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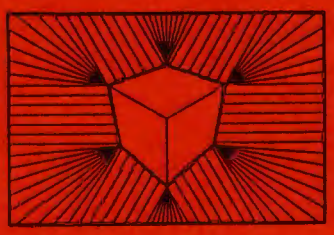

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INHOUDSOPGAVE

VAN DE REDAKTIE

Voor u ligt het winternummer van de IngeoKring Nieuwsbrief. De Nieuwsbrief bestaat nu al vijftien jaar, vandaar de feestelijke voorkant. Deze nieuwe uitgave is verzorgd door een nieuw team van studenten: Carl Messemaeckers, Albert Bloem en Pieter Dijkshoorn. In dit nummer is het beloofde artikel van Marina Giezen opgenomen naar aanleiding van de "ingenieursgeologische workshop". Ook dit jaar is de workshop weer een deel van het vierdejaars curriculum voor studenten ingenieursgeologie. U kunt dan ook in de volgende nieuwsbrief weer artikelen verwachten van de workshop '93. De copydatum voor de volgende nieuwsbrief is 23 april.

Naar aanleiding van vragen op de jaarvergadering van de Ingenieursgeologische Kring heeft de heer Rengers een stukje geschreven over de kwalificaties EUR ING en EUR GEOL. In dit artikel wordt ingegaan op de eisen waaraan voldaan moet worden om daarvoor in aanmerking te komen.

In diverse Nederlandse kranten en radio uitzendingen heeft de studiereis van het Dispuut IngenieursGeologie, met als onderwerp Environmental Geology, uitgebreid aandacht gekregen. In deze Nieuwsbrief vindt u een reisverslag, geschreven door de EECO, de subcommissie van het DIG die deze reis tot het grote succes gebracht heeft.

Tenslotte kunt u in deze nieuwsbrief de aankondigingen van het bestuur vinden.

Wij wensen u veel leesplezier en houden ons zoals altijd ten zeerste aanbevolen voor interessante artikelen en eventuele op- of aanmerkingen.

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NON-EXPLOSIVE DEMOLITION AGENTS FOR ROCKS AND CONCRETE

M. Giezen

Introduction

The use of explosives to break hard rock will often cause various problems. The problems, which may arise, depend on the type of project in which the explosives are used, the environment in which the project is executed and the encountered geology. A few common examples will now be given to stress the importance of this rather new and unknown method to break hard rock. In dredging projects the dredging efficiency becomes lower as the hardness of the rock increases until finally the dredge itself becomes impracticable due to huge amounts of wear on chisels [Miura, H. et al. (1992) p1]. The use of explosives is in general a rather difficult method to control and may cause overbreak in tunneling and mining projects and endanger the people working in it. The use of explosives generates vibrations and may thereby trigger faults or induce liquefaction in sandy deposits. In urban environments it may cause harm to the foundations of buildings and it is often not allowed to be used because of safety reasons.

For several reasons the use of non-explosive demolition agents can be a satisfacs on of ettringite and a volumetric expansion of eight times the original volume. The formation of gypsum already causes a volumetric expansion (see fig.4) [Reinhardt, H.W. (1985) pp22 & 253-254]. Chlorides may also react with the aluminum giving expansion in three steps (see fig.5) [Reinhardt, H.W. (1985) p255]. The well-known "alkali- aggregate" reactions also cause an enormous expansion (by a factor two) : a reaction between the alkalis (in the cement) and amorphous forms of silica (e.g. opal, borosilicates). The factors that control the reaction are the nature, the amount and the particle size of the silica and the amount of available alkalis and moisture (see fig.6) [Reinhardt, H.W. (1985) pp46-47]. Also the alkali-carbonate reaction is an expansive one, in which potassium oxides (from the cement) react with fine grained dolomitic limestone. This reaction is sometimes referred to as dedolomitization and is expansive due to the swelling of magnesium hydroxide (see fig.7) [Rein-hardt, H.W. (1985) p49].

Most of these reactions proceed very slowly and therefore, in their use as demolition agents, the cementitious agents need the aid of catalyzers. The manufacture process of the expansion agents can be found in especially Japanese articles, which are almost always patented. The manufacture processes (see fig.8 & 9) look like the manufacture processes of clinkers, except for their hidden catalyzers (setting accelerators), which are given names as Denca Natmic 5 [Hirano et al.(1989)] or Mighty 100 [Suzukawa et al.(1986)]. A German article (which is also patented) reveals some catalyzers: finely divided aluminum or heavy metal salts [Karam et al.(1985)].

Some modifications can be added to the expansion agents. Often a hygroscopic material is added to the expansion agents. This hygroscopic material (e.g. acrylic acid-vinyl alc. copolymers) prevents water loss through cracks in the concrete and rock, and thereby improves the efficiency of the agents [Iijima et al.(1990)]. Plugging the boreholes or adding lubricating oil or steel, glass or polymer fibers can prevent the expansive slurry from flushing out of the boreholes, which are filled with the expansion agents [Tomioka et al.(1988)].

Name of compound	Oxide Composition	Abbreviation
Tricalcium silicate	$3CaO.SiO_2$	C_3S
Dicalcium silicate	$2CaO.SiO_2$	C_2S
Tricalcium aluminate	$3CaO.Al_2O_3$	C_3A
Tetracalcium aluminoferrite	$4CaO.Al_2O_3.Fe_2O_3$	C_4AF

fig.1: Main compounds of Portland cement [Reinhardt, H.W. (1985) p10].

C_3S: $2(3CaO.SiO_2) + 6H_2O \rightleftharpoons 3CaO.2SiO_2.3H_2O + 3Ca(OH)_2$
C_2S: $2(2CaO.SiO_2) + 4H_2O \rightleftharpoons 3CaO.2SiO_2.3H_2O + Ca(OH)_2$
C_3A: $3Ca.Al_2O_3 + Ca(OH)_2 + (x\text{-}1)H_2O \rightleftharpoons 4Ca.Al_2O_{3,x}H_2O$ (1)
C_4AF: $½(4Ca.Al_2O_3.Fe_2O_{3)} + 2Ca(OH)_2 + {}_{(x\text{-}2)}H_2O \rightleftharpoons 4Ca.(Al_2O_{3)\cdot x}H_2O$ (1) hexagonal

(1) x = 13 or 19

fig.2: Hydration of Portland Cement clinkers [Reinhardt, H.W. (1985) p16].

$CaSO_4 + C_3A + 32H_2O \rightleftharpoons C_3A.3CaSO_4.32H_2O$ ettringite expansion

fig.3: Formation of ettringite [Reinhardt, H.W. (1985) p255].

$Ca(OH)_2 + Na_2SO_4 \rightleftharpoons CaSO_4 + 2NaOH$
$3CaSO4 + C_3A.nH_2O \rightleftharpoons C_3A.3CaSO_4.32H_2O$

fig.4: Formation of gypsum and ettringite [Reinhardt, H.W. (1985) pp253-254].

$CaCl_2 + C_3A + 10H_2O \rightleftharpoons C_3A.CaCl_2.10H_2O$	chloor aluminate, expansion
$(SO_3) \rightleftharpoons C_3A.3CaSO_4.32H_2O$	ettringite, expansion
$(CO_2 + SiO_2) \rightleftharpoons CaCO_3.CaSO_4.CaSiO_3.15H_20$	thaumasite, expansion

fig.5: Chlorides reacting with aluminates giving expansion in three steps [Reinhardt, H.W. (1985) p255].

$Na_2O + H_2O \longrightarrow 2NaOH$
$SiO_2.nH_2O + 2NaOH \longrightarrow Na_2SiO_3(n+1)H_2O$

fig.6: A reaction between alkalis (in the cement) and amorphous forms of silica [Reinhardt, H.W. (1985) p46].

$K_2O + H_2O \longrightarrow 2KOH$
$CaMg(CO_3)_2 \longrightarrow CaCO_3 + Mg(OH)_2 + K_2CO_3$
$K_2CO_3 + Ca(OH)_2 \longrightarrow 2KOH + CaCO_3$

fig.7: The alkali-carbonate reaction [Reinhardt, H.W. (1985) p49].

AB The expansion agents consist of .alpha.-Ca2SiO4, aluminates, lime, MgO, and Ca sulfate together with .gtoreq.1 agents for controlling their setting and hydration, and produce, in admixt. with water in the proper prepn., an expansive force of up to 7000 metric ton/m2 for a predetd. length of time selected with regard to the type of rock, ambient temp., and diam. of the cavity into which they are to be introduced. The expansion agents are manufd. by (a) sep. grinding the calcareous materials, dolomite, kaolinitic clay, bauxite, and mineralizers to <90 .mu.m, (b) prepg. a mixt. of the calcareous materials and dolomite 60-80, aluminum materials 15-35, and mineralizers 5%, (c) homogenizing and storing the mixt., (d) calcining the mixt. at 1500-1700.degree. until sintering, (e) cooling and storing the mixt. until size redn., (f) grinding the material with 3-5% additives, and (g) storing and packaging the material. These agents give a very high vol. increase.

fig.8: Manufacture process of a demolition agent [Baragano Coronas, J.R. (1989), Abstract].

AB An agent for demolition of concrete, rocks, etc., comprises 100 wt. parts of a mixt. of fine particles of 95-99 wt.% clinker sintered at .gtoreq.1200.degree. and contg. free CaO crystals 78-97, free C3S crystals 3-22, and impurities 0-10 wt.%, and 1-5 wt.% anhydrite, hemihydrate, gypsum and 0.4-4 wt. parts cement water-reducing agent, e.g., HCHO-.beta.-naphthalenesulfonic acid copolymer. The Blaine sp. surface of the clinker component may be 1500-4000 cm2/g. Holes are formed in a durable structure and filled with an aq. slurry of this compn. which is allowed to generate an expansion pressure to demolish the structure. Thus, 95 wt. parts of clinker, prepd. from CaCO3 and SiO2 by sintering pellets at 1400.degree. for 30 min and contg. free CaO crystals 60 and free C3S crystals 40 wt.%, was mixed with 5 wt. parts CaSO4, prepd. by burning gypsum at 500.degree., the mixt. was ball-milled to sp. surface 3000 cm2/g and then mixed with 0.6 wt. parts Mighty 100, and this mixt. was pulverized to give an expansion agent. A slurry of 100 wt. parts agent in 34 wt. parts water produced expansion pressures of 160, 310, and 450 kg/cm2 after 6, 12, and 24 h in a closed vessel at 20.degree..

fig.9: Manufacture process of a demolition agent [Suzukawa, Y.; Kobayashi, W.; Ohtaka, S. (1986), Abstract].

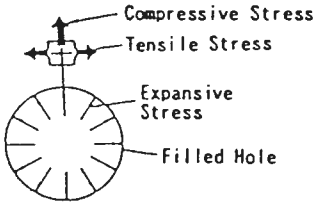

fig.10: Development of compressive and tensile stresses [Miura, H. et al. (1992) p3].

As temperature rises (up to 40°), there will be an increase in expansive stress. Therefore the expansion agents may be packed in heat-insulating sheets like polystyrene foams [(1) Yamazaki et al.(1989)]. The expansion agents may contain colorants to identify the agents. Methylene blue, black carbon or ferric oxide, which color upon mixing with water, can be used [(2) Yamazaki et al.(1989)]. The expansion agents are packed in various ways. They can be packed in breakable containers, made from nonwoven nylon fabric [Watabe et al.(1990)].

The rock and concrete breaking mechanism using cementitious expansion agents

If a hole is drilled and filled with demolition agents, a generated expansive stress will act on the wall of the filled hole and thereby create a compressive stress, which acts radially in the periphery of the hole and a tensile stress perpendicular to this compressive stress (see fig.10) [Miura, H. et al. (1992) p3]. Cracks will be formed when the deformation due to this stress exceeds the deformation formed at the tensional strength of the material. The tensile strength of brittle materials, like rocks and concrete, is about 1/10 to 1/15 times their compressive strength, so that they can be broken by the expansive stress emer-ging from the hydration reaction of the demolition agents (see fig.11 for some u.c.s. values of rocks) [Price, D.G. (1989) p156]. Expansive stresses up to 40 MPa arise from the hydration reaction [Miura, H. et al. (1992) p4]. Detailed information on the mechanics of hydraulic fracturing or borehole mechanics is beyond the scope of this subject, but these subjects are already described elsewhere [Roest, J.P.A. (1992) pp18-24].

If two or more holes are filled, the tensile stress generated between the holes produces cracks connecting each hole (see fig.12) [Miura, H. et al. (1992) p3]. The expansive stress in the hole is decreased as cracks are formed due to the increase of volume. But, the expansion still continues and therefore tensile stresses are still generated and new cracks are developed of which the width expands with the lapse of time. This process of production of cracks, followed by propagation of the cracks and expansion of the crack width, totally differs from the breaking mechanism of an instantaneous applied energy force as produced by dynamite.

In general, the expansive stress increases with the lapse of time and as the temperature rises, the expansive stress is increased (see fig.13) [Miura, H. et al. (1992) p4]. There is also a tendency, that the expansive stress increases as the borehole diameter becomes larger, or when the used amount of water for the hydration is decreased (see fig.14) [Miura, H. et al. (1992) p4].

After this "initial" fracturing not all of the hard rock will be broken, but will be nevertheless more breakable by the produced cracks. Of course, there is a limit to the depth of produced cracks [Miura, H. et al. (1992) p2].

Rock and concrete breaking techniques using cementitious expansion agents

The first step is to drill boreholes in order to be filled with the demolition agents. For hard rocks rotary percussion drilling can be applied. While drilling, compressed air or high pressure water is ejected out of the annulus from the tip of the bit into the borehole to remove the cuttings from the borehole (see fig.15) [Miura, H. et al. (1992) p5]. The borehole will be filled after the drilling is finished by replacing the compressed air or high pressured water by the slurry of the demolition agents reacting with water, while the rod is slowly pulled up (see fig.16) [Miura, H. et al. (1992) p7].
As the borehole diameter becomes larger, the distance between the boreholes should increase in order to increase the effect of

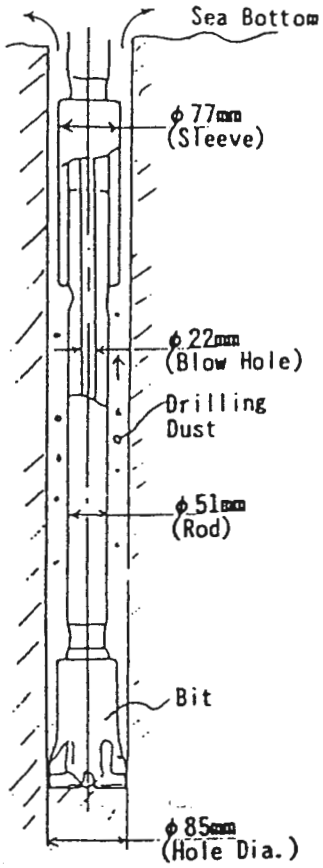

fig.15: Drilling a borehole to be filled by demolition agents [Miura, H. et al. (1992) p5].

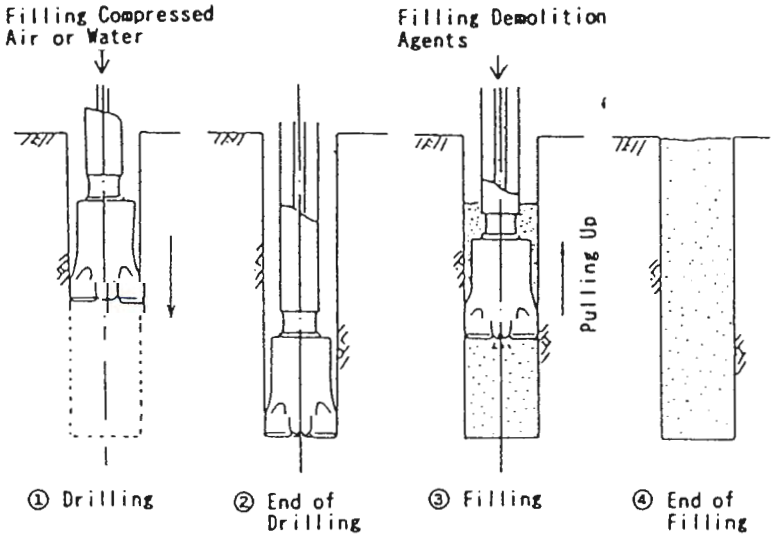

fig.16: Filling of the borehole by demolition agents [Miura, H. et al. (1992) p7].

Rock-name	Granite Basalt Dolerite etc.	Quartzite Gneiss Slate etc.	Limestone Sandstone etc.	Sandstone Siltstone Mudst. etc.
U.C.S (MPa)	mostly over. 150	from about 75 to 200	from about 50 to 150	from about 1 to 50

fig.11: Some u.c.s. values of rocks [Price, D.G. (1989) p156].

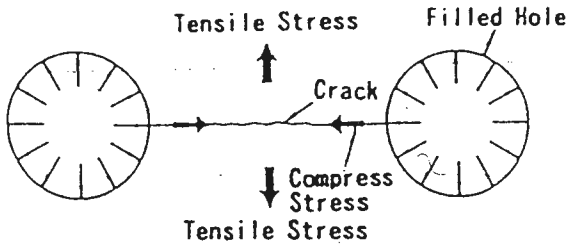

fig.12: Produced cracks, connecting the boreholes, due to generated tensile stresses, [Miura, H. et al. (1992) p3].

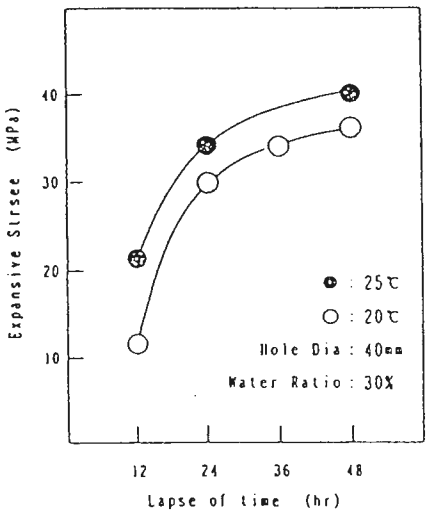

fig.13

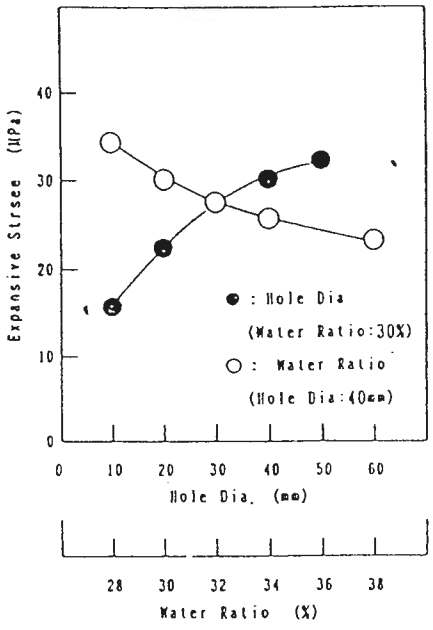

fig.14

fig.13: The expansive stress increases with the lapse of time and higher temperatures up to 40° [Miura, H. et al. (1992) p4].

fig.14: The expansive stress increases as the the borehole diameter becomes larger, or when the used amount of water for the hydration is decreased [Miura, H. et al. (1992) p4].

the rock splitting due to the demolition agents. Also the distance between the boreholes should decrease, as the rock becomes harder. Hideo Miura et al. (1992 p5) use an empirical relationship to express this:

L = K * d in which:

L = the distance between the boreholes in cm

d = the borehole diameter in cm

K = the fracturing coefficient, which is an empirical value to express the ease to split rocks in twenty-four hours. When the demolition agents are kept longer in the borehole, the fracturing coefficient will be increased with a factor 1.3 to 2.0. Hideo Miura et al. (1992 p5) give a table for standard K-values (see fig.17). The way in which these K-values are established is not given. According to this empirical relationship a distance between the boreholes of about 90 cm to 135 cm is used, when boreholes with a diameter of about 85 mm are drilled in hard (u.c.s. strength > 118 MPa) rock.

Since the rock splitting effect of the demolition agents takes some time (often over twenty-four hours will be needed), it will be more efficiently to drill deep boreholes in one time. Different borehole configurations can be used: breaking by empty boreholes alone with the aid of secondary breaking by for example a heavy breaking rod, by combining empty and filled boreholes in a parallel way or by combining empty and filled boreholes in a zigzag arrangement (see fig.18) [Miura, H. et al. (1992) p7]. The last configuration seems to be the most efficient one in decreasing the elastic wave velocity (km/s) of the rock and therefore in making the most cracks. The efficiency also increases when the boreholes are drilled in a rock volume with two free surfaces, as bench cut slopes do have. In this way, one surface can act as release surface for the developing crack. By changing the borehole depth and the borehole diameter a bench cut slope, having two free surfaces, can be made out of a rock unit having one free surface.

After the rock breaking by demolition agents not all of the rock will be broken and loosened, but part of the rock will be weakened by the formation of hair cracks, which are not visible with the eye. It will now be much more easy to loosen this rock material by secondary breaking with dredging devices in the case of a dredging project, a heavy breaking rod in the case of a mass excavation on land or by other mechanical breaking devices.

Rock and concrete breaking techniques using agents expanding by a physical process: phase transition

As already mentioned earlier a phase transition can cause a volumetric expansion e.g. a phase transition from liquid to gas. The use of this phase transition of carbon dioxide from liquid to gas, whereby a pressure will be build up in a semi- instantaneous way, will be discussed shortly. The method uses the rapid expansion of carbon dioxide to produce an instantaneous cold heaving force into the surrounding material, which then breaks down along its planes of weakness. The pressure, which is built up instantly, reminds to the principle in which explosive demolition agents break down rock or concrete.

However, important differences do occur. The wished pressure to break down the rock can be achieved much more accurately than explosives can achieve. Besides, this method is a "cold" method: it is save in the presence of inflammable vapors and gases. Damaging shockwaves will not be produced, there is a reduction of noise and dust, and noxious fumes will also not be produced. The method uses a controlled mechanism. The method starts with drilling a hole into the material to be broken and a tube is inserted (see fig.19) [Cardox Company (1992) p3]. The tube is charged with liquid carbon dioxide. A connection is made from

Item / Kind	Strength (MPa) [kgf/cm²] Compressive Strength	Tensile Strength	Standard K-Value
Soft Rock	under 58.8 [600]	under 5.88 [60]	10~18
Medium Hard Rock	58.8~118 [600~1,200]	5.88~9.8 [60~100]	8~12
Hard Rock	over 118 [1,200]	over 9.8 [100]	under 10

fig.17: Table with standard K-values [Miura, H. et al. (1992) p5].

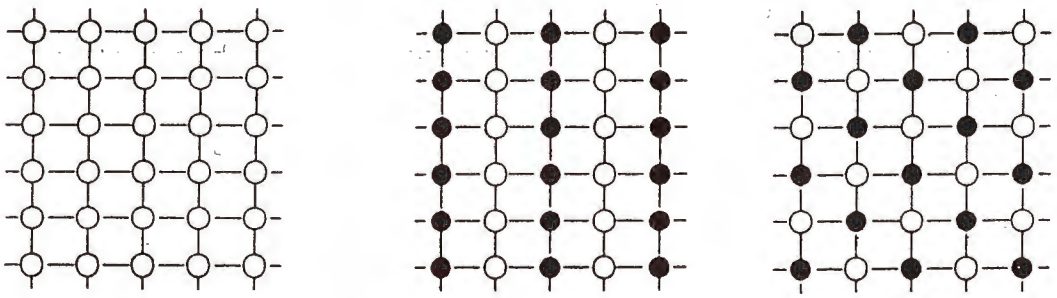

fig.18: Different borehole configurations: respectively empty boreholes alone, a combination of empty and filled boreholes in a parallel way and a combination of empty and filled boreholes in a zigzag arrangement [Miura, H. et al. (1992) p7].

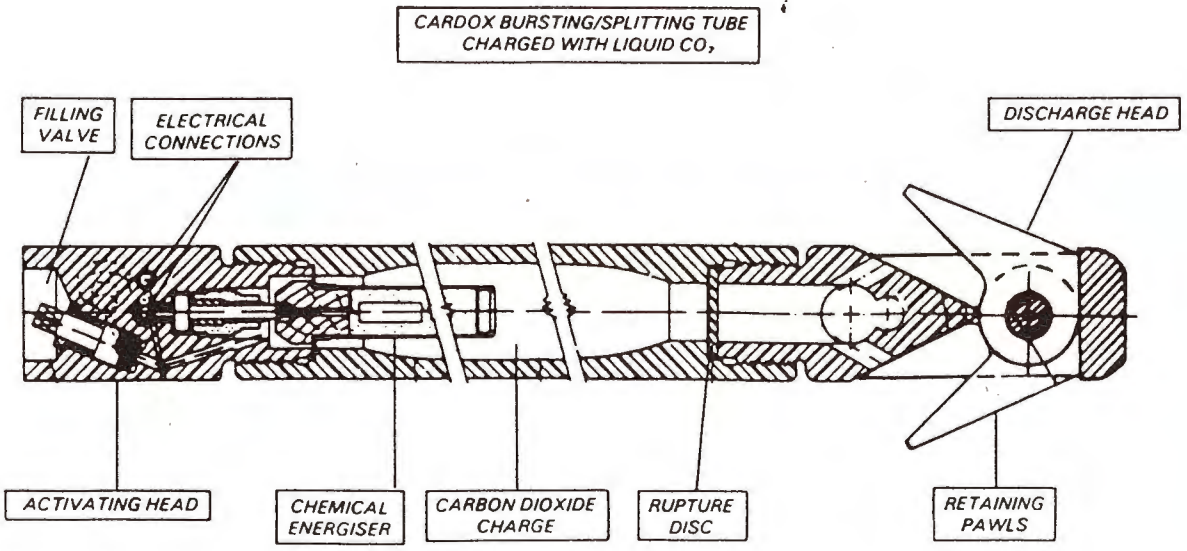

fig.19: The Cardox splitting tube, charged with liquid carbon dioxide [Cardox Company (1992) p3].

the tube to a safety hand-held magneto, and on pas-sing an impulse from this magneto to the charged cartridge, the low tension electric fuse initiates a rapid reaction in the energizer, resulting in the formation of an additional volume of gas. The internal pressure is instantly built up to the yielding point of a special shear disc, whereby the heaving mass of carbon dioxide instan-taneously is discharged into the surrounding rock or concrete mass, as the shear disc is ruptured. Retaining pawls keep the tube in place. The rock or concrete mass will break down along its planes of internal weakness. To suit individual requirements, the rupture disc thickness and the type of tube can be adap-ted to give a variety of respectively discharge pressures and discharge volumes. When discharged, the tube itself can be recovered. The chemical energizer and the shear disc can be replaced [Cardox Company (1992) p3].

Conclusions and recommendations

Non-explosive demolition agents can be applied in many situations, in which explosive demolition agents are too dangerous or destructive to be used. But also in many other cases, non-explosive demolition agents can be used as a new technique to remove hard rocks, concretes or other materials. The method has been used successfully to break rock in dredging projects, and also for the removal of bulk materials in silos, for the trimming of rein-forced concrete piles and pile caps, for con-trolled breaking of concrete, masonry and brickwork, but also as an aid to "landscape" reclamated land or to improve river schemes (re-servoir construction).

The needed chemical agents are rather easy to produce, except perhaps for the catalyzers, which are kept secret. With respect to this, the following might be said.

Mankind becomes more and more conscious of being citizens of the world. It seems, that we live in an age, in which pollution, famine, weapon-control, human rights and other problems are considered in an international, or even global, way. From this point of view, the world-citizen should strive to more openness with respect to scientific and other publications in order to co-operate instead of inven-ting the wheel for the second time and thereby spending lots of money, which could be invested in a much better way. As to do so, somebody should start and break up the legislation, concerned with all of this. As "short-term profits" belong to the behaviour of mankind, this will be a difficult aim to achieve.

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WAT BETEKENEN DE KWALIFICATIES EUR ING EN EUR GEOL VOOR DE NEDERLANDSE INGENIEURSGEOLOOG ?

Tijdens de jaarvergadering van de Ingenieursgeologische Kring op 27 februari 1992 is enige aandacht besteed aan de nieuwe Europese kwalificaties EUR ING en EUR GEOL. Gezien het belang van deze aangelegenheid voor onze leden lijkt het verstandig een aantal aspekten ook hier toe te lichten.

Geschiedenis

Enkele jaren geleden zijn de titels European Engineer en European Geologist ingevoerd door de FEANI (European Federation of National Engineering Associations) en de EFG (European Federation of Geologists), die beiden onder andere nastreven helderheid te verschaffen over de verschillende soorten graden en kwalificaties in Europa.

Aangezien de ontwikkelingen wijzen in de richting van acceptatie van de door de FEANI en de EFG voorgestelde titels door grote internationale organisaties en ondernemingen moet er mee rekening gehouden worden dat in de nabije toekomst voor de uitvoering van consultancy of contract research activiteiten of bij sollicitatie naar bepaalde functies een of beide genoemde kwalificaties ook voor ingenieursgeologen als eis gesteld zullen worden.

Ratificatie van het verdrag van Maastricht maakt binnen de EEG een vrij verkeer van personen mogelijk. In de praktijk blijken echter vaak de verschillen in de nationale wetgeving het werken van Nederlandse ingenieurs en geologen in andere landen te bemoeilijken.

The European Engineer (Eur Ing)

In het blad "De Ingenieur" (KIVI) Nr. 9, 1992 en aansluitend in een persbericht van het KIVI van 30 oktober 1992 is de stand van zaken rond deze titel uiteengezet. De belangrijkste conclusies zijn:

- Ingenieurs hebben het recht de titel Eur Ing te voeren wanneer zij een door de FEANI erkende ingenieursopleiding (met een minimum van 3 kollegejaren) hebben voltooid alsmede een getoetste praktijkervaring van tenminste twee jaar.
- Het totaal van studie en praktijk als ingenieur dient minimaal zeven jaar te zijn.

Hiermee is afgestapt van de kleurencode van de Eur Ing certificaten waarmee in het verleden het verschil in lengte van de academische opleiding (drie, vier of vijf jaar) werd aangegeven.

Aanvragen voor de Eur Ing-titel moeten worden gericht tot de heer A. van de Sande, p/a KIVI, Postbus 30424, 2500GK den Haag, tel 070 3 919 817

The European Geologist (Eur Geol)

Een aardwetenschapper komt in aanmerking voor de titel Eur Geol (welke voor de nationale titel komt) wanneer hij/zij beschikt over een wettelijk erkend diploma in de aardwetenschappen plus enige jaren professionele ervaring, ook hier met een minimum van totaal 7 jaar. Deze titel wordt verleend door de European Federation of Geologists (EFG). Gedurende een overgangsperiode wordt een driejarige studie plus vijf jaren professionele ervaring geaccepteerd, maar in de toekomst wil de EFG uitgaan van een minimumduur in de opleiding van 4 jaar.

Het Koninklijk Nederlands Geologisch en Mijnbouwkundig Genootschap (KNGMG) overweegt om meer dan voorheen de beroepsbelangen van geologen te gaan behartigen en zich op een of andere wijze aan te sluiten bij de EFG. Op deze wijze kan het KNGMG dan ook optreden als organisatie die behulpzaam kan zijn bij het verkrijgen van de titel Eur Geol. Nadere ontwikkelingen over deze materie bij het KNGMG zullen wij voor U volgen en daarvan melding maken zodra dat opportuun is.

Niek Rengers

REPORT STUDY-TRIP TO CENTRAL AND EASTERN EUROPE OF THE DISPUTE OF ENGINEERING GEOLOGY

This is a report of the study-trip made to Eastern- and Central-Europe. The official report with all the case histories is also still available. If you want to order this report (Dfl. 50,-) you can contact the Student Chapter of Engineering Geology (DIG) at the faculty of mining in Delft.

Monday, 7 September 1992

All the participants arrived at 10.45 for coffee and apple pie at Schiphol airport. At 12.45, 14 students, 2 staff members, 1 representative of IWACO consultants and 1 journalist departed with flight KL 279 from Amsterdam to Prague. The group arrived in Prague at 14.15. The bus driver, Roman, who would accompany us during the tour was waiting for us with a representative of his company. After loading all the luggage and participants in the bus, which did not have enough luggage space, we left for a bus-tour through the city of Prague. According to our guide every interesting object was on the left, even when he looked the other direction. Within two hours we arrived at hotel 'Pramen', which was nicely situated in the most outer outskirts of Prague. In the evening we hired a bus to get to the city to have diner with our contact mr. Tomik. The dinner was delicious and after sightseeing and some beers in the city we went back to the hotel before midnight.

Tuesday, 8 September 1992

On the second day of the study-tour an excursion through Northern Bohemia was made. Our contact mr. Tomik arranged an english interpreter, Eva Koznarova, and a colleague who functioned as our guide. Mr. Stevo Akkermans, a free lance reporter for the KRO radio and some regional newspapers, joined us for a day report.

This region is strongly polluted by the waste of electric power stations and chemical plants. This waste consists of slag and ashes, which contain heavy metals and sulphur. The expulsion from the chimneys contains high amounts of sulphur. The landscape of this region is dominated by the large scale open pit mining of low quality browncoal. First power plant Tusimice II was visited. Here, especially the deposition of the waste materials and the monitoring system for air and ground water pollution are in bad condition.

In the city of Most an excellent lunch was served. This was followed by a presentation of the rehabilitation program which was given by Ing. Petr Dvorak, who works for the Rehabilitation Institute of Most (RVM). Mr. Petr Pakosta, who works for The Green House of Litvinov, gave a presentation of the environmental geology in the Most region. The presentations were followed by an interesting discussion which also resulted in some information about the social situation of the inhabitants of Most.
In the afternoon a tour through the Most region was made. The whole city of Most has been replaced to a rehabilitated area to provide mining activities under the former city area. We were lucky to get a reasonable view of the area, because there are only 20 clear days per year. The tour ended with a visit to the castle Jezeri which is subsiding because of the nearby excavations in an open pit mine. On the way back we had dinner in a restaurant where they served a local dish.

Wednesday, 9 September 1992

We had breakfast at 6.45 and after loading our luggage in the bus, we left for Bratislava. At 13.00 we arrived in the capital of Slovakia, where we met our contact Dr.Rudolf Holzer at a petrol station. First

we had lunch before we left for a visit to the University of Bratislava. Prof. Rudo Ondrasik and Jan Vlcko gave a presentation of the engineering geological problems in Slovakia. Also a film about landslides classification and remedial measures at the territory of the Slovak Carpathians was shown followed by a discussion. Dinner was served in a typical Slovakian restaurant after we checked in at hotel 'Bratislava'.

Thursday, 10 September 1992

Today an excursion to the Nitra-river region. We had a coffee stop in the village of Partizanski, which is the old centre of the Bata shoe industry. The landslide area near Handlova was our first destination. Here the civil structures and mining activities are hampered by the landslides. A large drainage system is build to lower the pore pressure. In the village of Podhradie pod Vtacnikom subsidence and landslides take place as a result of underground mining and drink water supply. The houses in this village are seriously damaged due to horizontal movements.

Near Zimiansky Kostolany a storage for refused ash and slag from a thermal electricity plant is present. The dam of the reservoir collapsed a few years ago and all the ashes flowed in the valley. They rebuild the dam and filled the reservoir again. The hydrogeological circuit is not properly closed so the drainage water, which is heavily polluted causes ecological problems.

Friday, 11 September 1992

The Danube basin was our tour territory for this day. We visited the hydro-power plant in Gabcikovo, which is still under construction and will be one of the largest in Europe. The Gabcikovo project is a political sensitive subject between Slovakia and Hungary. In the afternoon the drinking water facility at Samourin was our destination. The water, polluted by heavy industry, is led to reservoirs where it can penetrate in the underlying sand layer. At several stations the water is pumped out of this layer, using it as a filter. This water is of high quality and suitable for drinking water purposes. We had our dinner in an underground space in Bratislava.

Saturday, 12 September 1992

At 7:30 in the morning we departed to Budapest where we arrived at 13:00. Our contact Dr. Tibor Cserny was waiting for us in front of the Headquarters of the Hungarian Geological Survey, which is located in a beautiful historical building.

Hungarian Geological society

After we enjoyed a delicious lunch, representatives of universities and the Geological Survey gave presentations of their work and organisations. When we arrived at hotel 'Platanus' the bus driver 'touched or did not touch' an old BMW which was parked there. Suddenly there were two witnesses and the owner screaming for money. The police found the driver guilty because he changed his statement. That evening we had dinner in the hotel. The service was extremely bad and the musicians were irritating. They did not stop playing at your table and in your ear unless they got some money.

Sunday, 13 September 1992

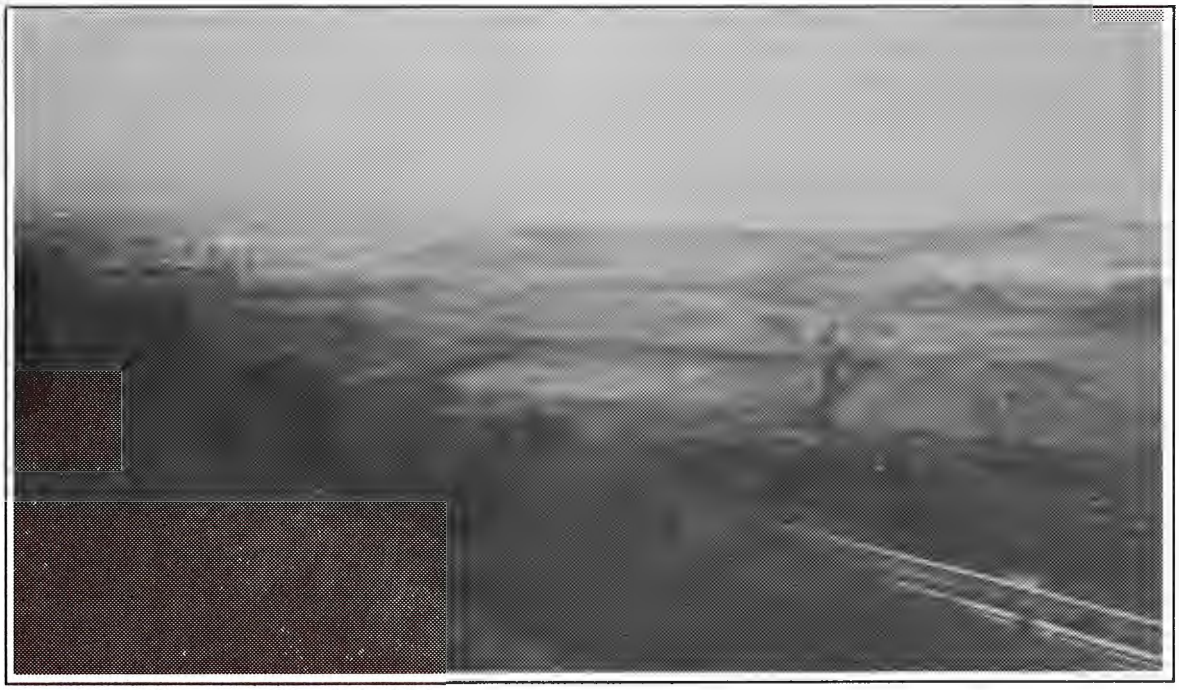
Excursion to the Transdanubian Mountains. Our Guides were Dr. Tibor Cserny and Dr. György Vitális, descendent from the world famous ancestry Vitális (they discovered the coal resources in Hungary). Dr. Vitális, Tibor Cserny's old teacher, knew exactly how to get your attention. In two days he turned out to be a walking encyclopedia and told us the total civil and geological history. When he blew the microphone everybody paid attention.

We first visited the geological museum Tata Kalvariadomb, which has been a limestone quarry since ancient times. The quarry is being preserved by pensioned geologists who also function as guides. The next stop was the bauxite mine in Gánt. This small mine is partly underground and partly open pit. It has been in operation since the beginning of this century, but now it is closed. After a visit to the accompanying mine museum we had a typical regional dish for lunch, which we already had eaten in Slovakia.

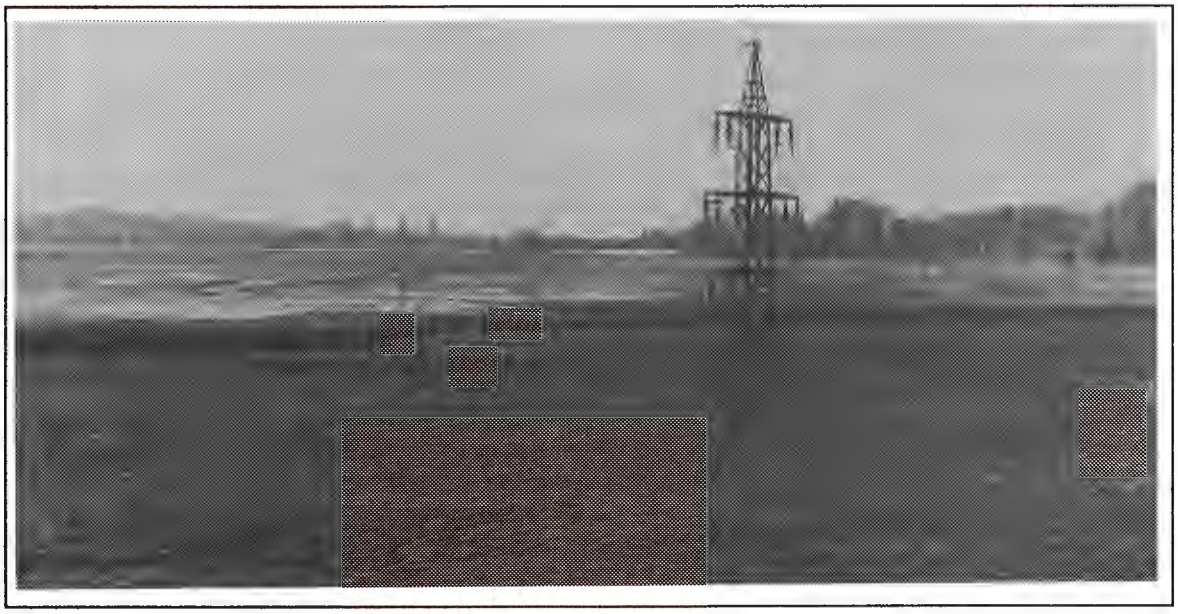
In the afternoon we drove to the beautiful northern part of Lake Balaton. Interesting is to see how the Hungarians clean the bottom of the lake. Before leaving we visited the local historical church from which we had a magnificent view over the lake. On the way back we had to stop to pick up some lost participants, but an old man on a motorcycle had not seen us pull over and a big bang was the result. Grandpa, who had played in the national football team of 1955, had drunk too much and his vehicle did not have any kind of brakes. After arrival of the police and ambulance we could continue our journey to the hotel. Our guide sighed: 'My great grandfather never came in contact with the police, my grandfather never came in contact with the police, my father never came in contact with the police, I never came in contact with the police, up until this week. Two days I guided a dutch group and we had to deal with the police twice."

Monday, 14 September 1992

After breakfast we left for Szendre-Visegrad. We drove along the Danube Band above Budapest to Visegrad. Standing on top of a hill we had a wonderful view over the meandering Danube. This region of Hungary is considered as one of the most beautiful parts of the country. Our Guides Dr. Tibor Cserny and Dr. György Vitális, explained the general geology of the Northern part of Hungary. After this overview we went to a castle a few hundreds meter up the road from where we could see the project of the dam that should have been built on that site. This dam was part of the same project as the Gabcikovo dam. It was cancelled due to strong opposition from the environmentalists in Hungary. We drove back along the same route as we came and stopped in Szentendre. We stayed for an hour in a thermal bath where we combined work and pleasure. The water was pumped up from 400 meters and had a temperature of 37°C, it gave us new energy for the rest of the tour. We returned to Budapest in the early afternoon and had a couple hours off to visit the city. In the evening we had a meeting with mr. Lennarts, office manager



Open pit mine near the city of Most



Not sealed storage for ashes near Ostrava

of IWACO in Budapest. He explained his mission and the policy of IWACO concerning environmental affairs in Hungary.

Tuesday, 15 September 1992
On this day we travelled from Hungary to Poland through the Czecho-Slovakian Tatra Mountains region. We lunched in the village of Banská-Bystrica, in a rather luxurious restaurant where a man molested the piano, in order to make the lunch more enjoyable. At the Polish border we had a two hour delay due to the Polish border posts. They told our driver that we needed a certain document because we wanted to return to Czecho-Slovakia at a different crossing. During a visit at the Czecho-Slovakian consulate it seemed that we did not need this form at all. We arrived two hours later in the city of Krakow where we met with our guide provided by the polish travel agency. Later that night we went for dinner in the old city of Krakow after checking in hotel Europejski (no Michelin stars for this hotel).

Wednesday, 16 September 1992
Our guides in Poland were Marek Niemec and Jacek Rózkowski from the department of Karst Geomorphology of the Silesian University in Sosnowiec. In the Katowice region three main mining activities take place. They mine at different levels for sand and gravel (up to 40 m), zinc and lead ores (200 m) and lignite (800 - 1000 m).

We left for the excursion at 7.00 a.m., because we had to be in time at a lead and zinc mine in the Upper Silesian Highland. We visited the mine Trzebionka for two and a half hours. Buying our lunch took us thirteen minutes at two shops. Our next stop was a sand pit. Here our hosts gave us a short introduction to the geology of the area, the function of the sand pit at Maczki-bar and the influence of this pit on the environment. The sand is used for backfilling in mines under cities in order to keep the damage due to subsidence limited. While driving through the country the indications of subsidence are visible everywhere. The profile of the landscape, which used to be relatively flat, turned into a hilly landscape with inclined standing houses.
We visited the university in the afternoon where we went up the roof of the building. From this high point (100 meter) we had a very impressive view over the area around Sosnowiec. On all sides you could see chimneys of factories, mines and power plants. Our guides gave us an overview of the serious damage done to the environment in the area of Upper Silesia. The laboratory of the University was very well equipped with modern analytical apparatus. We had dinner in the city of Katowice where we also checked in at our new hotel, hotel Slaski (no Michelin stars for this hotel either).

Thursday, 17 September 1992
The polish travel agency arranged an obnoxious person for us, which turned out to be our guide. We fired this person for the rest of our stay in Poland. After this good beginning of the day we visited an old and a new desalting plant where mine-water is treated.

Our next destination was a museum where we had a tour of an hour through an old lead and zinc mine. It was rather embarrassing for the museum guide to realize that he was the one that could learn from us. Finally time for lunch. The next stop was in the middle of nowhere where we met an hydrogeologist waiting for us in the field. From here we could see local subsidence due to mining reaching up to 24 metres. The embankments of the rail indicated the huge differential settlements. Driving through the province of Katowice gave us a depressive impression of the environmental conditions in this part of Poland. We imagined ourselves a century

back in time when we saw a long line of horse and carriages waiting by the Zabrze coal mine. The transport by railway has become so expensive that transport by trucks and horse and carriage is cheaper. According to our guides this is the most, or at least one of the most polluted areas in the world and the pollution is still going strong.

That night we had dinner in Katowice, a city in which the people and the city itself are marked by the toll they have to pay due to the environmental impact of the heavy industry.

Friday, 18 September 1992

In the morning we travelled to the city of Ostrava. Crossing the border between Czecho-Slovakia and Poland took us again a lot of time. Before reaching the city itself, we already passed through an area with abundant industrial activities. ' Nice' for us to take pictures but very bad for the environment. We checked in at our hotel in Ostrava, the Imperial hotel with mining signs all over the building. Glück Auf! Here we met our contact Stanislav Novosad from Novosad IG/EG-consulting and Jeng Smeets, first secretary for Environmental affairs of the Royal Netherlands Embassy in Prague. Mr. Smeets revealed us plans from the Dutch government, EEC, and the Worldbank for cleaning up the environment in Central and Eastern-Europe. He also gave information about the privatisation process and environmental legislation that will be constituted.

The first stop was in Karvina, where problems occurred due to mining subsidence. An old landslide was triggered due to the effects of underground mining. During the journey we saw more effects of mining such as a church that was destroyed due to differential subsidence. The tower had to be removed for preventing it from toppling. We also stopped at an artificial lake, which was filled with a black substance from a nearby factory. Some pictures were shown of a village that had to be abandoned because the village was drowned due to the fact that an artificial lake was produced due to the great subsidence of the village. Lunch was served at the hotel.

A landslide that was reactivated due to filling of a reservoir behind the Sance Dam was our next goal. This landslide situated near Frydek Mistek is carefully monitored for 22 years by mr. Novosad himself. There is a nice correlation between precipitation and movement of the landslide. Dinner was arranged for in Ostrava. Unfortunately this town did not have any nightlife at all.

Saturday, 19 September 1992

In the morning we drove to Slezska Harta where a site of a dam under construction was visited. This dam will provide the Ostrava Region of drinking water. At this site the construction procedure of the dam could perfectly be seen. The construction of the dam was halfway. The heart of the dam was visible and the construction materials could be seen and touched. This project had to be temporarily stopped because of a lack of financial means. Following we drove back to Prague where we dined in the old city and had an abundant and festive meal to finish the successful tour.

Sunday, 20 September 1992

After a late breakfast we drove into the heart of Prague for a cup of coffee at the beautiful and famous marketplace in the centre of the city. Thereafter our driver Roman took us to the airport of Prague. Remarkable detail: 500 m. from the airport our bus ran out of petrol and the driver had to hike to a gas station to get fuel for the bus to take us to the airport. That afternoon all members of the trip arrived safely with flight KL 280 at the airport of Schiphol, the Netherlands. A successful study-tour was finished.

A Proposal for EUROCK '94

ROCK MECHANICS IN PETROLEUM ENGINEERING

A JOINT ISRM - SPE SYMPOSIUM

29 August - 1 September 1994
Delft, The Netherlands

I.S.R.M., National Group of The Netherlands
S.P.E.- Society of Petroleum Engineers
Delft University of Technology

OBJECTIVE

The main objective of this EUROCK symposium is to bring together rock mechanics researchers and engineers from the petroleum industry with those from the fields of mining and engineering geology. Recent advances in theoretical and experimental rock mechanics will be presented and applications to solve petroleum engineering problems will be shown. A second objective is the stimulation of promising emerging technologies.

THEMES

I. ROCK MASS CHARACTERISATION

Acquisition, representation and interpretation of geological, rock mechanical, geophysical and geometrical data. In-situ stress/strength measurements, down-hole probes and acoustic emission. Formulation of constitutive behaviour. Micro mechanics, damage mechanics. Laboratory techniques; core measurements, fracture monitoring.

II. EXCAVATION AND PRODUCTION

Interaction of drilling/excavation tools and rock, bit design and selection. Drilling of deep boreholes/mine shafts. Stability of boreholes/barefoot completions/unsupported excavations; chemical, poro-elastic, temperature and time effects. Rock mechanics aspects of HP/HT drilling. Sandfailure prediction.

III. FRACTURE MECHANICS

Hydraulic and explosive fracturing; field studies, lab testing and modelling; acoustic imaging; data fracs; hydraulic impedance measurements. Proppant backproduction. High excess pressures. Frac and pack. Waterflood induced fracturing.

IV. ROCK MASS RESPONSE TO HYDROCARBON PRODUCTION
Compaction and subsidence, casing damage; induced seismicity including source mechanisms, seismoacoustic monitoring, case studies. Poro-elasticity. Natural fractures. Overpressure prediction. Thermal effects. Time effects.

V. STORAGE, WASTE DISPOSAL AND ENVIRONMENTAL APPLICATIONS
Storage of oil, gas and LNG in underground cavities or depleted reservoirs. Disposal by injection of produced water, waste water and drilling cuttings. Sealing by salt and caprock. Subsidence induced by (solution-)mining.

PLACE AND DATE

The Symposium shall take place at the Delft University of Technology,
Delft, The Netherlands, 29 August - 1 September 1994.

PROVISIONAL PROGRAMME

Date	Morning	Afternoon	Evening
Mon 29 Aug	Opening/ Technical Session	Technical Session	Reception by Delft Municipality
Tue 30 Aug	Technical Session	Technical Session	Social evening
Wed 31 Aug	Technical Session	Final lectures, Closing Ceremony	Symposium Banquet
Thu 1 Sep	Post Symposium Tours		

OFFICIAL LANGUAGES

English, French and German are the official languages of the Symposium. Papers have to be written in English. The papers may be presented in any of the three languages (English preferred), simultaneous translation from French and German into English will be provided.

REGISTRATION FEES

Participants	ECU 420 - ECU 450
Students	ECU 210
Accomp. persons	ECU 190

Registration fees for participants include the access to the sessions, one set of the Proceedings and attendance at social events. For students, the Symposium banquet is not included. A special program for accompanying persons will be organized.

TECHNICAL EXHIBITION

Indoor and outdoor space is available for exhibition of equipment and documentation.

INFORMATION

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ENGINEERING GEOLOGICAL HIGHLIGHTS
The Roermond Earthquake

This section of the IngeoKring Nieuwsbrief is devoted to developments in the Netherlands that can have which have significance for engineering geologists. Avid readers may have seen from time to time in the national newspapers that engineering geologists have hit the press; Eastern Europe environmental fact finding tours, underground space development and belatedly, but still newsworthy the Roermond Earthquake of 13th April 1992. De Telegraaf of 30th January, 1993 in their ***Wetenschap Sectie*** *reported on the recently held conference held at Veldhoven organised by the KNMI on the earthquake. "TU Delft" gets a special mention as one of the institutes carrying out research as a result of the earthquake. That's us! Hence it is worth giving some background information.*

Five years prior to 1992:

In 1987 Joris Lap, an engineering geology student in Delft produced a thesis entitled "Earthquake-induced liquefaction potential in the area south of Eindhoven, The Netherlands", Memoir No. 47. Earthquakes are of interest to the engineering geology section prior to the Roermond earthquake. Much of Joris's work was carried out on the guidance of Dr. Colin Davenport, who has been a visiting academic from time to time to our department. Colin specialises in a science not well known to most people though he has given presentations on behalf of the Ingeo-Kring on Palaeoseismology. Prior to recording of earthquakes by people of which since the year 1000 reasonably reliable data can be deduced from historical records one becomes increasingly more dependent on looking at geological features to determine older earthquakes that have left their signatures in the form of disturbed strata which in turn can be dated using palaeontological techniques.

The Peel Rand Fault is active and it was hoped to find such records in exposures along the fault. Firtly areas susceptible to earthquake disturbance were defined by Joris Lap; areas which had fine sandy deposits which could liquify as a result of earthquake disturbance. The Roermond Earthquake afforded a good opportunity to verify the predictions set out in Joris's thesis. It appears at first glance that such areas were correctly defined within an area of 20 to 40km radius of the epicentre.

Monday 03:30 hours April 13th, 1992

Most of the staff of the TU Delft engineering geology section were away on fieldwork in Spain when the event that shook the Netherlands happened. I had been away in the Far East and was to embark on an first years student's geological excursion early Monday morning to Belgium and Germany. Having to catch an early bus from Mijnbouwstraat meant being in Delft at 7:00 a.m. and getting up even earlier that morning. So one sleeps light to avoid sleeping through an alarm clock. At about 3:30 a.m. I awoke feeling the bed shake. This was in the fourth floor bedroom of my house in the Hague. The house is along a busy road. I assumed it was a heavily loaded truck that must have passed by except that I did not hear anything; it was very quiet outside. I got up went to the bathroom, returned to my bed looked at my watch to see how much time I still had available for further sleep: about two hours. I assumed the shaking must have been as the result of a restless sleep in anticipation of having to get up early.

I arrived at 06:45 a.m. at the car park of Mijnbouwstraat 120 and met thereWillem Nieuwenhuijs a colleague from petroleum geology who said "have you heard on the 6:00 a.m. news?" "No". "There has been an

earthquake in Roermond, about 6 on the Richter scale". "Don't tell" I said, "it must have been 3:30 or there abouts". So it wasn't a restless sleep after all.

1992 was a bad year to add research into earthquakes to an already over-commited schedule. A short visit with Jan Nieuwenhuis and staff and students from Physical Geography, Utrecht was all I could manage a month later to look at damage and special geological features such as the sand eruptions at Herkenbosch and a failed slope, probably due to liquefaction at Brunssum. David Price had managed to visited Roermond and Herkenbosch two weeks after the earthquake with Collin Davenport who flew over from the Norwich.

TU Delft

Faculteit der Mijnbouw en Petroleumwinning

ONDERZOEK NAAR HET ONTSTAAN VAN 'DRIJFZAND'
DE AARDBEVING, Door de TU Delft.

Door een aantal medewerkers van de Technische Universiteit Delft, Faculteit Mijnbouwkunde en Petroleumwinning, sectie Ingenieursgeologie, zal in de week 19 t/m 23 oktober onderzoek worden verricht in de omgeving van de dorpskern Herkenbosch.
Getracht wordt een relatie te vinden tussen ontstane schade en de aanwezigheid van bepaalde bodemlagen welke zich door aardbevingstrillingen als een vloeistof gaan gedragen.
Aanwijzingen hiertoe zijn restanten van zogenaamde zandfontijnen. Als onderdeel van het onderzoek zal bij de bewoners van de dorpskern Herkenbosch een vragenlijst worden rondgebracht.
In het belang van het onderzoek vragen wij U Uw medewerking te verlenen door genoemde lijst in te vullen. Aan het einde van de week wordt de lijst weer opgehaald.
Alvast onze dank voor Uw medewerking.

Onderzoekscoördinator: Prof D.G. Price

Figure 1:Add in local newspaper

Reactions from the KNMI and the mobile seismographic units property of the KNMI/Seismology section of the Instituut van Aardwetenschappen headed by Torild van Eck were much faster to react. That same morning they were already installing at strategic locations seismographs to record the aftershocks; they eventually will provided significant information on the Peel Rand Fault and the deep geology of which very little is known, as yet, in The Netherlands.

When it appeared that the hub-bub had died down after setting up of a "Rampen-fonds" disaster-fund the unease of in-action from the part of our section built up so that David Price and I payed a visit to the KNMI to discuss what possible research roles we could play as a result of earlier work and the Roermond earthquake. Surprisingly, we discovered, very little initiatives have been taken elsewhere. The physical geographers from the RUU had looked again at the sand boils in the sugar beet fields Herkenbosch and the slope at Brunssum.
At the faculty profits from special consultancy projects by staff are deposited in a Wetenschap Fonds which is used to finance conference visits or research for which little time is available to locate a donor. Despite the huge amount of damage caused by the earthquake (*f*150 million) the government in their economic wisdom sees little sense in providing a small tiny fraction for research into the damage caused by the earthquake. But then education, research and industry seems to have been a low priority on their political check list except when comes to cutting back funding.

This is no excuse, though, not to carry out research and by autumn time was found to spend a week with students and staff in Roermond to investigate some aspects of the Roermond earthquake. Torild van Eck and Hein Haak were organising a conference to be held at in January, 1993 so that added some urgency to carryout sufficient work to contribute positively in the conference.

Three themes were chosen to investigate

1. Sand eruptions
2. Brunssum failed slope
3. Damage in Herkenbosch.

These were determined after a preliminary visit to the municipality of Herkenbosch (housed temporaritly in a hotel in Meelick not, as many people believed, because the town hall was damaged in Herkenbosch, but because a new building was under construction). Further visits were made to the farm Beatrix Hoeve of Mr. C. Wolfhagen, who typically resembles the local squire for Herkenbosch, to seek permission to examine the sand eruptions located on his land and to the forestry comission officers at Brunssumerheide reserve to again seek permission to examine the failed slope.

Two weeks later we returned with a contingent of volunteers after making frenzied preparations which included preparing a questionnaire to be distributed amongst the households of Herkenbosch and advertising the campaign (figure 1) in the local newspaper "Ons Blad". To mail the questionnaire took one afternoon with engineering geology students, one lecturer and one geology graduate actings as mail - men/ -women. The questionnaires were then retrieved the following Thursday, the time took much longer as many people, especially the more elderly had difficulty answering them. Even the local gypsies provided two forms (after braving their ankle nipping mongrels). As they could neither read or write the whole procedure resembled some sort of marketing excercise.

In the meantime further students and staff were investigating the sand boils (by auger holes) and surveying the landslip in Brunssum both to obtained profiles of the landslip surface and by trenching, augerhole and hand operated cone penetration test to obtain information about the soil profile.

Three weeks later Colin Davenport and I together with two student helpers (Bernise Baardman and Albert Bloem) investigated the sand boils further by excavating trenches made by back-hoe in the now harvested sugar beet fields. From this work the sand vents could be traced through three metres thick slightly clayey silt (loamy soil) overlying the sand source layer. Colin produced a block "cartoon" diagram showing how these vents appeared. The firm that provided the excavator did an excellent job (recommended by Mr. Wolfhagen) who has had experience of excavating trial trenches for archaeologists working in this area.

In Delft the completed questionnaires were being transfered to a data base by our secretary Heleen van IJssel and by the voluntary services of Hans Grabandt. ITC loaned their GIS programme ILWIS to enable further digitization of the houses in Herkenbosch into Amersfoort coordinates. Preliminary damage distribution maps were then produced and a digitized version of the RGD's 1933 geology map of the area. This allowed a first comparison with damage and the geological setting of Herkenbosch in time for a poster presentation at the Roermond Earthquake conference held last January at the Koningshof, Veldhoven. Two more impressive posters were also made of the landslip in Brunssum and the sand eruptions of Herkenbosch. Had we first concentrated on finding external funding for this work we probably would not yet have started this work.Besides engineering geology at TU Delft the only other engineering geology/ geotechnical investigation carried out for the earthquake is that of the physical geographers from RUU and Grondmechanica Delft who carried out an investigation commissioned by Roermond Municipality to look at possible damage to foundations of houses in Maasniel.

The actual conference was a unique assembly of deep geologists, shallow applied geologists, seismologists and geotechnical engineers as well as people from the insurance industry who were particularly interested in work being carried out on damage surveys and possible susceptibility of ground liquifaction. Though the recurrence of Roermond magnitude

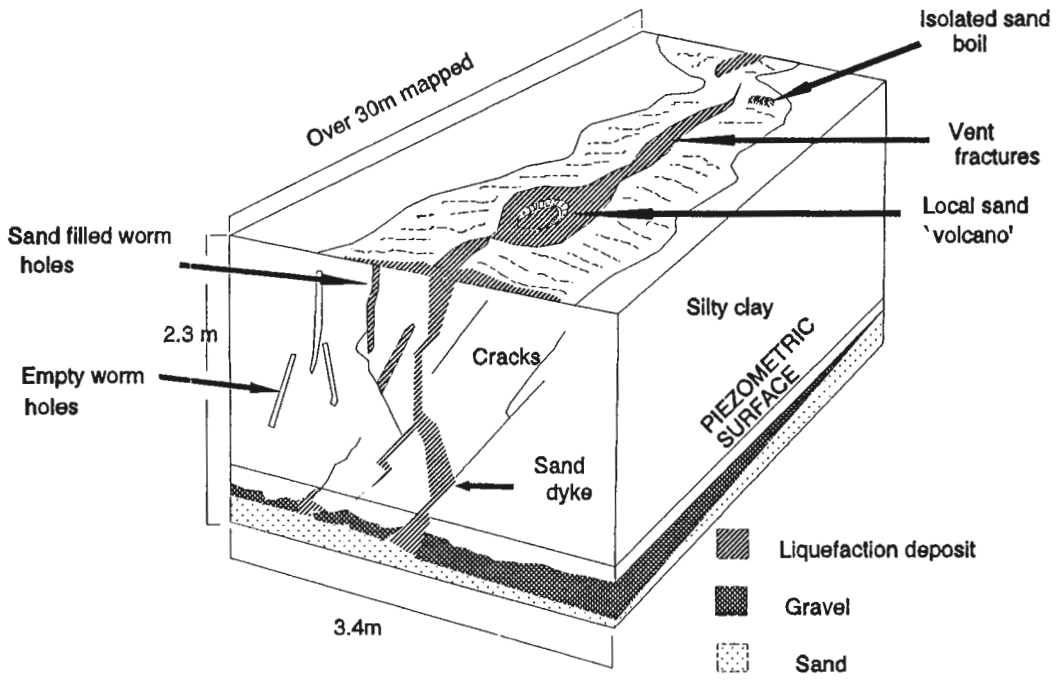

Figure 2: Sand boils

earthquakes are low for the Netherlands (130 years approximately) as was stated at the conference geology knows no borders and presumably insurance companies do not restrict their operations within one country especially with regard to the EEC open border commitments.

At the conference special workshop meetings were held; one to set up a information system to record all information that has bearing on the Roermond Earthquake and another to set up a geotechnical committee to ensure research is carried out, as far as possible, in cooperation with countries which have been effected by the earthquake. Though felt as far as the UK, France, Switzerland and Czech Republic damage occurred mostly in Germany, the Netherlands and Belgium. In the Bohemia some unique damage occurred in which radon gas appeared to have been released from the granites into mineral waters in conjunction with carbon dioxide release from volcanic waters (Bad Brambach). This release both preceded and followed the earthquake.

Both damage and phenomena resulting from earthquakes should be researched whilst memories and evidence remain fresh. At TU Delft Engineering Geology the intention is to continue with research on the earthquake, possibly for a number of years. At present preliminary work is expected to be concluded by May this year so that this can be published in a special edition of Geologie en Mijnbouw early next year, containing most of the conference presentations, discussions and developments since the conference up to the time of the submission date. The great interest shown by the numerous and varied participants at the conference should ensure that the special edition will be a worthwhile purchase and reading for those concerned with the earth and building sciences and earthquakes. For the longer term there is a huge amount of data that still requires attention to ensure the earthquake will be the best documented to date if, as Prof. David Price said at the conference: our children's children will have a proper account of what happened back in 1992 when we are not around or our memory has faded.

INGEOKRING JAARVERGADERING 1993

De jaarvergadering van de Ingenieurs-Geologische Kring zal gehouden worden op vrijdag5 maart, bij Fugro-McClelland, Veurse Achterweg 10 Leidschendam. Aanvang: 14.00 uur.
Het wetenschappelijk gedeelte van deze bijeenkomst zal verzorgd worden door sprekers van Ballast-Nedam en Fugro-McClelland.
Het thema zal zijn:

GEOTECHNISCH ONDERZOEK VOOR HET GROTE BELT TRACE, DENEMARKEN (Westbrug, Oostbrug en tunnel).

Sinds enkele jaren wordt er intensief grondonderzoek verricht langs het tracé van de vaste oeververbinding over en onder de Grote Belt. De bouw van de oeververbindingen bevindt zich op dit moment in een vergevorderd stadium van uitvoering. Ook tijdens de bouw vindt er geotechnisch onderzoek plaats. De glaciale afzettingen in dit gebied hebben het nodig gemaakt speciale onderzoekstechnieken te ontwikkelen.

Voorafgaand aan de jaarvergadering zullen enkele sprekers de geotechnische problemen en oplossingen van dit project belichten.

Het programma zal er als volgt uitzien:

14.00 uur	Ontvangst
14.15 uur	Lezing J. Hartevelt - "Geologie van de Grote Belt en resultaten van het geofysisch onderzoek"
15.00 uur	Lezing J. ten Hope - "Geotechnische onderzoekstechnieken"
15.45 uur	Lezing D.W. Bilderbeek/J. Visser - Toepassing resultaten grondonderzoek in het ontwerp.
16.30 uur	Jaarvergadering (de agenda zal voor de vergadering worden uitgereikt).

Het jaarverslag van de secretaris is reeds gepubliceerd in de Ingeokring Nieuwsbrief. Het jaarverslag van de penningmeester zal ter vergadering worden uitgereikt en toegelicht.
De secretaris, J.J.A. Hartevelt en gewoon lid bestuur P.M. Maurenbrecher hebben twee zittingsperioden van drie jaar achter de rug en treden reglementair uit het bestuur. Het bestuur draagt de heer S.J. Plasman (Fugro McClelland) en J.R. Deketh (TUD) voor als nieuwe bestuursleden. Tegenkandidaten kunnen tot drie weken vóór de jaarvergadering, schriftelijk en ondertekend door vijf stemgerechtigde leden, ingediend worden bij de secretaris.
Na afloop van de jaarvergadering zal u door onze gastheer Fugro-McClelland een borrel worden aangeboden.

J.J.A.Hartevelt
secretaris.

INGENIEURSGEOLOGISCHE KRING - JAARVERSLAG 1992

In 1992 vonden de volgende activiteiten plaats:

27 februari Jaarvergadering:
Het wetenschappelijk gedeelte, voorafgaande aan de jaarvergadering, werd verzorgd in samenwerking met de Rijks Geologische Dienst en Grondmechanica Delft en vond plaats bij Grondmechanica Delft. Het thema betrof de geotechnische aspecten van de Westerscheldetunnel. Lezingen werden gehouden door Ing. F.D. Lang (RGD): " Geologisch onderzoek vaste oeververbinding Westerschelde" en door Ir. R.O. Petschl (GD): "Grondmechanisch onderzoek vaste oeververbinding Westerschelde".
De bijeenkomst werd bijgewoond door 25 belangstellenden.

20 november:
Studiemiddag/avond in het kader van International Decade for Disaster Reduction (1990-2000)-IDNDR. Sprekers en onderwerpen waren:
J.D. Nieuwenhuis (GD en RUU): Inleiding.
J.T. van Eck (RUU): Geofysica van ondiepe aardbevingen.
D.G. Price (TUD): Geotechnische effecten van aardbevingen.
T.W.J. van Asch (RUU): Temporele analyse van aardverschuivingen.
C.J.van Westen (ITC): Gebruik van Geo-Informatie Systemen bij gevarenkartering.
H.J. Ogink (Waterloopkundig Laboratorium): Overstromingen in riviergebieden.
De studiebijeenkomst werd gehouden bij de Vakgroep Fysische Geografie van de Rijksuniversiteit Utrecht en werd bijgewoond door 46 belangstellenden.

Het bestuur van de kring kwam gedurende 1992 vijf maal bijeen. De voorzitter, de heer Rengers, werd in 1992 herkozen voor een tweede ambtstermijn van drie jaar. De heer Bloem volgde eind 1992 de heer Ammerlaan op als vertegenwoordiger van het DIG. Verder behield het bestuur zijn oude samenstelling:

Dr. N.Rengers	- Voorzitter
Dr. J.J.A. Hartevelt	- Secretaris
Ir. A.A.M. Venmans	- Penningmeester
P.M. Maurenbrecher MSc. CEng.	
Drs. F. Schokking	
Ir. J.P.A. Roest	- Vertegenwoordiger I.S.R.M.
P.J.M. Ammerlaan	- Vertegenwoordiger DIG (tot 20/11)
A. Bloem	- Vertegenwoordiger DIG (v/a 20/11)

Het ledental van de kring steeg gedurende 1992 van 212 naar 213. Het aantal IAEG-leden binnen de kring deelde van 95 naar 91 en die van de ISRM bleef 29. Het aantal studentenleden gaf dit jaar een daling te zien van 56 naar 50 leden.
De Ingeo-kring Nieuwsbrief is gedurende 1992 twee maal verschenen en wel in april (dubbele editie) en in augustus.

CONFERENCES, SEMINARS AND SYMPOSIA

1993

Liquefaction and flow failure during earthquakes
March 24
London, United Kingdom.
Topics: Mechanisms causing liquefaction, factors influencing the susceptibility of ground to earthquakes, prediction of the onset of liquefaction and flow slides, consequences of liquefaction.
Info: Secretary British Geotechnical Society at the Institution of Civil Engineers (071-222 7722)

EUG VI, Biennial Meeting.
April 4-8
Strasbourg, France
Topics: The largest regular geoscience meeting in Europe. It provides an interdisciplinary scientific forum for a wideranging variety of modern earth science topics of generalised and specialised nature.
Info: Geological Survey of The Netherlands, P.O. Box 157, 2000 AD Haarlem, The Netherlands, Fax. 31-23-351614.

19th General Assembly of the ITA
April 18-22
Amsterdam, The Netherlands
Topics: Soft ground tunnelling (cut-and-cover methods, underground methods, immersed tunnels, and comparative case studies); Rock tunnels (conventionally driven, mechnaically driven and comparative case studies); Submerged floating tunnels; General topics (cost optimsation of the total tunnel project, private financing of tunnels, research).
Info: Congress Office KIvI, P.O. Box 30424, 2540 GK The Hague, The Netherlands. Tel. 070-3919890. Fax 070-3919840.

Geotechnica 1993
May 5-8
Köln, Germany
Topics: International Trade Fair and Congress for the Geoscience and Geotechnology.
Info: F. van Dam, Dutch-German Chamber of Trade, P.O.Box 80533, 2508 GM The Hague, tel. 070-3614251, fax. 070-3632218.

Second Tunesian Meeting on Applied Geology
May 17-19
Sfax, Tunesia
Topics: Applied researches on works in urban areas, water and environment reseach, energetic and mine materials, geological tools and cases in environment and management fields.
Info: Department of Geology, Ecole Nationale d'Ingénieurs de Sfax, P.O.Box W-3038 Sfax, Tunesia.
(See also Nieuwsbrief Summeredition 1992)

Third International Conference on Case Histories in Geotechnical Engineering
June 1-6
St. Louis, Missouri, U.S.A.
Info: Shamsher Prakash, Conference Chairman, Dep. of Civil Engineering, University of Missouri-Rolla, MO 65401-0249, U.S.A.

EUROCK '93, 2nd International Workshop (Scale Effects in Rock Masses)
June 21-24
Lisboa, Portugal
Topics: Modelling in Safety Evaluation, Influence of the Environment in Rock Engineering, Stability of large underground structures, Contribution of Failures and Incidents to the Progress of Rock Engineering.
Info: A. Pinto da Cunha, International Workshop on Scale Effects, c/o LNEC, Av. de Brasil 101, P-1799, Lisboa Codex, Portugal. Tel (351) 1 8482131, Fax (531) 1 897660, Telex. 16760 LNEC P.

International Conference on Geoscience in Urban Development (Landplan IV)
August 11-15
Beijing, China
Topics: The main objective of the proposed International Conference is to offer an oppurtunity to meet geoscientists, engineering geologists, geotechnical and civil engineers working in the field of urbanization with focusing on the integrated consideration of geo-hazards, geo-environment and geotechnical conditions for urban planning and development.
Info: Prof. Wang Sijing, Chairman LANDPLAN IV, institute of Geology, academia Sinica, P.O. Box 634, Beijing, China 100029. Tel. 86-1-2027729. Fax. 86-1-4919140. Telex. 22474 ASCHI CN c/o Institute of Geology. (See also Nieuwsbrief Summeredition 1992)

International Symposium on Hard soils-Soft Rocks
September 20-24
Athens, Greece
Topics: Geological features; Mechanical properties and behaviour; Foundation, excavations and retaining structures; Slope stability and protection; Fills and embankments; Tunnelling and underground openings.
Info: Dr. N. Kalteziotis, HS-SR Symposium, P.O. Box 20034 GR, 11810 Athens, Greece.

ADVIESBUREAU VOOR GEOFYSICA EN GEOLOGIE
DR. D.T.BIEWINGA

Het Adviesbureau voor Geofysica en Geologie is een onafhankelijk adviesbureau en biedt een compleet pakket geofysische methoden voor diverse onderzoeken; ook adviseren wij bij koop en huur van instrumenten en software.

MILIEU	- opsporing metalen vaten en assenwegen - monitoring van de conductiviteit rond een afvalstortplaats en locatie van de vuiltong
CIVIELE PROJECTEN	- bodemonderzoek bouwlocaties en landslides
GEOL. ONDERZOEK	- voor zand-, grind- en waterwinning
ARCHEOLOGIE	- veldwerk met diverse methoden
BOORGATMETINGEN	- conductiviteit- en gammalogging in gaten met PVC casing
GRONDRADAR	- locatie grondwaterspiegel, enz.
INSTRUMENTEN EN SOFTWARE	- verhuur Geonics EM31, EM34 en EM38 - vertegenwoordiger ABEM en GEONICS.

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