

PERSATUAN GEOLOGI MALAYSIA

WARTA GEOLOGI

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The Society was founded in 1967 with the aim of promoting the advancement of earth sciences particularly in Malaysia and the Southeast Asian region.

The Society has a membership of about 600 earth scientists interested in Malaysia and other Southeast Asian regions. The membership is worldwide in distribution.

Assessing the adsorption capability of a clay soil

TAN BOON KONG
Jabatan Geologi,
Universiti Kebangsaan Malaysia

Abstract. This short note discusses two laboratory methods commonly used for assessing the adsorption capability of a clay soil, namely: the batch equilibrium method, and the leaching column test. The discussions are illustrated with example results obtained from a recent study in Canada.

INTRODUCTION

The sanitary landfill method is the method used world-wide for the proper disposal and management of solid wastes (both municipal solid wastes and toxic wastes). A key component in the sanitary landfill is the underlying clay liner which acts both as a physical barrier to impede or retard leachate migration, as well as a medium for the adsorption or retention of chemical or microbial pollutants, see Figure 1, Yong (1992). The suitability of a candidate clay soil that is to be considered for use as a clay liner depends on, among other factors, the adsorption capability of the soil.

This short note introduces and discusses, mainly for the benefit of Malaysian geologists and engineers, two laboratory methods commonly used for assessing the adsorption capability of a clay soil. The discussions are illustrated with an actual example study carried out recently in Canada, Yong *et al.* (1991).

The Batch Equilibrium Method

The batch method involves shaking a sample of the clay soil in a solution of pre-determined chemical composition, and measuring the amount of pollutants (for e.g. heavy metals, etc.) adsorbed by the soil. Either the natural landfill leachate solution, or an "artificial" or re-constituted solution can be used. A series of chemical solutions with increasing pollutant concentrations can also

be prepared and tested with the soil sample. Thus, an idea of the adsorption capability of the soil with respect to each pollutant species can be obtained. Details of the laboratory procedures are contained in ASTM (1984).

Figure 2 shows an example result of the batch equilibrium test. Among other things, the result shows that:

- i) increasing retention of Pb^{2+} , Zn^{2+} or $(Pb^{2+} + Zn^{2+})$ occurs with increasing initial cation concentration,
- ii) competition for the adsorption sites occurs when composite (multi-cation) solutions are used,
- iii) the maximum amount of heavy metals retained can exceed the cation exchange capacity of the soil, implying that other processes are involved in the retention of heavy metals besides cation exchange.

The Leaching Column Test

The leaching column test involves compacting the soil sample into a leaching cell, and allowing leachate or a chemical solution to flow through the soil column, Figure 3. The migration of the chemical species through the soil column is then monitored. Various results pertaining to the retention capability of the soil with respect to various ionic species can then be derived. In addition, the compatibility or otherwise of the particular soil with the

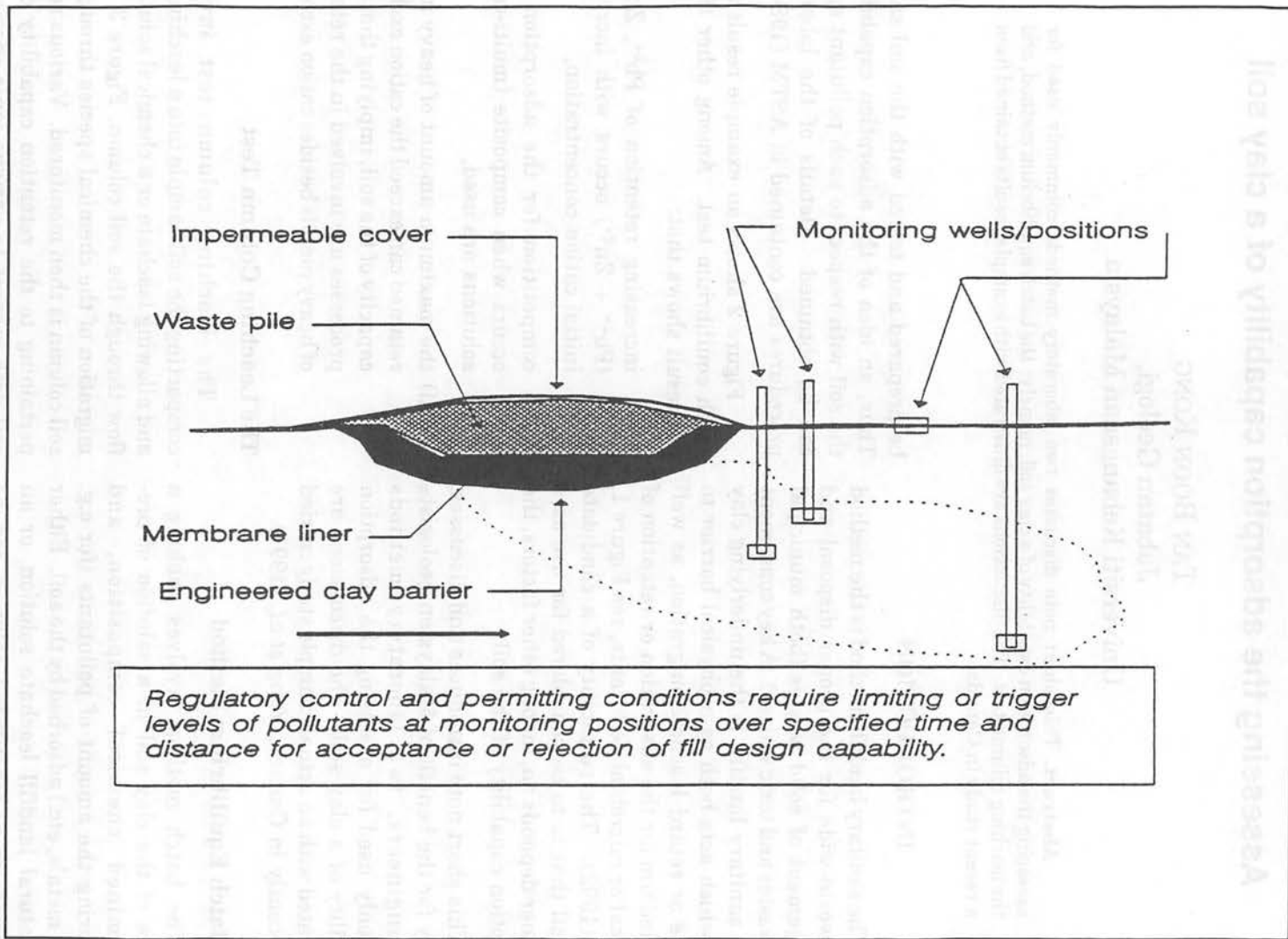


Figure 1. Elements of landfilling waste disposal and assessment points required for regulatory control and permitting. Trigger levels at various points and time to be set by regulatory and permitting bodies.

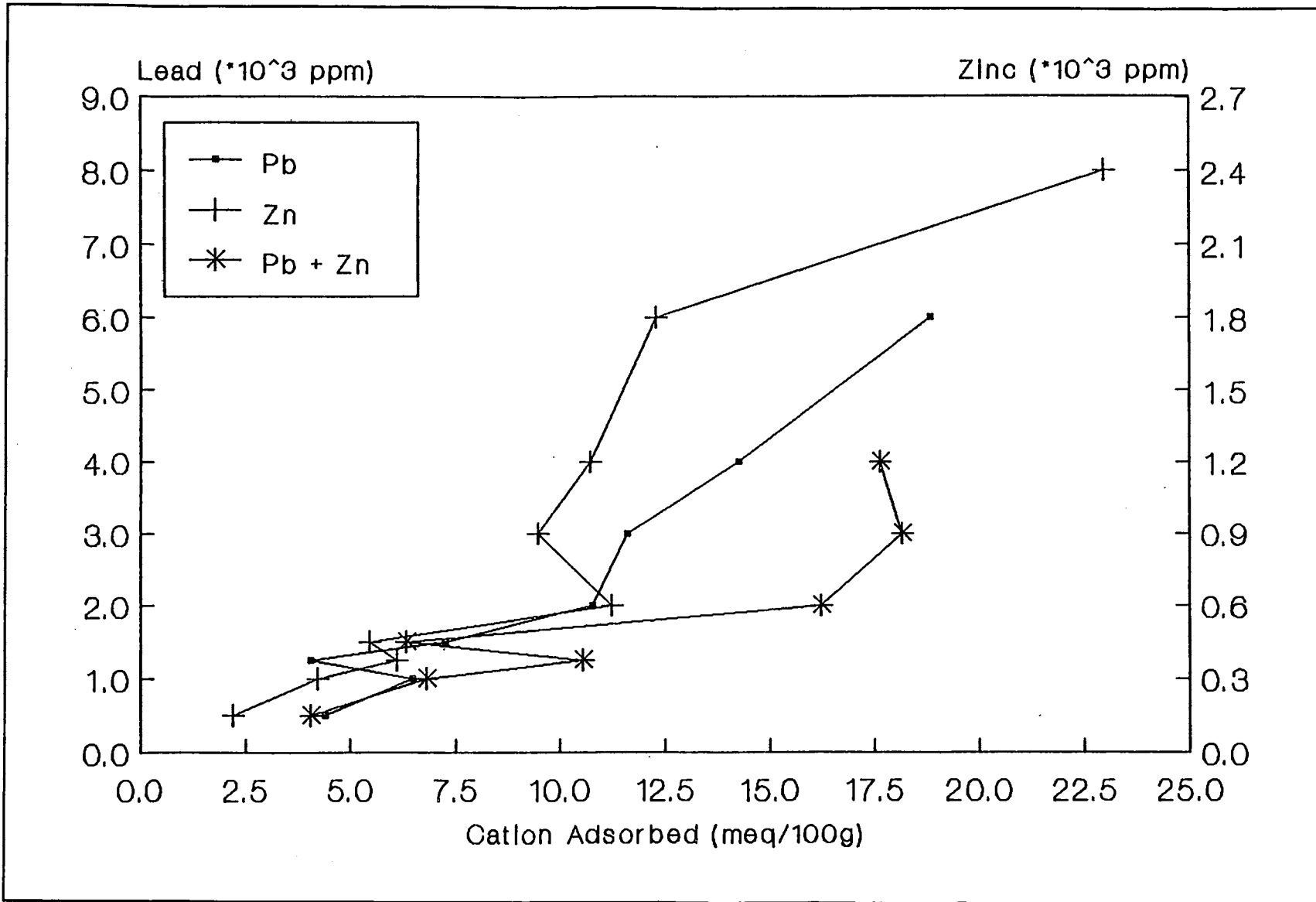


Figure 2. Heavy Metal Retention (Soil # CF1; CEC = 18.59 meq/100 g)

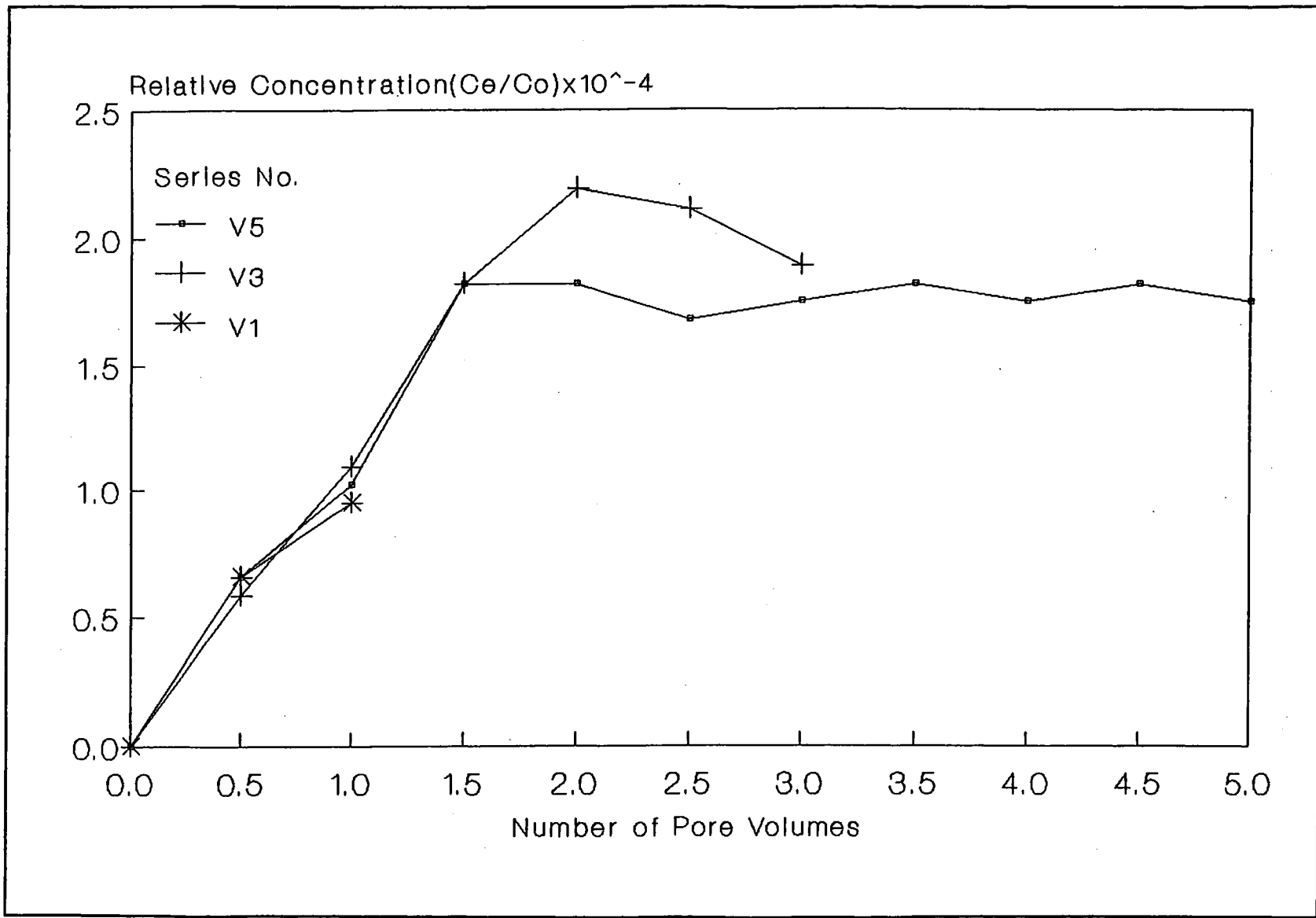


Figure 4. Breakthrough curve; sample V (Natural Soil) - Pb

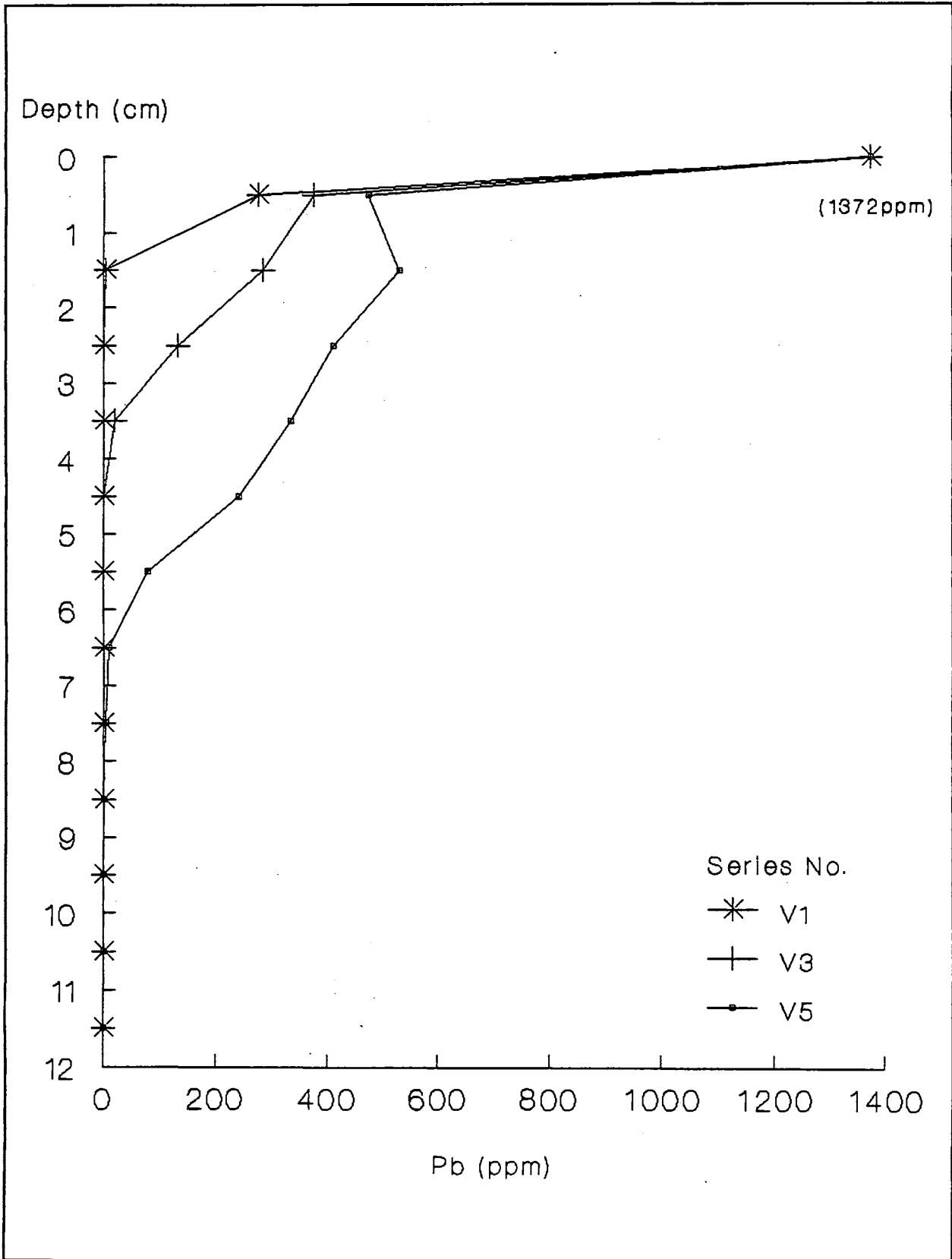


Figure 5. Migration profile; sample V (natural soil) – Pb

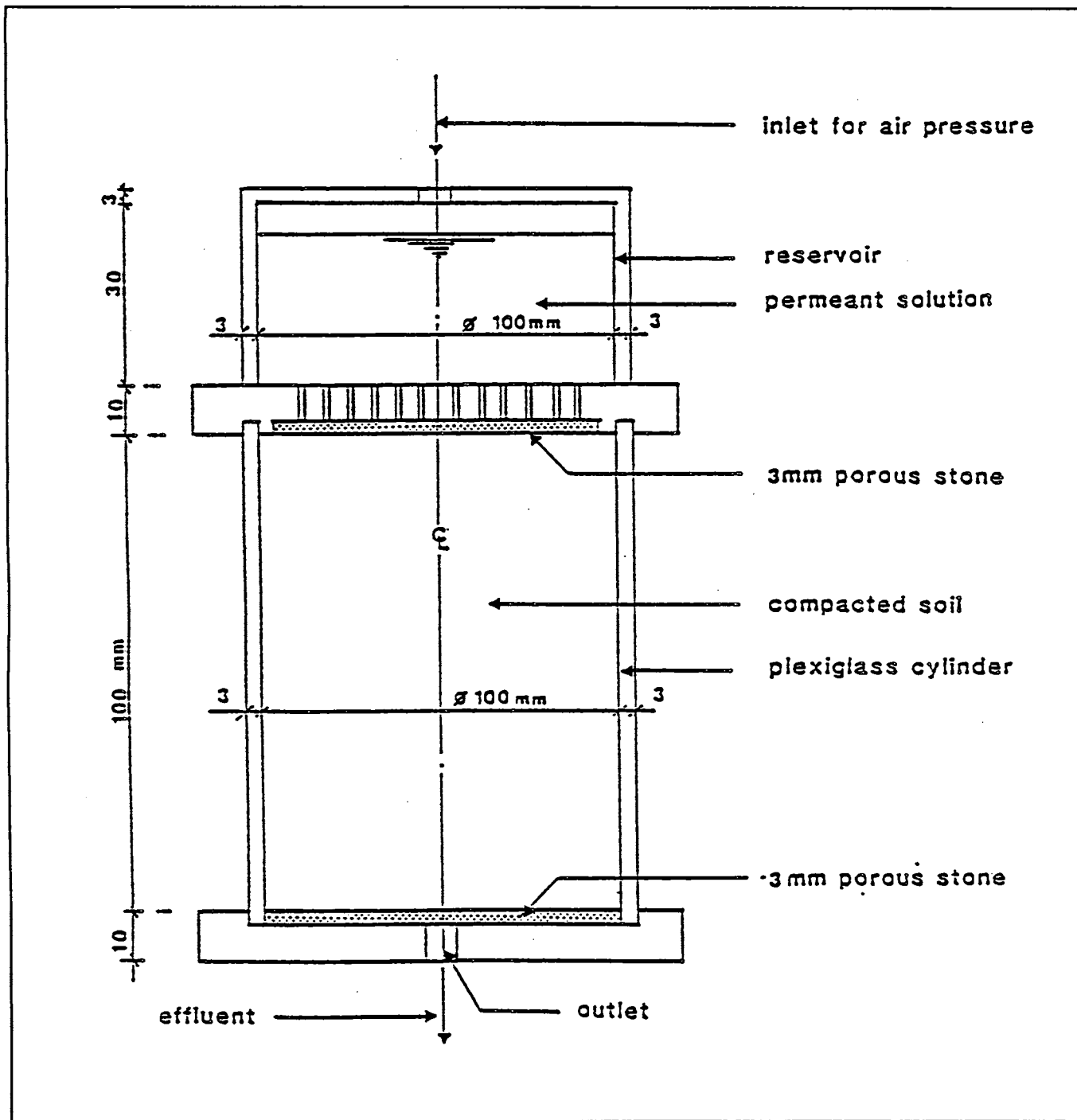


Figure 3. Schematic representation of laboratory leaching cell used in this study.

leachate can also be determined. Details of the laboratory procedures can be obtained in Bowders, *et al.* (1986).

Figures 4 and 5 show two example plots derived from such a study.

Figure 4 shows the breakthrough curve for Pb^{2+} (C_e = effluent concentration of a particular cation; C_o = influent or original concentration of the cation in the reservoir). Pore volume is the volume of pores in the soil sample. V1 means after leaching with 1 pore volume of leachate, V3 after 3 pore volumes and V5 after 5 pore volumes; i.e. V1 to V5 represents progressive leaching of the soil. Note the relative concentrations show very low values of the order of magnitude of $\sim 10^{-4}$, implying very little Pb^{2+} migrates through the soil column. In other words, most of the Pb^{2+} is retained or adsorbed by the clay soil.

Figure 5 shows the migration profile for Pb^{2+} through the soil column. The initial Pb^{2+} concentration in the influent (reservoir) is 1372 ppm. However, the Pb^{2+} is rapidly and largely adsorbed by the soil as it migrates through the soil column. For the V1 series, total retention of Pb^{2+} occurs at > 1 cm depth of the soil column. With progressive leaching, Pb^{2+} migrates further down the soil column, but in all cases, total retention of Pb^{2+} occurs (at > 4 cm depth for V3 series, & at > 7 cm depth for V5 series).

The above results indicate that the particular soil studied has high adsorption or retention capability for Pb^{2+} .

CONCLUSIONS

The batch equilibrium method and the leaching column test are two laboratory methods useful for the assessment of the adsorption

capability of a clay soil. The numerous results that can be obtained via these two methods can provide an insight into the adsorption capability as well as possible mechanisms or soil-pollutant interactions involved. In view of the growing concern for the environment and the increasing need for the proper disposal and management of solid wastes, it is envisaged that these two test methods would be used more often here (in Malaysia) for helping to assess the suitability of a candidate clay soil for use as a clay liner in future landfill operations.

ACKNOWLEDGMENTS

The author acknowledges UKM for granting sabbatical leave to undertake this study. I am also grateful to Prof. R.N. Yong for the opportunity and financial support to participate in this research at the Geotechnical Research Centre, McGill University, Montreal, Canada.

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CATATAN GEOLOGI

Geological Notes

Geologic features of the Pantai Acheh granite, Penang

LIM TOW HO
4, Solok Scott, Penang

INTRODUCTION

Pantai Acheh is a forest reserve which lies on the North Western corner of Penang island. It comprises granitic rocks and is part of the Main Range granites in Peninsula Malaysia which has been described by Hutchison (1973 and 1989) and others. Describing granites is an old tale and an uninteresting one but I hope, here it is being retold in a more interesting fashion. The figures that accompany this note are intended to illustrate the main geological features. The present area I examined is only the northern coastal region of Pantai Acheh and had made references to my previous study (Lim, 1976). This note is ordered according to the figures presented.

PORPHYRITIC BIOTITE GRANITE

Figure 1 shows a porphyritic biotite granite which is leucocratic, light gray in colour and coarse grained. This granite is the predominant granite and occurs over a large area in the Pantai Acheh area. In some areas it is medium grained and non-porphyritic but biotite is common everywhere. The megacrysts are mostly alkali feldspars, some 5 cm in length and generally do not show any preferred orientation. The predominant minerals present are quartz, alkali feldspars, plagioclase and biotite. The minerals occur as irregular masses, the result of near simultaneous crystallization. There are also indications of secondary alteration. Because this is a coastal outcrop, the surface of the granite is shaped by sea wave erosion. The proper classification for this rock is biotite adamellite but here it is simply called biotite granite.

BIOTITE CLOTS

Figure 2 shows clots of biotite in the biotite granite. The crystallization feature of this, is that substantial amounts of biotite occur together in a small area. The other dark mineral present is tourmaline.

PORPHYRITIC APLITE WITH QUARTZ-TOURMALINE VEINS

Figure 3 shows a porphyritic aplite with quartz-tourmaline veins. The porphyritic aplite is leucocratic, light gray in colour and fine grained. This porphyritic aplite occurs in the North-Western corner of Pantai Acheh. The fine grained nature of the porphyritic aplite indicates that it was emplaced after the main granitic body and occurred at a higher level of the granitic ascent. This porphyritic aplite represents the late (not last) phase of magmatic crystallization. The phenocrysts are mostly quartz, some 3 mm in diameter and alkali feldspars. The predominant minerals are quartz, alkali feldspars and plagioclase. Tourmaline occurs too but biotite is not common. Cutting across the porphyritic aplite are quartz-tourmaline veins (dark, parallel lines in figure) which are 2 mm in width. Elsewhere not shown in the figure are clusters of coarse grained tourmaline. The occurrence of tourmaline indicates that it crystallized very late in the magmatic solidification process.

JOINTS PATTERN

As in the biotite granite, the porphyritic aplite is heavily jointed (Fig. 4). A common feature of the joints are that they are vertical



Figure 1. Porphyritic biotite granite at Pantai Aceh, Penang.



Figure 2. Biotite clots in biotite granite, Pantai Aceh, Penang.



Figure 3. Porphyritic aplite with quartz-tourmaline veins, Sg. Tukun.

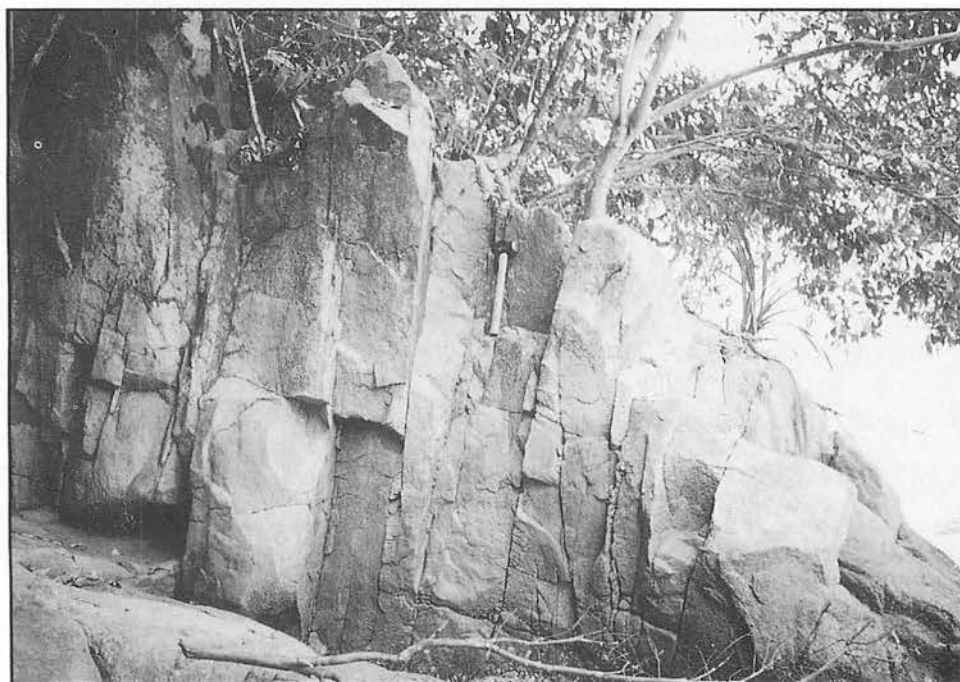


Figure 4. Joints Pattern in porphyritic aplite, Pantai Acheh, Penang.

or near vertical and in parallel formation. Some horizontal joints occur too. Joints occur either during the cooling or consolidation of the magma and are primary joints or due to brittle fracturing in the rocks as a result of compression. The primary joints are usually the ones that later forms quartz-tourmaline veins or quartz veins. Some of the joints have secondary infillings such as calcite and chlorite. The near vertical surface of the porphyritic aplite in the figure are probably joint surfaces and they range from rough to smooth. Anyhow, they show a regular pattern of near parallel surfaces.

CONCLUSION

In the Pantai Acheh area examined, there occurs porphyritic biotite granite and a porphyritic aplite with quartz-tourmaline veins. Elsewhere in the Pantai Acheh area, I have observed biotite schlieren, aplitic dykes, quartz

veins, miarolitic cavities, enclaves, shear zones, faults and pegmatites. However, these are not shown or described here because this is only a brief note on the main features of the granite at Pantai Acheh. This note shows that the Pantai Acheh granite, hence the Penang granites, show certain geological features that are common with the Main Range granites.

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Manuscript received 12.2.93

PERTEMUAN PERSATUAN Meetings of the Society

Forum on Highway Geology and Highway Site Visits, 11th-13 January, '93 — Report

Forum on Highway Geology

The Forum on Highway Geology was held on 11th January 1993 at the Dept. of Geology, University of Malaya. Seven speakers presented case studies on highways in Malaysia. Understandably, the North-South Expressway was much highlighted in the Forum with three presentations on this mega-project. The details of the programme are as shown below.

1:55 pm **OPENING REMARKS**

SESSION I

- | | |
|--------------|--|
| 2:00-2:30 pm | Dr. John K. Raj (<i>University of Malaya</i>)
Stability of cut slopes along highways in Peninsular Malaysia |
| 2:30-3:00 pm | Mr. Chow Weng Sum (<i>Geological Survey of Malaysia</i>)
Rockfall danger along the Ipoh-Kampar stretch of the North-South Highway |
| 3:00-3:30 pm | Mr. Ng Chak Ngon (<i>Subsurface Engineering</i>)
Geotechnical logging and interpretation of data |
| 3:30-4:00 pm | Mr. Muhad Salleh (<i>MINCO</i>)
Pre-splitting and stabilization work in the Bt. Lanjan Interchange, New Klang Valley Expressway |

4:00-4:30 pm **COFFEE BREAK**

SESSION II

- | | |
|--------------|--|
| 4:30-5:00 pm | Mr. Zahari Muda (<i>Geological Survey of Malaysia</i>)
Terrain mapping as a tool for highway alignment |
| 5:00-5:30 pm | Mr. Muhinder Singh (<i>Pengurusan Lebuhraya Bhd.</i>)
The role and emphasis on engineering geology in the design and construction of the North-South Expressway |
| 5:30-6:00 pm | Mr. Tan Boon Kong (<i>Universiti Kebangsaan Malaysia</i>)
Survey of slope failures along the Tambunan-Ranau Highway, Sabah. |

6:00 pm **CLOSING REMARKS**

Photos 1 to 11 show proceedings during the Forum. There was quite a large turn-out, due obviously to the great interests of geologists and engineers on the subject of highway geology, and in particular the experiences on the North-South Expressway.

Highway Site Visit

Following the half-day Forum, site visits to two different packages of the North-South Expressway were conducted on 12th & 13th January 1993. The packages visited were:

- i) Package 8B-1A and 8B-1B near Gunung Tempurong (south of Ipoh), &
- ii) Package 6B4 at Bukit Merah (north of Taiping)

Package 8B-1A and 8B-1B traverses limestone, schist, granite, colluvium, alluvium and mine tailings and reflects the Kinta Geology; while Package 6B4 traverses sedimentary rocks of the Semanggol Formation (conglomerate, sandstone, shale) besides soft ground (Quaternary deposits).

Mr. Muhinder Singh and his colleagues from Pengurusan Lebuhraya Bhd. as well as site engineers from the Consultants and the contractors conducted the technical visits and gave many interesting accounts of the projects during briefings and on-site visits. Lunches, snacks and drinks were also amply provided at the site.

On behalf of the Society, I thank all parties who have participated and contributed to the success of this event: the speakers, Universiti Malaya, Universiti Kebangsaan Malaysia, the Geological Survey of Malaysia, Projek Lebuhraya Utara-Selatan Bhd. (PLUS), Pengurusan Lebuhraya Bhd. (PLB), the project Consultants and Contractors. My special thanks to Mr. Muhinder Singh for personally looking into all the details of the site visits to ensure that they ran smoothly and were most enjoyable.

Photos 1 to 12 record going-ons during the highway site visits.

Tan Boon Kong
Chairman
Working Group on Engineering
Geology & Hydrogeology

FORUM ON HIGHWAY GEOLOGY

Caption to Photos

1. John K. Raj on stability of cut slopes.
2. Chow Weng Sum on rockfall danger.
3. Ng Chak Ngoon stressing on geotechnical logging.
4. Muhad Salleh on the Bt. Langan Interchange.
5. Zahari Muda on terrain mapping.
6. Muhinder Singh emphasising on role of engineering geology.
- 7-10. The good crowd at the forum.
11. Tan Boon Kong on the Tambunan-Ranau Highway.

FORUM ON HIGHWAY GEOLOGY



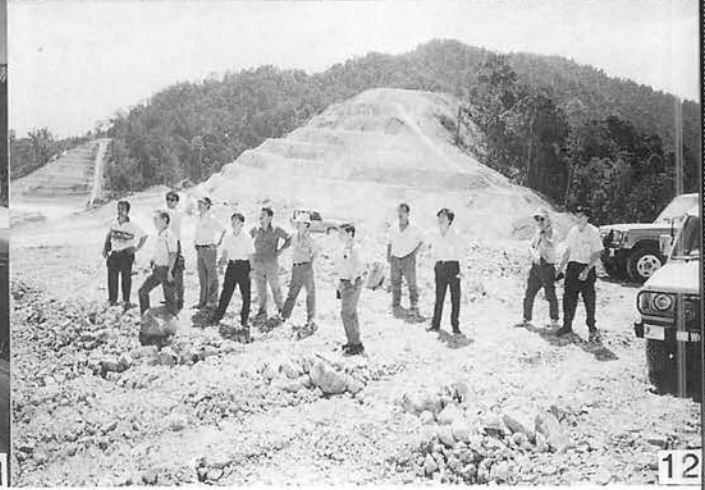
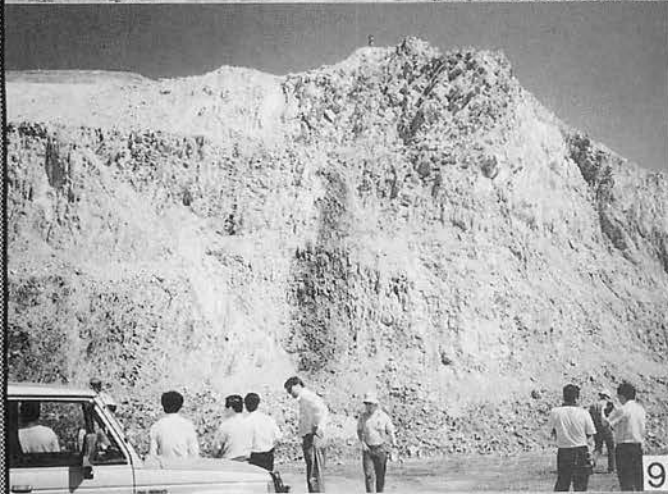
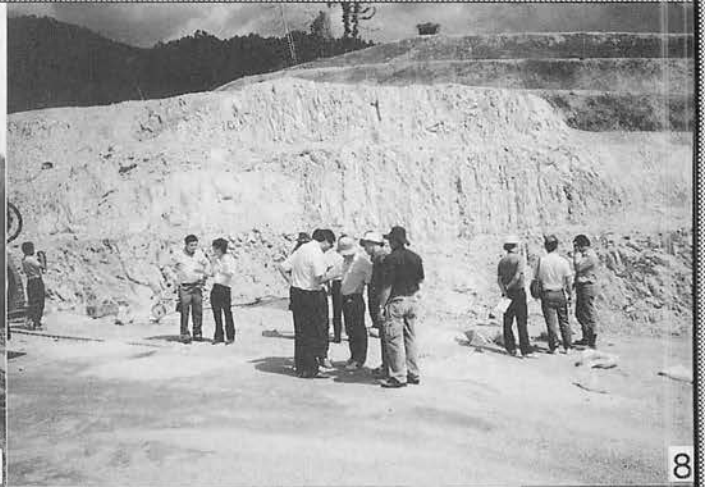
HIGHWAY SITE VISITS



Caption to Photos (Gopeng)

1. Group photo at site office, Package 8B-1.
2. Briefing around model of highway.
3. Briefing by Mr. Muhinder Singh.
4. Briefing by PL engineer.
5. Lunch before site visit, courtesy of PL.
6. Group photo in front of G. Tempurung.

HIGHWAY SITE VISITS



Caption to Photos (7 & 8Gopeng, 9-12 Bt. Merah)

7. Examining roadcuts at Package 8B-1A.
8. Granite rockslope, Package 8B-1B.
9. Examining roadcuts at Bt. Merah, Package 6B4 (Taiping).
10. "Now how do we get to the top?"
11. Some serious, academic discussion in progress.
12. "Why is everybody looking this way – the beautiful roadcut is at the back!"

Ceramah Teknik (Technical Talk)

The effects of sealevel fluctuations on prograding shorelines and estuarine valley-fill sequences in the Upper Mannville Sediments, Southern Alberta

MOHD. ZAHOOR FARSHORI

Laporan (Report)

The talk by Dr. Farshori (Visiting Lecturer, Universiti Kebangsaan Malaysia) on "The effects of sealevel fluctuations on prograding shorelines and estuarine valley-fill sequences in the Upper Mannville Sediments, Southern Alberta" was given on 22 February 1993 at the Department of Geology, Universiti Kebangsaan Malaysia, Bangi. The ~25-strong audience comprised students and staff of UKM only, with NONE from outside UKM. This was unfortunate, as the talk was based on many years of good work done by the speaker in Canada, with very high quality slides and illustrations as typical of professionals from the petroleum industry.

Abstrak (Abstract)

A detailed sedimentological study of the Upper Mannville Sandstone, Lower Cretaceous in southern Alberta was conducted in order to understand depositional history, the geometry, and production performance. Six distinct transgression/regression succession can be correlated across the study area.

The Upper Mannville Sandstones occur as thin sheets and ribbons sandwiched between regimes of coal and underlying Ostracod Beds or Glauconite sandstone in Southern Alberta. Six thin coarsening upward sedimentary cycles occur and each is overlain by either a thin coal or soil zone. A typical cycle begins with a scoured base overlain by transgressive lag and/or black shale that grades upward into bioturbated siltstone, then overlain by fine to medium grained kaolinic sandstone. The Upper Mannville Sandstone consists of stacked cycles of lenticular sand bodies deposited on beaches, tidal flats and lagoons. These cycles are also separated by incised tidal channels representing breaks in sedimentation.

These regressive cycle sand bodies result from the interplay of sedimentation, tectonics, climate variation and sea-level fluctuations. They contain zones of low porosity (10–15%) and low permeability (0.1–10 md) due to presence of kaolinite and calcite cement.

These sands are classified as heterogeneous feldspatic litharenite. As a result, fracturing of the sand bodies is generally required to enhance gas production. The gas bearing reservoir sandstones are widely distributed and roughly cover an area of about 5000 km² in the study area.



Footnote: For the benefit of many who missed the talk, in particular those who are working in the petroleum industry, the Society is planning to hold a second technical talk by Dr. Farshori sometime in July '93. So, look out for the announcement, and be sure to be present for another highly illuminating talk by Dr. Farshori!

Tan Boon Kong

GEOLOGICAL SOCIETY OF MALAYSIA PUBLICATIONS

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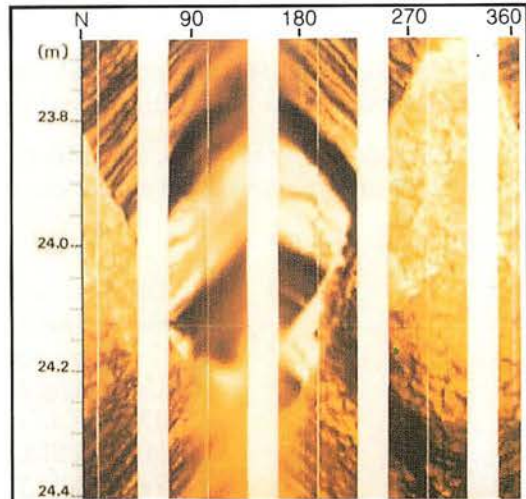
Fullbore Micro Imager*

Formation imaging using microelectrical arrays has benefited the oil industry since its introduction in the mid-80s. The FMI*, Fullbore Formation MicroImager tool, is the latest-generation electrical imaging device. It belongs to the family of imaging services provided by the MAXIS 500* system with its digital telemetry capability.

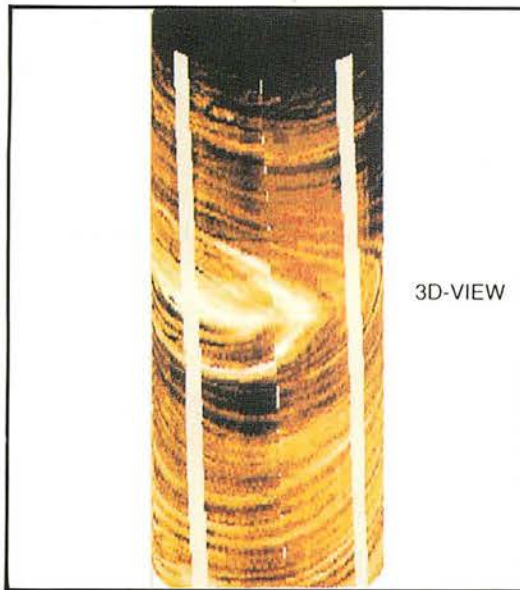
The FMI log, in conductive muds, provides electrical images almost insensitive to borehole conditions and offers quantitative information, in particular for analysis of fractures.

The FMI tool combines high-resolution measurements with almost fullbore coverage in standard diameter boreholes, thus assuring that virtually no features are missed along the borehole wall. Fully processed images and dip data are provided in real time on the MAXIS 500 imaging system.

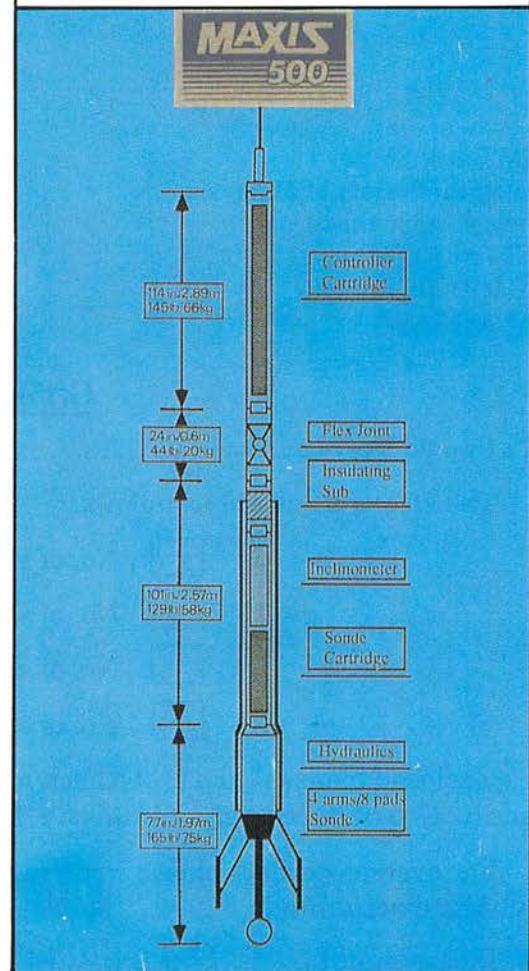
The tool's multiple logging modes allow wellsite customization of results to satisfy client needs without compromising efficiency.



Fault without associated drag



"Bullseye" structure



SOCIETY'S BATIK SHIRT

Computer-designed and handprinted with the latest technology of handprinting from the East Coast, the Society's batik shirt is of soft, rayon material and comes in a cool, soothing, grey colour.

The Society's logo is craftily concealed in the background so that besides the Society's functions you can even wear your batik shirt anywhere, anytime!

Priced reasonably at MR60, the batik shirt is a real bargain and worth adding to your wardrobe. So place your orders now before stocks run out!

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Enclosed please find a cash/check/money order/bank draft* for RM made to "Geological Society of Malaysia" for the purchase [* Please delete where applicable].

For overseas orders please write in to indicate ordinary mail or air mail and you will be charged accordingly.

Please mail to:
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BERITA-BERITA PERSATUAN **News of the Society**

Council List 1993/94

The Nominations Committee comprising Tan Boon Kong (Chairman), Azhar Hj Hussin and C.S. Hutchison presented the following list of the Council of 1993/94 after an election was held for the 4 posts of 2-year Councillors. At the same time the Council co-opted Effendy Cheng Abdullah to replace Mazlan Hj Madon who is overseas pursuing a higher degree.

President	:	Fateh Chand (GSD)
Vice-President	:	S.P. Sivam (UM)
Secretary	:	Ahmad Tajuddin Ibrahim (UM)
Asst. Secretary	:	S. Paramanathan (Consultant)
Treasurer	:	Lee Chai Peng (UM)
Editor	:	Teh Guan Hoe (UM)
Immediate Past President	:	Ahmad Said (Petronas)
Councillors		
(2-year)	:	Ali Mohd. Sharif (Petronas)
		Choo Mun Keong (Consultant)
		Idris Mohammad (SSB)
		Jimmy Khoo Khay Khean (GSD)
(1-year)	:	Chin Lik Suan (Consultant)
		Effendy Cheng Abdullah (Petronas)
		Nik Ramli Nik Hassan (FORAD)
		Tan Boon Kong (UKM)

GSM

KEAHLIAN (Membership)

The following applications for membership were approved:

Full Members

1. Ab. Basir Ali
Perbadanan Memajukan Ikhtisad Negeri
Terengganu, Tk. 14, Menara Permint, Jalan
Sultan Ismail, K. Terengganu, Terengganu.
2. Mohd. For Mohd. Amin
Fakulti Kejuruteraan Awam, UTM, Locked
Bag 791, 80990 Johor Bahru, Johor.
3. Ooi Teik Aun
Bina Logamaya Sdn. Bhd., 13th Floor, Mui
Plaza, Jalan P. Ramlee, 50250 Kuala
Lumpur.
4. Shirley E. van Heck
Sarawak Shell Bhd., XGS/1, 98100 Lutong,
Sarawak.

Student Members

1. Zaidi Daud
Jabatan Geologi, Universiti Malaya, 59100
Kuala Lumpur.
2. Hamid Ariffin
Jabatan Geologi, Universiti Malaya, 59100
Kuala Lumpur.
3. Azman Abd. Ghani
Jabatan Geologi, Universiti Malaya, 59100
Kuala Lumpur.
4. Zuhar Zahir Tuan Harith
Jabatan Geologi, Universiti Malaya, 59100
Kuala Lumpur.
5. Dorsihah Mohamad Jais
Jabatan Geologi, Universiti Malaya, 59100
Kuala Lumpur.

PERTUKARAN ALAMAT (Change of Address)

The following members have informed the Society of their new addresses:

- | | |
|--|---|
| <p>1. E.F. Durkee
General Manager, E.F. Durkee and Associates, Inc., Ste. 7B - LPL Towers, 112 Legaspi Street, Legaspi Village, Makati, Metro Manila, Philippines.</p> | <p>2. Lim Beng Kung
57C, Town Centre, Jalan Desa Bakti, Taman Desa, 58100 Kuala Lumpur, Malaysia.</p> |
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PERTAMBAHAN BAHARU PERPUSTAKAAN (New Library Additions)

The Society has received the following publications:

- | | |
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| <p>1. U.S. Geological Survey Bulletin: 1992: 2008, 1957, 1787-U, 1787-Q, 1904-M, 1808-J, K, 1974, 1904-N, 1839-G, H.</p> <p>2. USGS Circular 1992: 930-K</p> <p>3. USGS Professional Paper, 1992: 1505-A.</p> <p>4. AGID News no. 71, 1992.</p> <p>5. Bulletin de la Societe belge de Geologie, vol. 100, nos. 1 & 2, 1991.</p> <p>6. AAPG Bulletin, vol. 76/12, 1992 & vol. 77/1, 1993.</p> <p>7. Report of investigation no. 85 & 86, 1992.</p> <p>8. Journal of Hebei College of Geology, vol. 15, nos. 2-4, 1992.</p> <p>9. Bulletin of the Chinese Academy of Geological Sciences, no. 25, 1992.</p> <p>10. Acta Micropalaeontologica Sinica, vol. 9, no. 2 & 3, 1992.</p> <p>11. Acta Palaeontologica Sinica, vol. 31, 3-5.</p> <p>12. Palaeontological Abstracts, vol. 7, nos. 2-3, 1992.</p> | <p>13. Report of investigation no. 87, 1992.</p> <p>14. Scripta Geologica, nos. 98-101, 1992.</p> <p>15. Bulletin Centres de Recherches Exploration-Production Elf Aquitaine, vol. 16, no. 2, 1992.</p> <p>16. AAPG Explorer, Dec. 1992.</p> <p>17. IMM, Bulletin, no. 1009, 1992.</p> <p>18. IMM Section A, vol. 101, A127-204, 1992.</p> <p>19. SOPAC News, vol. 9, no. 3, 1992.</p> <p>20. Chronique de la Recherche Miniere no. 509, 1992.</p> <p>21. Explanatory notes for the Natural Hazards map of the Circum-Pacific Region, Pacific Basin sheet 1:17,000,000, 1990.</p> <p>22. Energy-resources map of the Circum-Pacific Region, Northwest Quadrant, 1992.</p> <p>23. Tectonic map of the Circum-Pacific Region, Southwest Quadrant, 1991.</p> |
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PERSATUAN GEOLOGI MALAYSIA
Geological Society of Malaysia

PERSIDANGAN TAHUNAN GEOLOGI '93

**Annual Geological
Conference '93**

12th & 13th June 1993

**DeLima Resort
Langkawi, Kedah**

*First Circular
January 1993*



PERSATUAN GEOLOGI MALAYSIA Geological Society of Malaysia

PERSIDANGAN TAHUNAN GEOLOGI '93 Annual Geological Conference '93

OBJECTIVES

The Geological Society of Malaysia is planning to hold the 1993 Annual Geological Conference on the 12th & 13th June 1993 at the DeLima Resort, Langkawi. The Conference is the eight in a series of such annual conferences organised by the Society.

Papers presented at the previous conferences have contributed significantly to the better understanding of the geology of Malaysia in particular and the S.E. Asia region in general. In addition, the Conferences have provided the forum for exchange of scientific and technical information among the many conference participants from companies as well as research organisations in the region and those interested in the geology and resources of the region.

PAPERS

In the wake of many outstanding papers that have been presented at the seven previous Conferences, the Geological Society of Malaysia would greatly appreciate your contribution of a paper to this Conference.

Papers on any topic relevant to the understanding of geology, energy and mineral resources of Malaysia and the S.E. Asia region would be most welcomed.

Please inform us of your intention to present a paper at this Conference before 28th February 1993. Abstracts should be submitted at the same deadline or latest by 15th March 1993.

Full papers submitted before 15th April 1993 will be made available to all registrants.

Authors are also encouraged to submit their full paper after the Conference for consideration for publication in the Society's Bulletin series.

REGISTRATION

All intending participants are advised to register early for the Conference as a large turnout will again be expected this year.

Advance registration for the Conference will be accepted until 2nd June 1993. Late registration will be accepted at the Society's Registration Desk at the Conference venue. Presenters of papers at the Conference will be exempted from payment of registration fees.

Membership	Advance Registration Fees	Late Registration Fees
Full Members	RM20.00	RM30.00
Non-Members	RM60.00	RM70.00
Student Members	RM5.00	-
Student Non-Members	RM10.00	-

Payment by crossed cheques, bank drafts or cashiers orders is acceptable and should be made payable to the "Geological Society of Malaysia". Outstation cheques should include sufficient bank charges.

Please send registration fees together with the attached Registration Form to:-

The Treasurer,
Geological Society of Malaysia,
c/o Department of Geology,
University of Malaya,
59100 Kuala Lumpur,
MALAYSIA.

to reach us before 31st March 1993.

ACCOMMODATION

Accommodation will be at the participants' own expenses but reservations can be arranged upon request on a first-come-first-serve basis at the following rates:-

DeLima Resort, Langkawi

The room rates are as follows:-

Superior single/double : RM90.00 nett per day & breakfast
Standard Ocean View : RM70.00 nett per day (room only)
Standard Resort view : RM60.00 nett per day (room only)

Please indicate clearly in the Registration Form if arrangements for accommodation is required.

TRAVEL & FIELDTRIPS

We are trying to arrange group travel (minimum 10) with MAS from Kuala Lumpur to Langkawi and back.

A pre-conference two-day fieldtrip is being proposed. To facilitate planning, please indicate your interest to participate on the Registration Form. The Society reserves the right to cancel the trip if there are not enough participants.

Details of the fieldtrip will be sent separately or included in the Final Circular.

A coach to Kuala Perlis will be arranged by the Society. Places on first-come-first-served basis.

REGISTRATION FORM

GEOLOGICAL SOCIETY OF MALAYSIA ANNUAL GEOLOGICAL CONFERENCE '93 12th & 13th June 1993

Name: Prof/Dr/Mr/Ms _____

Profession: _____

Company/Organisation: _____

Address: _____

Type of membership: _____

Please tick appropriate boxes:

I intend to participate in the above Conference.
 I intend to present a paper entitled: _____

I will not require accommodation
 I will require accommodation:

DeLima Resort, Langkawi

Superior single/double (RM90.00 nett per day)

Standard Ocean View (RM70.00 nett per day)

Standard Resort View (RM60.00 nett per day)

From: _____ to: _____

Name of person(s) sharing: _____

I intend to participate in the Pre-conference fieldtrip (RM20.00)
 I want to join group travel to Langkawi and back (RM253.00)
 I want to travel by Society's coach (RM10.00)
 I will make my own travel arrangements.

Please complete and return to the Geological Society of Malaysia before 31st March 1993.

BERITA-BERITA LAIN Other News



XV CONGRESS OF THE COUNCIL OF MINING AND METALLURGICAL INSTITUTIONS - 24 APRIL/14 MAY 1994

The South African Institute of Mining and Metallurgy and the Geological Society of South Africa, in collaboration with the Chamber of Mines of South Africa, have pleasure in announcing that the 15th Congress of the Council of Mining and Metallurgical Institutions will be held in Southern Africa in April/May 1994.

The theme of the Congress is *Resources and Technology* and the minerals industry of Southern Africa will be paraded in a comprehensive programme that will stimulate scientific and technical thought. At the same time visitors will be able to enjoy the natural beauty of the sub-continent and visit places of historical and contemporary interest.

From Sunday 24 to Friday 29 April 1994, Congress will be based at the spectacular Sun City complex in Bophuthatswana, which is about one-and-a-half hours by highway from Johannesburg. During that period technical sessions will be held in the complex and from Friday 29 April to Saturday 14 May 1994, a wide ranging series of excursions will radiate by road, rail and air to places of technical interest and scenic beauty throughout Southern Africa.

Call For Papers

In addition to plenary and keynote papers, it is envisaged that up to 30 papers will be accepted for presentation to each of the four Technical Programmes proposed for Congress.

The following is the timetable for the submission of papers:

Submission of abstracts:	January 1993
Provisional acceptance of papers:	March 1993
Submission of papers:	July 1993
Final circular and registration form:	September 1993

1. MINING TECHNICAL PROGRAMME

The Mining Technical Programme will concentrate on mining methods. Papers and presentations should be confined to individual mines and consist of a brief general overview of the operation including an introduction, geology, infrastructure and metallurgy, and a detailed and comprehensive description of the mining methods used. The description of the mining method should include factors such as ore reserves, layout and stope design, drilling, blasting, support, including backfill, loading, equipment, rock mechanics, ventilation, dilution, extraction and other mining factors, various control systems, manning and supervision, ore and material transport, cost aspects and special features.

It is intended that the papers accepted for presentation and publication will represent a wide range of mines and mining methods in Southern Africa and world wide. As far as possible a full range of mining methods should

be represented including tabular metalliferous, massive and vein metalliferous, opencase metalliferous, coal, industrial minerals and other mining methods.

2. EXTRACTIVE METALLURGY TECHNICAL PROGRAMME

The Extractive Metallurgy Technical Programme will focus on two sub-themes, these being cost control and beneficiation. Mineral beneficiation in Southern Africa has benefited from both local and overseas technologies and resources. Papers should focus on specific operations and detail the particular technological and resource based developments that led to improved beneficiation and/or cost control, whilst also taking account of potential environmental impacts where these are relevant.

Papers accepted for presentation and publication will be drawn from a wide range of extractive metallurgical operations, both from Southern Africa and the rest of the world. Presentations covering recent developments in Extractive Metallurgy on a broad spectrum of mineral and metals are required.

Papers should not be repetitions of well-known practices or ideas, but should incorporate developments that would be of real interest to technical people and of benefit to the minerals industry at large.

3. METALS TECHNOLOGY PROGRAMME

The Metals Technology Programme will concentrate on the technological advancements in the research, production and application of metals in the metallurgical industry.

Papers and presentations should focus on pyrometallurgical, physical metallurgical or mechanical metallurgical activities in metals technology. Research, production and application of precious metals, other non-ferrous metals and ferrous metals can form the basis of presentations.

Papers can cover developments, practical applications and new technologies. An area of interest would be the integration of environmental and economic considerations in decision making.

4. GEOLOGICAL TECHNICAL PROGRAMME

The Geological Technical Programme will concentrate on updated review papers on some of the major mineral fields or provinces of the African sub-continent. Similar papers from other parts of the world are also most welcome. The distribution of ore deposits and metallogenic provinces in relation to the broader geological and tectonic framework is of particular importance and should be highlighted where possible.

Papers describing the exploration history, exploration methods (emphasizing new techniques) and modelling and evaluation of individual mineral deposits would be preferable. Of particular interest are those deposits that have recently been developed or those that are being developed and have not as yet been thoroughly described.

Papers of a more general nature, both from Africa and further afield will also be encouraged and one of the sub-themes will be the earth sciences and environmental issues.

The 15th CMMI Congress is a MUST for all who are connected, directly and indirectly, with the mining and minerals industry worldwide. It promises to be an unforgettable experience

For further information:

*Bill Emmett Congress Manager 15th CMMI
Congress*

*P.O. Box 809 Johannesburg 2000 South Africa
Telephones: (27)(11) 838-8211 (office)
(27)(11) 788-2518 (home)
Fax: (27)(11) 834-1884*

KALENDAR (CALENDAR)

1993

► April 1993

◆◆◆ April 1-3

FRACTALS AND DYNAMICS SYSTEMS IN GEOSCIENCES (International Meeting), Frankfurt/Main, Germany (Jörn H. Kruhl, Geology-Paleontology Institute, JW Goethe-University, Senckenberganlage 32, D-6000 Frankfurt/Main, Germany. Phone: 0049-69-7982695)

◆◆◆ April 1-30

COMPUTER SIMULATED MINERAL EXPLORATION (22nd Workshop), Fontainebleau, France. (L. Zanone, Ecole des Mines de Paris, CGGM-IGM, 35, rue Saint-Honoré, 77305 Fontainebleau Cedex, France. Phone: (33 1) 64 69 49 30; telefax: (33 1) 64 69 47 01; telex: 694 736F)

◆◆◆ April 4-8

REMOTE SENSING AND GLOBAL ENVIRONMENTAL CHANGE (25th International Symposium), Graz, Austria. (Dorothy M. Humphrey, ERIM, P.O. Box 134001, Ann Arbor, MI 48113-4001, USA. Phone: (313) 994-1200, ext. 2290; telefax: (313) 994-5123)

◆◆◆ April 5-8

GLOBAL WARMING, int'l. mtg., Chicago. (Sinyan Shen, Natural Resource Management Division, SUPCON International, One Heritage Plaza, Woodridge, Ill. 60517-0275. Phone: 708/910-1551; 419/372-8207. Fax: 708/910-1561)

◆◆◆ April 17-20

INTEGRATED METHODS IN EXPLORATION AND DISCOVERY (International Conference), Denver, Colorado, USA. (SEG Conference '93, P.O. Box 571, Golden, CO 80402, USA. Telefax: (303) 279-3118)

◆◆◆ April 21-25

GEOSCIENCE EDUCATION AND TRAINING (International Conference), Southampton, UK. (Mrs. Esther Johnson, GEOED Conference Secretariat, Department of Geology, University of Southampton, Southampton S09 5NH, UK. Phone: (0703) 593049; telefax: (0703) 593052; telex: 47662 SOTONU G)

◆◆◆ April 19-23

REMOTE SENSING, int'l mtg., Enschede, The Netherlands, by international Institute for Aerospace Survey and Earth Sciences, and others. (Myriam Fahner, Box 6, 7500 AA Enschede, The Netherlands. Phone: 31-53-874 255. Fax: 31-53-874 436) Deadline for manuscripts: March 11.

◆◆◆ April 25-28

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (Annual Meeting), New Orleans, Louisiana, USA. (Convention Department, AAPG, Box 979, Tulsa, OK 74101, USA. Phone: (918) 584-2555; telefax: (918) 584-0469)

► May 1993

◆◆◆ May 5-8

PROTECTING THE EARTH - CHALLENGES TO SCIENCE AND TECHNOLOGY (1st International Fair and Congress), Koln, Germany. (Alfred-Wegener-Stiftung zur Forderung der Geowissenschaften, Wissenschaftszentrum Ahrstraße 45, Postfach 20 14 48, D-5300 Bonn 2, Germany. Phone: 02 28/302-260; telefax: 02 28/302-270; telex: 885 420 wzd).

◆◆◆ May 5-8

GEOTECHNICA '93 (International Symposium), Cologne, Germany. (Hans Teetz, Cologne International Trade Fairs Inc., 21st Floor, 666 Fifth Ave., New York, NY 10103-0165, USA. Phone: (212) 974-8836; telefax: (212) 974-8838)

◆◆◆ May 15-21

ENVIRONMENTAL HYDROLOGY AND HYDROGEOLOGY (2nd USA/CIS Joint Conference), Arlington, Virginia, USA. (Americal Institute of Hydrology, 3416 University Avenue, SE. Minneapolis, MN 55414-3328, USA. Phone: (612) 379-1030; telefax: (612) 379-0169)

◆◆◆ May 17-19

GEOLOGICAL ASSOCIATION OF CANADA/ MINERALOGICAL ASSOCIATION OF CANADA (Joint Annual Meeting), Edmonton, Alberta, Canada. (J.W. Kramers, Alberta Geological Survey, P.O. Box 8330, Station F, Edmonton, Alberta T6H 5X2, Canada. Phone: (403) 438-7644; telefax: (403) 438-3644)

◆◆◆ **May 25–June 15**

BASIN TECTONIC AND HYDROCARBON ACCUMULATION (International Conference), Nanjing, China. Professor Shi Yangshen, Department of Earth Sciences, Nanjing University, Nanjing, China. Phone: 86–25–634651, ext. 2890; telefax: 86–25–302728; telex: 34151 PRCNU CH. Or David Howell, U.S. Geological Survey, 345 Middlefield Road, MS 902, Menlo Park, CA 94025, USA. Phone: (415) 354–5430; telefax: (415) 354–3224

◆◆◆ **May 31–June 2**

APPLIED MINERALOGY, int'l. mtg., Perth, Western Australia. (Jim Graham, ICAM '93, Private Bag, P.O. Wembley 6014, Australia. Phone: 619/387-0371)

▶ **June 1993**◆◆◆ **June 1–5**

GEOTECHNICAL ENGINEERING (International Meeting), St. Louis, Missouri, USA. (Norma R. Fleming, 119 ME Annex, University of Missouri, Rolla, MO 65401-0249. Phone: (314) 341-6061; (800) 752-5057. telefax: (314) 341-4992)

◆◆◆ **June 7–16**

SUBCOMMISSION ON CARBONIFEROUS STRATIGRAPHY 1993 FIELD AND GENERAL MEETING (International Symposium), Liège, Belgium, and field excursions to Belgium, Germany, and the Pyrenees in France. (Dr. M. Streel, Paléontologie, Université de Liège, 7 Place du Vingt-Août, B-4000 Liège, Belgium)

◆◆◆ **June 20–27**

ZEOLITES (International Meeting), Boise, Idaho, USA. Sponsored by International Committee on Natural Zeolites. (F.A. Mumpton, Dept. of Earth Sciences, State University of New York, Brockport, 14420. Phone: 716/395-2635; 716/637-2324. Fax: 716/395-2416)

◆◆◆ **June 21–25**

ROCK ENGINEERING (Meeting and Workshop), Lisbon, Portugal. Sponsored by the International Society for Rock Mechanics. (Luis Ribeiro e Sousa, Portuguese Society for Geotechnique, Laboratório Nacional de Engenharia Civil, Av. do Brasil, 101, 1799 Lisboa Codex Portugal. Phone: 848 21 31; telefax: 89 76 60)

◆◆◆ **June 28–July 2**

INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS: HYDROGEOLOGY

OF HARD ROCKS (24th IAH Congress), Oslo, Norway. (Geological Survey of Norway, P.O. Box 3813, Ullevål Hageby, N-0805 Oslo, Norway. Phone: 47–2–950895)

▶ **July 1993**◆◆◆ **July**

ENVIRONMENTAL CONTEXT OF HUMAN EVOLUTION (International Scientific Congress and Exhibition), The Netherlands and Indonesia. (Dr. Hans Beijer, Geological Survey of The Netherlands, P.O. Box 157, NL-2000 AD Haarlem, The Netherlands. Telefax: 31 23 351614)

◆◆◆ **July 5–8**

ROCK FRAGMENTATION BY BLASTING (4th International Symposium), Vienna, Austria. (Dr. H.P. Rossmann, Institute of Mechanics, Technical University Vienna, Wiedner Hauptstraße 8–10/325, A-1040 Vienna, Austria. Phone: (222) 588 01 5514 or 5519; telefax: (222) 587 5863)

◆◆◆ **July 5–9**

FLUVIAL SEDIMENTOLOGY (5th International Conference), Brisbane, Australia. (Continuing Professional Education, The University of Queensland, Queensland 4072, Australia. Phone: 61 7 365 7100; telefax: 61 7 365 7099; telex: UNIVQLD AA40315)

◆◆◆ **July 5–16**

VERY LOW GRADE METAMORPHISM: MECHANISMS AND GEOLOGICAL APPLICATIONS (IGCP Project 294 Thematic Meeting and Field Excursions), Xi'an, People's Republic of China. (Dr. Wu Hanquan, Xi'an Institute of Geology and Mineral Resources, 116 Easy Youyi Road, Xi'an 710054, People's Republic of China)

◆◆◆ **July 17–24**

GEOLOGICAL AND LANDSCAPE CONSERVATION, int'l. mtg., Great Malvern, U.K. (Margaret Phillips, The Company, St. John's Innovation Centre, Cowley Road, Cambridge CB4 4WS. Phone: (0223) 421124. Fax: (0223) 421158)

◆◆◆ **July 18–23**

CLAY CONFERENCE (10th International Conference in conjunction with Commission VII of the International Soil Science Society), Adelaide, South Australia. (Dr. Tony Eggleton, Geology Department, ANU, GPO Box 4, Canberra, ACT 2601, Australia)

◆◆◆ July 25-30

ORIGIN OF PARENTAL ANORTHOSITE MAGMAS, TECTONIC AND METAMORPHIC PROCESSES IN THE EVOLUTION OF ANORTHOSSITES (Conference), Kadalaksha, Kola Peninsula, Russia. Sponsored by International Geological Correlation Programme Project 290. (Michael Higgins, Sciences de la Terre, Université du Québec à Chicoutimi, Chicoutimi, Québec G7H 2B1, Canada. Phone: (418) 545-5012)

▶ August 1993

◆◆◆ August

INTRAPLATE VOLCANISM: THE POLYNESIAN PLUME PROVINCE (International Workshop), Tahiti, French Polynesia. (Workshop Tahiti 1993, C. Dupuy, Centre Géologique et Géophysique, Case 060, Université de Montpellier II, place E. Bataillon, 34095 Montpellier Cedex 5, France. Phone: (33) 67-634-983; telefax: (33) 67-523-908)

◆◆◆ August 1-6

GEOCHEMISTRY OF THE EARTH SURFACE (3rd International Symposium), University Park, Pennsylvania, USA. (Lee Kump, Department of Geosciences, Pennsylvania State University, 210 Deike Bldg., University Park, PA 16802, USA. Phone: (814) 863-1274; telefax: (814) 865-3191)

◆◆◆ August 4-7

PALEOZOIC MICROVERTEBRATES (IGCP Project-328) (2nd International Symposium), Berlin, Germany. In conjunction with the birthday anniversary of Professor Walter Gross. (Dr. S. Turner, Queensland Museum, P.O. Box 3300, South Brisbane, Qld 4101, Australia. Telefax: 617 846 1918. Or Prof. H. Jaeger, Museum für Naturkunde, Invalidenstr. 43, 00-104 Berlin, Germany)

◆◆◆ August 8-12

STRATIGRAPHIC RECORD OF GLOBAL CHANGES: CLIMATE, SEA LEVEL, AND LIFE (SEPM Meeting), University Park, Pennsylvania, USA. (Mike Arthur, Department of Geosciences, Pennsylvania State University, University Park, PA, 16802, USA. Phone: (814) 865-6711)

◆◆◆ August 11-15

GEOSCIENCE IN URBAN DEVELOPMENT (International Conference), Beijing, China. (Professor Wang Sijing, Chairman LANDPLAN IV, Institute of Geology, Academia Sinica, P.O.

Box 634, Beijing 100029, China. Phone: 86-1-2027766; telefax: 86-1-4919140; telefax: 22474 ASCHI CN c/o Institute of Geology)

◆◆◆ August 15-19

CARBONIFEROUS TO JURASSIC PANGEA: A GLOBAL VIEW OF ENVIRONMENTS AND RESOURCES (International Symposium), Calgary, Alberta, Canada. (Dr. Benoit Beauchamp or Dr. Ashton Embry, Geological Survey of Canada, 3303 33rd St. NW, Calgary, Alberta T2L 2A7, Canada. Phone: (403) 292-7190; telefax: (403) 292-4961)

◆◆◆ August 23-29

GEOMORPHOLOGY (3rd International Conference), Hamilton, Ontario, Canada. (3rd International Geomorphology Conference, Department of Geography, McMaster University, Hamilton, Ontario L8S 4K1, Canada. Phone: (416) 525-9140, ext. 4535; telefax: (416) 546-0463; E-mail: GEOMORPH)

◆◆◆ August 23-29

COASTAL SEDIMENTOLOGY (Meeting), Hamilton, Ontario, Canada. (William F. Tanner, Dept. of Geology B-160, Florida State University, Tallahassee, FL 32306, USA) Phone: 904/644-3208)

◆◆◆ August 28-September 15

LANDSLIDES (International Meeting and Workshop), Czech and Slovak Federal Republic. (ICFL-C.S. Landslides '93, c/o NOVOSAD IG/EG, I. Sekaniny 1801, CS-70800 Ostrava 4, Czechoslovakia. Phone: (42-69) 473028; telefax: (42-2) 381848)

▶ September 1993

◆◆◆ September 5-11

NUCLEAR-WASTE MANAGEMENT, int'l mtg., Prague, Czech and Slovak Federal Republic, by American Society of Mechanical Engineers, Czech and Slovak Mechanical Engineering Society, and the Czech and Slovak Nuclear Society. (Radovan Kohout, Ontario Hydro (H11 A2), 700 University Ave., Toronto, Ontario M5G 1X6. Phone: 416/592-5384. Fax: 416/592-4485)

◆◆◆ September 6-8

STRUCTURES AND TECTONICS AT DIFFERENT LITHOSPHERIC LEVELS (International Conference), Graz, Austria. (Wolfgang Unzog, Department of Geology, University of Graz, Heinrichstrasse 26, A-8010 Graz, Austria. Phone: 43 316 380 5584; telefax: 43 316 38 28 85)

◆◆◆ September 8-13

JURASSIC GEOLOGY (Arnell International Symposium), London, UK. (Dr. Stewart Brown, Conference Secretary, Petroleum Science and Technology Institute, 25 Ravelston Terrace, Edinburgh EH4 3EX, UK. Phone: 031 451 5231; telefax: 031 451 5232)

◆◆◆ September 8-17

LAYERING IN IGNEOUS COMPLEXES - WAGER AND BROWN 25th ANNIVERSARY COMMEMORATIVE MEETING (Symposium), Johannesburg, South Africa. (Professor R. Grant Cawthorn, Department of Geology, University of the Witwatersrand, P.O. Wits 2050, Republic of South Africa. Phone: 11 716 2711 or 2608; telefax: 11 339 1697 or 430 1926)

◆◆◆ September 14-16

AFRICAN GEOLOGY (16th International Colloquium), Ezulwini, Swaziland. (The Chairman or Secretary, Organizing Committee, 16th Colloquium of African Geology, P.O. Box 9, Mbabane, Swaziland. Phone: 42411; telefax: 45215; telex: 2301 WD; telegram: GSM)

◆◆◆ September 21-23

ANDEAN GEODYNAMICS (2nd International Symposium), Oxford, UK. Sponsored by University of Oxford and Institut Français de Recherche Scientifique pour le Développement en Coopération (Orstom). (Pierre Soler, ISAG 93, Orstom, CS1, 213 rue Lafayette, 75480 Paris Cedex 10, France. Telefax: 33 1 48 03 08 28)

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INTERNATIONAL ASSOCIATION OF VOLCANOLOGY AND CHEMISTRY OF THE EARTH'S INTERIOR (Meeting), Canberra, Australia. (IAVCEI ACTS, GPO Box 2200, Canberra ACT 2601, Australia. Phone: 61 6 257-3299. Fax: 61 6 257-3256)

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ENVIRONMENTAL BIOGEOCHEMISTRY (11th International Symposium), Salamanca, Spain. (Dr. J.F. Gallardo Lancho, I.E.T./CSIC, Aptdo. 257, Salamanca 37071, Espana, Spain. Phone: (923) 219606; telefax: (923) 219609)

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GLOBAL BOUNDARY EVENTS (Interdisciplinary Conference of IGCP Project 293, Geochemical Marker Events in the Phanerozoic), Kielce, Poland. (Barbara Studencka, Muzeum Ziemi PAN, Al. Na Skarpie

20/26, 00-488 Warszawa, Poland. Phone: (4822) 217-391; telefax: (4822) 297-497. Or Helmut H.J. Geldsetzer, Geological Survey of Canada, 3303-33rd St. NW, Calgary, Alberta T2L 2A7, Canada. Phone: (403) 292-7155; telefax: (403) 292-5377)

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► October 1993

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INTERGEMS '93 (2nd International Symposium on Precious and Decorative Stones), Prague, Czechoslovakia. Sponsored by Czech and Slovak Geological Services and Museums. (Secretariat INTERGEMS, Malostranske nam. 19, CS-11821 Praha 1, Czechoslovakia. Phone: 535 357; telefax: 533 564)

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◆◆◆ October 25-28

GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Boston, Massachusetts, USA. (Vanessa George, GSA, P.O. Box 9140, Boulder, CO 80301, USA. Phone: (303) 447-2020)

▶ November 1993

◆◆◆ November 15-30

LOW TEMPERATURE METAMORPHISM: PROCESSES, PRODUCTS AND ECONOMIC SIGNIFICANCE (IGCP Project 294 Thematic Meeting), Santiago, Chile. (Professor M. Vergara, Universidad de Chile, Departamento de geología y Geofísica, Casilla 13518-Correo 21 Santiago, Chile. Telefax: 56 2-6963050)

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EUROPEAN ASSOCIATION OF EXPLORATION GEOPHYSICISTS (56th Annual Meeting and Exhibition), Austria Center, Vienna, Austria. (Evert Van der Gaag, Business Manager, European Association of Exploration Geophysicists, Utrechtseweg 62, NL-3704 HE Zeist, the Netherlands. Phone: (03404) 56997; telefax (03404) 62640; telex:33480)

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