target children, either directly or indirectly. Literature and videos are directed at school children - who are searching for meaning in life, are insecure and may be at odds with their parents, and looking for simple solutions to complex questions which in fact might be insoluble. To them, leadership underpinned by literally inerrant scripture might be attractive. It is because of the damage that creationists are doing to the next generation that I have fought them like a rabid dog, sold assets and will ultimately be declared bankrupt.

Creationists abuse the democratic process and demand that their view of the planet, which they claim is underpinned by science, should be taught in on an equal time basis with true science. It is simply unacceptable in a pluralist society to have fundamentalists teaching junk religion and fraudulent science to our children.

Creationism has a hint of totalitarianism, has neither theological nor scientific basis, and appeals to anti-intellectualism. It attracts the simple, the insecure, the violent, the authoritarian, the damaged, the displaced, the poor and the ill educated. It exploits people in a world where change has never been so rapid, where unemployment and insecurity are rife, and where there is spiritual hunger.

Creationism is about power. It is the ugly political face of fundamentalism. These cults want control of the minds and souls of the young. Because of this, one cannot ignore Jefferson's words: "Education is the defence of the state".

CREATIONISM

Creationism is a belief in the literal truth of the creation myth as told in the Chapter of Genesis. "Creation science" is an elaborate attempt by fundamentalists to pretend that there is scientific evidence to support this belief. Through this argument, they try to persuade education authorities and (ultimately) courts of law, that their belief is merely an unorthodox reading of known evidence.

Portraying themselves as embattled visionaries pitched against a Darwinian establishment with a vested interest in the outmoded concepts of evolution and deep time, creationists fight for "equal time" rulings. These allow them access to school science curricula.

The battle with creationism began in the USA with the infamous Scopes trial of 1925. It blew up again during the 1970s, when fundamentalists of the Bible Belt began to develop powerful financial muscle. It continues to this day, often unwittingly fostered by the "politically correct" notion that any belief system is as valid as any other in any context.

Legal battles in the US culminated in 1987 when the US Supreme Court voted down the last "equal time" statute (in Louisiana). This decisive vote hinged on the Court's recognition that it was no more than a ruse to inject religion into science, so violating the First Amendment, which vows to maintain the separation of Church and State.

It was two years before that, in 1985, that Australian geologist Ian Plimer had his first brush with creationism. Since then he has waged a tireless public campaign against creationists' attempts to masquerade as scientists. This year, he was involved in a spectacular court case that made headlines around the world.

Professor Plimer tried to use the Australian equivalent of the UK's Trades Descriptions Act to silence a group of creationists who, Plimer says, were using bogus scientific credentials and evidence to portray a closed synclinal structure in the mountains of Turkey as the remains of Noah's Ark. The case was lost on technical legal grounds, the judge deciding that creationist Allen Roberts had not acted in trade or commerce, and was not covered by the legislation.

An appeal was launched in June. It was heard this September and a verdict is expected in December. If Professor Plimer loses, he will be declared bankrupt. He was elected Honorary Fellow of the Geological Society in June.

TN– How have you held things together during the recent court case?

PP–The strain on my family has been overwhelming. My wife's health deteriorated, as did mine, our financial security evaporated and the pressures of work became a great burden. It was a constant juggling act to keep my head above water as Head of Department with heavy teaching load, five to seven research students and 80 public lectures a year, editorial duties, a weekly radio programme and sporadic other radio and TV work.

My solution was to switch my research from lab to field - that way I could still be active, but also recharge my batteries in the outback, sample my home-brew and have a modicum of stability.

Some will say that by challenging creationists in public you have given them "the oxygen of publicity", and that by losing the case, even on a technicality, you have handed them a PR victory. How do you answer that?

The creationists admitted under cross-examination that they had lied, copied the work of others, had no qualifications to undertake geological or archaeological work, that they had no permission from the Turkish authorities, that they stole materials from the site and illegally exported it, that their qualifications were falsified, that they undertook no scientific work, and so on. In my view, the cross-examination was crushing.

We were aware that the case would give oxygen to the creationists, but after more than a decade working with the media, I had enough faith in my friends in TV, radio and newspapers to know that the creationists would not fare well in public. In the public arena, we certainly won the war. The creationists were financially dented and it is now common for them to be refused church and school venues.

TN– And it hasn't been all hate-mail and death threats?

PP– We had overwhelming support during the case from science journalists and hundreds of letters from the "man in the street". The churches gave great support, and one organised a fighting fund that raised $30,000 for legal costs. My book Telling Lies for God (Random House 1994), with a foreword by the Anglican Archbishop of Brisbane, was published during the litigation, as were two others, including a book of short stories On the Rocks (also with Random House). Both were written in outback field camps in the pleasant company of my wife and research students.

There were brickbats but there were also bouquets. The most treasured of these were election as 1995 Humanist of the Year, the 1995 Eureka Prize for the promotion of science, the public support of Anglican Archbishops, and finally election as Honorary Fellow of the Geological Society.

I was very moved by the action of the Geological Society. Such support gives me the strength to continue.

6TH INTERNATIONAL CONFERENCE ON PALEOCEANOGRAPHY

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ENVIRONMENTAL GEOLOGY AND PROFESSIONAL CERTIFICATION IN THE NETHERLANDS AND BELGIUM

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Abstract

Professional certification of geologists is worldwide a 'hot' topic. Many US states and American professional organisations have implemented certification schemes, which involve a.o. geologists and engineers. In Europe too, there is a tendency towards professional certification on both a national and professional level. However, in spite of all efforts made by EFG and the introduction of the EurGeol title, certification in the geological profession has only developed in a limited number of European countries.
This article gives a short review of current developments in (applied) environmental geology and professional certification in both the Netherlands and Belgium.

Resumen

La certificación profesional de los geólogos es un tema candente en todo el mundo. Muchos estados de los Estados Unidos y las organizaciones profesionales americanas han implementado sistemas de certificación que involucran tanto a geólogos como a ingenieros. También en Europa hay una tendencia hacia la certificación profesional tanto a escala nacional como profesional. Sin embrago, y a pesar de todos los esfuerzos realizados por la FEG y la introducción del título de Geólogo Europeo, la certificación en la profesión geológica sólo se ha desarrollado en un número limitado de países europeos.
Este artículo proporciona una breve revisión de los recientes avances en la geología ambiental (aplicada) y la certificación profesional tanto en Holanda como en Bélgica.

Résumé

La certification professionnelle des géologues fait l'objet de discussions acharnées dans le monde entier. Aux USA, un grand nombre d'organisations professionnelles et d'états ont réalisé des systèmes de certifications incluant géologues et ingénieurs. En Europe il y a aussi une tendance à la certification professionnelle au niveau professionnel et national. Cependant, en dépit de tous les efforts faits par la FEG et de la création du titre de Géologue Européen, la certification en géologie ne s'est développée que dans un nombre limité de pays européens.
Cet article passe rapidement en revue les développements actuels, aux Pays-Bas et en Belgique, de la géologie (appliquée) de l'environnement et de la certification professionnelle.

Environmental Geology in the Netherlands

On the Netherlands most geologists are employed by the oil industry, directly or indirectly through exploration consultants, universities and the state geological survey. A relative low number of geologists is working in the environmental sciences. The Dutch environmental community is a multidisciplinary one, in which (civil, agricultural) engineers, chemists, and earth scientists are dealing with environmental problems such as soil quality and remediation and environmental impact assessments. Among Dutch consultants there is not much discussion about professional competence.

Soil and groundwater quality is in the dense populated Netherlands a main concern since the early 1980's. Since the Dutch subsurface mainly consists of unconsolidated sediments and the population for a large part depends on groundwater resources for drinking water, the Dutch subsurface may be considered highly vulnerable to contamination. Soil quality standards have been integrated in most Dutch planning and building regulations.

Until recently, the authorities carried out a policy based on a 'complete clean up' of all soil and groundwater contamination. Soil remediation then often involved digging up the contaminated soil, followed by a conventional pump-and-treat program. This approach resulted in huge and costly clean up operations; as a consequence a stagnation of economic developments of minor as well as major polluted sites took place.

Nowadays the Dutch authorities tend more towards prevention and a risk based approach. This means that remedial strategies tend to be focused on a risk reduction, rather than a 'removal of contaminants'. Most immobile[1] compounds (e.g. heavy metals) just will be contained, while mobile compounds (e.g. VOC's) will be removed or actively controlled. Technologies such as 'natural attenuation' fit very well into this risk bases approach. However, before implementing such 'in situ' methods one has to have a thorough knowledge of the hydrogeology, biogeochemistry and contaminant behaviour in the subsurface.

[1] Using the expresion 'Immobile' one has to considor long torm changes which may cause mobilisation in time (e.g. ació rain, sos invot riso, pic).

Dutch Regulatory Settings

Environmental legislation in the field of soil and groundwater in the Netherlands dates from the early 1980's. Soil and groundwater quality standards have been issued by the Dutch government in the "Soil Protection Act", promulgated on 10 May 1994. The formerly used A, B and C-levels, for both soil and groundwater are nowadays replaced by the newly established categories: Target Value (S-value), long-term clean-up goal and the Intervention Value (I-value), the concentration above which risks may be involved and remediation may be obliged.

In the Netherlands the provincial authorities (including the 4 largest cities) deal with soil quality matters. They deal with most of the larger soil surveys and contaminated sites. Within the framework of the Building and Planning Acts also the local communities may be involved in minor soil quality and remedial issues.

Soil and groundwater contamination which causes actual risks for humans and environment, legally will have to be cleaned-up. The Dutch authorities apply the "polluter-pays-principle" for soil and groundwater remediation. However, responsibility/liability questions related to soil and groundwater quality issues are rather difficult and take a lot of time. This formal approach resulted in a stagnation of the Dutch soil remediation program. Most businesses and governmental rganisations only implemented a soil quality control program and did consider the costs of full remedial action as not cost/effective.

Currently the Dutch legislation is being reevaluated by the national authorities. The Dutch will turn to a more risk based approach. Remedial actions will move to a more functional methodology, focused on the (future) use of a contaminated site. However, new soil and groundwater contamination still has to be removed, which operation in general is enforced on the basis of the environmental permits of facilities.

Environmental Geology in Flanders

In Belgium geology is taught at a relative large number of universities, which resulted in a broad based geological community, in the past mainly active in mining operations and engineering geology.

Flemish Regulatory Settings

In Flanders, the legislation governing liability in respect of soil remediation has been established on 22 February, 1995 with the publication of the "Decree relating to Soil Remediation". Soil and groundwater quality standards have been issued by the Flemish government and include an Achtergrondwaarde (Background Value, long-term clean-up goal) and a Bodemsaneringswaarde (Remedial Value, the concentration above which risks may be involved and remediation must commence).

The central authority concerning this legislation is the Public Waste Agency of Flanders (OVAM). They deal with all soil surveys and contaminated sites. OVAM must draw up a register of contaminated land and provides soil certificates upon request.

Flemish land-owners are obliged to carry out an exploratory soil survey when:

- the land is transferred and in the past there was a soil threatening activity
- an establishment is closed, or operations are suspended
- on the basis of a periodicity for specific categories of establishments or operations.

Likewise the Dutch, the Flemish authorities apply the "polluter-pays-principle" for soil and groundwater contamination. In case of historical contamination (originated before the Decree) OVAM applies a risk based approach: these kind of contamination will only have to be handled in case of certain or probable threats for humans, plants and animals. New soil contamination (originated after the Decree) will have to be cleaned-up immediately when remedial values are exceeded. All contaminated grounds will be registered in the Register of Contaminated Lands.

In the Flemish Region of Belgium environmental legislation in the field of soil and groundwater is well developed. By this reason there are a lot of environmental geologists in Flanders occupied with environmental impact assessments[2], soil surveys and soil remediation projects.

As in the Netherlands, the Flemish subsurface mainly consists of unconsolidated sediments and therefore highly vulnerable for (groundwater) contamination. Since soil quality legislation in Flanders is relatively recent the Flemish Region did not choose for a full clean up program, as the Dutch initially did.

In Flanders the soil quality must (a.o.) investigated in case of a transfer of property. All soil quality reports have to be submitted to the authorities. The responsible authority is the OVAM, the Public Waste Agency of Flanders. Historically contaminated land will have to be cleaned up in case of actual risks. New pollution will have to be cleaned up in case of exceedance of the remedial values. Without permission of the authorities (contaminated) land can not be transferred.

Professional Certification

Professional certification is currently being discussed in Europe and the USA. The main questions are: - Does it guarantee a certain level of quality? - Does it guarantee a professional conduct?

Professional certification in Flanders is regulated in several decrees. Soil surveys and soil remedial actions legally will have to be carried out by recognized experts, appointed by legal bodies. Individual or company experts will be judged on the basis of their (academic) qualifications, their experience and their expertise in the field of interest. This means that not only educated geologists, but also e.g. 'experienced engineers' may be recognized as a soil remediation expert and therefore may fulfil the conditions of the geological expertise. Recognition of experts will officially be announced. In case of malfunctioning recognition may be suspended or withdrawn by the Flemish authorities. Currently about 75 experts (individuals and companies) are recognized as Category I expert for soil surveys and about 50 experts are classified as Category II expert for soil remediation projects.

In the Netherlands professional certification simply does not exist. The Dutch consultancy market is dominated by relatively large broad based consulting companies (the top 10 have well over 500 employees), most of them with an engineering background. Professional standards are among others kept by

[2] The responsible Flemish authority for environmental impact assessorements is ANIMAL, not the OVAM.

Summary of Groundwater Action Levels in The Netherlands and Flanders

Compound	Groundwater Alert Level in µg/l			
	Netherlands, old C-level	Netherlands, present I-level	Flanders, remedial value	WHO limits
Metals				
• Chromium	200	30	50	50
• Nickel	200	75	40	20
• Copper	200	75	100	2000
• Zinc	800	800	100	–
• Arsenic	100	60	20	10
• Cadmium	10	6	5	3
• Mercury	2	0,3	1	1
.Lead	200	75	20	10
Volatile Compounds				
• Benzene	5	30	10	10
• Toluene	50	1000	700	700
• Ethylbenzene	60	150	300	300
• Phenols	50	2000	–	–
• PCE	50	40	40	40
• TCE	50	500	70	70
• DCE	–	20	–	50
• Vinylchloride	–	0,7	–	5
Pesticides				
• Sum DDT/DDD/DDE	only indiv	0,1	–	only indiv
• Sum HCH	only indiv	1	–	only indiv
• Aldrin/Dieldr/Eldrin	only indiv	0,1	–	only indiv
• Anthrazine	2	150	–	2
Mineral Oil (C10-C40; NL: GC, B: IR)	600	600	600	–

means of ISO-9000 Quality Assurance and Quality Control programs. Most Dutch consultants are member of the Dutch organisation of consulting engineers (ONRI), which imposes a code of conduct.

Summarising Conclusions

Environmental geology in the Netherlands and Flanders is technically and scientifically similar. However, the professional market shows a number of differences. At first in Flanders there are relatively a lot of small consulting companies (e.g. individual geologists), whereas in the Netherlands the market is dominated by large internationally known consultants. Secondly quality of professional standards in Flanders are maintained by means of the certification scheme of the Flemish authority on a personal basis. In the Netherlands quality and professional conduct is guaranteed by Quality-approval programs and by the market mechanism. In case of liability the Dutch consultant will

end up in court, while the Flemish consultant may loose it's recognition and even then may be prosecuted in a legal action. Both may loose their professional reputation.

It is interesting to observe the differences in perception in neighbouring countries. In one country professional certification may primarily be imposed by the authorities, unimpeded the market approach, while another country just chooses for a market approach. Quality relies on (academic) qualifications and a profound experience. Why professional certification and by whom? Is this really a responsibility of authorities or can it be considered as a 'unique selling proposition' issued by professional bodies. We believe the discussion will continue.

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Using the expression 'immobile' one has to consider long term changes which may cause mobilisation in time (e.g. acid rain, sea level rise, etc).

The responsible Flemish authority for environmental impact assessments is AMINAL, not the OVAM.

GEOLOGISTS ACTIVELY PARTICIPATE IN THE PROTECTION AND SURVEILLANCE OF DANISH GROUNDWATER

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Abstract

The purpose of this article is to illustrate the challenges met by geologists working in a Danish consultant. Two case studies are discussed. One is an example of investigation and remediation of petrol pollution of groundwater. The second illustrates how geophysical monitoring of salt-water intrusion at a chalk plant can allow a stable balance to be maintained between fresh and salty groundwater. Thus deterioration in the quality of the water and seeping of salt water into the chalk can be avoided.

Resumen

El objeto de este artículo es ilustrar los retos a que se enfrentan los geólogos que trabajan en una consultora danesa. Se estudian dos casos. Uno es un ejemplo de investigación y remediación de la contaminación de aguas subterráneas por hidrocarburos. El otro ilustra como el control geofísico de la intrusión marina en una planta de carbonatos puede permitir establecer un equilibrio entre las aguas subterráneas dulces y saladas evitando el deterioro de la calidad de las aguas y la penetración de aguas saladas en la creta.

Résumé

L'objet de cette article c'est d'illustrer les challenges confronté pour les géologues qui travail dans une compagnie des services a la Danemark. Deux cases ce sont étudies. Une c'est une exemple d'investigation et réparation de la contamination pour hydrocarbures de l'eau souterraine. L'autre illustres comme le contrôle géophysique de l'intrusion marine dans une installation des carbonates, peut permettre établir l'équilibre entre des eaux souterraine douces and salades, pour éviter le détériore de la qualité des eaux, et la pénétration de l'eau salade dans la crête.

Introduction

We are three geologists, who graduated from Aarhus University in Denmark. For a number of years, we have been employed at the geological consultancy Danish Geo-servEx a/s (DGE), where we work with environmental protection and ground water surveillance. In this article, we would like to give the readers an idea of the type of challenges, we as geologists meet in a Danish consultancy.

Geologists became increasingly involved in working in the environmental sector during the 80's, in step with the Danish public and the administrative authorities becoming more aware of the need to safe guard the natural environment in Denmark and not least, to ensure the continual exploitation of the country's huge fresh groundwater resources.

The environmental threats are typically due to pollution by mineral oil, tar, chlorinated solvents, heavy metals and pesticides.

Danish Geo-servEx was established in 1985 and has been involved with environmental technology ever since. The company's professional colleagues(and the management) are mainly geologists who specialise in geophysics and geohydrology, but the staff also include chemical engineers, environmental technicians and geologists with other specialisation.

Our clients include private companies, public institutions and the Danish environmental authorities.

An important part of the geologists work involves investigations of the environmental conditions on the existing and redundant industrial sites, where many years of operation has caused considerable pollution of the soil and ground water.

Planning of the project takes place in close collaboration with the client and environmental authorities. This type of investigations usually consists of the following phases.

– Drilling investigation layout. A program is planned, which usually includes doing a series of drilling samples. After studying the previous use of the site, drilling takes place on the spots with the highest risk of pollution.

– Implementing the drilling investigation. The drilling investigation is carried out by a hydraulic drilling rig. The geologists carry out descriptions of the soil samples collected and carry out relevant tests for closer analyses. If possible the drilling is taken to beneath the water-table, which allows a water sample to be taken for chemical analysis and allows examination of the hydraulic conditions on the site.

– Environmental risk calculation. Based on the collected data, calculations are made of the extent to which the ascertained pollution, constitutes an environmental risk for the users of the site or the groundwater recovery in the area. Additionally the risk of further spread of pollution is evaluated on the basis of the results, including the hydraulic examinations.

If the pollution is estimated to be an environmental problem, steps must betaken to remove or reduce the pollution.

Until recently, it was by and large only possible to clean up soil pollution by excavating and to purify groundwater by extracting the polluted water.

During the past few years, methods have been developed which enable the cleaning of soil and groundwater polluted with organic substances like mineral oil and chlorinated solvents, without undertaking excavation or pumping up the pollution. These in-situ methods are now used on an increasing number of sites, where digging is not possible or would be extremely expensive - e.g. in the case where the pollution is located under a building etc.

Most organic pollution can, under the right circumstances, be decomposed by naturally found micro-organisms. When using In-situ techniques, substances are added to the soil and groundwater which are vital to the bacteria that are capable of degrading a particular pollutant. In the case of oil or petrol pollution, oxygen and nutrients will typically be added to the formation. In most cases, it is possible, due to experience in using the in-situ method, to reduce an organic pollution to a harmless level in the coarse of 2- 4 years.

Application of the in-situ technique is, to say the least, an exciting working area for geologists, as effective cleaning requires detailed knowledge of the micro-geology and the hydraulic interconnectivity of the sediments.

In many cases, it is necessary to undertake pumping of groundwater centrally in a polluted area in conjunction with an in-situ cleaning technique to ensure that the pollution does not spread further during the remediation period. It is becoming more and more usual to clean extracted polluted groundwater 'On-site' in a bio-reactor, where the degradation of the pollution occurs by means of bacterial decomposition, as in the case of in-situ cleaning.

We have chosen to illustrate how a project develops in a major pollution case, by giving examples from real life. In this case, the problem presented is, how to handle severe and wide-spread unleaded petrol pollution. When lead was banned as a petrol additive it was substituted by Methyl Terts Buthyl Ether (MTBE), which like lead, has octane enhancing properties.

The problem with MTBE is, that it has a high water solubility, extreme mobility and a very poor bio-degradability.

Examination and remediation of petrol pollution

In connection with renewal of pipes on a service station, in 1995, petrol fumes were ascertained in the upper soil layer under a petrol pump. For this reason, the petrol company requested DGE to undertake an investigation of the extent of the pollution.

After initial examination, which consisted of a few screened wells, it was obvious that serious petrol pollution had taken place. Considerable amounts of free phase petrol were found on the groundwater surface about 5 m below ground level.

The source was localised to a leaking pipe between the tank and the pumps. An examination of the petrol accounts (wet stock records) showed, that at least 4,000-5,000 litres of unleaded petrol, had leaked.

After determining the direction of groundwater flow, supplementary drilling was undertaken in order to demarcate the polluted area. It was here by ascertained, that there was an accumulation of petrol in free phase on the groundwater surface in an area of about a hundred square meters. The propagation was ascertained as a depression in the groundwater surface. The petrol was trapped in a layer of gravel, situated upstream a layer of medium-grained sand.

A plume with dissolved petrol components had spread in the direction of groundwater flow, more than hundred metres downstream and threatened a well, supplying the local waterworks.

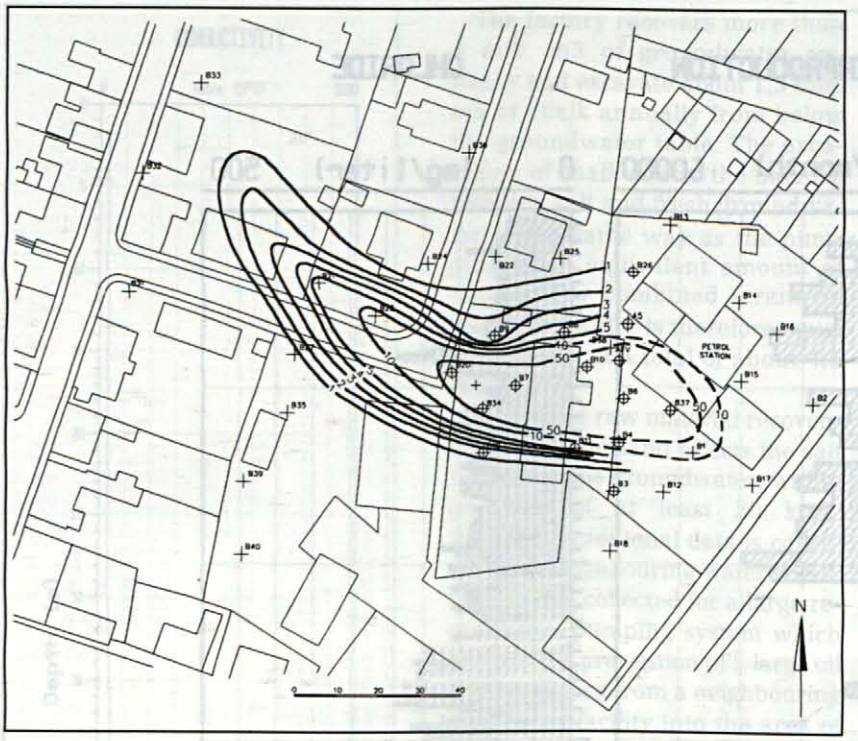

Figure 1: Petrol pollution. Distribution of benzene in the groundwater around a service station (mg/litre).

A pumping well was immediately installed to accumulate the free phase. During the next 3 months, by using a centrifugal pump, about 3,500 litres of pure petrol was extracted. The water and petrol was separated in a combined separator-coalescence filter system.

Subsequently a vacuum suction system was designed and constructed which was connected to 15 existing monitoring wells in the most polluted area of the plume of dissolved components. The suction wells appear on fig. 1 as circles. By sealing the suction wells from the atmosphere caused the added vacuum to not only suck water, but also to establish a soil vapour ventilation of the unsaturated zone. The system was therefore able to partly remove dissolved petrol and petrol vapours, and partly accelerate the biological degradation of the petrol by oxidation of the polluted layer.

After 6 months of operation, the concentration of hydrocarbon was reduced by an average of 85%, while by and large, the decrease of the concentration of MTBE was not discernible.

On fig. 1 and 2 the spread of benzene and MTBE respectively, can be seen. Approximately 6-8% of both substances are found in unleaded petrol. It shows that MTBE spreads more readily, which is due to a very poor biodegradability combined with high water solubility. In the front of the plume only MTBE can be seen. The relation between benzene and MTBE can thus be used as an indicator for the biological break down of petrol pollution.

The water contaminated with dissolved components was cleaned in a combined bio reactor and air stripper, where the biological decomposition was supplemented by air stripping (blowing air through the water). Here too it can be seen that MTBE is very difficult to remove. We therefore have to develop supplementary cleaning methods.

The use of geophysical methods for monitoring purposes

Danish Geo-servEx a/s has advanced digital logging equipment at their disposal, used by geophysicists in geological and geotechnical surveys. The following example illustrates how the equipment is used to monitor the effect of salt water intrusion during deep exca-

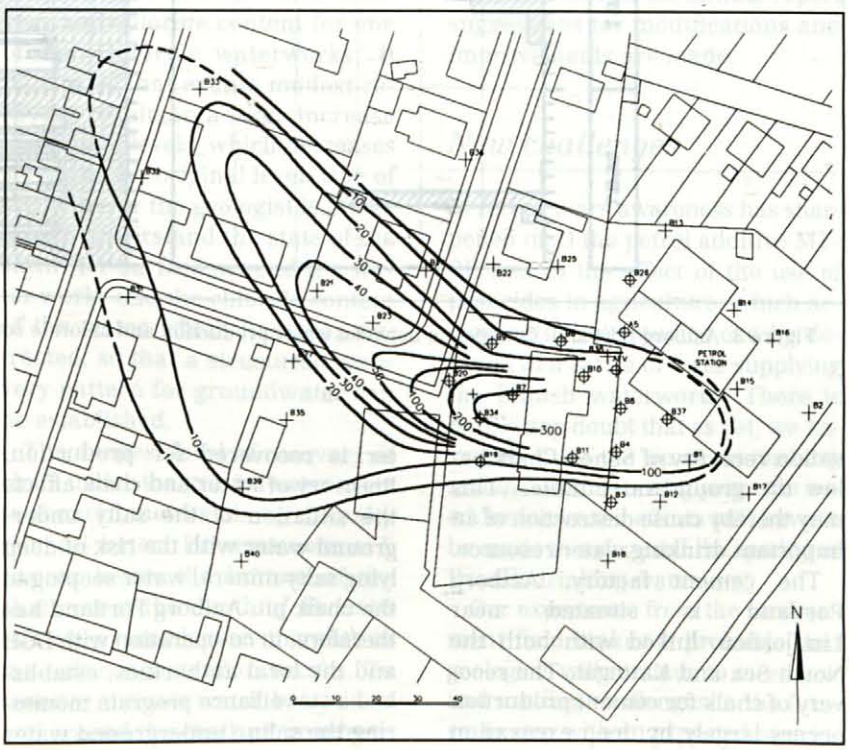

Figure 2: Petrol pollution. Distribution of MTBE in the groundwater around a service station (mg/litre).

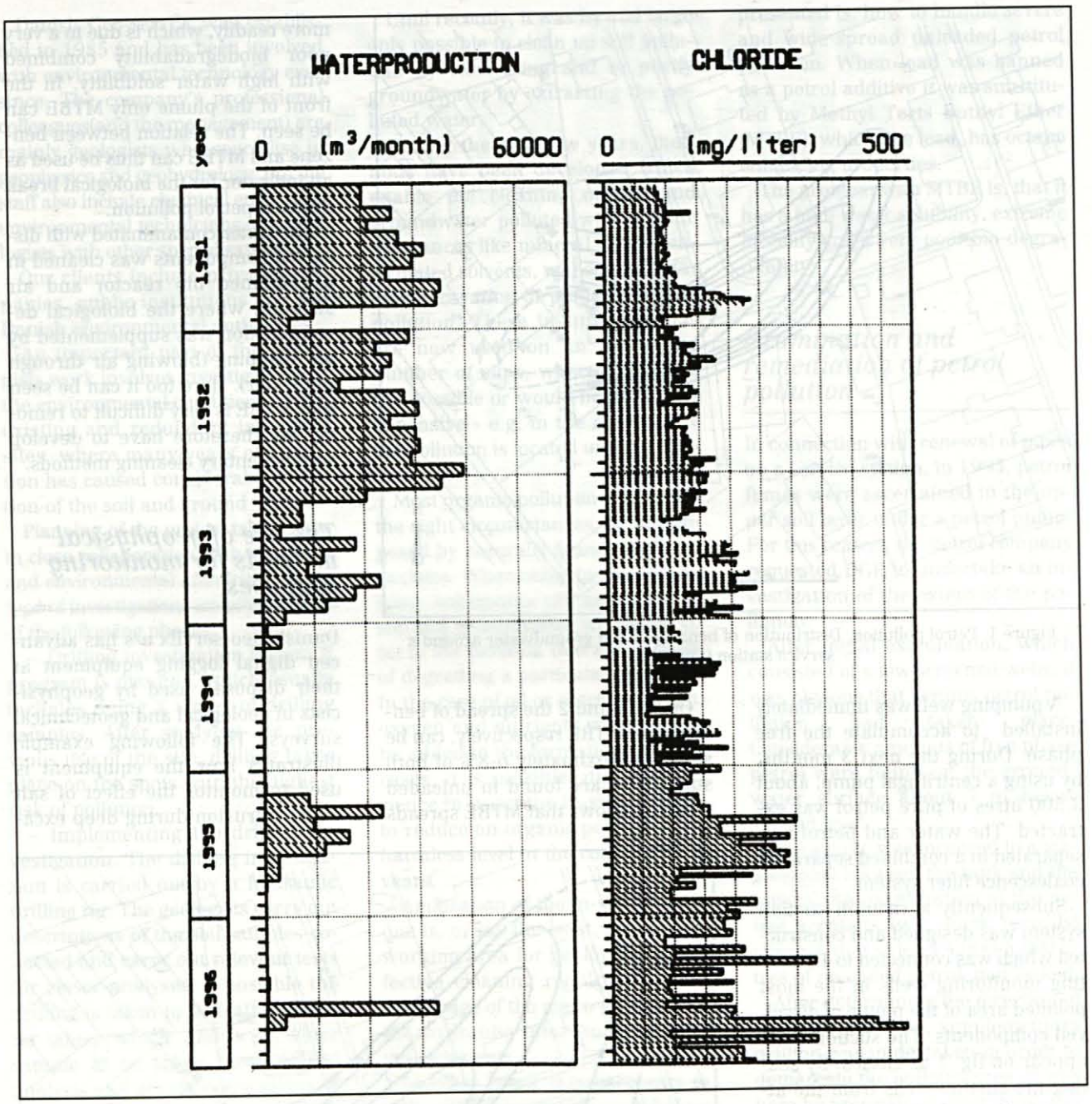

Figure 3: Aalborg Portland. Connection between water production and chloride concentration in the extracted groundwater.

vation recovery of Senon Chalk below the groundwater table. This may thereby cause destruction of an important drinking water resource.

The cement factory, Aalborg Portland is situated near Limfjorden, linked with both the North Sea and Kattegat. The recovery of chalk for cement production occurs largely by deep excavation under the phreatic surface/table base and a large amount of fresh water is recovered for production. Recovery of water and chalk affects the situation of the salty underground water with the risk of deep lying salty mineral water seeping to the chalk pit. Aalborg Portland has therefore, in co-operation with DGE and the local authorities, established a surveillance program monitoring the saline underground water and the general quality of the water in the area constitute an important part. Monitoring has the objective of securing the possibility of recovering chalk from the area without risk of negative effects on the quality of the groundwater.

Surveillance of raw materials and groundwater is carried out partly by automatic equipment for data collection and partly by a series of manual measurements, which are undertaken once a month. The automatic equipment consists of a

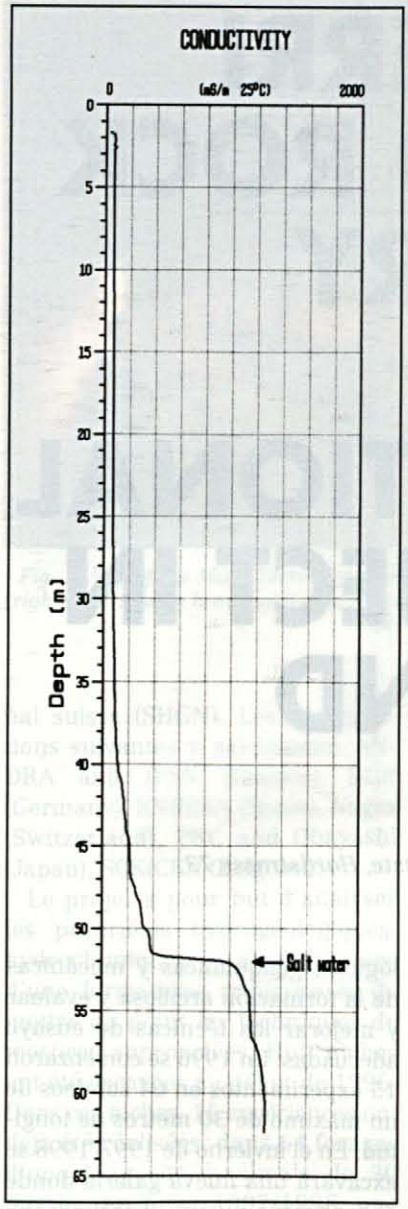

Figure 4: Aalborg Portland. Conductivity log showing the transition zone between fresh and salty groundwater in an observation well.

range of data logger installed in monitoring wells in and around the chalk pit and in the recovery wells, which supply the factory with fresh water. In these measuring areas, data is collected concerning the state of the groundwater and the conductivity in the groundwater. The geologists also take bearings manually of the groundwater hydraulics, collect water samples for analysis of the chloride content and carry out geophysical well logs in a series of wells.

The factory recovers more than 3 mill. m3 of groundwater annually and excavate about 1,5 mill. m3 of chalk annually from below the groundwater table. The excavation of chalk affects the balance between salt and fresh groundwater in the same way as the pumping of an equivalent amount of water. This combined strain on the groundwater is therefore equal to pumping of a total of about 4,5 mill. m3.

Water and raw material recovery at Aalborg Portland affects the salt balance in the groundwater, within an area of at least 20 km2. Therefore additional data is collected from neighbouring waterworks. Data is also collected for a large remediation pumping system which ensures the prevention of a large oil spill spreading from a neighbouring oil storage facility into the area of the chalk formations.

One of the effects of this large recovery of raw material and groundwater, which has occurred for a number of years, is that around a number of the factory's waterworks, a very sensitive balance between fresh and salt water exists. Fig. 3 shows water recovery and chloride content for one of the factory's waterworks. It illustrates that even a modest recovery results in a large increase in chloride levels, which decreases slowly to the original level. One of the tasks for the geologist is therefore to understand the state of the saltwater surface around the water works and the chloride content of the water which has been extracted, so that a structured recovery pattern for groundwater can be established.

The deepest level of recovery of chalk under the groundwater table is about15 metres above the salty mineral water. However even at 5 metres below the bottom of the chalk pit at the depth of about40 meters, a considerable increase in the salt concentration occurs. To monitor the salt water balance in and around the chalk pit geophysical well logs (especially temperature/conductivity logs) are used. The geophysical well logs provides a detailed picture of the salt water level month by month. In the chalk pit, conductivity probes are placed at different levels. Groundwater level data is collected twice a day. Fig. 4shows an example of a conductivity log from a well situated near the chalk pit.

The close surveillance, together with stipulated alarm levels, measured chloride content and water levels enables a detailed control of the groundwater recovery in the area. It has therefore been possible to obtain a stable balance between fresh and salty groundwater so that any deterioration in the quality of the water and seeping of salt water into the chalk, can be avoided.

One of the major tasks facing geologist who are involved with the surveillance program, is the compilation of the vast amount of data collected. Every year, a report is compiled on the basis of the observations made, which gives an evaluation of the hydro-geological conditions, raw material recovery etc. The extent and content of the surveillance program is frequently evaluated and in the annual report suggestions for modifications and improvements are made.

New challenges

In recent years awareness has sharpened of 1) the petrol additive MTBE and 2) the effect of the use of pesticides in agriculture, which according to new studies can be detected in a series of wells supplying the Danish waterworks. There is hardly any doubt that as yet, we have only seen the tip of the iceberg and that in the coming years the need for increased efforts will have to be made to safeguard the quality of Danish drinking water.

Our experience from the environment field makes it probable that geologists will continue to meet new and exciting challenges in the future, in step with an expected ever increasing strain on the Danish natural environment.

THE MONT TERRI UNDERGROUND ROCK LABORATORY

A NEW INTERNATIONAL RESEARCH PROJECT IN SWITZERLAND

by Marc Thury

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Abstract

In many countries, argillaceous formations are considered as potential host rocks for repositories of radioactive waste. Therefore, in 1995 several organisations decided to start an international research project in the reconnaissance gallery of the Mont Terri motorway tunnel, in Opalinus Clay (Aalenian).

This project is under the patronage of the Swiss National Hydrological and Geological Survey. The following organisations are partners of the project: ANDRA and IPSN (France), BGR (Germany), ENRESA (Spain), Nagra (Switzerland), PNC and Obayashi (Japan), SCK(CEN (Belgium).

The aims of the project are to analyse the hydrogeological, geochemical and rock mechanical properties of an argillaceous formation and to evaluate and improve appropriate testing techniques. 15 experiments were started in 1996 in 64 boreholes of maximum 30 metres length. In winter 1997/1998 a new gallery will be excavated to host further experiments. Mont Terri will never be a site for a repository.

Resumen

En muchos países las formaciones arcillosas se consideran potencialmente aptas para el almacenamiento de residuos radioactivos. Por ello en 1995 varias organizaciones decidieron comenzar un proyecto de investigación internacional en la galería de reconocimiento del túnel de la autopista de Mont Terri, en las arcillas Opalinus (Aleniense).

Este proyecto está patrocinado por el Servicio Hidrológico y Geológico Nacional de Suiza. Las siguientes organizaciones son socios en el proyecto: ANDRA y IPSN (Francia), BGR (Alemania), ENRESA (España), Nagra (Suiza), PNC y Obayashi (Japón) y SCK.CEN (Bélgica).

Los objetivos del proyecto son analizar las propiedades hidrogeológicas, geoquímicas y mecánicas de la formación arcillosa y evaluar y mejorar las técnicas de ensayo adecuadas. En 1996 se comenzaron 15 experimentos en 64 sondeos de un máximo de 30 metros de longitud. En el invierno de 1997/1998 se excavará una nueva galería donde se realizarán nuevos experimentos. Mont Terri no será nunca un almacén de residuos radioactivos.

Résumé

Plusieurs pays étudient les formations argileuses pour déterminer si elles sont aptes à accueillir des dépôts finals de déchets radioactifs. En 1995, quelques organisations se sont donc mises d'accord pour réaliser en commun un projet international de recherche dans la galerie de reconnaissance du tunnel autoroutier du Mont Terri dans les Argiles à Opalinus (Aalénien).

Ce projet est placé sous le patronage du Service hydrologique natio-

Fig. 1:View of the Mont Terri reconnaissance gallery (left) and one of eight niches (right) which have been excavated for the project. The tunnel walls are covered with shotcrete.

nal suisse (SHGN). Les organisations suivantes y participent: ANDRA and IPSN (France), BGR (Germany), ENRESA (Spain), Nagra (Switzerland), PNC and Obayashi (Japan), SCK(CEN (Belgium).

Le projet a pour but d'analyser les propriétés hydrogéologiques, hydrochimiques et géotechniques d'une formations argileuse et de mettre au point les techniques de mesures appropriées. Huit niches ont été excavées au début de 1996. Dans ces niches, 15 expériences ont déjà été réalisées, dans 64 forages d'une longueur maximale de 30 mètres. En hiver 1997/1998, une nouvelle galerie sera excavée; elle permettra d'exécuter des expériences plus complexes. Mont Terri ne sera jamais un site pour un dépôt.

Aims of the project

In the Mont Terri underground rock laboratory, experiments are being carried out to investigate the geological, hydrogeological, geochemical and rock mechanical properties of the Opalinus Clay. The results of these experiments provide input for assessing the feasibility and safety of a repository for radioactive (or chemotoxic) waste in such a host rock.

Mont Terri is a rock laboratory in a well-consolidated, fractured claystone. Under certain conditions, when water flows into the formation, swelling clay minerals are capable of healing fault zones and the rock thus retains a very low hydraulic conductivity. The strong reactions that occur between the Opalinus Clay and inflowing water also mean that drilling and measurement techniques used in rocks such as granite are in many cases not appropriate. One of the first priorities of the project is to identify and improve suitable drilling and measurement techniques.

Location and layout

The site is located in north-western Switzerland, in the Jura Mountains. In this area a motorway is under construction, which will link the Swiss plateau (Berne, Bienne) with Belfort in eastern France. Several motorway tunnels have been excavated, one through Mont Terri, with a length of about 4 km.

The underground rock laboratory is located in the reconnaissance gallery of Mont Terri (see Fig. 1 and 2). This gallery was constructed in 1989 to investigate geological and geotechnical aspects. Following the opening of the motorway tunnel at the end of 1998, the reconnaissance gallery will serve as an escape route and has to be kept free of all obstructions. The project partners therefore excavated eight niches into the wall of the gallery at the beginning of 1996 and most of the experiments are located in these niches. A new gallery approximately 250 metres long will be excavated before summer 1998 to house further experiments (see Fig. 2).

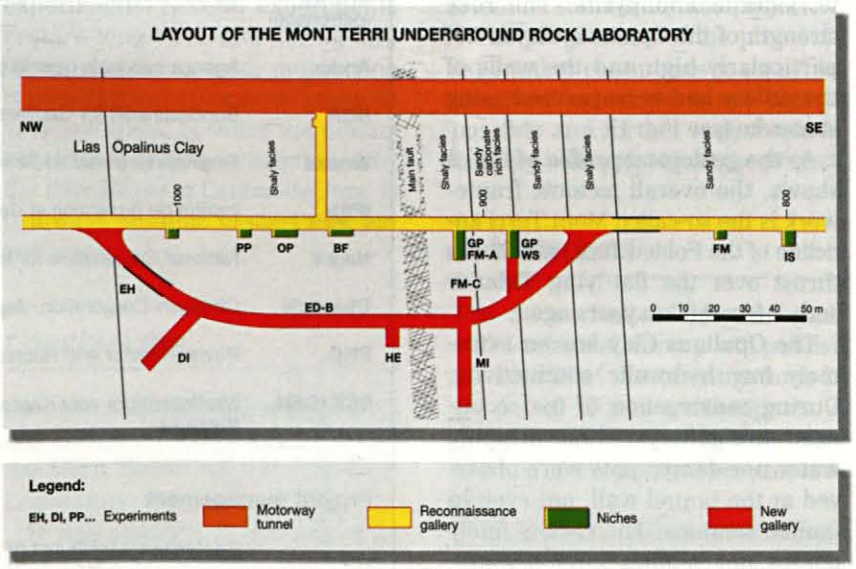

Fig. 2: Layout of the Mont Terri underground rock laboratory, located in Opalinus Clay.

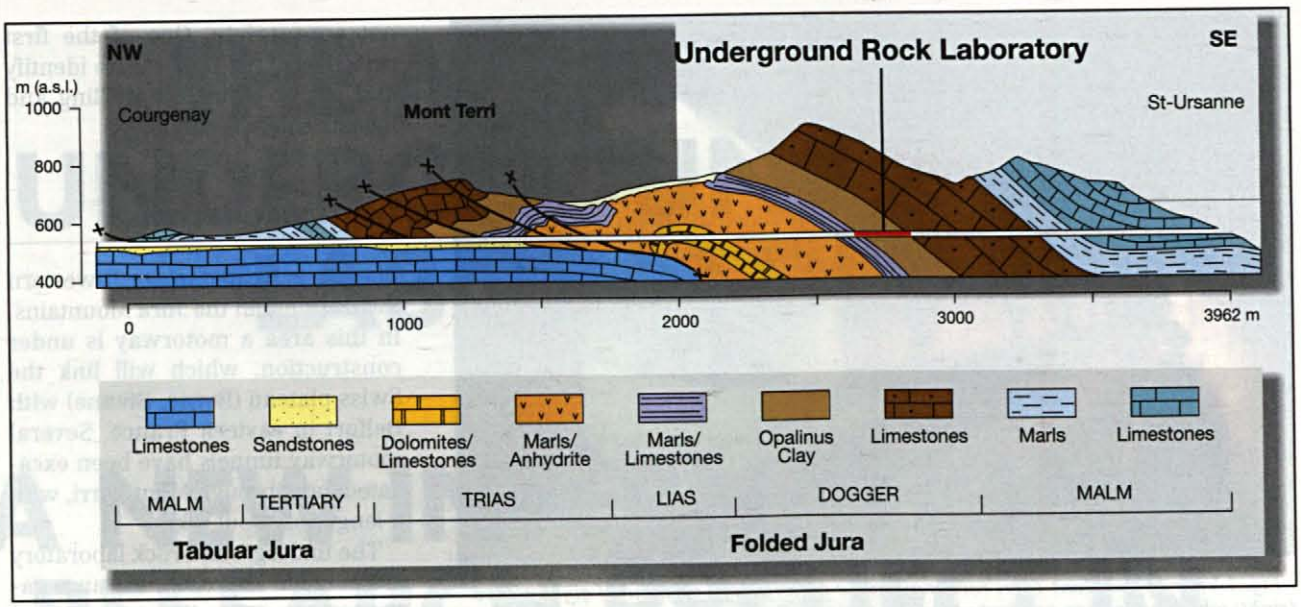

Fig. 3: Geological profile along the Mont Terri motorway tunnel and location of the underground rock laboratory.

Geological situation

Fig. 3 shows a geological cross-section along the Mont Terri motorway tunnel and the location of the underground rock laboratory.

The Opalinus Clay was formed in a very shallow marine environment in the Middle Jurassic (Aalenian). At Mont Terri, the formation is approximately 140 metres thick. 40 to 80 % of the Opalinus Clay is made up of clay minerals. Around 10 % of these minerals are capable of swelling. Other components include quartz (sand and silt fraction), calcite, siderite and pyrite. The rock strength of the Opalinus Clay is not particularly high and the walls of the gallery had to be secured using shotcrete (see Fig. 1).

As the geological profile of Fig. 3 shows, the overall tectonic framework is the so-called Mont Terri anticline of the Folded Jura, which was thrust over the flat-lying Tabular Jura a few million years ago.

The Opalinus Clay has an extremely low hydraulic conductivity. During construction of the reconnaissance gallery, neither dripping water nor damp spots were observed at the tunnel wall, not even in faulted sections. The rock is finely porous and contains 5 to 8 % water. Initial investigations revealed a strongly mineralised sodium chloride water with a total dissolved solids content of around 20 grams per litre. Chemistry and isotopic composition of these porewaters show evidence of very long underground residence times (millions of years).

Organisations involved in the Mont Terri Project

Responsible for the Mont Terri motorway tunnel system

République et Canton du Jura,
Département de l'Environnement et de l'Equipement

Project partners

SNHGS (patronage)	Swiss National Hydrological and Geological Survey, **Switzerland**
Andra	Agence nationale pour la gestion des déchets radioactifs, **France**
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe, **Germany**
Enresa	Empresa Nacional de Residuos Radiactivos, **Spain**
IPSN	Institut de protection et de sûreté nucléaire, **France**
Nagra	National Cooperative for the Disposal of Radioactive Waste, **Switzerland**
Obayashi	Obayashi Corporation, **Japan**
PNC	Power Reactor and Nuclear Fuel Development Corporation, **Japan**
SCK•CEN	Studiecentrum voor Kernenergie, Centre d'étude de l'énergie nucléaire, **Belgium**

Project management

Geotechnical Institute Ltd., Berne, **Switzerland**

Objectives of experiments

Mt. Terri Project

Characterisation of the rock for repository safety assessment

Questions	*Experiments*
• What are the predominant mechanisms (conceptual models) of groundwater flow and solute transport? Advective flow in faults? Advective flow in joints? Advective flow through pores of the undisturbed rock? Stagnant porewater and solute (radionuclide) transport by diffusion? What are typical characteristic values and ranges for radionuclide transport parameters (geometry, flow porosity, diffusion coefficient, diffusion-accessible porosity, mineralogy) in identified waterconducting features?	FM-A, FM-B, DI, MI
• What is the groundwater composition in faults, joints, undisturbed rock? Are there differences between groundwater composition in the discontinuities (faults, joints) and in the undisturbed rock?	WS-A, WS-B
• Is osmosis a process which significantly influences the measured hydraulic pressures?	OP
• What are typical values and ranges for water/gas permeabilities and gas threshold pressures of faults, joints and undisturbed rock?	GP, PP, FM-D

Characterisation of repository-induced changes in the rock

Questions	*Experiments*
• What are the effects of excavation of a gallery on the rock? How does the excavation disturbed zone (EDZ) evolve around a gallery (convergence, settlements, porewater pressures, hydraulic conductivities, stress redistribution, chemical and mineralogical changes), and what are the parameters?	ED-B, DM, IS-C
• What is the hydraulic conductivity of the possibly interconnected open (airfilled) fracture system in the first 50 to 100 centimetres of the EDZ around a gallery?	ED-A
• What are the changes (reductions) in the seismic velocities of the rock in the EDZ? What are the relations between reduction of seismic velocities and increase in hydraulic conductivities?	ED-C
• How does the unsaturated zone of the rock around a gallery develop?	UZ
• Do fractures in the EDZ seal off when water infiltrates after repository closure? What is the reason for self-healing: swelling of clay minerals, creep?	EH
• What are the thermal characteristics of the Opalinus Clay and what are the effects of heat on this formation?	HE-B
• Do fractures in the formation produced by gas escape from a repository seal off when groundwater infiltrates (due to swelling of clay minerals)?	GS
• Are significant hydraulic or geochemical changes induced in the rock by hyperalkaline (high pH) water from concrete liners and the waste matrix?	CW

Experiments, project phases and activities

Mt. Terri Project

		1996	1997	1998	1999	2000+
	Experiments	**Phase 1 + 2**	**Phase 3**	**Phase 4**	**Phase 5 + further phases**	
FM-A	Flow mechanism (fluid logging)	D, M				
FM-B	Flow mechanism (resin)	F, L, D, O				
FM-C	Flow mechanism (tracer)	F, L	F, L, E	D, O, L		
WS-A	Groundwater sampling (in-situ)	D, L	D, L, I	M	?M	
WS-B	Porewater sampling (laboratory)	L	D, L			
GP	Hydraulic and gas permeability	D	D, F			
BF	Borehole fluid effects	D, M	M	M	M	
DT	Drilling technique	D, O				
ED-A	EDZ hydraulic and pneumatic tests *EDZ = Excavation disturbed zone*	D, M	D			
ED-C	EDZ seismic characterisation	D	D			
OP	Osmotic pressures	F, L	D	M	M	
CW	Cement porewater	F, L	D	M	M	
UZ	Unsaturated zone	F, L		D?		
ED-B	Evolution of EDZ around new gallery		D, E, F	D, M, I	M	
EH	EDZ self-healing		E	L, D		
GS	Gasfrac self-healing		L	D		
DI	Diffusion in rock		F, D, E	D, O, I	O	
MI	Migration in main fault zone		F, E	D, M, I	M	
HE-B	Heater experiment		F, E	D, M, I	M	
DM	Deformation mechanisms		D, L	D, L		
IS-A	In-situ stress (over/undercoring)	D, O				
IS-B	In-situ stress (borehole slotter)	D				
IS-C	In-situ stress (hydraulic fracturing)		D, L			
PP	Porewater pressure	F, D	M	M		
FM-D	Evaporation logging		D, L	D, I		

Legend

F Feasibility studies, design calculations
L Laboratory work
D Drilling, logging, installation, testing
? Not yet decided
M Long-term monitoring
O Overcoring, additional boreholes
E Excavation and site preparation for the experiment
I Interpretation, modelling

Organisation of the Project

The box on page 11 shows the organisations involved in the project. The project is under the patronage of the Swiss National Hydrological and Geological Survey, which holds the permits of the République et Canton de Jura for the investigation programmes. The programme consists of a series of experiments and is divided into project phases, each of one-year duration. Each project partner can propose experiments and selects for each phase the experiments in which he wants to participate, steer and finance. Further partners are welcome to join the project.

The Research Programme

The left box on this page shows the questions, which are covered by the research programme. A series of experiments have been designed and the right box on this page shows the programme of experiments. In phases 1 and 2, simple experiments were carried out to test a range of drilling and measurement techniques and to provide a first rough characterisation of the Opalinus Clay.

The programme for phases 3 and 4 consists of the excavation of the new gallery (see Fig. 2) and the initiation of a series of more complex experiments. Several experiments require long-term monitoring and overcoring. Long-term monitoring is possible over 10 or more years, at very low costs, because the motorway tunnel system is maintained by the République et Canton du Jura. It is always possible to start new experiments.

Conclusions

An international research project has been successfully started, called the Mont Terri Underground Rock Laboratory.

It was possible to gain the support of the government and administration of the République et Canton du Jura, which is not self-evident for a project dealing with research for radioactive waste.

More than one hundred scientists from the partner organisations and from universities, research institutes and service companies of six European countries and Japan have learnt to work together and are motivated to contribute to a high scientific standard in the project.

The programme of the project is expected to continue over many years. New experiments are always possible and further organisations are very welcome to join the project.

Publications

The Swiss National Hydrological and Geological Survey will publish the results of the investigations in the series of geological reports. A report on the results of phase 1 and phase 2 of the project is in preparation.

For further information please contact the author of this article, who acts as elected chairman of the project.

ENVIRONMENTAL GRAVEL EXTRACTION IN LIMBURG

by Gerard Green
Panheel Group, Gravel extraction consortium, Heel, the Netherlands

Abstract
Gravel extraction in Limburg, the southern most province of the Netherlands, dates from 1929 and is concentrated in the Pleistocene sediments of the Central Graben in the large floodplain of the river Meuse. The author reviews the geology, history and environmental impact of gravel extraction in this area and the remediation measures taken by the Panheel Group, a consortium of 18 dredging companies, in the last decade. In the near future, imaginative developments sponsored by the Group, such as the use of surface water from old extraction as drinking water and extraction plans that will allow to raise depressed water tables and reduce the risk of flooding in the Roermond areas will serve to enhance the simbiosis between the need to exploit the aggregate resources as raw material for the development of the construction industry, the protection and improvement of the surrounding environment and social welfare.

Resumen
La explotación de gravas en Linburg, la provincia más septentrional de Holanda, data de 1929 y está concentrada en los sedimentos Pleistocenos del Graben Central, en la inmensa llanura aluvial del río Meuse. El autor repasa la geología, historia e impacto ambiental de la extracción de gravas en esta zona y las medidas paliativas llevadas a cabo por el Grupo Panheel, un consorcio de 18 compañías de dragado, en la última década. En el futuro inmediato, ideas imaginativas patrocinadas por el Grupo, tales como el empleo de las aguas superficiales de antiguas explotaciones como agua para consumo humano y planes de explotación que permitan elevar los niveles freáticos deprimidos por diversas causas y reducir el riesgo de avenidas en la zona de Reormond, servirán para remarcar la simbiosis entre la necesidad de explotar los recursos de áridos como materia prima para el desarrollo de la industria de la construcción, la protección y mejora del medio ambiente local y el bienestar social.

Résumé
L'extraction des graviers dans le Limburg, province la plus méridionale des Pays-Bas, qui date de 1929, est concentrée dans les sédiments pleistocènes du Graben Central dans la grande plaine alluvionnaire de la Meuse. L'auteur passe en revue la géologie, l'histoire et l'impact environnemental de l'extraction des graviers dans cette région et les mesures palliatives prises ces dix dernières années par le groupe Panheel, un consortium de 18 sociétés de dragage. Dans un futur proche, des réalisations originales parrainées par le Groupe, telles que l'utilisation de l'eau de surface des anciens sites d'extraction

Figure 1. The Meuse.

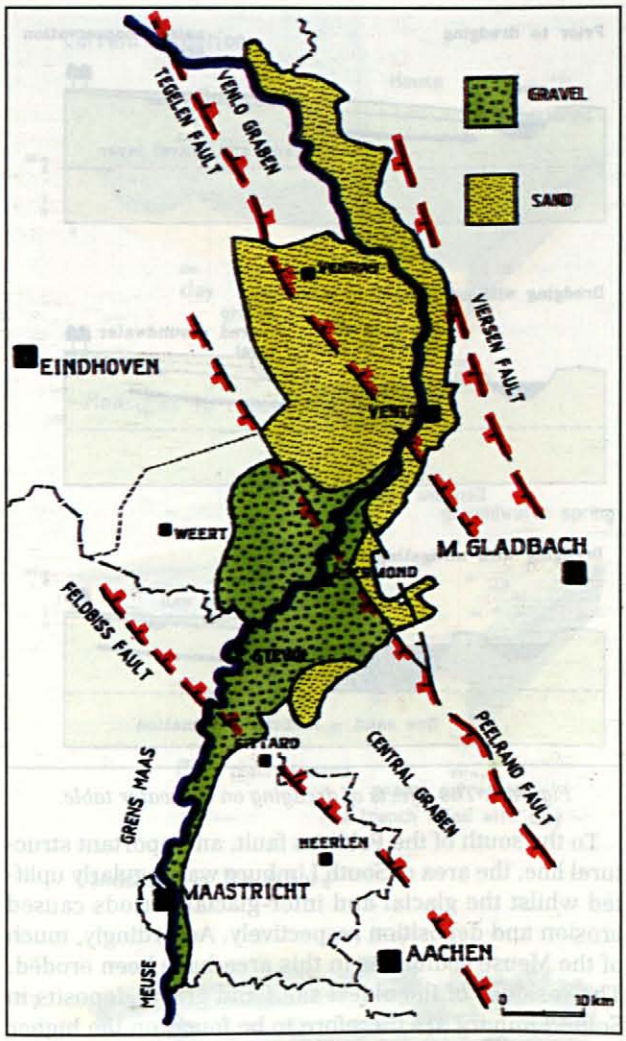

Fig. 2. Sand and gravel deposits in Limburg.

comme eau potable et l'organisation de plans d'exploitation permettant de relever le niveau des nappes et de réduire le risque d'inondation dans la région de Roermond, serviront à améliorer la symbiose entre la nécessité d'exploiter la ressource en agrégats comme matière première pour l'industrie du bâtiment, la protection et l'amélioration de l'environnement immédiat et le bien être social.

Geological Background

The structural and sedimentary history of Limburg, the southern most province of the Netherlands, has been dominated by two important faults bordering the Central Graben; the Feldbiss fault and the so-called Peelrand fault (figures 1 & 2). In Quaternary times, the Central Graben was still a subsiding sedimentary basin whereas the area south of the Feldbiss was uplifted.

The oldest sand and gravel sediments in the province of Limburg were deposited by both the Rhine and the Meuse in Lower Pleistocene-Tiglian times. These old flu-

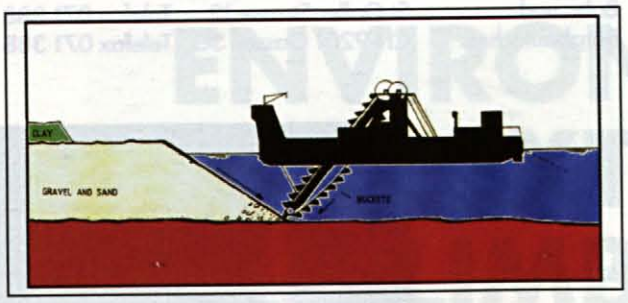

Figure 3. Bucket dredger.

vial deposits are mainly limited to the northern part of the Central Graben and to the more northerly situated Venlo Graben.

In Cromerian times (Middle Pleistocene), the Meuse adopted a more westerly course through Limburg and the Rhine veered off to the east into Germany. Initially, the Meuse rose in Northern France and the Vosges, meeting the Moselle near Toul in France. Around 200,000 years ago (upper part of the Middle Pleistocene), the course of the Moselle was blocked forcing it to flow eastwards into the Rhine. Since then, the tremendous volumes of sediment carried by the Meuse have originated in Northern France and the Belgian Ardennes. North of the Ardennes, the Meuse created a large floodplain covering much of Limburg and the Belgian Campine area.

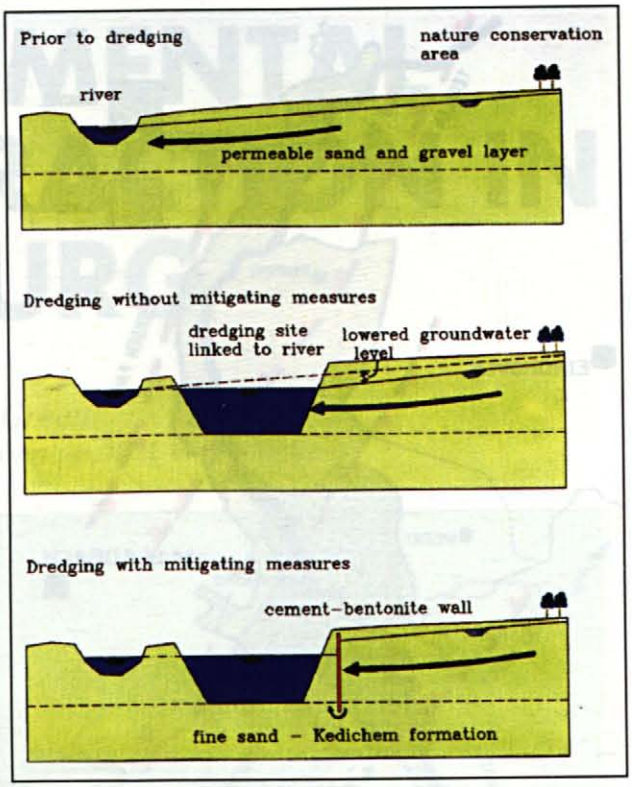

Figure 4. The effects of dredging on the water table.

To the south of the Feldbiss fault, an important structural line, the area of South Limburg was regularly uplifted whilst the glacial and inter-glacial periods caused erosion and deposition respectively. Accordingly, much of the Meuse sediments in this area have been eroded. The residues of the oldest sand and gravel deposits in South Limburg are therefore to be found on the higher terraces of the Meuse valley.

In the Central Graben to the north of the Feldbiss fault, down-throwing occurred, allowing continuous sedimentation of sand and gravel to take place. It is in this area, now known as Central Limburg, where most of the gravel deposits in the Veghel and Sterksel formations are to be found. Not surprisingly, gravel extraction has largely been confined to the Central Graben. As it constitutes about 25 % of the deposits, sand has been an important by-product. Further downstream in North Limburg, where the sediment becomes more and more sandy, large sand extraction sites are to be found.

Gravel extraction past and present

Just as it was the Meuse which deposited most of the sand and gravel in Limburg, it is now this same river which plays a key role in the extraction and transport of more than 5 million tonnes of gravel per year.

Gravel has been extracted in Limburg since 1929. At first, the gravel which was extracted and sold was purely a by-product from the canalisation of the Meuse. This canalisation was necessary in order to make the river navigable for larger vessels. Around 1935 the ex-

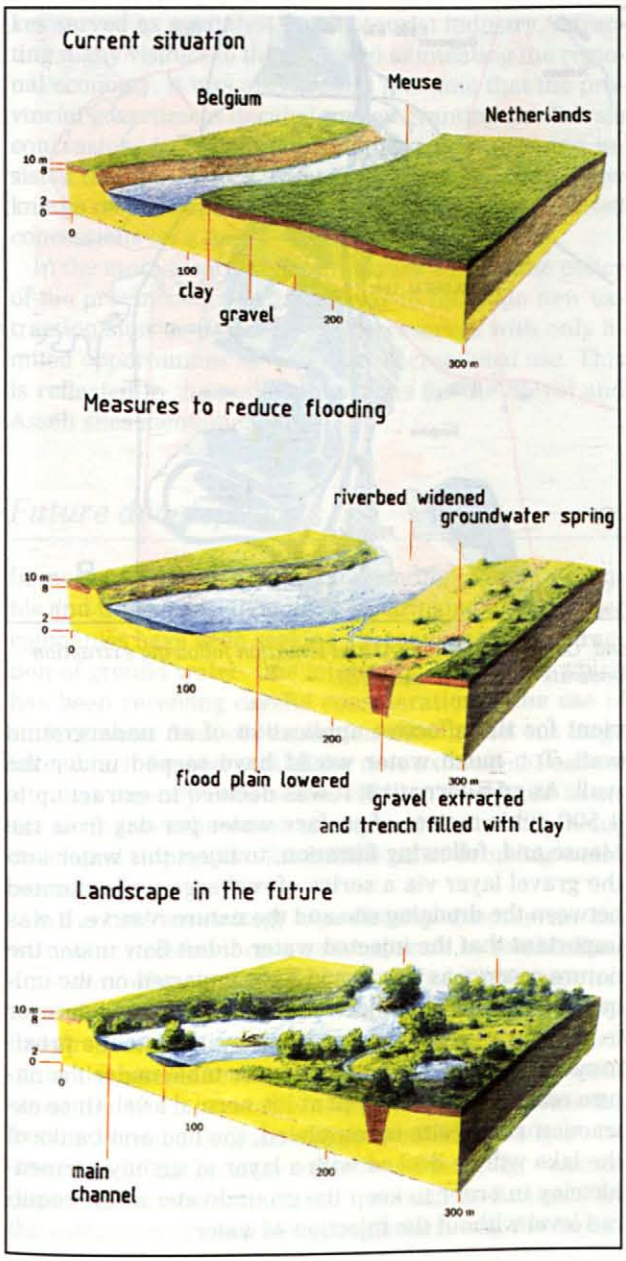

Figure 5. The principles of the Grensmaas plan.

traction of gravel became an industry in itís own right when it was extended to the low lying meadows along the banks of the Meuse which were prone to regular flooding. As a result of the Second World War and the subsequent need to rebuild much of the Netherlands, the demand for sand and gravel, essential for the production of concrete and other building materials, increased dramatically.

For many years bucket dredgers have been used for the extraction of gravel in the Meuse valley. As most of the gravel is situated below the water table, these floating installations are ideally suited for this work. Working their way inland from the river, the dredgers scoop the gravel up with buckets from a depth corresponding with the base of the gravel layer. In front of the dredgers, the face of the gravel layer continually collapses to feed the buckets, situated at depths of between 10 and 20 metres, with more gravel (figure 3). On board the dredgers, the gravel is graded, washed and crushed, prior to being loaded into barges with capacities of up to 2,000 tonnes. As it were, the dredgers create a lake which is linked to the river, thereby allowing the processed gravel to be transported directly to ready-mix and prefab concrete plants which are also situated along the major inland waterways of the Netherlands. The local roads and villages are spared the adverse effects of heavy road transport.

Geohydrology.

Although this «wet» extraction method has many advantages for the environment, there is a drawback to the technique. By dredging inland from the river, the gradually expanding lake assumes the water level of the river at the point where they are connected. As this level is usually lower than that of the original water table at the site prior to extraction, the result is inevitably a lowering of the groundwater table in the surrounding area (figure 4). The water table in Limburg has been falling for many years due to a combination of factors such as the construction of canals, the lignite mining across the border in Germany, the extraction of groundwater for agriculture

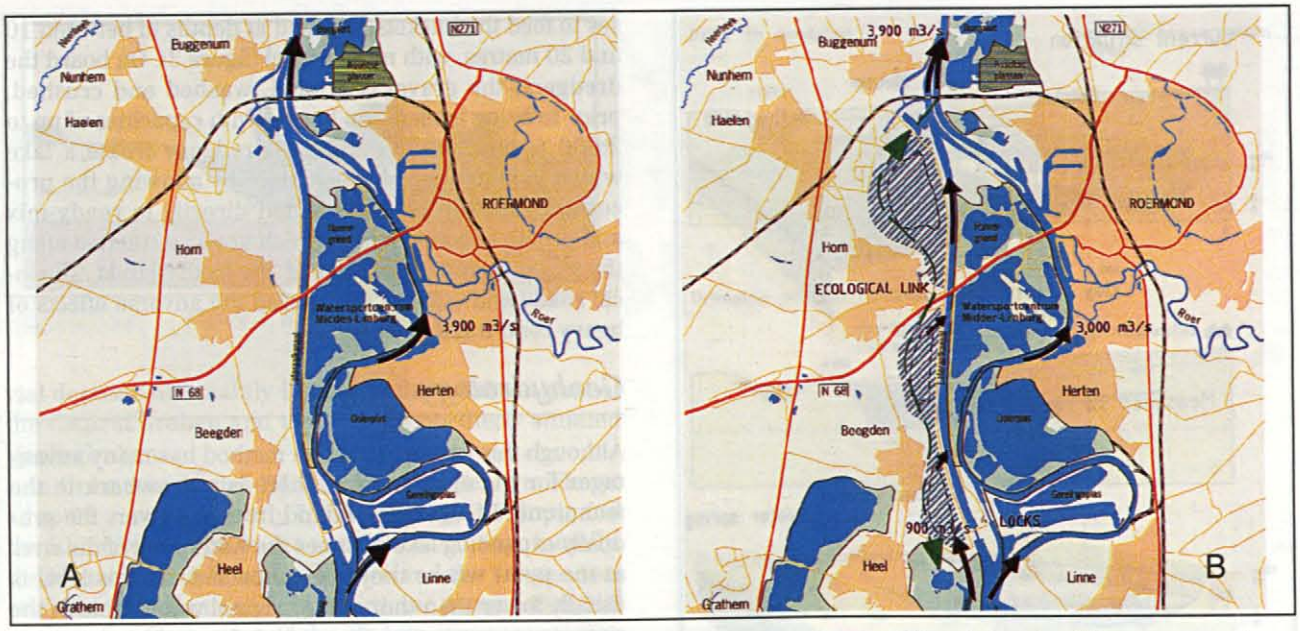

Figure 6. The proposed lateral canal extraction site near Roermond. Corrent situation (A) and situation following extraction when it will be possible to divert floodwater along the canal (B).

and industry, and gravel extraction. In order to prevent further lowering of the water table, the provincial government now insists that mitigating measures are implemented as a condition in new extraction licences.

In the environmental impact statement for the large Stevol site in Central Limburg, where 25 million tonnes of gravel are currently being extracted, an underground wall along the boundary of the concession was proposed in order to protect the groundwater dependent ecology of a nature conservation area situated at a distance of 5 km from the site . Over a length of 1 km, a 60 cm wide trench was excavated to a depth of 17 metres, through the permeable sand and gravel layer (Veghel/Sterksel formation) and into the fine sand of the Kedichem formation (Upper part of the Lower Pleistocene) which has a much lower permeability. During excavation the trench was constantly filled with a slurry, comprising cement, bentonite and water, which quickly hardened to form an almost impermeable wall. Although groundwater can still reach the dredging site by seeping around and under the wall, this underground barrier provides sufficient resistance to the flow of groundwater to ensure the water table «upstream» of the wall is maintained at itís original level (figure 4).

At another gravel extraction site to the north, near Asselt, mitigating measures were required to avoid a lowering of the water table in a nearby nature reserve. The vegetation in this reserve is dependent on the seepage of spring water from the foot of an embankment. As the sand under the gravel layer at this site was known to be course and therefore relatively permeable, the construction of a deeper cement-bentonite wall down to a clay layer at a depth of 30m was considered. However, the results of electro-magnetic measurements (EM 34) carried out by the Geological Survey indicated that the lateral continuity of the clay layer was insufficient for the effective application of an underground wall. Too much water would have seeped under the wall. As an alternative, it was decided to extract up to 4,500 cubic metres of surface water per day from the Meuse and, following filtration, to inject this water into the gravel layer via a series of recharge wells situated between the dredging site and the nature reserve. It was important that the injected water didnít flow under the nature reserve as this would have impacted on the unique vegetation. The injected water now forms a barrier to the flow of groundwater whereby, despite the proximity of the dredging site, the water table under the nature reserve has been kept at itís normal level. Once extraction at this site is completed, the bed and banks of the lake will be decked with a layer of slightly permeable clay in order to keep the groundwater at the required level without the injection of water.

Restoration of extraction sites.

The overburden which is removed prior to extraction, typically a 2 - 5 metre thick layer of clay and loam, is used for the restoration of extraction sites. Initially, the policy of the provincial government was to totally reclaim extraction sites for agricultural purposes. At one time, even waste from the declining coal mining industry was used to reclaim lakes. However, it soon became evident that it would not be possible to totally refill all extraction sites. In the sixties the provincial government decided to redevelop what had by then become a cluster of lakes in Central Limburg into a water-sport and recreational area with leisure facilities such as campsites and marinas - a sort of inland Riviera. The costs of the restoration were met from the «gravel fund» which was financed by a levy on every ton of gravel and sand which was extracted. The reinstatement of the la-

kes served as a catalyst for the tourist industry, attracting many visitors to the area and stimulating the regional economy. It was also around this time that the provincial government decided to stop granting small scale concessions to individual dredging companies and insisted that the 18 companies formed a consortium, now known as the Panheel Group, which would be granted concessions on a larger scale.

In the more environmentally aware 1980's, the policy of the provincial government was to reinstate new extraction sites as potential nature reserves with only limited opportunities for extensive recreational use. This is reflected in the restoration plans for the Stevol and Asselt sites mentioned above.

Future developments

In more recent years, with the lowering of the water table and the increased demand for drinking water, water companies have been seeking alternatives to the extraction of ground water. One interesting alternative which has been receiving careful consideration is the use of surface water from old extraction sites. In fact one large lake, which formed part of the now exhausted Panheel site, has recently been sealed off from the Meuse in order to improve the water quality and is currently being developed to provide 20 million m³ of drinking water per year.

In the 1980's a strategy was developed to improve the natural environment on a national scale by establishing a network of ecological corridors to link important natural habitats. This concept was reflected in the so-called Grensmaas plan, which proposed measures to facilitate the spontaneous evolution of a nature reserve along the 40 km stretch of the Meuse which forms the frontier between Belgium and the Netherlands (figure 2). The costs of the primary objective of this plan - nature conservation and restoration - were to be financed by the extraction of sand and gravel which was the secondary objective.

With the provincial government taking the initiative, this plan was still at the preparatory stage when overtaken by events. Following serious flooding along the Meuse in 1993, a report was commissioned to propose how the risk of future flooding could be reduced to an acceptable level. The report recommended both short term and long term measures. The short term measures entailed the construction of dikes around towns and villages. The implementation of this measure has already reduced the risk of flooding in built-up areas to a frequency of once in 50 years.

In the long term, the cross sectional area available to floodwater in the Meuse is to be increased by widening the river channel and lowering the level of the meadows in the present flood plain (figure 5). This project will entail the excavation of 14 million m³ of clay and loam, and the extraction of 23 million m³ of sand and gravel along the Dutch bank of the Meuse. Further inland from the river, an additional 14 million m³ of sand and gravel shall be extracted from deep trenches and replaced with the clay from the river banks in order to create slightly permeable barriers to the flow of groundwater to the Meuse. This will raise the water table and allow groundwater to seep out in the lowered flood plain to stimulate the growth of new vegetation. Therefore, although the primary aim is now to reduce the risk of flooding to a frequency of once in 250 years, this plan still provides for the creation of natural habitats and migration routes along the Meuse as envisaged in the Grensmaas plan. A large part of this project is situated to the south of the Feldbiss fault where the gravel deposits are not as thick as in the Central Graben. Whether the extraction of gravel will be enough to finance the plan is debatable.

Meanwhile, the Panheel Group has prepared a plan for an extraction site in Central Limburg which runs parallel with the Lateral Canal near Roermond. This plan involves the extraction of about 25 million tonnes of gravel at three locations along the west bank of the canal. Once the site has been reinstated, it will create an ecological link in the Meuse valley where the existing cluster of lakes used for water sport and recreation forms a barrier to the migration of wildlife (figure 6). Should a concession be granted, this project also has the potential to help solve some other problems:

- The Lateral Canal was constructed in the 1960's to bypass the large bends in the Meuse near Roermond which were an inconvenience to shipping. The river falls some 6 metres over the stretch which is covered by the canal. In order to bridge the difference in water level, it was necessary to construct a lock complex upstream in the canal, whereby the level of the canal would be lowered to that of the river at the downstream junction. This had an adverse effect on the water table to west of the canal. However, by dredging at three locations on the west bank, it will be possible to raise the water table again. Prior to extraction, a cement-bentonite wall shall be constructed around the site to ensure that the dredging doesnít cause a further lowering of the water table. Following extraction, the lakes shall be sealed off from the canal and their banks decked with slightly permeable clay to prevent water draining from the lakes into the canal. This will cause the water level of the lakes to rise, which in turn will raise the water table to the west.

- Although the Lateral Canal is used by shipping in preference to the Meuse near Roermond, it cannot contribute to the discharge of water due to the presence of the upstream lock complex. This means that, when the level of the Meuse rises, up to 3,900 cubic metres of floodwater per second must flow past Roermond. This resulted in serious flooding and even the evacuation of areas of Roermond in 1993 and 1995. However, following extraction at the Lateral Canal site, it will be possible to reduce this high discharge by diverting about 900 cubic metres of floodwater per second around the locks and through the series of lakes before allowing it to overflow into the canal. The canal can then discharge this water back into the Meuse downstream of Roermond. It has been calculated that this measure would reduce the level of the floodwater near Roermond by 40 cm.

- Depending on the quality of the floodwater and how often it will have to be diverted via the Lateral Canal, this site could form an ideal buffer for the existing drinking water extraction site at Panheel. This aspect is presently being studied.

Conclusion

For many years, the extraction of gravel in Limburg has been an industry in itís own right. Although this gravel will continue to serve as an essential raw material for construction in the Netherlands, it is the imaginative reinstatement of extraction sites and the opportunities that they create which now guarantee the future of this industry.

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SOBRE UN IMPORTANTE YACIMIENTO DE FELDESPATO SODICO EN LA PROVINCIA DE SEVILLA

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Resumen

El trabajo describe un yacimiento de feldespato sódico con aplicación industrial en la fabricación de pavimentos cerámicos de pasta blanca. El yacimiento supone un importante aumento de las reservas del feldespato de tipo sódico en España, que actualmente depende de las importaciones. Se actualiza el origen y tipos de yacimientos de feldespato en España y se analiza la importancia de la inclusión del yacimiento descubierto dentro del panorama minero nacional.

Abstract

The work describes a deposit of sodium feldspar with industrial applications in the manufacture of whiteware paving units. It represents a considerable increase in the reserves of sodium feldspar in Spain which is currently heavily dependant in foreign imports. A review on the origin and types of Spanish feldspars in carried out and the importance of including the new deposit discovered within the national mining panorama.

Résumé

L'article traite d'un gisement de feldspath sodique dont l'utilisation industrielle concerne la fabrication de carreaux de céramique blanche. Le gisement représente une augmentation considérable des réserves de feldspath sodique en Espagne qui actuellement est fortement tributaire d'importations de l'étranger. Une analyse est faite de l'origine et des différents types de feldspaths présents en Espagne en mettant l'accent sur l'importance de ce nouveau gisement au sein du panorama minier espagnol.

Foto 1. Facies fina.

Introducción

El yacimiento descrito, descubierto en Julio de 1993 y nombrado «Reata» cuyos derechos mineros pertenecen a Albitas Minera, S. L., se encuentra situado al Sur de España, en la vertiente meridional de Sierra Morena, a 90 Kms. de Sevilla. (Figura 1, pág. 48).

Foto 2. Facies aglomerática.

Descripción del yacimiento

El yacimiento, de disposición tabular, se distribuye con dirección NW-SE a lo largo de aproximadamente 5 Km. (Figura 1, pág. 48). La masa mineralizada encaja en cuarzoesquistos y pizarras paleozoicas. Se trata de una roca que ha sufrido un intenso proceso de transformación hidrotermal. La hipótesis genética, a falta de estudios de detalle, indica una posible génesis subvolcánica o filoniana.

En el yacimiento están presentes dos tipologías diferenciadas, aunque ambas de igual composición química. (Fotos 1 y 2).

Facies fina: Conforma una capa continua de potencia homogénea y con niveles estratificados.

Facies aglomerática: De aspecto de un aglomerado con pequeños fragmentos angulosos, de igual composición que la matriz, constituyendo engrosamientos irregulares.

El yacimiento presenta una montera superior meteorizada, teniendo la roca feldespática un color beige-rosado. Tras una zona de tránsito, en profundidad se pasa gradualmente a la roca sana, siendo en este caso el feldespato de coloración gris-claro.

Composición mineralógica: La roca presenta una textura granuda de grano fino heterogranular. La observación microscópica (Foto 3) muestra un agregado granudo irregular de cristales de oligoclasa de bordes suturados como componente mineral principal y ocasionalmente cuarzo. Entre los minoritarios se han observado, sericitas, opacos y turmalina. Esta última procedente de una fuerte tumalinización hidrotermal asociada.

Los análisis de difracción de rayos X muestran una composición mineralógica de oligoclasa (0,84 Albita, 0,16 Anortita) e indicios de cuarzo y micas.

Composición química: 10,97% Na_2O máximo, 8,03% Na_2O mínimo, $Na_2O+K_2O>10\%$. SiO_2:65%, Al_2O_3:20%, MgO:0.2%, CaO:0.3-0.9%, Fe_2O_3: 0.3-0.7% y Pérdida por calcinación a 1000ºC: 0.8-1.2.

Conos de fusión: La propiedad física por la que es apreciable el feldespato sódico en la industria cerámica, es su aplicación como fundente, dado el bajo punto de fusión de la albita. Los ensayos de los conos de fusión muestran buena fundencia, una superficie homogénea brillante y lisa, con ausencia de puntos negros. Son de color 10YR 7/6 a 10YR 7/2 de la Carta de colores Munsell, esto es, de coloración crema para el feldespato de la montera superior del yacimiento a gris claro para la roca sana (Foto 4). La pérdida de altura relativa del cono (h/H, siendo h: altura final de la probeta ensayada y H: 37 mm, altura inicial de la probeta), fue de 0,6 para la roca de superficie y 0,57 para la roca sana, que es ligeramente más fundente. Los ensayos fueron realizados en el Instituto de

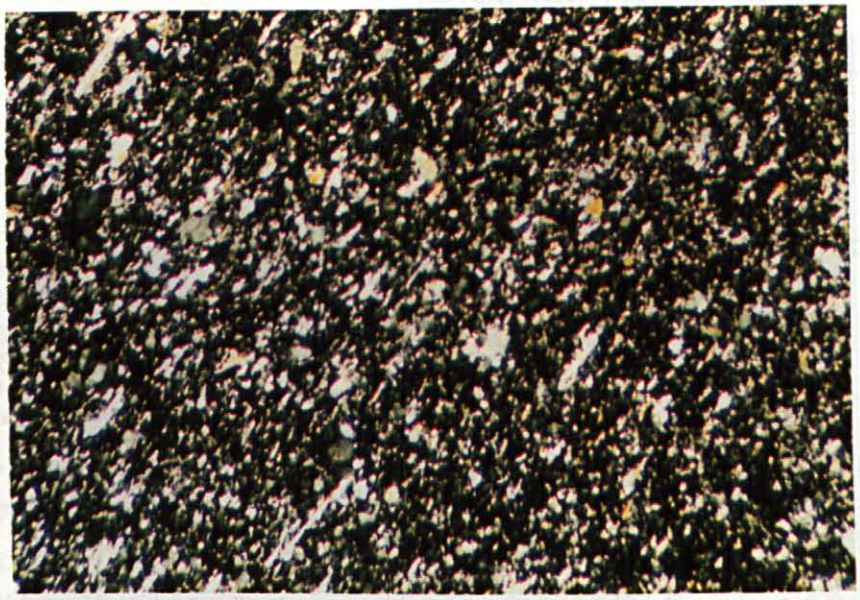


Foto 3. Fotografía microscópica de la roca. Nicoles cruzados x 40 aumentos. Mosaico microcristalino de oligoclasa.

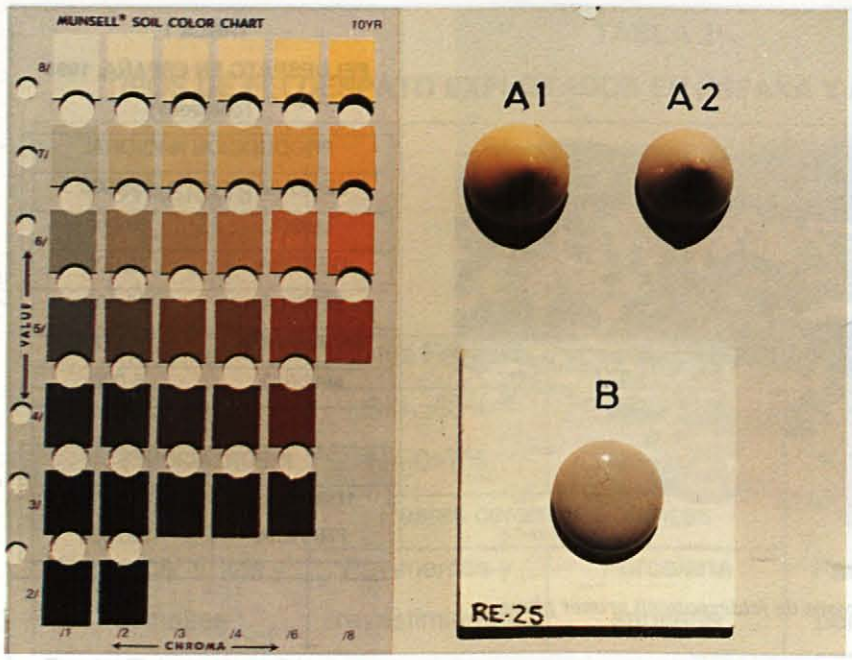


Foto 4. Conos de fusión. A: Temperatura máxima 1.280°C, 6 minutos, probeta cónica inicial de 37 mm de altura. (A1: Zona superior del yacimiento, A2: Roca sana). Instituto de Tecnología Cerámica (ITC) Castellón.
B: Temperatura máxima 1.250°C, 25 minutos, probeta cónica inicial de 22 mm de altura. Laboratorio de Industria cerámica. Castellón.

Tecnología Cerámica (ITC) a una temperatura máxima de 1280°C durante 6 minutos.

Laboreo y aplicación industrial: El yacimiento se caracteriza por presentar grandes masas aflorantes que ocupan extensas superficies y que evitan el movimiento de estériles. Dada la homogeneidad micro y macrogranular del feldespato es viable por una parte, la obtención de un todo/uno en cantera con regularidad y calidad. Por otra parte, dada la ausencia de impurezas, es factible la explotación del yacimiento tal como se encuentra, sin tener que ser necesario someter la roca feldespática a ningún otro tratamiento que la exclusiva molturación del producto extraído a una granulometría 0-8/10 mm.

El feldespato cumple los requerimientos como materia prima para la fabricación de pavimentos cerámicos de gres de monococción de pasta blanca.

Recursos del yacimiento: Se ha alcanzado un perfecto conocimiento geológico-minero del mismo, tanto por las investigaciones y muestreos realizados, así como por la existencia de grandes superficies aflorantes de la roca feldespática (Fotos 5 y 6).

Considerando exclusivamente la extracción de recursos hasta una profundidad de 20 metros, se obtienen unas reservas inferidas de 11,8 millones de toneladas. Además para el inicio de la extracción del yacimiento, se han prospectado y medido 1.468.000 toneladas seguras y 936.000 indicadas en un área de 2,5 Has de la zona Cincho. De esta manera se demuestra que los recursos del yacimientos son superiores a 14 millones de toneladas. Es evidente que existen aun mayores reservas económicas que las inicialmente previstas al permitir tanto la disposición del yacimiento como el valor del feldespato una reprofundización superior a los escasos 20 metros considerados en la cubicación inicial.

Panorama minero del feldespato en España

Producción y demanda: La producción de feldespato en España, en el año 1995, fue de 360.000 toneladas, siendo las principales provincias productoras Segovia, que ocupo el primer lugar con el 44% del total, Lugo 24% y Gerona 21%. Las importaciones ascendieron a 168.000 toneladas. (Tabla 1.)

Los principales sectores industriales demandantes de feldespato fueron el sector cerámico (64%) y el vidrio (32%), representando otros sectores (pinturas, plásticos, caucho) el 2%.

Foto 5. Zona Gallinero 1. Loma de feldespato.

Foto 6. Zona Cincho 1. Afloramientos rocosos de feldespato en primer plano.

TABLA 1

FELDESPATO EN ESPAÑA. 1995

(Toneladas)

PRODUCCIÓN NACIONAL	
SEGOVIA	158.000
LUGO	88.000
GERONA	75.000
SEVILLA	24.000
SALAMANCA	10.000
MADRID	5.000

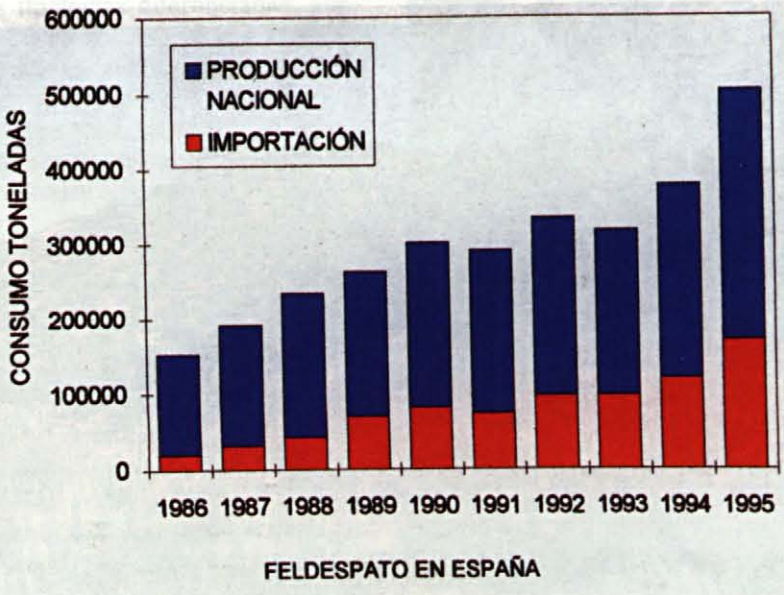
IMPORTACIONES	
TURQUÍA y FRANCIA	168.000

La demanda de feldespato muestra una tendencia ascendente La producción en 1995 se incrementó en un 32% respecto al año anterior. El fuerte aumento de la demanda por el sector cerámico, su principal consumidor, se ha traducido en un constante incremento de las importaciones con un crecimiento de la demanda exterior del 30,6%. Por ello, la dependencia técnica (Importación-Exportación / Consumo) fue del 28.5% (Gráfico 1).

Tipos de feldespatos producidos: En España se benefician diferentes tipos de feldespatos, siendo el volumen de sus recursos y sus aplicaciones industriales diferentes (Gráfico 2). Los tipos producidos son fundamentalmente: Potásicos, sódicos y mixtos (Tabla 2).

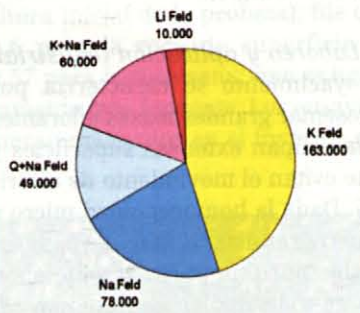
Los feldespatos potásicos *K Feld* con contenidos en K_2O>9%, representan el 44% de la producción nacional. Actualmente se obtienen a partir del tratamiento de arenas eólicas feldespáticas, en detrimento de los yacimientos pegmatíticos que han experimentado una fuerte recesión. Su destino principal es la industria del vidrio los esmaltes y fri-

GRAF. 1



Fuente: Panorama Minero (ITGE)

GRAF 2.
TIPOS DE FELDESPATOS PRODUCIDOS EN ESPAÑA.1995



GRAF. 3
TIPOS DE FELDESPATOS CONSUMIDOS EN ESPAÑA.1995

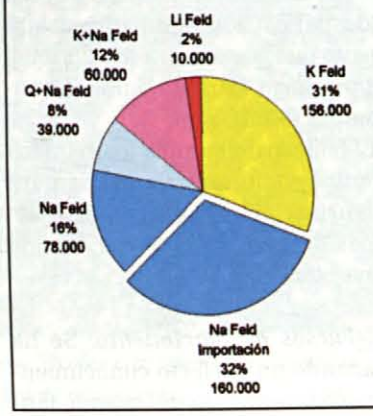


TABLA 2

TIPOS DE FELDESPATO EXPLOTADOS EN ESPAÑA Y APLICACIÓN INDUSTRIAL

POTASICOS $\left(\frac{K}{Na}>3\right)$	SODICOS $\left(\frac{K}{Na}<\frac{1}{3}\right)$		MIXTOS $\left(3>\frac{K}{Na}>\frac{1}{3}\right)$	OTROS
K Feld	Na Feld	Q+Na Feld	K+Na Feld	Li.Feld
$K_20 \geq 9\%$	$Si0_2 \cong 68\%$ $Na_20 > 7\%$	$Si0_2 > 71\%$ $Na_20 \cong 7\%$	$K_20 = 4\text{-}6.5$ $K_20/Na_20 = 1\text{-}2$	
Vidrio	Pastas cerámicas blancas		Cerámica:	Cerámica
Cerámica: Fritas y esmaltes	Pavimentos y revestimientos	Porcelana sanitaria	Pasta blanca y porcelana fina	Aditivos

Fuente: Elaboración propia

tas cerámicos. Su temperatura de fusión está entre los 1.250ºC y 1.280ºC.

Entre los feldespatos sódicos se han diferenciado feldespatos albíticos *Na Feld* y cuarzo-albíticos *Q+Na Feld*. Los primeros se obtienen a partir de depósitos de origen volcánico y los segundos de masas aplíticas y diques cuarzo-feldespáticos. Su aplicación principal es la industria cerámica de pastas blancas. La albita funde a 1.130ºC.

Los feldespatos mixtos *K+Na Feld* representan el 17% de la producción total. Se obtienen a partir de yacimientos de diques pegmatíticos, aplíticos o cuarzo-feldespáticos. Existe un feldespato mixto, que además de potasio y sodio en proporciones similares, contienen óxido de litio y que ha sido denominado Li Feld. Se utilizan en general en la industria cerámica.

Tipos de feldespatos demandados: La producción nacional abastece parcialmente a la industria, exportándose pequeñas cantidades de feldespato cuarzo-albítico (Q+Na Feld) y feldespato potásico (K Feld) de calidad. Sin embargo, la producción nacional no puede abastecer la demanda de la industria de pavimentos y revestimientos cerámicos de pasta blanca, siendo por ello necesario, pese al esfuerzo productor, importar mayoritariamente feldespato sódico (Na Feld). (Gráfico 3).

TABLA 3

CARACTERIZACIÓN DE YACIMIENTOS

EXPLOTACIONES DE FELDESPATO EN ESPAÑA.1997

PROVINCIA	EMPRESA	MINA	GENESIS YACIMIENTO	TAMAÑO	TIPO FELDESPATO
SEGOVIA	INCUSA	Carrascal del Río	ARENAS EÓLICAS	Grande	K.Feld.
	SAMCA	Navas de Oro	ARENAS EÓLICAS	Grande	K.Feld.
LUGO	BASAZURI S.L	Quinta	DEPÓSITO VOLCÁNICO	Mediano	Na.Feld
	J.PERNAS.	Silán	DIQUES PEGMATÍTICOS	Grande	K+Na Feld
GERONA	LLANSÁ, S.A.	Carmina	DIQUES CUARZOFELDESPÁTICOS	Mediano	K+Na Feld.(70-75%) Q+Na.Feld (25-30%)
SEVILLA	OSTALÉ	Barcelona	MASA APLITÍCA	Mediano	Q+Na.Feld
SALAMANCA	MOLCASA	Feli	DIQUE PEGMATÍTICO	Pequeño	Li.Feld
MADRID	J. SANCHIS	G.M.Pepe	DIQUE PEGMATITICO	Pequeño	K.Feld.
SEVILLA	ALBITAS MINERA, S.L.	REATA	DEPÓSITO SUBVOLCÁNICO	Grande	Na.Feld

(Tamaño grande >1.500.000 toneladas). Fuente: Elaboración propia

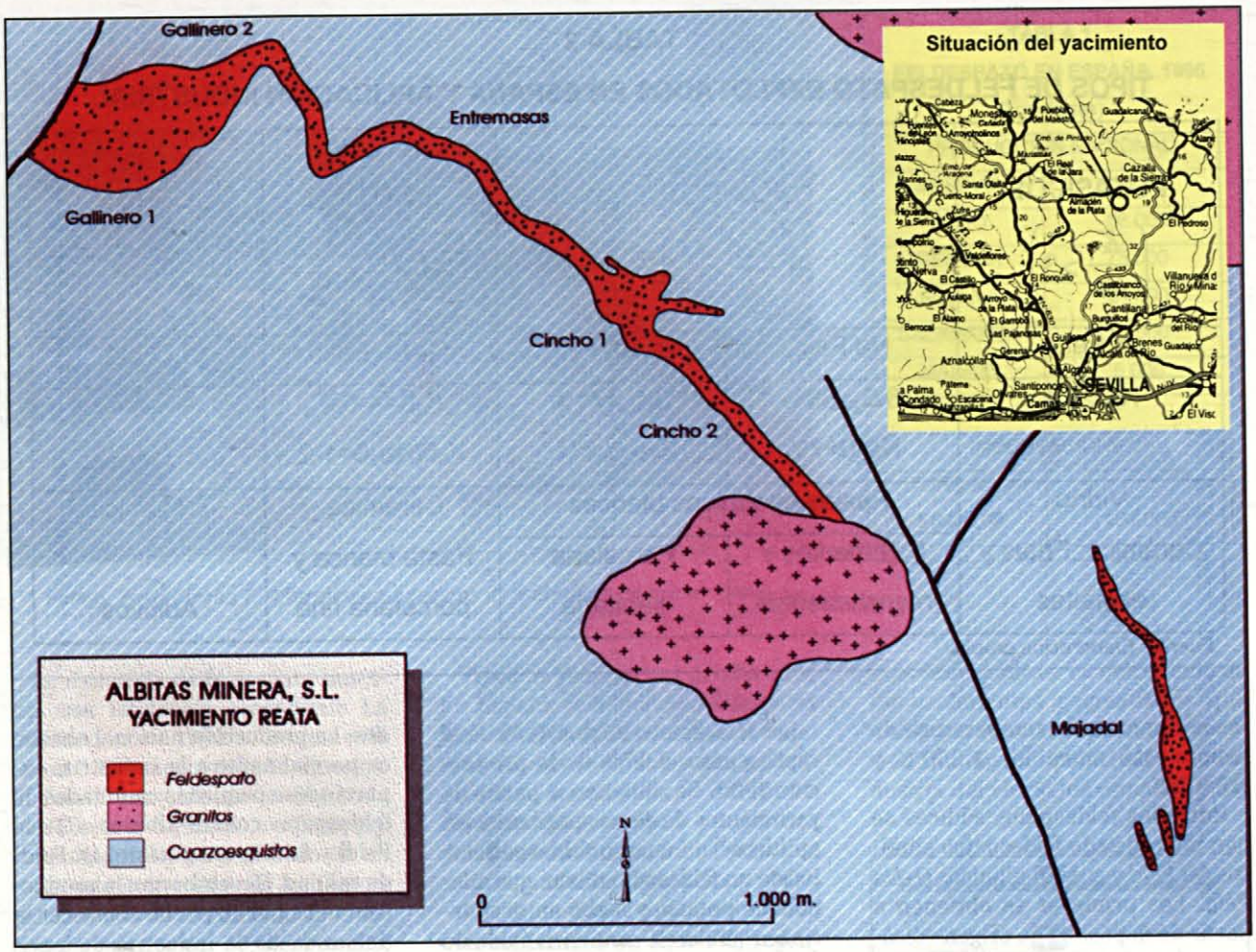


Figura 1

Encuadre del yacimiento descubierto dentro del panorama minero nacional de feldespato: importancia de su incorporación

En la Tabla 3 se caracterizan los diferentes yacimientos españoles, indicándose su génesis, tamaño, y el tipo de feldespato extraído. Como se puede observar el yacimiento descubierto es del tipo «Quinta» en Lugo. Su génesis, composición y conos de fusión semejantes así lo atestiguan.

En la Tabla 4, se hace patente la diferenciación entre los feldespatos sódicos. La composición teórica de la albita es: 68% SiO_2, 19.4% Al_2O_3 y 11,8% Na_2O = 100%. En la composición de los feldespatos cuarzo-albíticos (Q+Na Feld), la presencia del orden de un 10% de cuarzo, origina un aumento de SiO_2 en su composición química, actuando esta sílice libre (no combinada) como un refractario, elevando el punto de fusión. Por esta razón, el Q+Na Feld es difícilmente utilizable como sustituto de las importaciones de Na Feld para la fabricación de pavimentos cerámicos y ello explica su exportación.

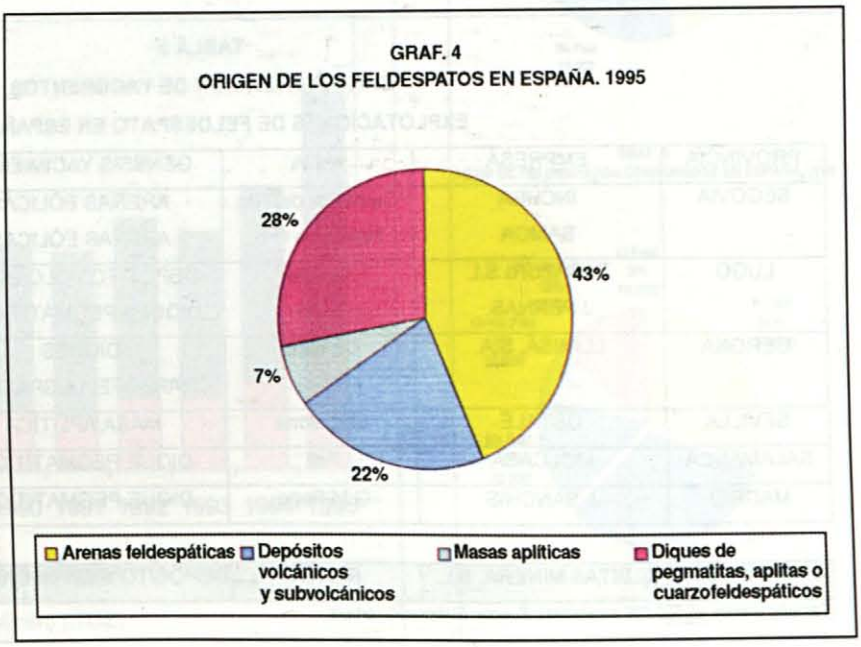


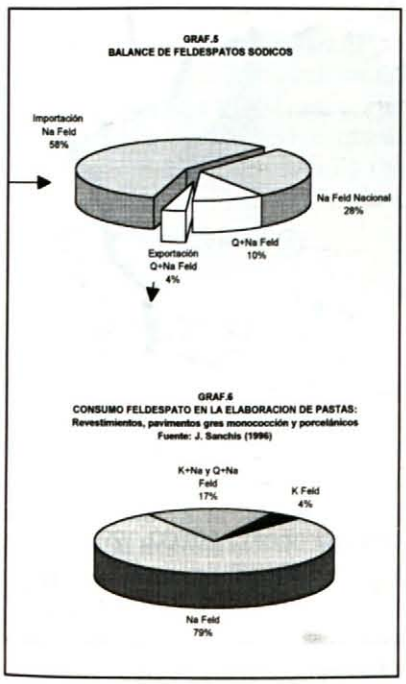
TABLA. 4

FELDESPATOS SÓDICOS: COMPOSICIONES QUÍMICAS

%	GERONA LLANSA	SEVILLA OSTALE	LUGO BASAZURI	SEVILLA ALBITAS MINERA
	Q+Na.Feld.		Na.Feld.	
SiO_2	≅75	≅75	66-69	65 ± 1
Al_2O_3	15	15 - 17	19	20
Fe_2O_3	0.2	0.2 - 0.4	0.4 - 0.8	0.3 -0.7
CaO	0.8	0.1-0.9	0.4-0.8	0.3-0.9
MgO	0.2	0.2	0.5	0.2
Na_2O	6 - 7	7.2 - 8.3	8.6 - 10.8	8.03 - 10.9
K_2O	2.8 - 1.2	0.2 - 0.1	1.8 - 0.2	2.2 - 0.7
P.p.c.1000·C	0.2-0.7	0.6	0.9-1	0.8-1.2
Na_2O+K_2O	8 - 9.2	7.4 - 8.4	10.4 - 11	10.2 - 11.6

En el Gráfico 5 se muestra el balance de los feldespatos sódicos. La proporción de las importaciones de este producto es bastante alta 58%, lo que obliga a una alta dependencia exterior. Los recursos importados son originarios de Turquía 77%, procedentes de yacimientos albitíticos, y de Francia 23%.

La elaboración de pastas blancas para revestimientos, pavimentos de gres monococción y porcelánicos, (sin contar engobes, fritas, esmaltes y colorantes) demanda la mayor parte del feldespato dentro del sector cerámico, utilizándose en sus procesos de fabricación un 79% de Feld Na. (Gráfico 6). Dentro de la industria española, el sector de pavimentos cerámicos, con vocación claramente exportadora y en constante expansión, es de los más competitivos en el mercado exterior. Según el Consejo Superior de Colegios de Ingenieros de Minas (1996), el valor de la producción de azulejos y pavimentos de cerámica blanca, en el año 1994 fue de 288.000 Millones de pesetas (de los que se exporta la mitad de su producción) con 15.000 empleos en este subsector. La cerámica blanca (azulejos y pavimentos) inició su reconversión en los años 80, contando actualmente con unas 180 empresas, ubicadas en su mayoría en la provincia de Castellón, que acapara el 93% de la producción total. La mayor parte de las fábricas han adoptado el proceso de monococción, en el que España es líder indiscutible.



España cuenta con importantes recursos de feldespato, no siendo así para la variedad sódica. Según el Inventario Nacional de Recursos de Feldespato (IGME, 1983), las reservas económicas demostradas españolas de feldespato superaban los 32 millones de toneladas. Existían sin embargo pocas reservas conocidas de feldespatos sódicos (2 Mt) ya que la mayoría son feldespatos potásicos (30 Mt). Por otra parte las reservas de Na Feld son de 0,75 Mt. (ITGE, 1993). Con las reservas del yacimiento descubierto, se incrementa un 700% las primeras y 14 veces, como mínimo, las reservas nacionales de feldespato sódico.

Conclusiones

La incorporación del feldespato del yacimiento Reata de Albitas Minera, S. L., al Panorama minero nacional, con la puesta en funcionamiento de su explotación, proporcionará a la industria de pavimentos cerámicos de pasta blanca, feldespato sódico a un precio y calidad competitivos frente a la alta dependencia de las actuales importaciones y con suficientes reservas para garantizar el creciente suministro demandado, permitiendo el normal funcionamiento del sistema industrial sin supeditarlo a intereses foráneos como ocurre actualmente.

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PRESENT STATE OF REGIONAL GEOLOGICAL MAPPING IN THE SLOVAK REPUBLIC

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Geological Survey of the Slovak Republic

Abstract

The authors briefly review the history of geological mapping in the Slovak Republic and its main geological characteristics. They also describe the current availability of geological and geomorphological maps at different scales and future mapping plans of the Geological Survey of Slovak Republic.

Resumen

Los autores describen la historia de la cartografía geológica de la República Eslovaca y sus principales características geológicas. También describen la actual disponibilidad de cartografía geológica y geomorfológica a diferentes escalas, y los futuros planes de cartografía geológica del Servicio Geológico de la República Eslovaca.

Résumé

Les auteurs révisent brièvement l'histoire des cartographie géologique de la République Slovaque et ses principal caractéristiques géologiques. Ils parlent aussi du disponibilité actuelle des cartes géologiques et géomorphologiques aux échelles varies et les projets futurs au point de vue de la cartographie géologique de la Service Géologique de la République Slovaque.

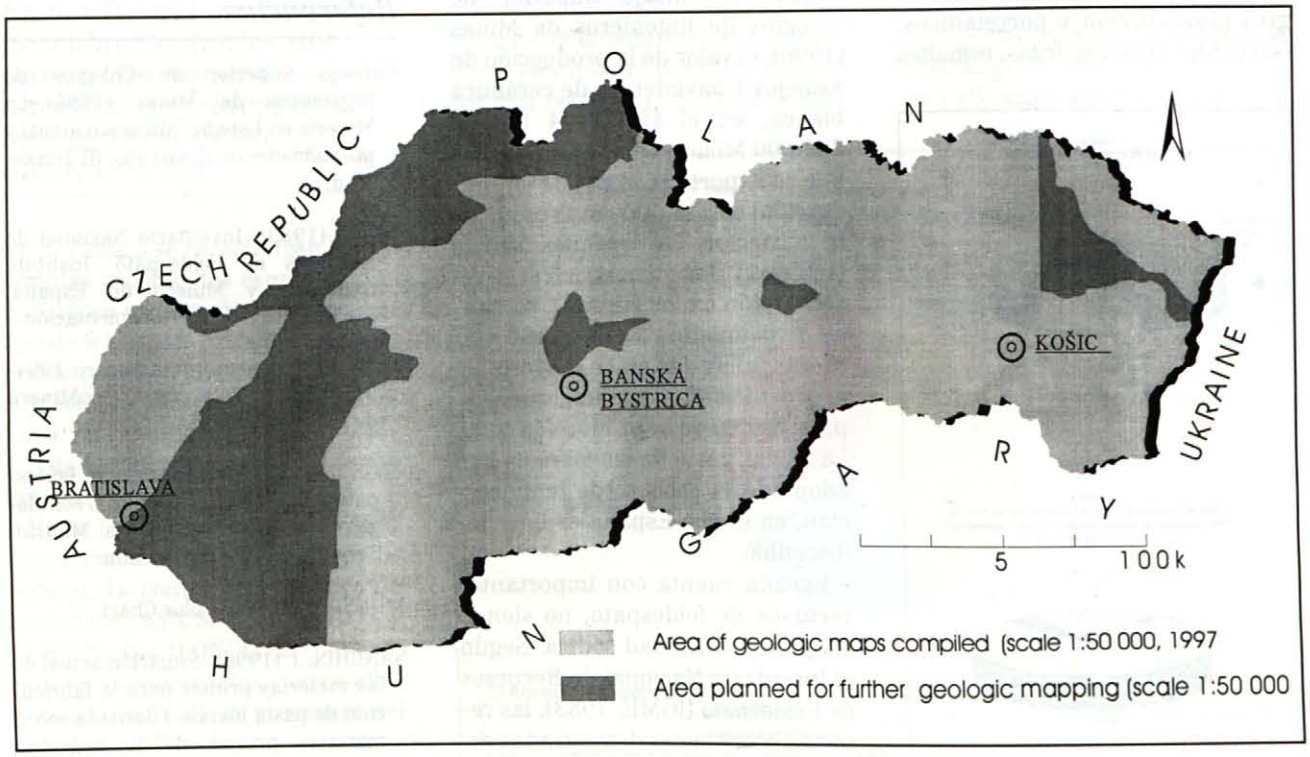
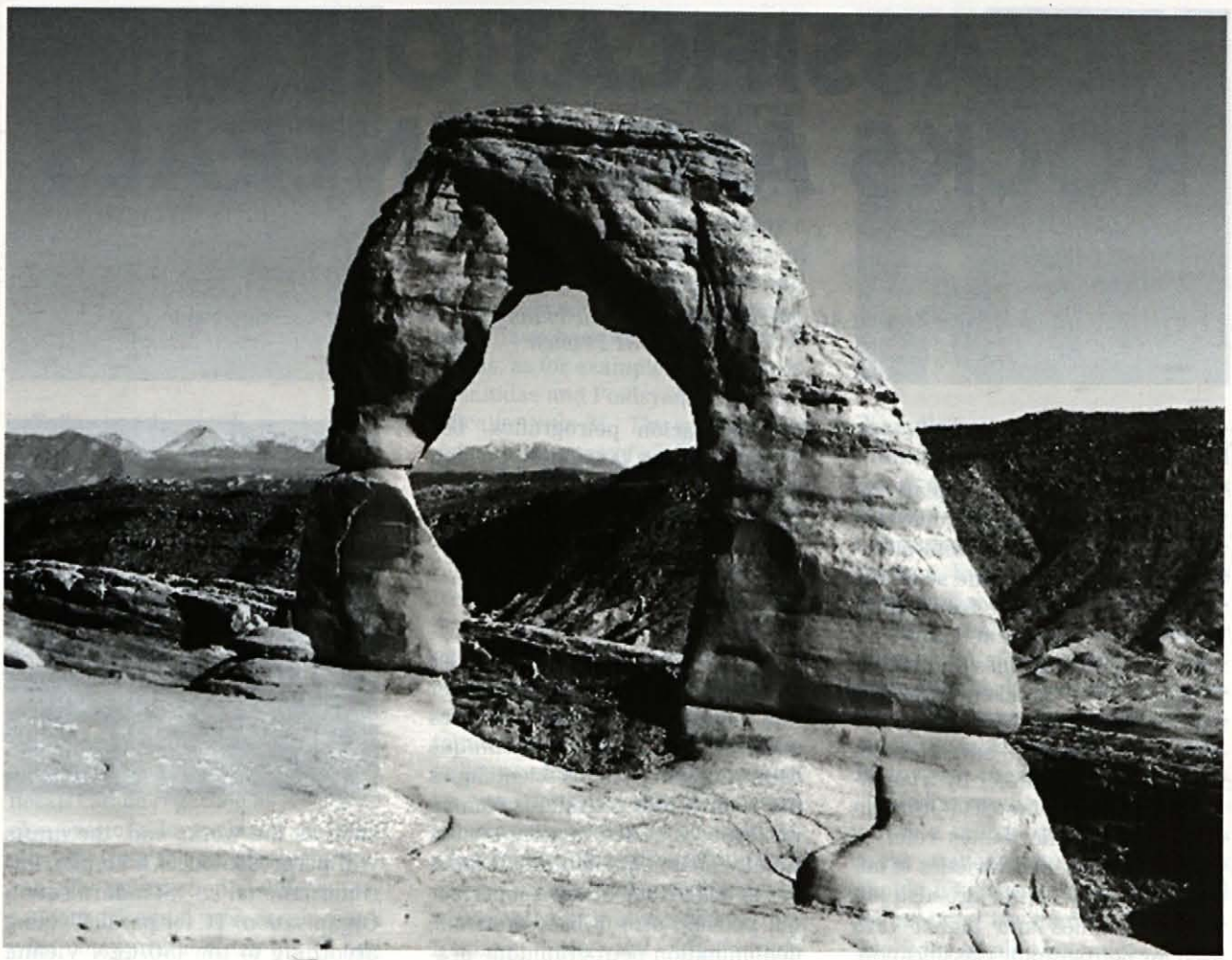


Fig. 1. Slovak Republic - Edited Geological Maps at the Scale 1:50 000.



History

he history of geological research and mapping of the territory of Slovakia, which includes part of the Western Carpathians mountain range, covers about 150 years. The publication of geological maps at the scale of 1:200 000 covering the whole area of Slovakia was finished during the sixties.

Geological Survey

The program of geological mapping of the Slovak Republic is the main responsibility of the Geological Survey of the Slovak Republic (former Dion˝z ätúr Institute of Geology) in Bratislava.

At present the Geological Survey of Slovak Republic is aiming to finish the production of geological maps at the scale of 1:50 000. A new geologic map of Slovakia at the scale of 1:500 000 was also compiled.

Geology

The geological structure of the Western Carpathians is the result of a complicated tectonic development that can be traced back from the Paleozoic up to present times. The Western Carpathians are formed by many tectonic fragments, and this feature is very clearly expressed by their morphology. They do not represent a united zonal mountain range, instead they are scattered into a set of isolated relatively small mountain ranges and basins (horsts and grabens). This tectonically and geomorphologically complicated orogen, requires a specific approach for studying and interpreting its structure.

Mapping in Slovakia

Geological maps provide the essential basis to evaluate the geologic environment affecting human activities.

Geomophological features need to be displayed in larger units when mapping at 1:50,000 scale, this has made it necessary to compile them not as map sheets, but as geomorphologically distinguished regions. Up to now 32 such regions were edited or compiled in manuscripts. They represent nearly 80% of the total area of the Slovak Republic (Fig.1). These so-called maps of regions at 1:50 000 scale, serve as the basis for the compilation of several special thematic maps (e.g. environmental, hydrogeological, engineering geological) which provide essential information for decision-makers in public administration, economy and environmental policy.

CLASSIFICATION OF ROCKS AND MINERALS

by Uwe Kraeft

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Abstract

The aim of this text is to explain the reasons which led to the proposal of a classification of rocks and minerals by CEN/TC 246. The scientific names of the rocks are regarded as species and varieties and were joined in few rock families and higher taxa which can be taken for practical petrographic denomination. Most of these families have been defined in known manner by triangular diagrams. In the case of minerals the scientific names refer to groups, species, and varieties of minerals. The two latter are also joined in families and higher taxa used for petrographic classification. The names of the taxa can be given with equal Latin endings or for example in English language.

Resumen

El objetivo de este texto es explicar las razones que han conducido a la propuesta de una clasificación de rocas y minerales por parte del Comité Técnico CEN 246. Los nombres científicos de las rocas se consideran especies y variedades y se han agrupado en unas pocas familias de rocas y taxones superiores que pueden utilizarse para denominaciones petrográficas prácticas. La mayoría de estas familias se han definido del modo habitual utilizando diagramas triangulares. En el caso de los minerales, los nombre científicos se refieren a grupos, especies y variedades de minerales. Estos dos últimos se agrupan en familias y taxones superiores para su empleo en la clasificación petrográfica. Los nombres de los taxones se pueden dar con terminaciones idénticas en latín o por ejemplo en inglés.

Résumé

Le but de ce texte est d'expliquer les raisons qui ont amené à proposer une classification des roches et des minéraux par le comité technique CEN/TC 246. Les noms scientifiques des roches sont considérés comme des espèces et des variétés et sont réunies en un petit nombre de familles et des taxons d'ordre supérieur qui peuvent être utilisés pour une dénomination pétrographique pratique. La plupart de ces familles ont été définie à l'aide de la méthode bien connue des diagrammes triangulaires. Pour les minéraux, le nom scientifique se réfère aux groupes, espèces et variétés des minéraux. Les deux derniers sont aussi réunis dans les familles et taxons d'ordre supérieur utilisés pour la classification pétrographique. Les noms des taxons peuvent être donnés avec les mêmes terminaisons latines ou, par exemple, en anglais.

1. Introduction

With the aim to produce the European standards (EN) related to natural stone, in 1991 the CEN (European Standardisation Committee) Technical Committee 246 "Natural Stone" commenced to work, organised in three working groups. Several standards have already been drafted so far, and as

soon as the works end, the drafts will be presented to a similar ISO (International Standardisation Organisation) TC for parallel voting according to the ISO/CEN Vienna Agreement.

Working Group 1 dealt with the classification and terminology of rocks. During the discussion it was clear that simple but accurate scientific classifications were needed. So it was proposed to join different species and varieties of rocks in new families following certain rules. It became soon clear that also for minerals such a system should be taken for precise definitions of rocks in relation to the mineral content. The proposal of this simplified classification of rocks has been published by Kraeft 1994 (2 papers) and that of minerals by Kraeft 1996. As a result the following proposals for European standards made by CEN/TC 246 have been printed:

prEN 12407 "Petrographic description of natural stone",

prEN 12440 "Denomination of natural stone", and

prEN 12670 "Terminology of natural stone".

Following the set theory it is necessary for the membership of e.g. a species in a higher taxon (=taxonomic unit) that certain attributes like similar origin, fabric, and mineral content in rocks, and comparable chemical-structural properties in minerals are existing. This mathematical-logical foundation is valid following certain well-known axioms and can be taken for certification and quality management. In detail each taxon of rocks and minerals can be regarded as a set with elements of a lower taxon or as an element from the set of a higher taxon. The intersection of different taxa sets of equal taxonomic rank with comparable elements of one taxon should be normally the empty set. When it is not empty especially in petrography because many rock species have an old definition there is no misunderstanding if it is clear which taxon is meant, as for example the family or the species.

2. Classification of rocks

The classification of rocks has been described by Le Maitre a. o. 1989 for the International Union of Geological Sciences IUGS, MacKenzie a. o. 1982, Adams a. o. 1984, Yardley a. o. 1990, and many other authors. The first step towards a new classification system was to simplify all known classifications in order to establish only few families and other groups of rocks for practical use by joining species and varieties (classification rule 1). The number of families can be increased by scientific necessity.- The classification should be done as far as possible by petrographic (mineral content) and not by petrogenetic, technical, or commercial means (classification rule 2).- Because in the triangular diagram a ratio of two components, e.g. plagioclase to alkali feldspar is represented by a straight line to the apex (corner) of the third component, e.g. feldspathoids these and other logical border lines have been taken in the diagrams, as for example in the case of Syenitidae and Foidsyenitidae (classification rule 3).- The scientific results and names of species and varieties are not touched by a descriptive classification system of higher taxa (=taxonomic units).

In using these rules some families were proposed by Kraeft 1994 using the work of Le Maitre a.o. (igneous rocks), Folk (see Adams a. o.: sandstones), and Fritsch, Meixner, and Wieseneder (see Winkler: metamorphic rocks). Most of these families are based on combined well-known triangular diagrams. Each single triangle has three corners representing different minerals -this can be a species or a higher taxon of minerals- or in some cases a rock fragment. Each point within a triangle corresponds to a certain volume-proportion of the three minerals (or rock fragments) adding up to 100 %. Such proportions are established by petrographic analysis, be it with a polarising microscope, or by XRD, or other analytical means.

Most of the proposed taxa are derived from known rock names and contain these.- The corners of the selected classification diagrams are built by: alkali feldspars, quartz, plagioclases, and feldspathoids (adding analcimes) - or olivines, hornblendes, and pyroxenes in magmatites; phyllosilicates, carbonates, feldspars and feldspar-quartz-fragments, lithic fragments, and quartz in clastic sedimentites - showing progressive alteration of the original rocks from right (lithic fragments) to left (phyllosilicates); feldspars, quartz, carbonates, micas and chlorites, epidotes, and hornblendes in metamorphites.- The fields in the charts have been discussed. For

example an upper limit of the granites and rhyolites can be defined or a triangle with the corners quartz, feldspar (and feldspar-quartz-fragments), and phyllosilicates can become considered. The field of marl can become divided (like other fields) in many smaller parts. A lot of discussion is on metamorphic rocks because in this case beside the mineralogical composition the fabrics are of importance. In any case there must be any decision what can be taken in practice.

It is a special question of not so great importance which names should be given to the families and higher taxa. The names could be taken from existing languages or defined in new manner. The latter has the advantage that it is immediately seen which taxon with which rank is meant. It has been proposed to take for the higher taxa Latin endings or English terms. Each family with ending -idae belongs to an order -oida, class, and phylum. Each family contains more or less species and varieties. There can be more taxa, like e.g. superfamily (-acea), subfamily (-inae), tribe (-ini), and subvarieties. In any case in current use the rock names of the different languages can be taken in each country. In English language an example can be the granite family.

Examples could be as follows:

phylum	Magmatita	Magmatita
class	Plutonita	Plutonita
order	Granitoida	Foidplutonitoida
family	Granitidae	Foidolithidae
species	granite	foidolite
variety	rapakivi	ijolite
local name (subvariety)	wiborgite	lujavritite

As can be seen in the example the scientific names from phylum until family can be international with Latin endings (or in English language); the names for species and varieties are in English language or can be translated. It could be useful to have general rules for the translation of these terms.

In petrography a rock species and variety can belong to different families because their definitions are in practical use since long time. This is no difficulty if it is clear which taxonomic unit is meant. In a systematic arrangement which is lacking in the book of Le Maitre these species and varieties can be put to the nearest family. If they occur also in a second or third family the terms could stand there in brackets. For example: harzburgite is mainly an element of the peridotite family. To a list of the elements of the pyroxenite family it can be added in brackets as (harzburgite).

Following prEN12440 in denomination of natural stone the petrographic rock families are mandatory in English; the names of species and varieties can be given if they are known. Perhaps it could be necessary to take in magmatites and metamorphites higher and in sedimentites lower taxa than the proposed families if there is no compromise in the definition of the families.

The terms structure and texture should be avoided. Both are replaced by fabric for the microscopic scale and geological structure for the larger visible units. It has been proposed to arrange the fabrics in systematic manner.

3. Classification of minerals

The classification of minerals has e. g. been published by Strunz 1978, Fleischer & Mandarino 1995, and many other authors. The recent classification of amphiboles was given by Leake a.o. 1997 for the subcommittee on amphiboles of the International Mineralogical Association IMA. The minerals can be classified in a similar manner like rocks

as described before. A classification is necessary for the precise definition of rocks according to the mineral content. This classification can be done in different manner, e. g. by crystallographic (structural), chemical, physical (colour, hardness, a. o.), paragenetic, petrographic, gemmological, collectors, or industrial means. Here is not the place for a comprehensive discussion. It is proposed to take the known chemico-structural system. Following the above said the species and varieties can be combined in families and higher taxa. The proposal for the taxa of some selected rockforming minerals was given by Kraeft 1996. This is an advantage in comparison with the single word group for all higher taxa of different rank as in the book of Fleischer & Mandarino.

Examples could be as follows:

class	Silicata	Oxida
order	Tectosilicatoida	Corundoida
superfamily	Feldspatacea	Corundacea
family	Orthoclasidae	Corundidae
species	microcline	corundum
variety	amazonite	ruby

Again the scientific names from phylum until family can be international with Latin endings (or in English language). Here are names more clear and comfortable than any abbreviations with letters and digits.- The names for species and varieties are in English language or can be translated.

Acknowledgements: This work has been done in close discussion with the members of CEN/TC 246 (Chairman: Mrs. A. Morandini Frisa, Secretary: Mr. M. Sanvito) and especially WG 1 (Convenor: Mr. M. Lombardero, Secretariat: Mr. M. Regueiro). For proposals I have also to give my thanks to the national institutes of normalisation members of CEN, the companies and institutes sponsoring the work, and many geoscientists.

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DIE POLITISCHE RELEVANZ GEOLOGISCHEN TUNS

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Abstract

In Germany there is a big dispute today about the possibilities of reaching a sustainable development without dangerous effects on environment. The geosciences are completely involved in this disagreement. Nevertheless the geosciences have an embarrassing situation because of the lack of working places and the reduction of education capacities. Therefore there is a strong requirement to call out the importance of geoscientific knowledge by demonstrating the effects of human activities in natural processes on a regional and global scale. Professional associations have to fulfil his importance mandate, to inform about the necessity and benefit of geoscientific work in environmental protection, and to support the access of this particular knowledge to the general public.

Zusammenfassung

Derzeit wird über Möglichkeiten und Maßnahmen zum sustainable Development, d.h. zum Streben nach einem nachhaltigen, nicht umweltgefährdenden ndustriewachstum heftigst diskutiert. Die Geowissenschaften im eigentlichen Sinne als Wissenschaft der festen Erde stehen mitten im Widerstreit dieser Meinungströmungen. Trotzdem befinden sich die Geowissenschaften in der Bundesrepublik Deutschland in einer Zwangslage, da der Arbeitsmarkt immer weiter eingeengt und die Ausbildungskapazitäten ausgedünnt werden. So wächst die Erfordernis, die Unverzichtbarkeit der geowissenschaftlichen Erkenntnisse anhand der Bedeutung des menschlichen Handelns für die natürlichen Kreisläufe regionaler und globaler geologischer Prozesse zu deklarieren. Ein Berufsverband hat damit die wichtige Aufgabe, die Öffentlichkeit über die Notwendigkeit und den Nutzen geowissenschaftlicher Arbeit für den Umweltschutz und für die Gesellschaft zu informieren und den Einsatz von einschlägigem Fachwissen zum Wohle der Allgemeinheit zu fördern.

Resumen

Hoy en día existe una gran controversia en Alemania sobre las posibilidades de alcanzar un desarrollo sostenido sin que se produzcan efectos nocivos para el medio ambiente. Las Ciencias de la Tierra están totalmente involucradas en este desacuerdo. No obstante las Ciencias de la Tierra tienen una situación comprometida debido a la falta de puestos de trabajo y la reducción de las capacidades educativas. Por lo tanto es muy importante destacar la importancia del conocimiento geocientífico, demostrando los efectos de las actividades humanas sobre los procesos naturales a la escala regional y global. Las asociaciones profesionales deben cumplir este importante mandato, para informar sobre la necesidad y los beneficios del trabajo geocientífico en la protección ambiental y para apoyar el acceso de determinados conocimientos al público en general.

Résumé

En Allemagne il y a actuellement un grand débat sur les possibilités d'atteindre un développement durable sans effets dangereux sur l'environnement. Les géosciences sont totalement impliquées dans ce différend. Toutefois, les géosciences sont dans une situation embarrassante à cause du manque de postes et de la réduction des capacités de formation. Il y a donc un grand besoin de rappeler fortement l'importance du savoir géoscientifique en démontrant les effets des activités humaines sur les processus naturels à l'échelle régionale et globale. Les associations professionnelles doivent remplir cet important mandat: informer sur la nécessité et l'apport du travail géoscientifique dans la protection de l'environnement et contribuer à l'accès du public à ce savoir particulier.

I. Geowissenschaftliche Kompetenz

In der Öffentlichkeit wie in der Wissenschaft ist eine breite Diskussion über Möglichkeiten und Maßnahmen zum sustainable Development, d.h. zum Streben nach einem nachhaltigen, nicht umweltgefährdenden Industriewachstum in Gang gekommen. Der Widerstreit ist polarisiert zwischen Gruppierungen, die a priori ein Wirtschaftswachstum ablehnen, und solchen, die vorhandene Umweltrestriktionen durch technologischen Fortschritt zu umgehen suchen.

Die Geowissenschaften im eigentlichen Sinne als Wissenschaft der festen Erde stehen mitten im Widerstreit dieser Meinungströmungen, ohne nur der einen oder anderen Position eindeutig zuzuordnen zu sein. Haben uns noch vor kurzer Zeit Radikalökologen vorgeworfen, «Erfüllungsgehilfen der extrahierenden Industrie» zu sein, nur weil die Geowissenschaften als Teildisziplin die Rohstoffexploration und Lagestättenkunde enthalten, so sind heute die wichtigen Kompetenzen der Geowissenschaften auch in der Öffentlichkeit bekannter geworden. Jedoch muß in Deutschland durch die Nichtberücksichtigung der Geologie in den schulischen Lehrplänen immer noch ein Defizit beklagt werden.

Unter Fachleuten ist die Bedeutung der Geologie, Geophysik und Mineralogie nicht umstritten, wobei gerade die Umweltaspekte (Erkundung, Erhalt, Sanierung) eine gewichtige Rolle spielen. Jedoch wenn sich auch auf der Basis der geowissenschaftlichen Erkenntnisse zusammen mit anderen naturwissenschaftlichen Disziplinen wie z.B. Biologie, Chemie oder Ing.-Wissenschaften eine technologische Entwicklung als Geotechnik etabliert hat, so findet häufig der Geoingenieuranteil kaum noch Eingang in die Problemlösungskompetenz, da diese eben von den anderen Disziplinen adaptiert wurden und werden.

II. Beschäftigungssituation in Deutschland

Die Wandlung des Berufsbildes, früher geprägt vom Bedürfnis nach Rohstoffen, ging einher mit dem Umweltverständnis, dem Bestreben zum Umweltschutz und -erhalt. Viele Berufsgruppen wie Juristen, Ingenieure, Chemiker etc. haben frühzeitig auf diesen gesellschaftlichen Erkenntnisprozeß reagiert und über ihre Berufsvertretungen Zeichen gesetzt, indem sie neu entstehende Wissensdisziplinen oft zum Nachteil der Geowissenschaften besetzten. Nicht anders ist zum Beispiel zu erklären, warum bis heute Informationssysteme mit raum- und zeitbezogenen Daten gern als "Geographische Informationssysteme" bezeichnet werden, obwohl lediglich ein Teil der Daten geographisch referenziert ist, die Bedeutung dieser Computersysteme aber aus der Sachdatenanbindung und deren Analyse abzuleiten ist. Der teilweise energisch geführte Verdrängungswettbewerb auf dem Arbeitsmarkt macht den heute auch die Berufsaussichten für Geowissenschaftler in der Bundesrepublik sehr klein. Nach der Globus-Graphik 4211, veröffentlicht in der WAZ vom 10.09.97, sind in den alten Bundesländern derzeit von je 100 arbeitslosen Geowissenschaftlern inklusive Geographen 25 % Berufsanfänger ohne praktische Berufserfahrung. Mit dieser sehr hohen Arbeitslosenquote bei Berufsanfängern liegt unser Berufsstand an der traurigen Spitze der akademischen Berufe. Allerdings ist zu berücksichtigen, daß sich der Arbeitsmarkt für Geologen, Geophysiker und Mineralogen im Zeitraum 1988-1997 von ca. 15000 auf ca. 28000 Akademiker vergrößert hat, wobei die Gesamtstudentenzahl von ca. 9000 auf 8000 absank.

III. Politische Relevanz

Unstrittig ist seit einiger Zeit, daß gerade die Wissenschaft der festen Erde für die Lösung der anstehenden Wirtschafts- und Umweltprobleme unverzichtbar ist. Dem diametral entgegengesetzt laufen sog. Konzentrationsbestrebungen für Hochschulen, um vorhandene Ausbildungsgänge zu straffen und zu modernisieren (wozu sicher auch eine bessere technische Einrichtung gehören müßte). Jedoch artet dieses rotstiftdiktierte Streichkonzert derartig aus, daß Institutionen einfach geschlossen, Fachbereiche ohne Beachtung der Kompatibilitäten zusammengeklebt und neue Abschlüsse in die Welt gesetzt werden, ohne sich auf die eigentlichen, ja schon vorhandenen Stärken der Geowissenschaften zu

besinnen. Dazu paßt auch eine jüngst aufgekommene Ingenieursmeinung, daß wohl das Privatisierungspotential bei der Bundesanstalt Geowissenschaften und Rohstoffe (BGR) in Hannover nicht ausgeschöpft sei.

Genau an dieser Stelle wird die politische Relevanz geowissenschaftlichen Tuns und damit der Zwang zur politischen Aktion überdeutlich: Parlamentarier sind demokratisch gewählte Repräsentanten des deutschen Volkes, die ihrem Gewissen verpflichtet sind. Die derzeitigen Entwicklungen sind nicht nur besorgniserregend, weil sie geowissenschaftliche Arbeitplätze kosten, sondern fatal, weil sie zur Ausdünnung der geowissenschaftlichen Kenntnisse in Deutschland führen. Es paßt einfach nicht zusammen, daß Deutschland einen blühenden Export von Umwelttechnikanlagen betreibt, andererseits aber die umweltrelevanten Wissenschaften unzulässig auf Teildisziplinen beschränkt. Auch auf dem Weg in die Infor-mationsgesellschaft stolpern wir vor uns hin, ohne recht vom Fleck zu kommen. So sind die Geowissenschaften in einem großangelegten Projekt zur "Weiterentwicklung der Informationsinfrastruktur als Herausforderung für die Hochschulen" gar nicht erst vertreten.

Guía Ciudadana de Riesgos Geológicos.

Berührt die Entwicklung auf die Informationsgesellschaft zu unsere Disziplin nicht? Sind wir nicht beteiligt an der weltweiten Dematerialisierung der Produktion, d. h. Mehrwertschöpfung bei weniger Materialverbrauch durch größeres Wissen? Das Problem ist allgegenwärtig: es gibt kein welttragendes Modell oder eine innere Weltlogik, welche bei anhaltender Bevölkerungsexplosion und extremer ‹bernutzung der natürlichen Ressourcen ein umweltgerechtes Wirtschaftswachstum sichern. Je weiter die Dynamisierung des globalen Weltmarktes voranschreitet, desto stärker stehen wir im Leistungsdruck zum Erhalt der Umwelt. Dazu brauchen wir geowissenschaftliche Höchstleistungen in der Ausbildung, Wissenschaft und Praxis!

IV. Berufsverbandsaufgaben

Aus der Zwangssituation der Geowissenschaft in der Bundesrepublik Deutschland erwächst die Erfordernis, die Unverzichtbarkeit der geowissenschaftlichen Erkenntnisse anhand der Bedeutung des menschlichen Handelns für die natürlichen Kreisläufe regionaler und globaler geologischer Prozesse zu deklarieren. Nur mit naturwissenschaftlichem Sachverstand sind ressourcenschonende Rohstoffexploration und Gewinnung zur Sicherung der Rohstoffbasis, nachhaltige Wasserversorgung, aber auch sichere Deponierung von Schadstoffen zu erreichen. Ein Berufsverband hat damit die wichtige Aufgabe, die Öffentlichkeit über die Notwendigkeit und den Nutzen geowissenschaftlicher Arbeit für den Umweltschutz und für die Gesellschaft selbst zu informieren und den Einsatz von einschlägigem Fachwissen zum Wohle der Allgemeinheit zu fördern. Arbeitslosigkeit, Forschungsreduzierungen und Institutsschließungen führen ganz zwangsläufig zum geowissenschaftlichen Kenntnis-Notstand!

IN MEMORY OF RENZO ZIA

by Floriano Villa, President. ANGI
via C. Battisti 4. 20122 Milano. Italy

The National Association of Italian Geologists has lost its Vice President and FEG's delegate Renzo ZIA. He was born in Livorno in 1929, graduated with full marks in Pisa in 1954, researcher at CNR's Study Centre for Geology of the Apennines up to 1956 and since 1960 Associate Professor of Geology and Lithology at Pisa University. From the first years post-degree, he has been independent professional of environmental and applied geology, geotechnics and hydrogeology.

Renzo Zia was member of various national and international associations, consultant of the Agency for Promotion and Development of the South and he was well-known in Italy as an advisor to various Public Bodies from Tuscany to Sardinia, from Sicily to Campania and Basilicata, member of the LL.PP.

Renzo Zia - EFG President, 1983 to 1986

Ministerial Committee for restructuring of the Italian Geological Survey. Abroad he was an F.A.O. adviser and an U.N.I.D.O. expert for hydrogeology; particularly he has performed expertises in Africa and in the Middle East. Since 1980 Renzo ZIA was member of F.E.G.'s Council, its President from 1983 to 1986 and was a member of the Editorial Committee of "The European Geologist" magazine.

Member of the board of ONGI from 1975 to 1985, and its President from 1979 to 1985. He has always distinguished himself by a civil action of charge and incentive, in order to achieve a correct national environmental policy, to the use of the sustainable development of natural resources, in promotion and elaboration of legislative instruments in the problems of soil's defence and civil protection.

He is remembered as an example for ethical strictness, for humanity and for the enthusiasm that he knew how to transmit.

He suffered from an incurable disease. Renzo Zia left us the 6th of December 1996.

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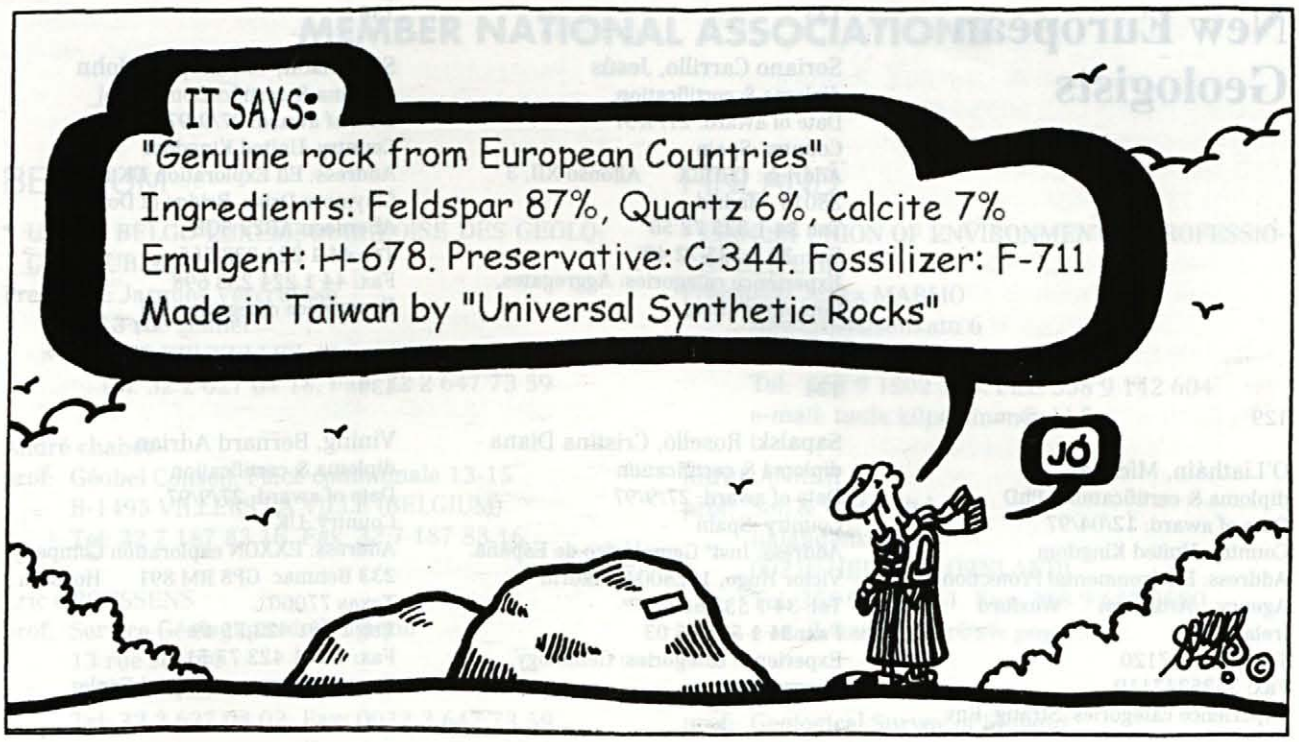
Directory of the European Geologists

The directory contains name, degrees, country of professional membership, address, telephone fax and e-mail and areas of expertise of the European Geologists.
It is available on paper or on disk.

Price: paper: 100 FF
disk: 125 FF



RULES, LAWS AND PRINCIPLES TO USE IN THE WORKING ENVIRONMENT

Bralek rule on success
Give your confidence only to those who would lose as much as you if things go bad.

Webster's definition
An expert is one that knows every day more about less things, until he knows nothing about everything.

Warren's rule
If you want to identify an expert. choose the one that predicts that the work will last more and will cost more.

Matz's law
A conclusion is the point when you got tired of thinking

Hlade's Law
If you have a difficult chore, give it to a lazy man. He will fin the easiest way of doing it.

Meyer's Law
It is very easy to make things look difficult, but it is very difficult to make them easy.

Project Management 90/90 rule
The first 90% of the work requires 10% of the time, and the last 10%, the remaining 90%.

Tilli's Organisation Principle
If you file it, you will know were it is, but you will never need it. If you don't file it, you will need it, but you will never know were it is.

Hetch's Law
There is no better moment than now, to delay something that you don't want to do.

Brintnall's Law
If you receive two contradictory orders, obey both

McGee's Law
It is extraordinary the time it takes to complete a task in which you are not working.

Van Herpen's Law
The solution to a problem lies in finding somebody to solve it.

Vail's Axiom
In any human enterprise, work find the lowest hierarchic level.

Fourth Parkinson's Law
The number of staff in a team tends to increase no matter the work to be done.

Fifth Parkinson's Law
If there is a way to delay an important decision, an efficient bureaucracy, be it public or private, will find it.

Christie-Davis Theorem
If your data are false, but your logic is perfect, then your conclusions will be inevitably false. Thus, if you introduce some errors in your logic, you have at least one fortuitous possibility of reaching the right conclusions.

Howe's Law
We all have a plan that will never work

Munder's Corollary to Howe's Law
Those who do not work do have a project that does work.

Hiram's Law
If enough experts are consulted, any opinion can be confirmed.

Perrusels' Law
There is no task so simple that can not be badly done.

New European Geologists

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• *Senior Geophysicist* (Ref. Geof Af 1). Based in North African country, managing exploration activities in a production lease 15+ years of relevant experience with established operators. Previous experience in geophysical operations in desert areas wuould be preferred.

Please send your CV, including experience (references will be requested) and current salary, quoting the above position refs., exclusively to:

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Direccion de Area de Recursos Humanos
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The successful applicant should have an advanced degree in geology, demonstrated research focus on geophysics applied to petroleum exploration and field characterization, and petroleum industry experience. Knowledge of theory, acquisition, and interpretation of conventional, 3D and 4D seismic data and of other geophysical methods (e.g., gravity and magnetics) is required, as is familiarity with seismic sequence stratigraphy and generation of synthetic seismic sections. In addition to the general employment requirements defined above, the hire will be expected to teach courses in geophysics (as applied both to the petroleum and environmental geology industries), signal processing, and occasional courses in computer applications. Preference will be given to candidates with experience in GIS (Global Information Systems) and other large database system, with the potential for organizing and directing a GIS facility for university- wide and community use.

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Applicants must indicate in which position they are interested, and should submit curriculum vita, description of teaching and research interests, selected copies of relevant publications, evidence of teaching excellence, transcripts of academic work, and the names of 3 professional references (include postal and E- mail addresses) to: Dr. Collette Burke, Chair, Department of Geology, Wichita State University, 1845 Fairmount, Wichita, Kansas 67260-0027. Wichita State University is an AA/EOE. Women and minorities are encouraged to apply. Deadline for receipt of applications for these positions is January 2, 1998 or the first of each month until the positions are filled.

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1.- UNB GEOLOGY GRADS WWW GEOLOGY RESOURCES
http://craton.geol.brockn.ca/guest/jurgen/grad.htm

2.- UNIVERSIDAD COMPLUTENSE. FACULTAD DE CIENCIAS GEOLÓGICAS
http://www.ucm.es/OTROS/Geología/Direcciones/direcion.html

3.- WEST GEOLOGY DIRECTORY
http://www.soton.ac.uk/~imw/links.htm

4.- THE GREAT GLOBE GALLERY
http://hum.amu.edu.pl/~zbzw/glob/glob34d.htm

5.- EARTH SCIENCES
http://www-vl-es.geo.ucalgary.ca/VL-EarthSciences.html

6.- PLATE MOTION CALCULATOR
http://manbow.ori.u-tokyo.ac.jp/tamaki-html/plate motion.html

7.- SELECTED WEB SITES FOR GEOSCIENTIST
http://www-marine.stanford.edu/branner/sel.geo.html

8.- ILUSTRE COLEGIO OFICIAL DE GEÓLOGOS
http://www.icog.es/

9.- GEOLOGY RESOURCES ON THE INTERNET VIA ICE
http://ice.englib.cornell.edu/ice/lists/geology.html

10.- GEOLOGY MATERIALS
http://zebu.uoregon.edu/geol.html

11.- EARTH VIEWER URL
http://www.fourmilab.ch/earthview/vplanet.html

12.- EARTH AND ENVIRONMENTAL SCIENCE URL
http://info.er.usgs.gov/network/science/earth/earth.html

13.- PETROGRAPHIC WORKSHOP URL
http://pong.igpp.ucla.edu/pet/pet intro.html

14.- STRUCTURAL GEOLOGY HOME PAGE URL
http://www-geol.unine.ch/STRUCTURAL/StructuralHomePage.html

15.- ACCES TO THE CURRENT SEISMICITY URL
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http://skye.gsfc.nasa.gov/wwvolcano.html

17.- NATURAL DISASTER INFO URL
http://web66.coled.umn.edu/hillside/franklin/disaster/Project.html

18.- PLANETARY GEOPHYSICS HOME PAGE URL
http://www.wdcb.rssi.ru/

19.- EARTH SCIENCE AND SOLAR SYSTEM EXPLORATION DIVISION URL
http://www-sn.jsc.nasa.gov/

20.- HURRICANES URL
http://www.huricane.com/

MINING WEBS

1.- GLOSSARY OF MINING TERMS.CANADA CLAIMNET
http://www.duenorth.net/claim-net/glossery.html

2.- INFO-MINE
http://www.info-mine.com/

3.- MINERAL COMMODITY SUMMARIES 1997
http://minerals.er.usgs.gov/minerals/pubs/mcs/1997/

4.- MINERAL RESOURCES, ECONOMICS AND THE ENVIRONMENT
http://www-personal.umich.edu/~skesler/book4.htm

5.- MINERALS AND MINING STATISTICS DIVISION (MMSD)
http://www.nrcan.gc.ca/mms/efab/mmsd/

6.- WORLD MINING EQUIPMENT
http://www.wme.com/

7.- MINERAL PRODUCTS TRADE LINK
http://www.euro-biz.com/trade li/db/25012716.htm

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http://ourworld.compuserve.com/homepages/eworks

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http://engineeringjobs.com/

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http://Jobs.adverts.de/index.html

6.- SOFTLEX
http://softlex.es/soflex.html

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http://ups.purdue.edu/student/internal.html

8.- PARIS-ANGLO
http://paris-anglo.com/pics/html/pics7.html

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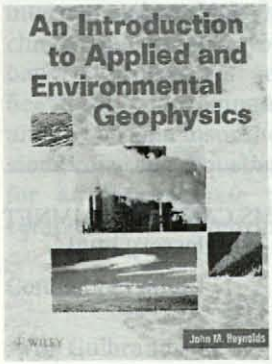

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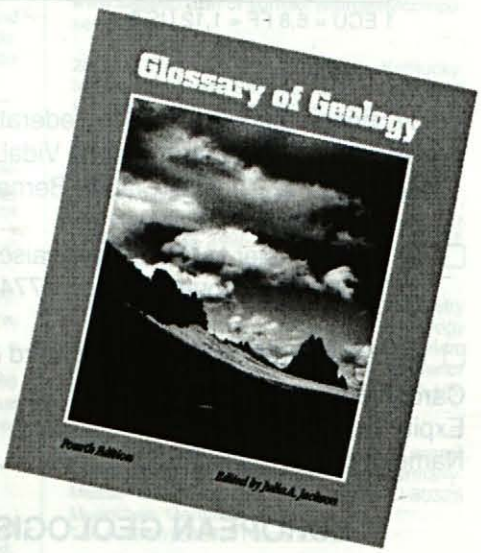

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25-26. Vancouver Mining Investment Conference. Vancouver, British Columbia. Inf: Tel: 604 687 4151. Free advance registration for NWMA members 888 2277722.

26-29 Tailings and Mine Waste 98, Colorado State University, US. Linda Hinshaw, Dept. of Civil Engineering, Colorado State University, Fort Collins, CO 90523, US. Tel: (+1 970) 491 6081. Fax: 491 3584. E-Mail:lhinshaw@vines.colostate.edu

27-30 Exploration Methods '98, Vancouver, Canada. BC and Yukon Chamber of Mines, 840 West Hastings St., Vancouver, British Columbia, Canada V6C 1C8. Tel: (+1 604) 681 2363.

February 1998

3-5 Investing in African Mining Conference/ Indaba 98, Cape Town, South Africa. International Investment Conferences, 6310 Sunset Drive, Miami, FL 33143-4823, US. Tel: (+1 305) 669 1963. Fax: 0404. E-mail: iiconf@iiconf.com

5-8. The petroleum Landman's Association of New Orleans Ninth Annual Oil and Gas Seminar- PLANO, Beaver Creek, CO. Contact: David W. Rusch, 1795 W. Causeway Approach#203, Mandeville, LA 70471. Tel:504 626 8484, Fax: 504 626 9416.

8-11. 24th Annual Conference on Explosives and Blasting Technique, New Orleans, US. International Society of Explosives Engineers, 29100 Aurora Rd, Cleveland, OH 44139-1800, US. Tel: (+1 216) 349 4004. Fax: 349 3788. 16-18 Comminution 98, Brisbane, Australia. Dr. Barry Wills, CSM Associates, Trevenson, Pool, Redruth, Cornwall TR15 3SE, UK. Tel/Fax: (+44 1326) 318352. E-mail: bw@minerals.avel.co.uk

10-13. Gestión Medioambiental. 2ª Conferencia Internacional. Wollongong, New South Wales. Inf: Conference Secretary ICEM2. Departmenent of Civil & Mining Engineering. University of Wollongong. Northfields Avenue. Wollongong, NSW 2522 Australia. Tel: (+61 42) 21 3055. Fax: (+61 42) 21 3238. E-mail: icem2@uow.edu.au

16-20. Intl. Erosion Control Assn, 29th Annual Conference and Trade Exposition, Reno, NV. Contact: 1998 IECA Conference Program, P.O. Box 774904, Steamboat Springs, CO 80477, Tel: 800 455 4322. E-mail: ecinfoieca.org.

18-22 SMOPYC'98, 10th Salón Internacional de Maquinaria para Obras Publicas, Construccion y Minería, Zaragoza, Spain. Javier Telleria, General Manager, Comercial Feria Zaragoza, PO Box 108, E 50080 Zaragoza, Spain. Tel: (+34 976) 53 4420. Fax: 33 0649.

March 1998

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.

2-5 15th International Pump Users Symposium and Short Courses, Houston, US. The Turbomachinery Laboratory, Texas A&M University, College Station, TX 77843-3254, US. Tel: (+1 409) 845 7417. Fax: 845 1835. E-mail: inquiry@turbo-lab.tamu.edu WWW: http://www.mengr.tamu.edu/turbo/

2-6. ENVITEC. Tecnología para la Protección Ambiental y la Gestión de Residuos. Inf: Messe Düsseldorf. Postfach 10 10 06. D-40001 Düsseldorf, Alemania. Tel: (+49 211) 456001. Fax: (+49 211) 4560 668. http://www.traderfair.de

8-11 1998 International Convention of the Prospectors and Developers Association of Canada, Toronto. PDAC, Suite 900, 24 King Street E., Toronto, Ontario, Canada M5C 2X8. Tel: (+1 416) 362 1969. Fax: 362 0101.

9-12. Society for Mining, Metallurgy and Exploration. Annual Meeting & Exhibit, Orlando, US. Contact: Meetings Dept. SME, PO Box 625002, Littleton, CO 80162-5002, US. Tel: (+1 303) 973 9550. Fax: 979 3461. E-mail: smenetaol.com.

11-12. III Congreso Nacional del Agua y del Medio Ambiente. Zaragoza, España. Inf: Tiasa. C/ Palmeras 23, 28700, San Sebastian de los Reyes, Madrid, España. Tel: 91 6539726. Fax: 91 6545021.

11-14. SMAGUA'98. Zaragoza, España. Inf: Carretera Nacional II, km 311, 50012 Zaragoza, España. Tel: 976 534420. Fax: 976 330649.

16-19 7th Annual Investing in the Americas 98 Conference, Miami, Florida. International Investment Conferences, 6310 Sunset Drive, Miami, FL 33143-4823, US. Tel: (+1 305) 669 1963. Fax: 0404. E-mail: iiconf@iiconf.com

17-20 Mintek'98, 3rd Moscow International Mining Exhibition, Moscow, Russia. ITE JV Ltd, 112A Shirland Rd, London W9 2EQ, UK. Tel: (+4 171) 306 0033. Fax: 306 0067.

24-26 International Conference on Coal Seam Gas & Oil, Brisbane, Australia. Suzanne Best, Event Manager, Intermedia Convention & Event Management, PO Box 1280, Milton, Qld 4064, Australia. Tel: (+61 7) 3369 0477. Fax: 3369 1512. E-mail: csgo98@im.com.au

22-26 Symposium on the Application of Geophysics to Environmental and Engineering Problems (SAGEEP). Palmer House Hilton Hotel, Chicago, Illinois. SAGEEP is the national meeting of the Environmental and Engineering Geophysical Society. The meeting will present three days of technical sessions and poster presentations: in geophysical applications covering Infrastructure (transportation), engineering hazards, environmental assessments, groundwater, remedial monitoring, surfacewater (wetlands, waterways, and coastal), and expedited site characterisation (ESC); in technical applications covering borehole geophysics, very shallow reflection seismology, and induced polarisation; and in new technologies covering geostatistics, breakthroughs in hardware technologies, and new methods of interpretation and imaging; and much more. A special session has been added this year in co-operation with the National Groundwater Association covering advances in direct push techniques for hydrogeologic site characterisations. Other sessions will focus on workshops covering equipment and software applications, an introduction to geophysics and various applications, and professional issues. Additional focal points at this year's symposium include four short courses: An Introduction to Near-Surface Environmental and Engineering Geophysics; Nondestructive Testing (NDT); Three Dimensional GPR; and Application and Pitfalls of GPS Surveys, plus equipment demonstrations, software presentations, and keynote addresses including Illinois. Environmental Protection Agency's, brownfields development lead, Steve Colentino.For more information, please visit our website at http:// www.sageep.com or contact jsturges@compuserve.com.

28-30. COAL PREP'98. Lexington, Kentucky. Inf: Intertec Trade Shows&Conferences, 9800 Metcalf, Overland Park, KS 66212-2215.

30-April 1 2nd International Conference on Combined Cycle Power Generation, Leeds, UK. Dr. B.M. Gibbs, Dept.of Fuel and Energy, University of Leeds, Leeds LS2 9JT, UK. Tel: (+44 113) 233 2496. Fax: 244 0572. E-mail: B.M.Gibbs@leeds.ac.uk

30-April 4 American Society for Photogrammetry & Remote Sensing Resources Technology Institute Annual Conference, Tampa, Florida. ASPRS/RTI Annual Conference, 5410 Grovenor Lane, Suite 210, Bethesda, MD 20814-2160, US. Tel: (+1 301) 493 0290. Fax: 0208.

30-April 5 Bauma98, The World's Largest Construction Exhibition, Munich, Germany. Messe Muenchen, Messegelaende, D-80325 Muenchen, Germany. Tel: (+49 89) 51070. Fax: 5107506.

31-April 3. In Sight of the Suture: The Geology of the Isle of Man in its Iapetus Ocean Contex. Isle of Man, UK. Att: Dave Quirk, Geology & Cartography Division, Oxford Brookes University, Gipsy Lane, Oxford OX3 OBP. Fax: 01865483926. E-mail: dgquirkbrookes.ac.uk. Bill Fitches, (Aberystwyth) & Nigel Woodcock (Cambridge).

April 1998

1-4 Vietnam Coal and Mining Exhibition, Hanoi. CP Exhibitions. Tel: (+852 251) 17427. Fax: 19692. E-mail: cpexhbit@hk.super.net.

1-30 Computer Assisted Training in Mineral Resources Development, Fontainebleau, France. E. Sauzay, Ecole des Mines de Paris, CGES-Claim, 35, rue Saint-Honore, 77305 Fontainebleau Cedex, France.
Tel: (+33 164) 646 94930. Fax: 94711

13-17. 15th International Sedimentogical 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 Ordoñez. Chairman.
Tel: 34 65903552, Fax: 34 65903552.
E-mail:ctierravm.cpd.ua.es.

13-17. Kimberlites. 5th International Conference, Cape Town, South Africa, Inf: JJ Gurney, 71KC, Department of Cape Town, Private Bag, Rondebosch 7700, South Africa.
Tel: 27 21 5313162. Fax: 27 21 6503783.
E-mail:71KCGEOLOGY.UCT.AC.ZA. http://www.uct.ac.za/depts/geolsci/71KC/

14-16 Minefill'98, 6th International Symposium on Mining with Backfill, Brisbane, Australia. Conventions Department, The AusIMM, PO Box 660, Carlton South, Victoria 3053, Australia.
Tel: (+61 3) 9662 3166. Fax: 9662 3662.
E-mail: conference@ausimm.com.au

14-18 Geoscience 98, Keele University, UK. The Conference Dept., The Geological Society, Burlington House, Piccadilly, London W1V 0JU, UK.
Tel: (+44 171) 434 9944. Fax: 439 8975.
E-mail: conf@geolsoc.cityscape.co.uk

19-23 APCOM '98, the 27th international symposium on Computer applications in the Minerals Industries, London, UK. The Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, England.
Tel: (+44 171) 580 3802. Fax: 436 5388.

20-23. Hydrology, Water Resources and Ecology in Headwaters. International Interdisciplinary Conference. Merano, Italy. Inf: Head Water'98. c/o European Academy, Weggensteinstrasse 12/A, 1-39100 Bozen/ Bolzano, Italy.
Tel: 39 471 306111. Fax: 39471 306099.
E-mail: HeadWater98@ms.sinfo.interbusiness.it

21-23. HYDROTOP'98. Gestión del Agua, Servicios y Tecnologías. Marsella, Francia. Inf: Hydrotop. 314 avenue de Prado, 13008 Marseille, France.
Tel: 33 4 91227272. Fax: 33 1 91 227171.
http://www.gima.de

21-23 DanMiljo. 8ª Feria Escandinava del Medio Ambiente y Procesos Tecnológicos, Herning, Dinamarca. Inf: Exhibition Centre Herning. Vardej 1. DK-7400 Herning, Dinamarca.
Tel: (+45 99) 269926. Fax: (+45 99) 269900.

22-25. Environment Brazil'98. Exhibición Internacional de Tecnologías Ambientales.Río de Janeiro, Brasil. Inf:ITE France SARL. 9, Rue Lagrange, 75005 Paris, France.
Tel: 33 1 5542 6205. Fax: 33 1 5542 6209.

25-30. Tunnels and Metropolises World Tunnel Congree'98. Saô Paulo, Brasil. Argimiri Alvarez Ferreira, IPT-DEC (ABMS/CBT)- Caixa Postal 7141. 01064-970 Saô Paulo-SP-Brasil.
Tel: 55 11 268.7325/55 11 283 7464.
E-mail: abms@mandic.com.br

May 1998

3-7. CIM/CMMI'98. 100th Annual General Meeting of the Canadian Institute of Mining, Metallurgy and Petroleum*, Montréal. Chantal Murphy, CMMI, 3400 de Maisonneuve Blvd. West, Suite 1210, Montréal, Quebec, Canada H3Z 3B8. Tel: (+1 514) 939 2710. Fax: 2714.

3-7. 34th Forum on the Geology of Industrial Minerals-Industrial Minerals of the Southern Midcontinent, Norman, Oklahoma, USA. Inf: Kenneth S. Johnson, Oklahoma Geological Survey, 100 East Boyd, Room N-131, Norman, Oklahoma 73019.
Tel: 1 405 325 3031. Fax: 1 405 325 7069.

5-6. II International Natural Stone Congress. Madrid, España. Federación Española de la Piedra Natural (FDP), C/ Alenza 1, 28003 Madrid, España.
Tel: 341 553 24 03. Fax: 341 533 03 43.

6-9. PIEDRA'98. II Feria de la Piedra Natural. Parque Ferial Juan Carlos Y. Apdo. de Correos 67.067. 28042 Madrid. España.
Tel: (91) 722 50 42, 722 5000. Fax: 91 722 5790.
E-mail: piedraifema.es. http://www.piedra.ifema.es

10-13 STDA's Sixth International Symposium on the uses of Selenium and Tellurium, Scottsdale, Arizona, US. Selenium-Tellurium Development Association, 301 Borgtstraat, B-1850 Grimbergen, Belgium.
Tel: (+32 2) 252 1490. Fax: 2775.
E-mail: info@stda.be WWW: http://www.stda.be

12-16 EXPOMIN'98, Fifth World Exhibition for Latin American Mining, Santiago, Chile. Jorge Solis, EXPOMIN'98, Casilla 40-D Correo Central, Santiago, Chile.
Tel: (+56 2) 533 2838. Fax: 533 1667. http:///www.fisa.cl. E-mail: info@fisa.cl.

13-15 4th International Conference on Clean Technologies for the Mining Industry, Santiago, Chile. Dr Mario Sanchez, Department of Metallurgical Engineering, University of Concepcion, Casilla 53 - C, Chile.
Tel: (+ 56 4) 124 3418. Fax: 120 4241.
E-mail: msanchez@buhu.dpi.udcc.cl WWW: http://www.met.udec.cl/eventos.html

14-18. Linking Spatial and Temporal Scales in Paleoecology and Ecology, Annapolis, MD. Contact: Lois j. Elms, Western Experience Penrose Conference Coordinators for the GSA, 4881 Evening Sun Lane, Colorado Springs, CO 80917,
Tel: 719 597 9201. E-mail: ljeims@aol.com.

17-22. American Society for Surface Mining and Reclamation, Mining-Gateway to the Future!, St. Louis, MO. Contact: Dianne Thoogmorton, Coal Research Center, Southern IL Univ. Carbondale, IL 629014623,
Tel: (618) 536 5521. E-mail:diannet@siu.edu.

17-21. CONSOIL'98. VI Confrencia Internacional de Suelos Contaminados.Edinburgh, Alemania. Inf: Forschungszentrum Karlsruhe-PSA (Mrs. B. Mathes). P.O. Box 3640, D-76021 Karlsruhe, Alemania.
Tel: 49 7247 823967. Fax: 49 7247 823949.
E-mail:mathes@psa.fzk.de

27-28 Gold Show Diamond Mining Conference*, New York, US. International Investment Conferences, 6310 Sunset Drive, Miami, FL 33143-4823, US.
Tel: (+1 305) 669 1963. Fax: 0404.
E-mail: iiconf@iiconf.com

June 1998

1-5. X Congreso Internacional de Minería y Metalurgia. Valencia, España. Inf: Asociación Nacional de Ingenieros de Minas. Ríos Rosas 19. 28003 Madrid, España.
Tel: 96 333 2818. Fax: 96 3332776.

3-4 Roofbolting in Mining, 3rd International Symposium. Symposium Secretary, Institute of Mining Engineering I, University of Technology, WÂllnerstrasse 2, 52056 Aachen, Germany.
Tel: (+49 241) 807976. Fax: 8888272. E-mail: bbk1@bbk1.rwth-aachen.de

3-5 NARMS'98, 3rd North American Rock Mechanics Symposium, Cancún, Mexico. Jorge Orozco, Mineria No.145, Edif. "C", 2o. Piso, Col. Escandón, 11800, Mexico, D.F., Mexico.
Tel: (+525) 272 9991. Fax: 227 5066.
E-mail: guasquea@ica.com.mx

7-9 International Congress on Underground Construction in Modern Infrastructure*, Stockholm, Sweden. Stockholmsmässan, S-125 80 Stockholm, Sweden.
Tel: (+46 8) 749 4100. Fax: 992044.
E-mail: staff@stofair.se

8-12. 60th Conference on European Association of Geoscientist and Engineers. Leipsig, Germany. Inf: EAGE, E H, Bornkamp, PO Box 298. NI 3700, AG Zeist. The Netherlands.
Tel: 31 3069 62655. Fax: 31 3069 62640/29.

14-17 Fifth International Symposium on Mining in the Arctic, Yellowknife, Canada. Tony Keen, Cominco Ltd, #500-200 Burrard St., Vancouver, BC., V6C 3L7, Canada.
Tel: (+1 604) 685 3048. Fax: 3066.

22-25 Mining Geophysics 98, St. Petersburg, Russia. Dr Jury Isaev, VNIMI, Sredny pr. 82, St. Petersburg, Russia 199026.
Tel: (+7 812) 356 6095. Fax: 213 5587.
E-mail: isaev@vnimi.spb.su

28-July 5. Gondwana 10. Cape Town, South Africa. Organising Committee Gondwana 10, Department of Geological Sciences, University of Cape Town. Rondebosch, South Africa.
Tel: 27 21650 3171. Fax: 27 21650 3167.

29-July 2. 15th Caribbean Geological Conference, Kingston, Jamaica. Inf: Dr. Trevor Jackson, c/o Department of Geography and Geology, University of the West Indies, Kingston 7, Jamaica. Fax: 809 927 1640.

29-July 18. International Platinum Symposium. IA-GOD/CODMUR, Johannesburg, South Africa. (C.A. Lee, Box 68108, Bryanston 2021, South Africa.
Tel: 2711/4112253. Fax: 2711/6923693.

July 1998

4-11. Processes of Crustal Differentiation: Crust-Mantle Interactions, Melting and Granite Migration through the Crust, Verbania, Italy. Contact: Lois J. Elms, Western Experience Penrose Conference Coordinator for the GSA, 4881 Evening Sun Lane, Colorado Springs, CO 80917,
Tel: 719 597 9201. E-mail: ljelms@aol.com.

6-10. BHS International Symposium on Hydrology in a Changing Environment. Exeter, UK. Inf: Bruce Webb, Department of Geography, University of Exeter, Amory Building, Rennes Drive, Exeter, Devon EX4 4RJ, UK.
Fax: 44 0 1392 263342.
E-mail: B.W.Webb@exeter.ac.uk

8-10 Geocongress 98, University of Pretoria, South Africa. Congress Secretary, Geological Society of South Africa.
Tel: (+27 11) 841 1167. Fax: 841 1221.
E-mail: eaucamp@geoscience.org.za. Internet: geoscience.org.za/geocongress

12-16. International Conference on Future Groundwater Resources at Risk. Changchun, China. Inf: Zhao Yongsheng, Changchun University of Earth Sciences, PO Box 298, Changchun 130 026, P R China.

15-18 Mining Philippines 98, Manila, Philippines. Overseas Exhibition Services, 11 Manchester Square, London W1M 5AB, England.
Tel: (+44 171) 486 1951. Fax: 8773.
E-mail: pmckean@montnet.comv

August 1998

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: imaquartz.geology.uturonto.ca).

10-16. International Ophiolite Symposium and Field Excursion. Generation and Emplacement of Ophiolites Througt Time- Oulu, Finland. International Ophiolite Symposium 98/Jouni Vuollo, University of Oulu, Institute of Geosciences and Astronomy, Linnaanmaa, FIN-90570 Oulu, Finland.
Fax: 358 81 553 5531484.
E-mail: vuollosveka.oulu.fin.

17-20. The Jurassic System, 5th International Symposium, Vancouver, Canada. Inf: P.L. Smith, Earth and Ocean Science, University of British Columbia, 6339 Stores Rd, Vancouver, BC, V6T 1Z4 Canada.
Tel: 604 8226088.
E-mail:psmitheos.ubc.ca, http://www.eos.ubc.ca/jurasic/announce,html

20-26. 16 Congrés mondial de Science du sol. Montpellier, France. CNEARC, 16 Congrés mondial de Science du sol, 11 01 avenue d' agropolis, B.P. 50 98, 34033 Montpellier Cedex, France.
Tel: 33 67 61 7023. Fax: 33 67 41 0232.

September 1998

1-10. XXI Congrés Mondial de Routes du AIPCR. Kuala Lumpur, Malasia. AIPCR. La Grande Arche, Paroi Nord, Niveau 1. La Défense. 92055 Paris La Défense. Cedex 4, Francia.
Tel: 33 1 47 9681. Fax: 33 1 49 000202.
Tel: 90 312 432 3085. Fax: 90 434 2388.
E-mail: jdoganet.cc.hun.edu.tr.

8-10 9th European Symposium on Comminution, Albi, France. Florenc Foucaud, 18 Chemin de la Loge, 31078 Toulouse Cedex 4, France.
Tel: (+33 5) 6225 2380. Fax: 6225 2318.
E-mail: Progep@ensigct.fr WWW: http://www.enstimac.fr/manif/comminution98

13-16 10th CIM Maintenance/Engineering Operators Conference, Saskatoon, Canada. Dave Thomson, Conference Secretary.
Tel: (+1 306) 664 2226. Fax: 652 3235.
E-mail: dthomson@kilborn.com

14-16 Minerals Engineering 98, Edinburgh, Scotland. Dr. Barry Wills, CSM Associates, Trevenson, Pool, Redruth, Cornwall TR15 3SE, UK.
Tel/Fax: (+44 1326) 318352.
E-mail: bw@minerals.avel.co.uk

14-17 Fifth International Symposium on Mining in the Arctic, Yellowknife, Canada. Tony Keen, Cominco Ltd, #500-200 Burrard St., Vancouver, BC., V6C 3L7, Canada.
Tel: (+1 604) 685 3048. Fax: 3066.

14-18 Electra Mining Africa '98, Johannesburg, South Africa. John Kaplan, Director, Specialised Exhibitions, PO Box 2900, Johannesburg 2000, South Africa.
Tel: (+27 11 11) 835 1565. Fax: 496 1161.
E-mail: specialx@icon.co.za

21-25. 8º Congress of the International Association of Engineering Geology. Vancouver, British Columbia, Canada. Ms. Kim Meidal, Secrétariat 8e Congrès de l'IAEG. a/s BC Hydro, 6911 Southpoint Drive, Burnaby, British Columbia, Canada V3N 4X8.
Tel: (604) 528 2421. Fax: (604) 528 2558.
E-mail: kim.meidalbchydro.bc.ca

28-2 Minesafe International 1998, Sun City, South Africa. Mike Gouws, Minesafe International 1998, South Africa.
Tel: (+27 11) 498 7429.
E-mail: mgouws@bullion.org.za

October 1998

3-8 American Institute of Professional Geologists Annual Meeting. Baton Rouge. Lousiana U.S.A. Contact: William V. Knight. 7828 Vance Drive, Suite 103, Arrada, Colorado 80003-2124.
Tel: (303) 431 08 31. Fax: (303) 431 13 32.
e-mail: aipg@aipg.com.

5-9 Seventh International Symposium on Mine Planning & Equipment Selection, Calgary, Canada. Dr Raj K. Singhal, PO Box 68002 Ranchlands RPO, 7750 Ranchview Drive N.W., Calgary, AB, Canada T3G 3N8. Fax: (+1 403) 241 9460. E-mail: Singhal@agt.net

6-9 Kazmin 98, 4th Kazakhstan International Mining Exhibition and Conference, Almaty. International Trade and Exhibitions, UK.
Tel: (+44 171) 286 9720. Fax: 286 0177.
E-mail: inquiry@ITE-Group.com

18-22 1998 Powder Metallurgy, world congress and exhibition (PM'98), Granada, Spain. European Powder Metallurgy Association, Old Bank Bldgs., Bellstone, Shrewsbury, SY1 1HU, UK.
Tel: (+44 1743) 248899. Fax: 362968.
E-mail: epma@dial.pipex.com

19-21 CAMI'98, 4th Conference on Computer Applications in the Mineral Industry. CAMI Organizing Committee.
Tel: (+1 306) 966 5714. Fax: 966 8593.
E-mail: stead@pangea.usask.ca

November 1998

17-21. FICOP'98. Feria Internacional de Maquinaria para Construcción, Obras Públicas, Minería y Manuntención. Parque Ferial Juan Carlos I, Madrid, España. Inf: IFEMA. Aptdo 67067, 28080 Madrid, España.
Tel: 91 7225050. Fax: 34 1 7225791.

December 1998

Northwest Mining Association 1998 annual convention, Spokane, US. NWMA, 10 N. Post St, Suite 414, Spokane, WA 99201-0772, US. Tel: (+1 509) 624 1158. Fax: 1241.
E-mail: nwma@nwma.org

March 1999

1-4 SME Annual Meeting & Exhibit, Denver, US. Society for Mining, Metallurgy and Exploration, PO Box 625002, Littleton, CO 80162-5002, US.
Tel: (+1 303) 973 9550. Fax: 979 3461.

3-7 SAMOTER'99, Verona, Italy. Mr Mauro Albano, VeronaFiere.
Tel: (+39 45) 8298274. Fax:8298288.
Http://www.veronafiere.it.

23-27 Conexpo-Con/Agg '99, the western hemisphere's largest construction and aggregates exhibition, Las Vegas, US. Andrews/Mautner, Inc., 839 N. Jefferson St, Suite 402, Milwaukee, WI 53202, US.
Tel: (+1 414) 291 7620. Fax: 7633.

June 1999

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

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

September 1999

Dates to be announced. V National Spanish Geological Congress. Alicante. Spain. Sociedad Geológica de España. Departamento de Ciencias de la Tierra y Medio Ambiente. Facultad de Ciencias. Campus de San Vicente de Raspeig. Universidad de Alicante. Spain. Dr. Salvador Ordoñez. Ph +34 65903555.
Fax +34 65903552 e-mail:

Dates to be announced. Meeting of the European Geological Societies 11. Alicante. Spain. Sociedad Geológica de España. Departamento de Ciencias de la Tierra y Medio Ambiente. Facultad de Ciencias. Campus de San Vicente de Raspeig. Universidad de Alicante. Spain. Dr. Salvador Ordoñez. Ph +34 65903555. Fax +34 65903552 e-mail:.

Dates to be announced. 1st International Professional Geologists Conference. Alicante. Spain. European Federation of Geologists. EurGeol Prof. Manuel Regueiro. Ph: +34 13495778 Fax: +34 1 4426216
e-mail: mregueir@santandesupernet.com

Dates to be announced. European Federation of Geologists Council Meeting. Alicante. Spain. European Federation of Geologists. EurGeol Prof. Manuel Regueiro. Ph: +34 13495778
Fax: +34 1 4426216
e-mail: mregueir@santandesupernet.com

October 1999

5-8 American Institute of Professional Geologists Annual Meeting. Anchorage, Alaska, U.S.A. Contact: William V. Knight. 7828 Vance Drive Suite 103, Arrada, Colorado. 80003-2124.
Tel: (303) 431 08 31. Fax: (303) 431 13 32.
e-mail: aipg@aipg.com.

March 2000

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

July 2000

Dates to be advised XXI International Mineral Processing Congress, Rome Italy. XXI IMPC Organising Committee, c/o Dipartimento di Ingegneria Chimica, dei Materiali, delle Materie Prime e Metallurgia, PO Box 5077, 00153 Roma Ostiense, Italy.
Tel: (+39 6) 44585 891. Fax: 44585 891.

September 2000

11-14 MINExpo International 2000*, Las Vegas, US. North American Mining Association, Manufacturers and Services Division.
Tel: (+1 202) 463 2607. Fax: 463 9799.

October 2000

11-15 American Institute of Professional Geologists Annual Meeting. Milwaukee, Wisconsin. U.S.A. Contact: William V. Knight. 7828 Vance Drive Suite 103, Arrada, Colorado. 80003-2124.
Tel: (303) 431 08 31. Fax: (303) 431 13 32.
e-mail: aipg@aipg.com.

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. A brief abstract should be included in English and in the language of the article. Articles submitted on diskette along with a hard copy are appreciated. The Editor uses Word 6, Word 7, WP for Windows 95, or Mac files, both preferably in 3,5 diskettes. Photographs, figures, tables, etc are welcome. Photographs enhance articles and make great EG covers. Be sure to send photographs when possible with your article, or send your favorite photograph for considerations for a future EG issue. Submission deadline is weeks preceding month of issue. 1st May for June issue and 1st November for December issue.

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

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

1.–Send files via e-mail to MREGUEIR@SANTANDERSUPERNET.COM and follow with a fax to 34-1-4426216 for confirmation of the text.

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

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- –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
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  - FOREGS, EuroGeosurveys
  - Public Works
  - Hydrogeology

Publications

Geo Calendar

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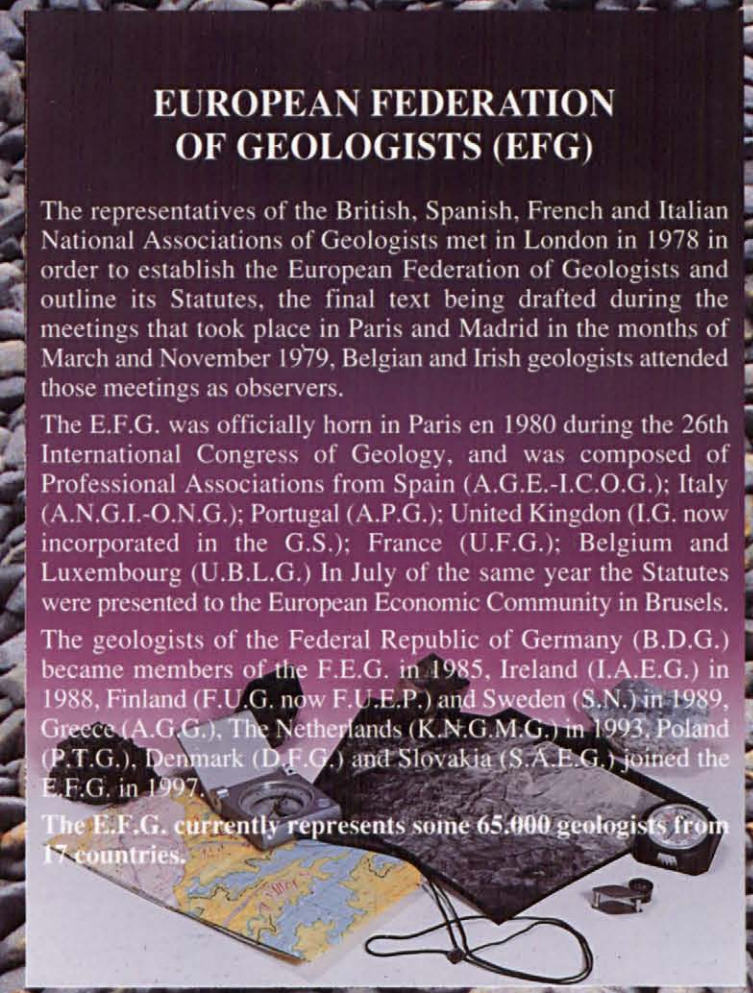
EUROPEAN FEDERATION OF GEOLOGISTS (EFG)

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

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

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

The E.F.G. currently represents some 65.000 geologists from 17 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.