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CATATAN GEOLOGI

Geological Notes

The Kudat Ophiolite Complex, northern Sabah, Malaysia — field description and discussion

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Abstract: Middle Jurassic to Early Cretaceous ophiolitic rocks occur scattered in the Kudat Fault Zone, Kudat and are referred to for the first time as the Kudat Ophiolite Complex (KOC). This complex tectonically represents a dismembered ophiolite sequence, however all components of a complete ophiolite are present with the exception of a gabbroic and/or cumulate mafic-ultramafic layer. A generalized igneous stratigraphy for the KOC may be reconstructed from these dismembered remnants, consisting of sheared and brecciated serpentinite, plagiogranite, doleritic to basaltic dykes and submarine pillow basalt overlain by radiolarian chert. The KOC may represent as supra-subduction zone ophiolite type (SSZ-ophiolite type).

INTRODUCTION

Rocks of an ophiolite sequence occur scattered in the Kudat Fault Zone, northern Sabah (Fig. 1). These Middle Jurassic to Early Cretaceous ophiolitic rocks are unconformably overlain by the late Early Miocene Kudat Formation and early Middle Miocene Kudat Mélange (Sanudin, pers. comm.).

The occurrence of the association of basaltic rock-dolerite dykes and felsic plutonic/plagiogranite rocks along the coastal-line in Kampong Pangaraban, north of Kudat town clearly suggests an ophiolite complex. The Kudat area has previously been mapped by Stephens (1956). Subsequent geological works were carried out by several students from University of Malaya (Tang, 1976; Koh, 1977; Samsudin, 1977) and Universiti Kebangsaan Malaysia (Sanudin, 1978; Saing, 1983; Velan, 1985). Basir *et al.* (1985) has studied the age of the radiolarian chert in the Chert-Spilitic Formation. Tjia (1988) considered that the Kudat area is part of the Kinabalu Suture. Detailed study on the structural and tectonic evolution of the northern Sabah was discussed

by Tongkul (1990, 1991). Gassim *et al.* (1993) explained the tectonic evolution of the Marudu Bay.

This paper gives a brief description of the ophiolitic volcanic-plutonic rocks in the Kudat Fault Zone which were not described in detail by previous workers.

OPHIOLITIC VOLCANIC ROCKS

Pillow Basalt

These rocks were mainly exposed along the coastline at Tanjung Bangau (Fig. 1 and Fig. 2). The other localities are in the Jalan Tamalang and Jalan Pinangsoo (Agung-Agung) (Fig. 1). These rocks are characterised by well-developed pillow structure which vary in size and shapes. However, the greenish basaltic rocks occurring at the Tanjung Pangaraban coastline do not show the pillow structures (Fig. 3). These basalts are intruded by dolerite dykes and plagiogranite. Amygdaloidal and vesicular textures are commonly preserved in the rocks. A few millimetres thick of calcite veins and quartz-feldspathic veins are always

seen associated with the pillow basalts. Fresh pillow basalts are greenish in colour and brownish when weathered. Pillow basalts which were observed in the Jalan Pinangsoo are associated with reddish to brownish bedded chert. Pillow basalt exposed in the Tanjung Bangau has been intruded by a single basaltic dyke which range in size between 2-4 cm (Fig. 4).

Brecciated Basalt

Brecciated basalts are always found adjacent to and within the Kudat Fault Zone and/or shear zone. Only two localities of these rocks were observed, about 20 m north of Tanjung Bangau and at Jalan Sin San (Fig. 1).

Metabasalt

This rock is only found along the Tanjung Pangaraban coastline, approximately 5 km north of Kudat town (Fig. 1). It is characterised by foliation which has developed in the rock (Photo 4). This feature clearly suggests that the rock has undergone metamorphism. About 10-20 cm thick of metadolerite dyke occurs parallel to the foliation planes (Fig. 5). This metabasalt is cut by several shear zones (of a few cm

width) trending east-west (Fig. 6) and intruded by dolerite dyke (40-50 cm thick) and a plagiogranite suite (Fig. 7). Pods and/or lenses of epidotised metabasalt are commonly observed in the outcrop, suggesting hydrothermal alteration.

OPHIOLITIC PLUTONIC ROCKS

Basalt Dyke

A single basaltic dyke (2-4 cm thick) occurs within the pillow basalt at the Tanjung Bangau coastline (Fig. 4). This dyke is of fine- to medium-grained size. It is interpreted as a residual melt after the fractional crystallisation of dolerite and gabbroic and/or cumulate rocks if this basaltic rock represents a part of an ophiolite sequence (Shariff, 1993).

Dolerite Dyke

No sheeted dyke complex has been observed in this study. However, doleritic dykes are found in the coastline of Tanjung Pangaraban (Fig. 7). These dykes cut the metabasalt with a few millimetres of chilled margin. These



Figure 2. Pillow basalt exposed along the Tanjung Bangau coastline, western Kudat. The geometry of the pillow structures indicate that the pillow lava young upwards, indicating normal disposition. View of photograph towards west.

dykes generally trend E-W direction and dip steeply to the south. A few centimetres of plagiogranite veins cut these dykes. The dykes are fine- to medium-grained, pale grey in colour with ophitic to subophitic textures and show thickness of about 40-50 cm. Several fault and/or shear zones cut the dykes. These dykes are interpreted to be formed by continuous injection of basaltic melt along a zone of extension (Coleman, 1977; Gass, 1980).

Plagiogranite

Plagiogranitic rocks are only observed in Tanjung Pangaraban (about 5 km north of Kudat town) and occur as a small intrusive body with irregular boundaries intruded into metabasalt and dolerite dyke (Fig. 3). The rocks are light, pale pink and greenish in colour, and medium- to coarse-grained in size. On the basis of hand

specimen observation, the rocks show hypidiomorphic granular texture and consist of quartz, feldspar, amphibole and Fe-Ti oxides. Plagiogranites are commonly considered to be the late products of differentiation by fractionation in a magma chamber within ophiolite sequences (Coleman, 1977; Gass, 1980), crystallised from a late-stage melt expelled from a cumulate pile lower in the magma chamber (Jaques and Chappell, 1980) and/or as a melts residual after the fractional crystallisation of the dolerite and gabbroic and/or cumulate rocks (Shariff, 1993).

Serpentinite

The serpentinite can be found in a few places within the Kudat Fault Zone (Fig. 1). No peridotite body can be observed in the study area. Serpentinites are dark blue in colour,

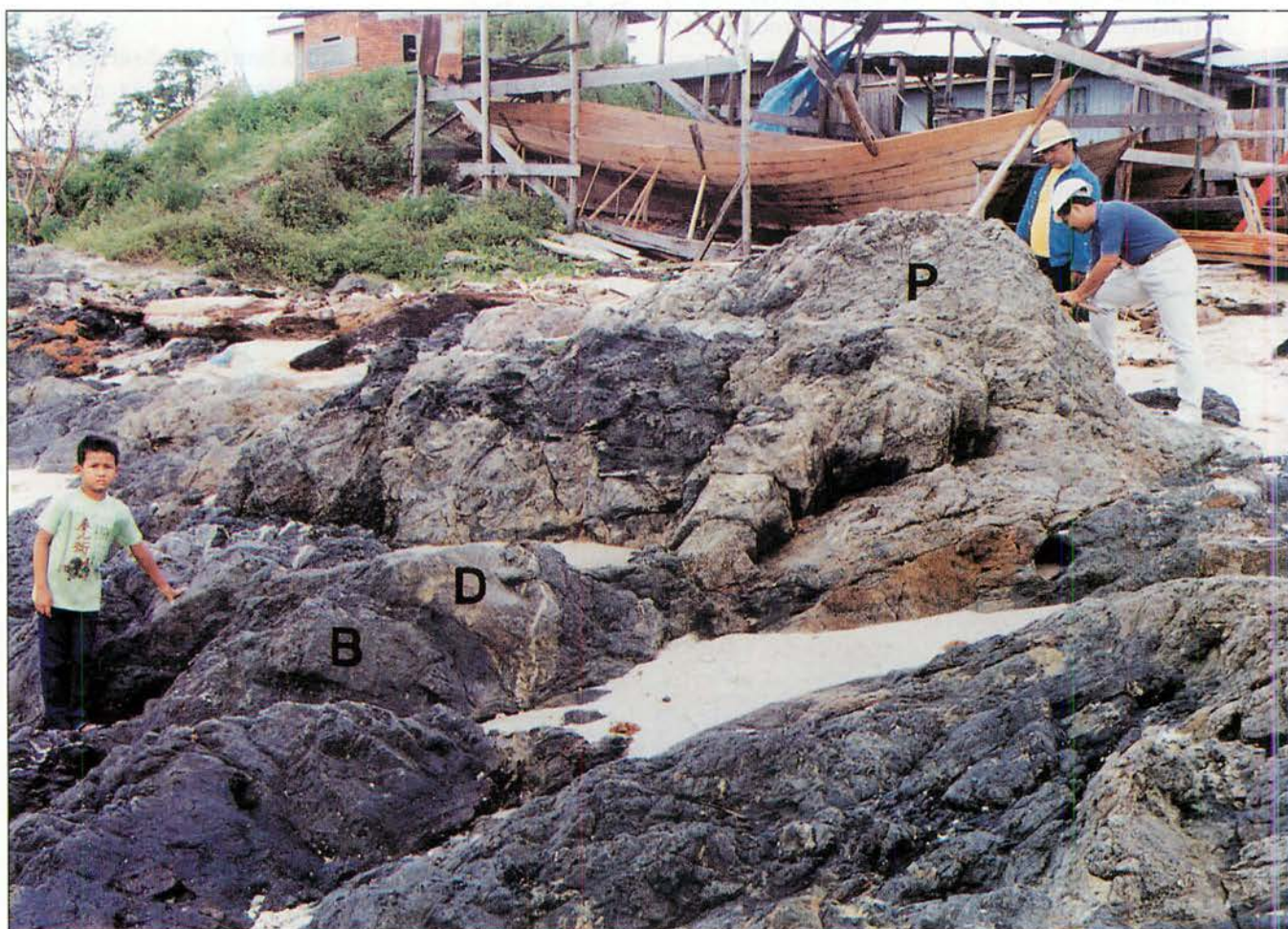


Figure 3. Ophiolitic rocks exposed at Kampong Pangaraban, along the coastline. B — basalt; D — dolerite; P — plagiogranite. View towards northwest.



Figure 4. Basaltic dyke (2-4 cm thick) cuts the pillow basalt. Location: Tanjung Bangau coastline. Marker pen points to the west.



Figure 5. Metadolerite dyke within the metabasalt exposed at the Tanjung Pangaraban coastline, approximately 5 km north of Kudat town. Head of the hammer is pointing to the north.



Figure 6. Shear zones in the metabasalt exposed at Tanjung Pangaraban, north of Kudat. View of photograph towards east.

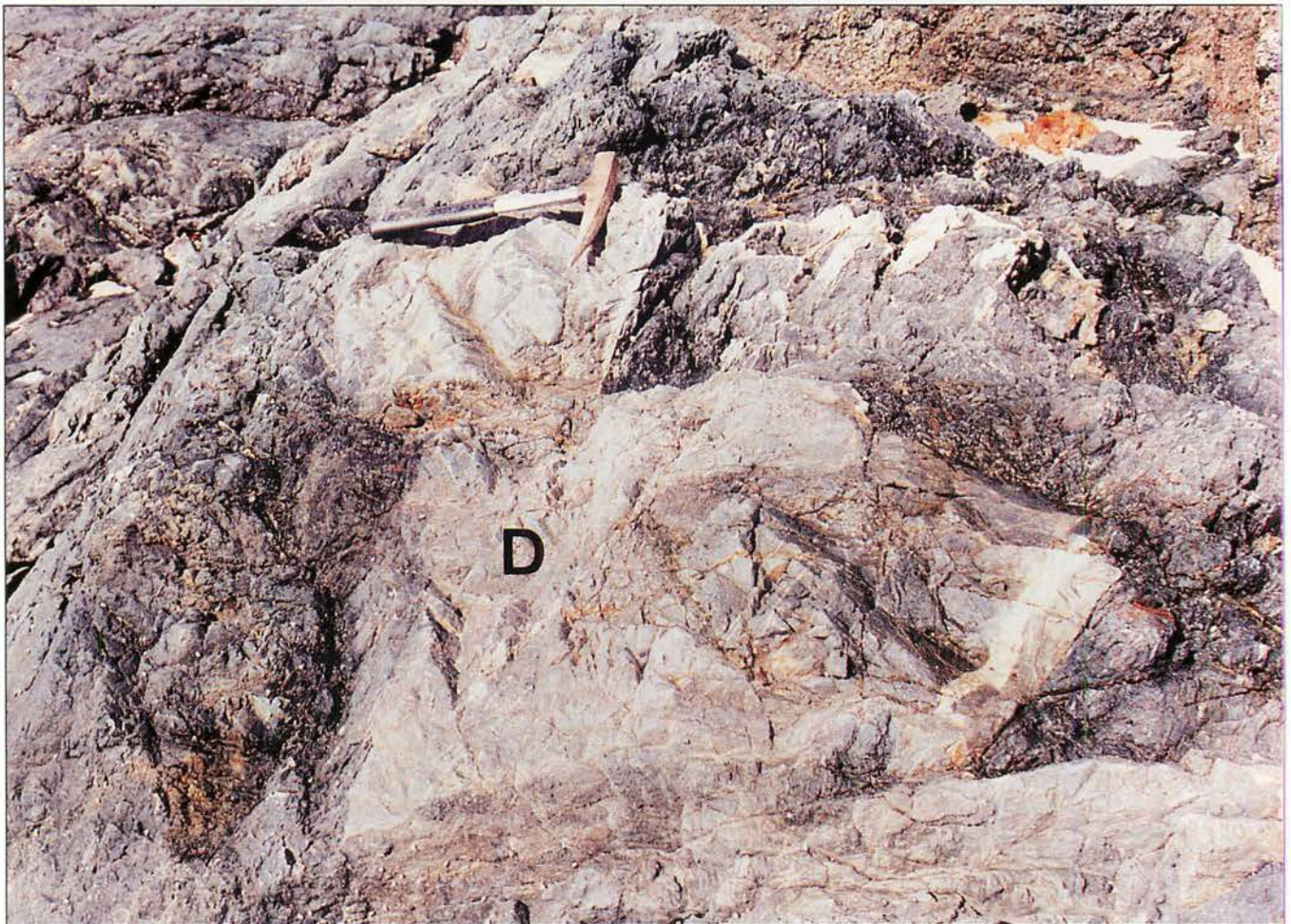


Figure 7. Dolerite dyke (D) cuts the massive basalt. This dyke has been displaced by small scale wrench faults and/or shear zone. Location: Tanjung Pangaraban. Hammer head points towards west.

sometime black, with waxy or polished surface and commonly characterised by being sheared and/or foliated and also brecciated (Fig. 9). Brucite $[Mg(OH)_2]$ veins and/or lenses which represent the product of serpentinization processes are sometimes associated within the serpentinites (Fig. 10). Foliation planes within the serpentinites trend between E-W and ESE-WNW with dips ranging between 50-80°. Serpentinites are commonly considered to be the products of serpentinization of oceanic peridotite (Gass, 1980) which later rise up to the surface as a diapiric body.

DISCUSSION

Ophiolite Sequence

The igneous rocks preserved in the Kudat Fault Zone clearly represent an ophiolite sequence, named the Kudat Ophiolite Complex (KOC). This complex is considered to be a dismembered ophiolite within the terms of the Penrose Field Conference definition (Anonymous, 1972). Generally, all components

of a complete ophiolite are present in the study area with the exception of a gabbroic and/or cumulate mafic-ultramafic layer. A generalized igneous stratigraphy for the KOC (Fig. 8) may be reconstructed from this dismembered remnants, consisting of sheared and brecciated serpentinite, plagiogranite, doleritic to basaltic dykes and submarine pillow basalt overlain by radiolarian chert.

Age of Formation of the Kudat Ophiolite Complex

The Kudat Ophiolite Complex can be deduced by studying the associated deep sea sediments (cherts). This sediment formed a sedimentary cover overlying the ophiolite when it was in the ocean or marginal basin. Basir *et al.* (1985) studied the age of radiolarian chert in the Kudat area and obtained an age of Early Cretaceous for the bedded chert associated with the pillow basalt of the Kudat Ophiolite Complex. This age indicates the minimum age for the formation of the Kudat Ophiolite Complex. However, the maximum age for the formation of the Kudat Ophiolite Complex is interpreted to be between Middle to Late Jurassic (Leong, 1974; Shariff, 1993).

Tectonic Environment

It is not easy to determine the tectonic environment for the Kudat Ophiolite Complex without studying the rock geochemistry of the ophiolite components. However, based on the research carried out in the surrounding area (Darvel Bay Ophiolite Complex) by Shariff *et al.* (1992) and Shariff (1993) the Kudat ophiolitic rocks have been shown to have similar characteristics to those of the Darvel Bay Ophiolite Complex. Therefore, the Kudat Ophiolite Complex may also represent a supra-subduction zone ophiolite type (SSZ-ophiolite type).

CONCLUDING REMARKS

1. The rocks preserved in the Kudat Fault Zone clearly represent a fragment of an oceanic lithosphere, named the Kudat Ophiolite Complex (KOC). This complex tectonically represents a dismembered ophiolite sequence, consisting of sheared

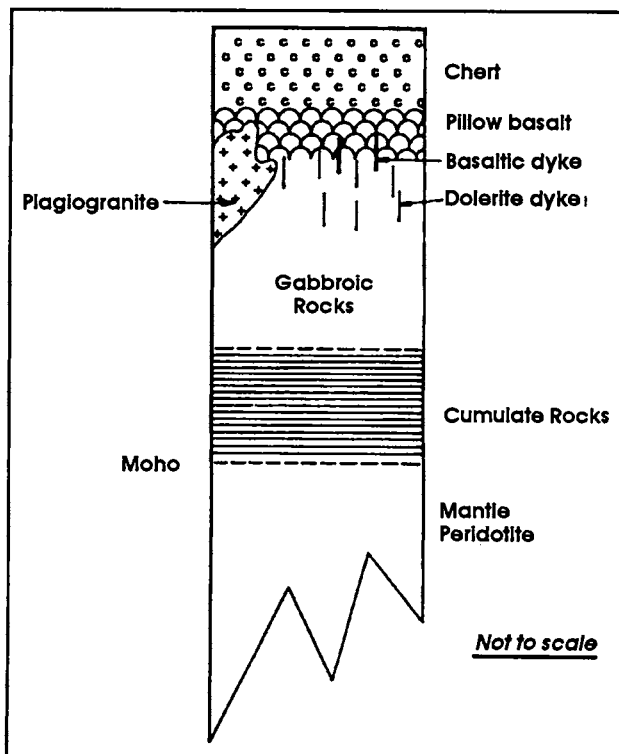


Figure 8. Ophiolite sequence of the Kudat area. Components of gabbroic and cumulate rocks were not observed.



Figure 9. Sheared and/or brecciated serpentinite exposed at Jalan Bangau, west of Kudat. View of photograph towards west.



Figure 10. Brucite veins and/or lenses within the serpentinite exposed at Jalan Bangau. View of photograph towards west.

and brecciated serpentinite, plagiogranite, doleritic to basaltic dykes and submarine pillow basalt overlain by radiolarian chert.

2. All components of a complete ophiolite are present in the Kudat Ophiolite Complex with the exception of a gabbroic and/or cumulate mafic-ultramafic layer.
3. This complex is probably of Middle Jurassic to Early Cretaceous age.
4. The tectonic setting for the Kudat Ophiolite Complex is interpreted to represent a supra-subduction zone ophiolite type (SSZ-ophiolite type). This interpretation is based on similarity of features of the Kudat Ophiolite Complex with the Darvel Bay Ophiolite Complex, Lahad Datu, Sabah.

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CATATAN GEOLOGI

Geological Notes

Physico-chemical properties of basalt soils from Kuantan, Pahang

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Abstract: Some 20 basalt soil samples from the Kuantan area were analysed for their physico-chemical properties. The results show the following characteristics for the basalt soils: relative density is high with most values > 2.7 ; water content is generally high with $W_o > 30\%$ indicating high adsorption of water; liquid limits can attain high values in excess of 50%; grain size comprises the whole range from G (gravel) to C (clay), but is predominantly fine-grained (M/C); the fines fractions of the soils are classified under ML-MH soils, i.e. silts with low-high plasticity. Surprisingly, the compacted maximum dry densities show rather low values ranging from 1.22-1.60 g/cm³ in spite of the fact that basalt soils generally make good embankment fill materials. The low $\gamma_{dm\max}$ values could be attributed to the rather high optimum moisture contents of the soils ($\omega_{opt} = 29.0-47.5\%$).

Results for the pore fluids chemistry indicate the following: pH is on the acidic side (< 7); conductivity is low, reflecting the low cations contents of the pore fluids; cations Na⁺, K⁺, Ca²⁺, Mg²⁺ are generally low in concentrations, with K⁺, Ca²⁺ and Mg²⁺ all having values of < 5 ppm. Interestingly enough, there appears to be a distinct predominance of Na⁺ concentrations. As such, the ratios of monovalent cations (Na⁺ + K⁺) versus divalent cations (Ca²⁺ + Mg²⁺) show high values ranging from 3-17, with a few values being in excess of 100, thus indicating the high dispersivity of the basalt soils. Anions Cl⁻, CO₃²⁻, and HCO₃⁻ were not detected, while SO₄²⁻ shows considerable values of 35-122 NTU.

Although in the field the soil profile shows 3 distinct layers or horizonations having colours ranging from (top to bottom) dark brown, red, to purple, it would appear from the test results obtained that the physico-chemical properties of the soil samples taken from these 3 horizons do not reflect any significant differences or variations from one another, contrary to expectations. Moreover, some of the physico-chemical properties of the basalt soils taken from the same layer/horizon also appear to plot in 2 distinct clusters — the reasons for this are not entirely clear.

INTRODUCTION

Basalt and basalt soils are of widespread occurrence in the Kuantan area. An academic study was initiated recently to investigate the physical and chemical properties of the basalt soils, as part of a broader study on the material properties of granitic and basaltic soils and rocks in the area. This paper summarises and discusses the results on the physico-chemical properties of the basalt soils from Kuantan.

METHODOLOGY

Some 20 basalt soil samples were collected from the Kuantan area and vicinities, and analysed for their physico-chemical properties. The laboratory methods adopted are in accordance with BS1377 (1975), U.S. Dept. of the Army (1970), and the GRC Manual (undated), McGill University, Montreal. Pore fluids of basalt soils were extracted using the "Saturation Extract" method employing vacuum suction.

In the field, the basalt soil profile shows 3 distinct layers or horizonations having colours of dark brown, red, and purple (from top to bottom). These layers have been designated here as 'a', 'b' and 'c' respectively.

PHYSICAL PROPERTIES

The physical properties of the soils analysed are: relative density, water content, the Atterberg Limits, grain size distribution, and compaction properties. The results are shown in Table 1, plotted in Figures 1a-1j and discussed herein.

Relative Density, G_s

The values for the relative density of the soil grains range from 2.62-2.86 for the entire set of samples. As seen from Figure 1a, most values are rather high, i.e. > 2.7 , indicating minerals with higher G_s , e.g. iron oxides, etc. Note the lack of significant differences between type 'a' (upper brown soil layer) and type 'b' (lower red soil layer) soils.

Water Content, W_o %

The water contents are generally high, with $W_o > 30\%$ in general. The range of values is from 17.32-54.18%. These high values would seem to indicate high adsorption of the water by perhaps the more clayey soils. Once again, there appears to be no significant differences between the water contents of type 'a' and type 'b' soils, see Figure 1b.

Atterberg Limits, LL and PL

The liquid limits (LL) are rather high, with the range from 31-85%, with many values being $> 50\%$. High liquid limits can be tied up with high adsorption of water by the clay particles or certain clay minerals (not investigated at this stage). Comparing the type 'a' and 'b' soils, Figure 1c, there is similarity in the pattern of distribution of the LL values, with both showing distribution in two distinct clusters. Once again, there are no significant differences in the LL values between the two types of soils ('a' and 'b').

Values for the plastic limit (PL) are also relatively high, ranging from 26-52%. Similar values and pattern of distribution are also shown

by both soils (type 'a' and 'b'), Figure 1d, with two clusters as before, though not as distinct as the LL case.

Grain Size Distribution

It would appear that the basaltic soils contain the whole range of grain sizes from Gravel (G) to Clay (C). Nevertheless, they are predominantly fine-grained, i.e. comprising mostly Silt (M) and Clay (C). Figures 1e-1h compare the grain size distribution for the type 'a' and 'b' soils. It appears that no significant differences are detected for G, S (Sand) and M; however, the type 'a' soil shows a higher clay content compared to the type 'b' soil. This is to be expected since the upper soil layer 'a' has undergone a higher degree of weathering which thus produces more clay particles.

Compaction Parameters, γ_{dmax} and ω_{opt}

The compaction parameters are plotted in Figures 1i-1j. Surprisingly, the compacted maximum dry densities (γ_{dmax}) of the soils show rather low values ranging from 1.22-1.60 g/cm³. It is common knowledge that basaltic soils generally make good embankment fill materials (such as for highways, etc.). The low γ_{dmax} values could be attributed to the rather high optimum moisture contents of the soils where $\omega_{opt} = 29.0-47.5\%$. Perhaps further studies on the clay mineralogy of the basalt soils can help shed some light on the high adsorption of water by the soils.

Values for the compaction parameters are similar for type 'a' and 'b' soils.

Soil Classification

The fines fraction (M/C) of the basaltic soils are classified under ML and MH soils, i.e. silts with low-high plasticity (Fig. 2). Once again, Figure 2 shows the data points for both type 'a' and 'b' soils being plotted in two distinct clusters. Comparing type 'a' and 'b' soils there are no significant differences in the plots as shown in Figure 2.

PORE FLUIDS CHEMISTRY

Pore fluids of the soils extracted using vacuum suction are analysed for: pH,

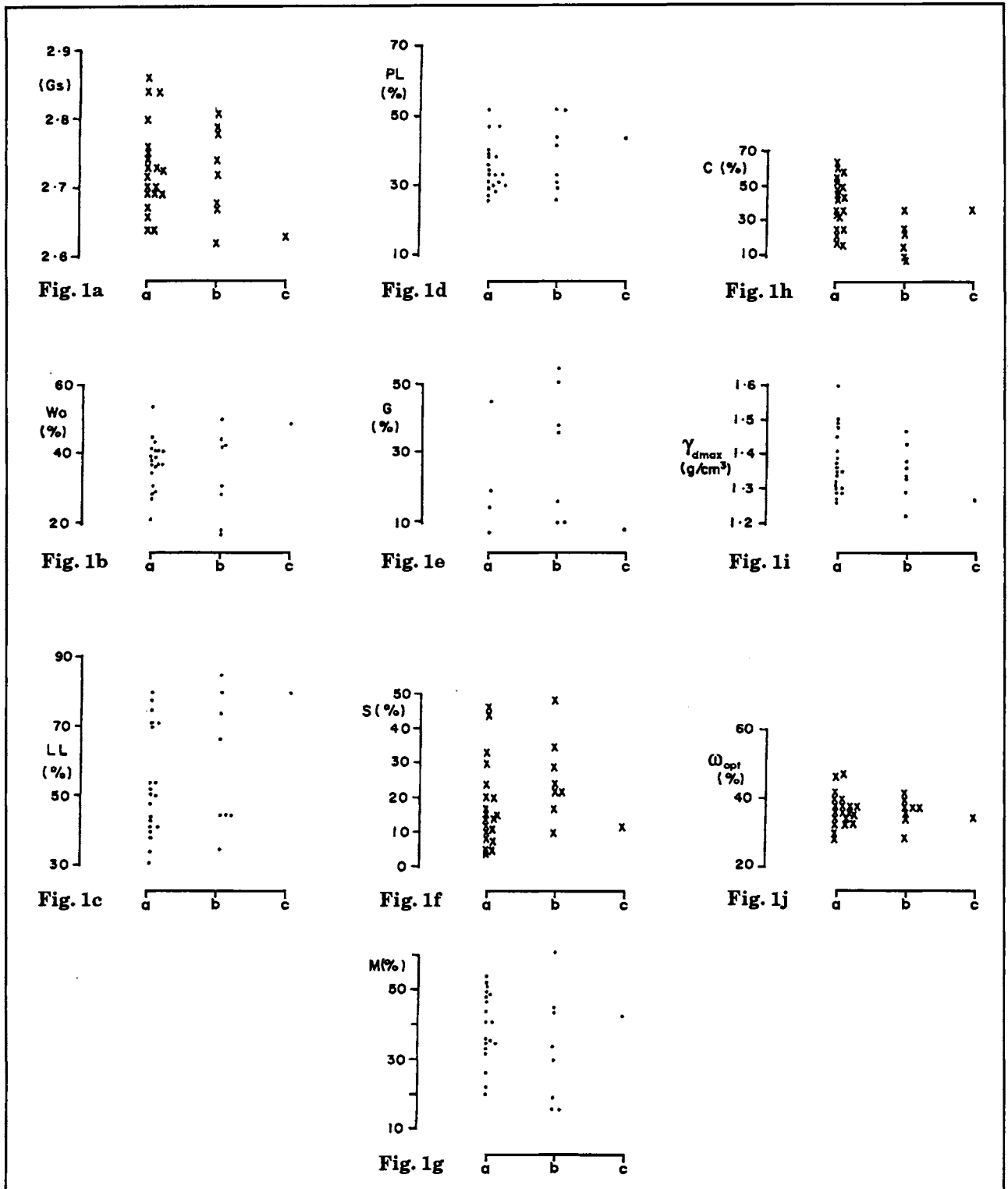


Figure 1. Physical properties of basalt soils, Kuantan.

Table 1: Summary of physico-chemical properties of basalt soils, Kuantan.

Physical Property	Range of Values	Chemical Property	Range of Values
Relative Density (Gs)	2.62-2.86	pH	5.94-6.94
Water Content (W _o %)	17.32-54.18	Conductivity (mS/cm)	0.050-0.229
Atterberg Limits:		Na ⁺ (ppm)	2.06-21.5
LL (%)	31-85	K ⁺ (ppm)	1.25-4.31
PL (%)	26-52	Ca ²⁺ (ppm)	0-3.73
PI (%)	4-36	Mg ²⁺ (ppm)	0.05-0.68
Grain Size:		SO ₄ ²⁻ (NTU)	35-122
G (%)	0-55	Cl ⁻ , CO ₃ ²⁻ , HCO ₃ ⁻	NIL
S (%)	4-48		
M (%)	16-66		
C (%)	0-63		
Compaction:			
γ _{dm} max (g/cm ³)	1.22-1.60		
ω _{opt} (%)	29.0-47.5		
Classification (fines)	ML - MH		

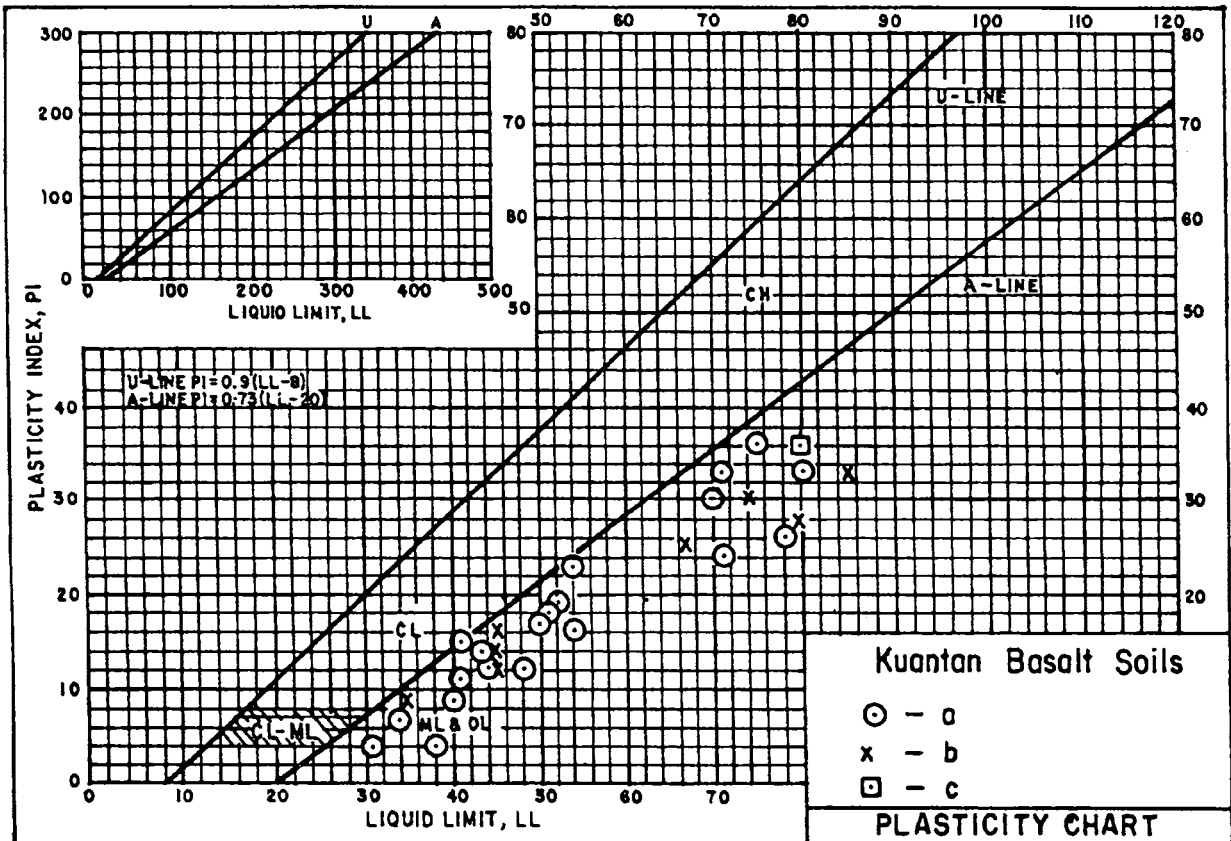


Figure 2. Plasticity chart, Kuantan Basalt Soils.

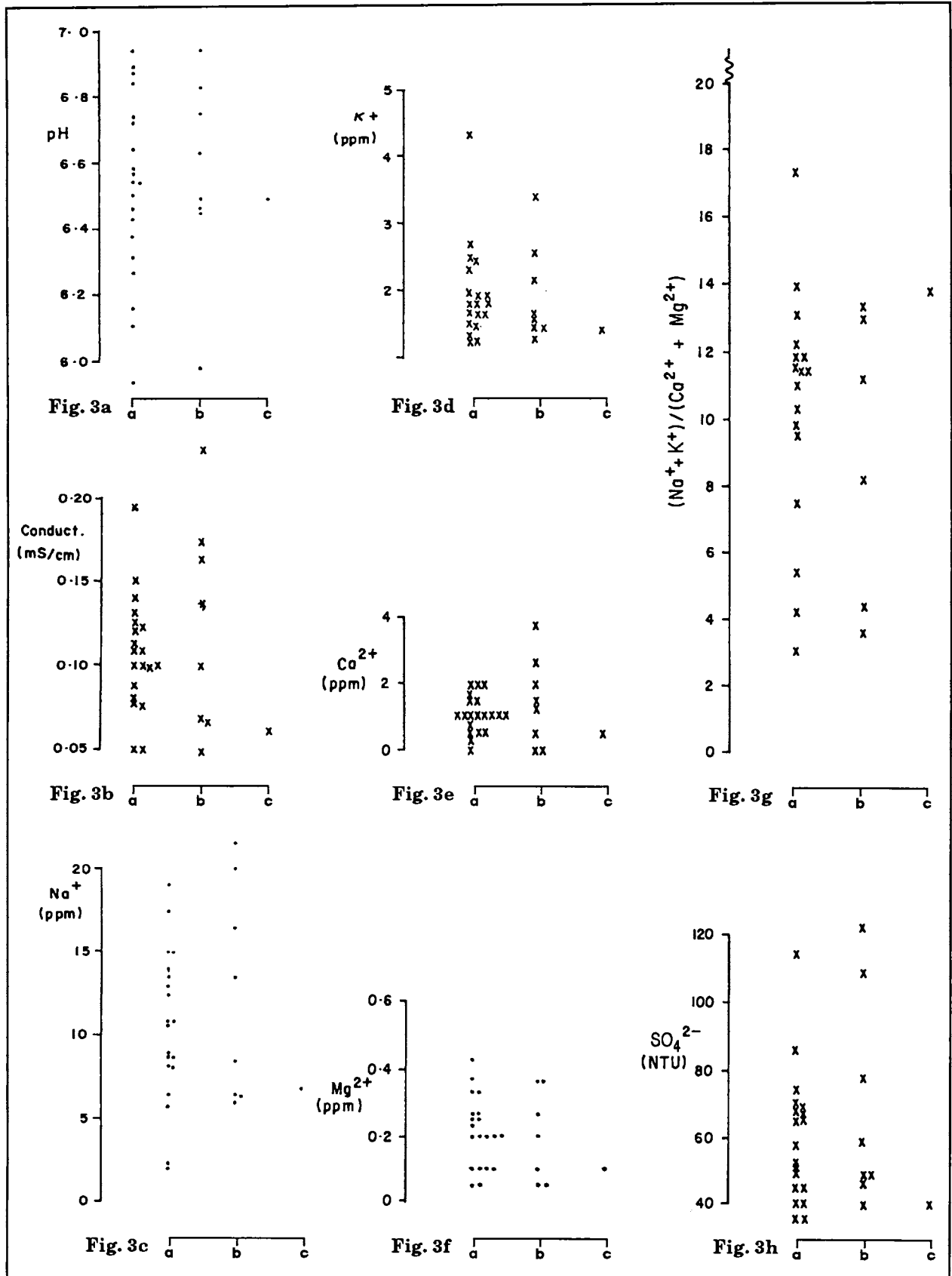


Figure 3. Chemical properties of pore fluids, Kuantan soils.

conductivity, cation concentrations (Na^+ , K^+ , Ca^{2+} , Mg^{2+}) and anion concentrations (SO_4^{2-} , Cl^- , CO_3^{2-} , HCO_3^-). The results are summarised in Table 1, plotted in Figures 3a-3h and discussed below.

pH

pH values are on the acidic side ($\text{pH} < 7$). Figure 3a shows that type 'a' soils (upper brown layer) can have slightly lower pH values (say $\text{pH} = 6-6.4$) compared to type 'b' soils (lower red layer) where $\text{pH} > 6.4$. This slight difference can perhaps be partly attributed to the presence of organic acids (humic acid, etc.) at shallow depths.

Conductivity

Conductivity is generally low, i.e. 0.050-0.229 mS/cm (milli Siemen per cm), reflecting the low cations contents of the pore fluids. Comparing type 'a' and 'b' soils, there are no significant differences in conductivity values, Figure 3b.

Cations Concentrations (Na^+ , K^+ , Ca^{2+} , Mg^{2+})

Cations concentrations are generally low, Figures 3c-3f, with K^+ , Ca^{2+} and Mg^{2+} all having values of < 5 ppm. Interestingly enough, there appears to be a distinct predominance of Na^+ concentrations (mostly > 5 ppm, up to ~ 20 ppm). The order of abundance is thus: $\text{Na}^+ > \text{K}^+ > \text{Ca}^{2+} > \text{Mg}^{2+}$. Because of the predominance of the monovalent cations, in particular Na^+ , the ratios of monovalent cations ($\text{Na}^+ + \text{K}^+$) versus divalent cations ($\text{Ca}^{2+} + \text{Mg}^{2+}$) show high values ranging from 3-17, with a few values being in excess of 100, Figure 3g. This would indicate the high dispersivity or dispersion potential of the basalt soils, Mitchell (1976).

Comparing the type 'a' and 'b' soils, there are again no significant differences in the cations concentrations and distributions.

Anions Concentrations (SO_4^{2-} , Cl^- , CO_3^{2-} , HCO_3^-)

Cl^- , CO_3^{2-} and HCO_3^- were not detected

in the pore fluids. Values for SO_4^{2-} are considerable, i.e. 35-122 NTU (N turbidity units). The two types of soils 'a' and 'b' show similar range of SO_4^{2-} values, Figure 3h.

CONCLUSIONS

Although in the field the basalt soil profile shows 3 distinct layers or horizonations having colours ranging from (top to bottom) dark brown, red, to purple, it would appear from the test results obtained that the physico-chemical properties of the soil samples taken from these 3 horizons do not reflect any significant differences or variations from one to another, contrary to expectations. Moreover, some of the physical properties (e.g. Atterberg Limits) of the basalt soils taken from the same layer/horizon also appear to plot in 2 distinct clusters — the reasons for this are not entirely clear.

ACKNOWLEDGEMENTS

The results reported herein form part of a broader study on material properties of granitic and basaltic soils and rocks of the Kuantan area, funded by UKM (code no. 59/93). The author also acknowledges help rendered in field sampling, laboratory analyses, and typographical niceties from the following: Sdr. Jailani Miskam, Alias Noon, Zahari Hussin, Sdri Mahani Samad, Saoodah Ahmad, and Haidar Ludin, all of the Dept. of Geology, UKM, Bangi.

REFERENCES

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PERTEMUAN PERSATUAN Meetings of the Society

Ceramah Teknik (Technical Talk)

Uranium deposits in granitic rocks

REGIS CAMBON

Laporan (Report)

Dr. Regis Cambon, a Consulting Geologist with GME, France and a IAEA Consultant with the Geological Survey of Malaysia gave the above talk to an audience of about 30 at 5.30 pm on 8th September 1994 at the Geology Department, University of Malaya.

Dr. Cambon began his talk by summarising the geologic histories and cycles of uranium and thorium mineralization and the classification of granitic rocks. Despite their variation in chemical composition, uraniumiferous mineralization appears to be associated with granites showing the more complex evolution where the mixing of rocks is most important.

To illustrate this point, Dr. Cambon then selected some uranium deposits known around the world to be associated with granitic rocks.

1. Midnite Mine (Spokane — Washington State — USA)
Mineralization is associated with the fractured intrusive contact between Pre-Cambrian metasediments and Cretaceous porphyritic quartz monzonite.
2. Schwartwalder Mine (Golden, Colorado, USA)
The deposit is located along a shear zone between the metamorphic formations and the granodiorite/quartz monzonite intrusions.
3. Bondons deposit (France)
The mineralization is at the contact between the metasediments and calc-alkaline U rich granites.
4. Bokan Mountain (Alaska, USA)
The mineralization is disseminated inside secondary albitized rocks.
5. Uranium deposits associated with the Hercynian granites (France, Portugal and Germany)
 - i) Bernardan deposit
The most important uranium deposit in France is located inside a dequartzified two mica granite known as episyenite in the Massif Central.
 - ii) Limousin uranium deposit
One of the best areas in France for uranium mineralization associated with granite in the NW central part of the Massif Central.

Of the different igneous rocks, Dr. Cambon indicated that the ones that contain the most uranium are granitic rocks and those with most potential for uranium deposits are the more acidic ones. The three common types of U and Th enriched granitic rocks are the low calcium peraluminous granites, the high calcium metaluminous granites and the peralkaline granites.

In the peraluminous magma most of the thorium content is incorporated in monazite. Uranium does not fractionate significantly in the main granite forming minerals and rarely exceeds 1 wt% in monazite. Thus a major proportion of uranium will crystallize as low Th uraninite. The high Ca metaluminous granites have as accessory minerals sphene, allanite, apatite, zircon and magnetite. Allanite does not accept important U and Th substitutions. In the peralkaline magmas, large amounts of a wide variety of accessory minerals crystallize more-or-less simultaneously and uranium will be distributed in these accessory minerals and cannot crystallize in significant amounts as uraninite.

Dr. Cambon then summarised the characteristics of favourable environments for uranium deposits associated with granitic rocks. These include peraluminous granites, association with two micas granites, granites with high Th, U or K values, granites containing uraninite and monazite as accessory minerals, ratio U/Th > 0.4, multiple intrusions, post tectonic activity with formation of breccia or porous rock body.

In the search for uranium deposits, the Spectrometric Airborne Survey can be carried out, like in the Central Belt of Peninsular Malaysia, to delineate the anomalies. From the airborne map all the different geological environments and features can be delineated, these include the granitic intrusions, structures like faults and folds and the limestones. Areas with high U (and Th) and K contents supported by field recognition of 2-mica granites will help delineate areas for detail uranium exploration.

G.H. Teh



REGIS CAMBON

YIN-KWAN, FOONG

TEA TIME



Contaminated land — assessment and remediation — Australian case histories

YIN-KWAN, FOONG

Laporan (Report)

Mr. Foong, Business Development Manager Environmental, CMPS & F Environmental, Brisbane, gave the above talk on 27 October 1994 at the Geology Department, University of Malaya. The talk was well-attended by over 30 people from academia, industry and government agencies indicating the keen interest in environmental matters.

After a brief review of international environmental perspectives, the speaker impressed upon us the high cost of environmental clean-ups — soil washing to cost more than \$20 million at BP Bayside, Port Melbourne contaminated with petroleum products; soil removal and replacement costing \$22 million at Pulpit Point, Hunters Hill, Sydney; and \$10 million to clean up the Albion Explosive site, Melbourne where dangerous levels of TNT, DNT and RDX with small amounts of mercury and cadmium have contaminated the 500 hectares site to be used for housing. The US expenditure projection ran into \$300 billion on 1,200 Super fund sites, \$8 billion for 1990 and \$24 billion for 1993. His message — environmental clean-up can cost a lot of money to owners and so Environmental Audit for purchases is the “ounce of prevention” needed.

Contaminated sites result from:-

- Inappropriate disposal of wastes
- Misuse of chemicals or finished products
- Accidental spillage of hazardous material
- Leakage during plant operations
- Uncontrolled use of pesticides and herbicides
- Release of polluted air or water onto site

The costly remediation technologies include capping for groundwater and soil, extraction for groundwater, physical and chemical treatment for groundwater, biological treatment for soil and thermal treatment for soil.

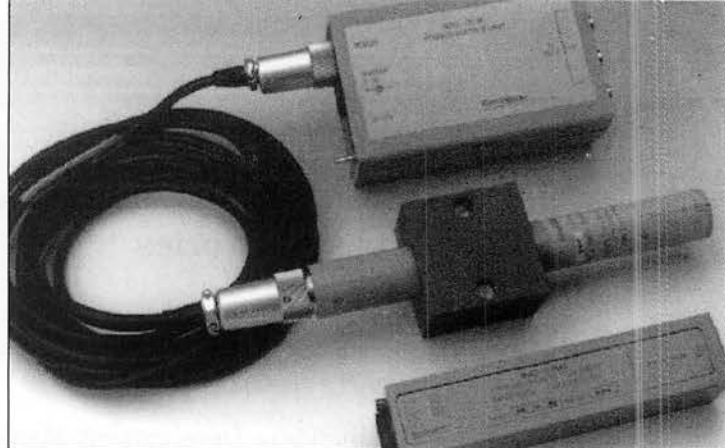
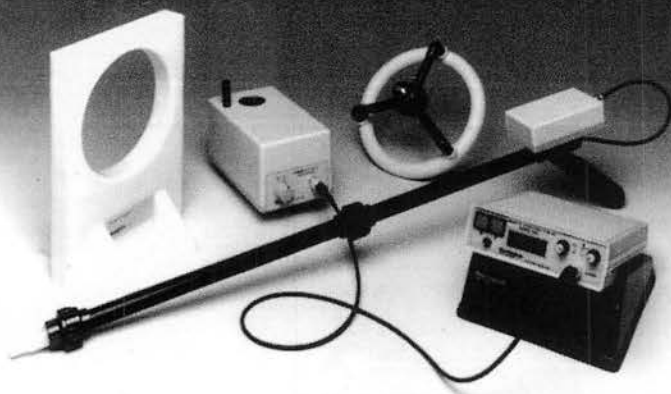
He then briefly tried to answer the questions “What to look for?” and “What can go wrong?” in contaminated site assessments, stressing the need for suitably trained geologists as investigators, good rules such as knowing the complete history of the site, the health and safety plans to protect the investigators, work plans and sampling procedures and the results and their interpretations.

This was followed by a review of investigations done at eight sites in Australia.

- 1) Cairns NQ — Old service station where fuel had leaked into groundwater from old petrol storage tanks.
- 2) Atherton Tableland — Land leased for residential use but contaminated by mineral assaying chemicals.
- 3) Bayside Port Melbourne — Refinery terminal with contaminated soil and groundwater.
- 4) Oil Refinery — Large volume of contaminated waste material buried on site putting marine and estuarine system at risk.
- 5) Carindale Residential Land — Tanners and woolscours had contaminated the land with insecticides and other chemicals.
- 6) Milton Road — Lead contamination from ash and sand from a foundry used as landfill.
- 7) Cattle Dip Nanango — Groundwater contaminated by chemicals used in cattle dip and municipal refuse tips.
- 8) Clayfield Service Station — Unknown old tanks and piping on site with leaks into fractured rocks.

The talk finished with a look at the Malaysian perspective with emphasis on the need to protect the environment even as industrialisation accelerates in the pursuit of economic development in the hope that we would avoid some of the costly mistakes others have committed elsewhere.

Lee Chai Peng



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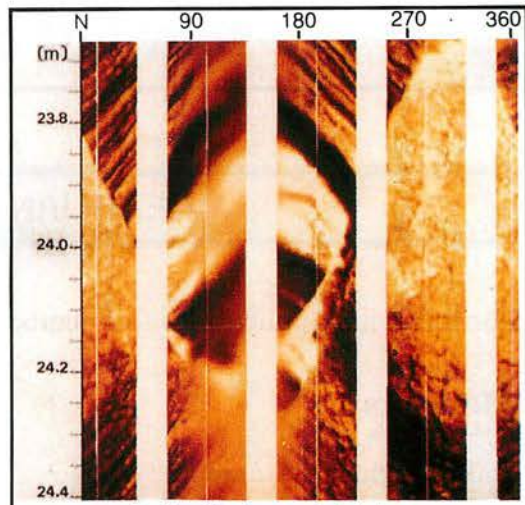
Fullbore Micro Imager*

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.

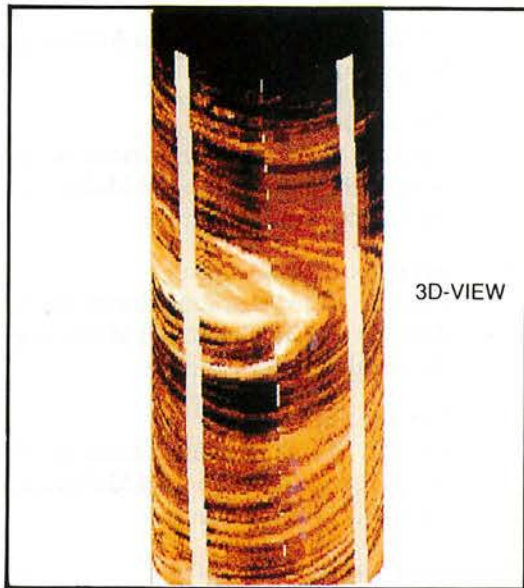
The FMI log, in conductive muds, provides electrical images almost insensitive to borehole conditions and offers quantitative information, in particular for analysis of fractures.

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.

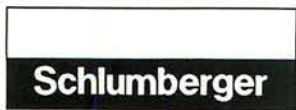
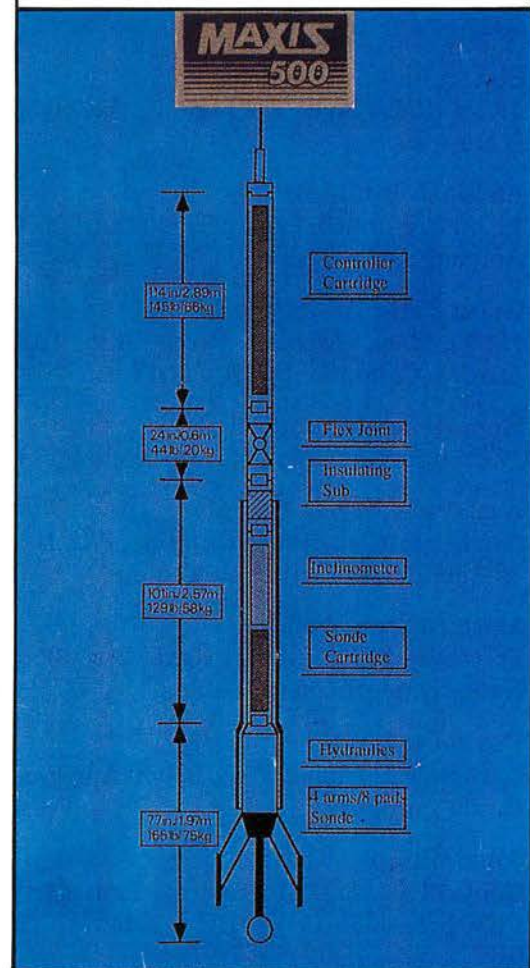


Fault without associated drag



3D-VIEW

"Bullseye" structure



BERITA-BERITA PERSATUAN News of the Society

KEAHLIAN (Membership)

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3. Abdullah Bin Dim
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4. Galen Verhulst
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5. Hamish John Campbell
17 Chamberlain Road, Karotu, Wellington.
6. Katherine Marion Bartram
IGNS, State Insurance Building, P.O. Box 30-366, Lower Hutt, New Zealand.
7. Mark Andrew Webster
Petrocorp Exploration, Private Bag 2056, New Plymouth, New Zealand.
8. David Curtin
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9. John Milsom
Dept. of Geological Sciences, University College London, Gower St., London WC1E 6BT.
10. Leonore Hoke
Department of Oxford, Parks Road, OX1 3PR U.K.

11. Taj Madira Bin Taj Rhmad
No. 29 Jalan 9/18A, Taman Mastiara, Kampong Batu, Batu 5 Off Jalan Ipoh, 51200 Kuala Lumpur.
12. Tung Yuen Wah, Jeremy
57-3, Block E, Rampai Court, Taman Sri Rampai, Setapak, 53300 Kuala Lumpur.

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2. Zaimi Bin Salleh
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3. Amir Sani Bin Ab. Bak
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6. Philip Ukul
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7. Ahmad Zaidi Bin Hampden
Jabatan Geologi, Universiti Malaya, 59100 Kuala Lumpur.

- | | |
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| <p>8. Mohd Imran Bin Idris
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Kuala Lumpur.</p> |
|---|--|

Associate Member

1. Paul D. Vrolijk
P.O. Box 596, 2600 AN Delft, The
Netherlands



PETUKARAN ALAMAT (Change of Address)

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

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Fugro Geosciences (Malaysia) Sdn. Bhd.
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Core Laboratories Malaysia, No. 17, Jalan
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Industrial Park, 40000 Shah Alam,
Selangor. | <ol style="list-style-type: none"> 4. Nicholas Jacob
Geological Survey Department, Peti Surat
1015, 30820 Ipoh, Perak. 5. Aswin Hariman
c/o Triton Oil Company of Thailand, Suite
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Jalan Tun Razak, 50400 Kuala Lumpur. 6. Goh Kiat Tze
c/o Triton Oil Company of Thailand, Suite
13.01, 13th Floor, Menara Tan & Tan, 207
Jalan Tun Razak, 50400 Kuala Lumpur. |
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PERTAMBAHAN BAHARU PERPUSTAKAAN
(New Library Additions)

The Society has received the following publications:

1. USGS Professional Paper, 1993: 1531, 1533, 1532, 1542, 1386-E, 1414-E, 1410-D, 1535, 1414-B, 1404-K, 1570, 1410-H. 1994: 932-D, 1538-A-C, 1439, 1541, 1540, 1413-B, 1553-A.
2. USGS Bulletin, 1994: 1995-D, E, 2080, 1926, 2074, 2059-D, 2045. 1993: 2031, 2046, 1842-F, 1904, 1846, 2067.
3. USGS Circular, 1994: 1103-A, 1120-E. 1993: 1101, 1115.
4. Earthquakes & Volcanoes, vol. 24, no. 3, 1993.
5. AAPG Explorer, Sept, Oct 1994.
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7. Explanatory text of the geologic map of Taiwan, sheet 71: Lanyu: scale 1:50,000, 1994.
8. Explanatory text of the geologic map of Taiwan, sheet 65: Lutao: scale 1:50,000, 1994.
9. Geological Service of Belgium, Professional Paper 1994/1 - no. 268, 1994/2 - no. 269, 1994/3 - no. 270.
10. Journal of Geosciences, Osaka City University, vol. 37, 1994.
11. AAPG Bulletin, vol. 78, nos. 5, 8 & 9, 1994.
12. Seatrad Centre, Report of investigation 90-92, 1993.
13. Monthly statistics on mining industry in Malaysia, May, 1994.
14. IMM, Transactions, Section A, vol. 103: May-Aug, 1994.
15. Chronicle of Mineral Research & Exploration, no. 514, 1994.
16. National Science Museum Monographs no. 8, 1994.
17. Bulletin of the National Science Museum, vol. 20, nos. 1 & 2, 1994.
18. Journal of Hebei College of Geology, vol. 16, nos. 2 & 5, 1993.
19. U.S. Geological Survey Yearbook Fiscal Year 1993, 1994.
20. A history of the water resources Branch, U.S. Geological Survey: vol. 1, From Predecessor Surveys to June 30, 1919.
21. Special publication of the Central Geological Survey no. 8, 1994.
22. Acta Micropalaeontologica Sinica, vol. 10, nos. 3 & 4, 1993.
23. Acta Palaeontologica Sinica, vol. 32, no. 6 (1993), vol. 33, nos. 1 & 2 (1994).
24. Palaeontological abstracts, vol. 8, no. 4, 1993 & vol. 4, no. 1, 1994.
25. Oklahoma Geology Notes, vol. 54, nos. 1-3, 1994.
26. Episodes: vol. 12, nos. 3-4 (1989); vol. 13, nos. 2-3 (1990); vol. 14, nos. 1-4 (1991); vol. 15, nos. 1-4 (1992); vol. 16, nos. 1-4 (1993).
27. SOPAC Newsletter, vol. 11, no. 2, 1994.
28. Bull. Centres Rech. Expl.-Prod. Elf Aquitaine, vol. 18, no. 1, 1994.
29. Index 1993: Des periodiques Francais des Sciences de la Terre.
30. The University of Kansas, Paleontological Contributions, no. 5, 1994.

BERITA-BERITA LAIN **Other News**

Mineral Deposit Evaluation

13-24 February 1995

A two 5-day short course for individuals who hold technical and financial appointments in mineral resource organizations responsible for mineral exploration and mine pre-production development

**Organised by the
Department of Geology
with the Continuing Education Centre
at Imperial College
in collaboration with
Ecole Des Mines De Paris**

STRUCTURE OF COURSES

The ten-day programme covers a wide range of inter-related topics which are of practical interest to potential participants from mineral resource organisations. In the first week, important issues associated with the "Technical and Financial Appraisal of Mining Projects" are addressed. The second week will be devoted to Mineral Exploration and Evaluation Management. In this module, particular emphasis will be given to developing presentation and communication skills. A series of video recorded role-playing exercises based on real scenarios will form an integral part of the course.

WHO SHOULD ATTEND?

The course would be of particular interest to individuals who hold technical and financial appointments in mineral resource organizations responsible for mineral exploration and mine pre-production development.

MODULE 1: Technical & Financial Appraisal of Mining Projects *13-17 February 1995*

Background

For mining projects to proceed from the exploration and evaluation stages to full-scale production, all available information is used in a feasibility study. Given the high level of mining failures, the mining industry and lending institutions are concerned to improve the reliability of projections incorporated into the studies and in reviewing the methodologies used. Recent debates have focused on the current communications gap between the mining and ore evaluation communities and the financial fraternity. The financial ramifications of an inappropriate choice of estimation technique, particularly for recoverable reserves, are not clear to either side and is an area which would benefit from an integrated approach to project modelling and appraisal.

Course Objectives

Risk is the uncertainty in outcome of a particular investment proposal. Sources of error in project evaluation which increase risk include production cost and revenue assumptions as well as grade estimation. The former are less amenable to numerical treatment which would permit quantitative determination of uncertainty. The course will analyse these independent and interdependent variables present in a mining operation.

MODULE 2: Mineral Exploration & Evaluation Management 20-24 February 1995

Background

Failure by exploration geologists to appreciate the criteria used by mining and mineral process engineers to develop a deposit can result in an inappropriate choice of engineering design. Given the availability of reliable models for predicting primary controls on the distribution of mineralization, sophisticated reserve estimation techniques, the success of mining projects will be very dependent on a systematic approach to data acquisition. This requires effective management from exploration through to evaluation to ensure that all key parameters required for effective design are constrained, and the results effectively communicated to engineering staff.

In addition to the normal demands for sound management imposed by the project, there is also an increasing requirement to communicate complex technical issues to outside organizations as part of environmental impact enquiries and applications for exploration and mine permits. Geologists are also required to produce long-term strategic plans, examine funding alternatives and understand the long term implications of Joint Ventures and particular corporate structures. The manner in which these tasks are undertaken can have a profound influence on the evolution of a project.

Course Aims

Mineral exploration should reflect the interdisciplinary approach needed in any programme of work, with contributions in the fields of exploration geology, reserve estimation and mineral processing. Technical briefs should be prepared in a manner which will ensure that individual tasks are mutually complementary. The results should aim to provide a firm basis from which decisions could be made to commit expenditure on establishing a production capability, as well as on ground-based exploration.

The course will be directed towards reinforcing the importance of sound management in undertaking mineral exploration and mine development within the context of the need to establish effective communication both within minerals industry and to outside bodies. This requires the development of presentation and communication skills.

GENERAL INFORMATION

JOINING INSTRUCTIONS: Joining instructions, including a map, will be sent to all participants 10-14 days prior to the commencement of the course.

FEES: The full fee for the whole ten-day programme is £1100. For those wishing to attend for individual module/week, the fee is £700 per module with a discount for early payment one month before the course start date (see application form). The fee covers tuition, a full set of course notes, lunches and light refreshments but **do not cover accommodation**. A limited number of subsidised places are available for academic participants.

VENUE: Department of Geology, Royal School of Mines, Imperial College, Prince Consort Road, South Kensington, London SW7 2BZ. The College is ideally placed for making use of public transport. Parking facilities for course participants are not available at the College.

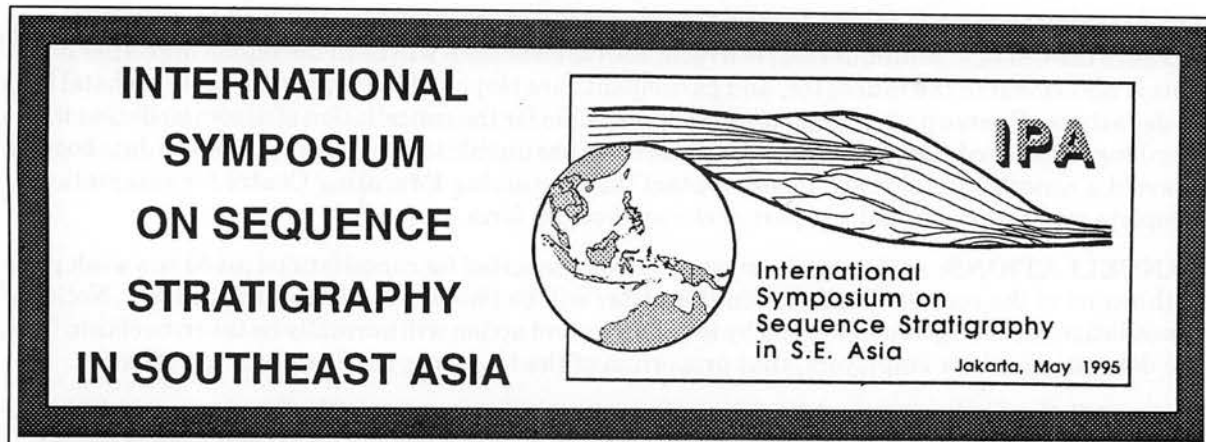
ACCOMMODATION: Single bedroom accommodation is available in local hotels within easy access to the College. Minimum cost of a room with shower/bath will be in the region of £55 per night. This is additional to the course fee, and participants are responsible for payment of their hotel bills on departure. Course participants are also responsible for the cancellation of accommodation if this is no longer required. Hotels should be advised if you are unable to arrive at the time and date booked, to avoid a cancellation charge. Please contact the Continuing Educating Centre for reservation or complete and return the bottom part of the application form.

CANCELLATIONS: A 10% administration fee will be levied for cancellations made one week prior to the start of the course. Cancellation thereafter will be liable to the loss of the full fee. Notice of cancellation must be given in writing by letter or fax and action will normally be taken to obtain from the delegates or their employers, that proportion of the fee owing at the time of cancellation.

Imperial College reserves the right to cancel a course at short notice and will not accept liability for costs incurred by participants or their organisations for cancellation of travel arrangements and/or accommodation reservations. If the course is cancelled, fees will be refunded in full. Imperial College also reserves the right to make such alterations to the content of a course as may be necessary.

QUERIES: Queries regarding the technical content of the course may be obtained from Professor Dennis Buchanan on Tel: +44 (0) 171 589 5111, Ext. 46440 or 46443; Fax: +44 (0) 171 594 6464.

Queries regarding registration, accommodation and administration should be directed to Sally Verkaik, Continuing Education Centre, Imperial College, Room 558 Sherfield Building, South Kensington, London SW7 2AZ, UK. Tel: +44 (0) 171 594 6882 or 6881, Fax: +44 (0) 171 594 6883, email: s.verkaik@ic.ac.uk



**Organized by
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and supported by PERTAMINA**

**DATES: May 16-18, 1995
VENUES: Jakarta, Indonesia**

ORGANIZATION:

The symposium will consist of 2 days of lecture sessions followed by a full day of poster sessions and workshops. Lecture sessions will comprise a presentation by lecture leaders and submitted papers. Poster and workshop presentations will emphasize "hands-on" interpretation of data from various sources, and they are intended to encourage audience participation. All sessions will be organized and directed by recognized experts in the field of sequence stratigraphy. As appropriate, field trips will be organized to precede or follow the symposium.

Papers are invited on all aspects of sequence stratigraphy in Southeast Asia. Workshop or poster presentations may be linked to a lecture talk to fully develop ideas and to encourage discussion and participation. Suggested topics include sequence stratigraphic studies at all scales, in both clastics and carbonates, with an emphasis on exploration and development of hydrocarbons. Priority will be given to papers with direct relevance to Southeast Asia.

LEADERS:

Lecture session leaders currently include George P. Allen, with Total Exploration and Production in Saint-Remy-Les-Chevres, France, Henry W. Posamentier, with ARCO Exploration and Production Technology in Plano, Texas, and J. Fredrick Sarg, with Mobil in Dallas, Texas. Other leaders may be added as needed for particular sessions.

ABSTRACTS: Deadline: January 2, 1995

For registration information and other details, contact: INTERNATIONAL SYMPOSIUM ON SEQUENCE STRATIGRAPHY IN SOUTHEAST ASIA, Indonesian Petroleum Association, Jl. M. Ikhwan Ridwan Rais 3, Jakarta 10110, Indonesia. Fax: (62-21) 375228.



Cretaceous Environmental Change in East and South Asia

3rd Symposium
International Geological Correlation Programme
Project 350

8-13 May 1995
National Institute of Geological Sciences
College of Science
University of the Philippines
Diliman, Quezon City
Philippines

INVITATION AND CALL FOR PAPERS

The Cretaceous has been the subject of intense research in the past several years. It is recognized as a period of transition and significant plate tectonism. The history of East and South Asia during this time has been studied in the past; but much remains to be discovered.

The theme of the IGCP-350 1995 is Environmental Change in Cretaceous systems in East and South Asia. The range of topics includes all fields of geology, including paleontology, stratigraphy, tectonics, and geophysics.

SCHEDULE OF THE SYMPOSIUM

The schedule of events for the Third Symposium is as follows:

- May 7 : Arrival of participants
- May 8 : Registration; Scientific Sessions
- May 9 : Scientific Sessions; Business Meeting
- May 10 : Field trip to Cretaceous outcrops in Tanay, Rizal
- May 11-13 : Field trip to Palawan
- May 14 : Department of participants

SCIENTIFIC PROGRAM

General Arrangements

The official language of the Scientific Program is English. Papers can be presented either in oral or poster sessions. Each oral session will be given 15 minutes, with 5 minutes at the end of the session for an open forum. Posters will be

displayed prominently throughout the duration of the program. The authors will be requested to be present during designated times to entertain queries on their respective displays.

Excursions to selected Cretaceous deposits in the Philippines will also be scheduled towards the end of the program.

Abstracts

The Organizing Committee requests all authors to submit abstracts on or before 7 November 1994. The abstracts should be written in English with a maximum of 500 words on one letter-sized page.

DATES TO REMEMBER

For your guidance, please take note of the following dates:

- July 1994 : Release of First Circular
- August 15 1994 : Deadline for submission of response to first circular
- August 31 1994 : Release of Second Circular
- November 7 1994 : Deadline for submission of abstracts and pre-registration forms

Address all inquiries to:

Dr. Priscilla J. Militante-Matias
Regional Coordinator, IGCP 350 Philippines

National Institute of Geological Sciences
College of Science, University of the Philippines
Diliman, Quezon City 1101 PHILIPPINES
Tel # (632) 97-60-46, (632) 97-60-60 to 69 ext 7117, 7445
Fax # (632) 97-60-47, (632) 97-12-66

Local News

Work starts on the final stretch

SHAH ALAM: Work on the central stretch of the North-South Expressway, linking Shah Alam, Sepang and Nilai, began yesterday and is expected to be completed by August next year.

Works Minister Datuk Leo Moggie performed the ground-breaking ceremony for the RM1 billion project yesterday.

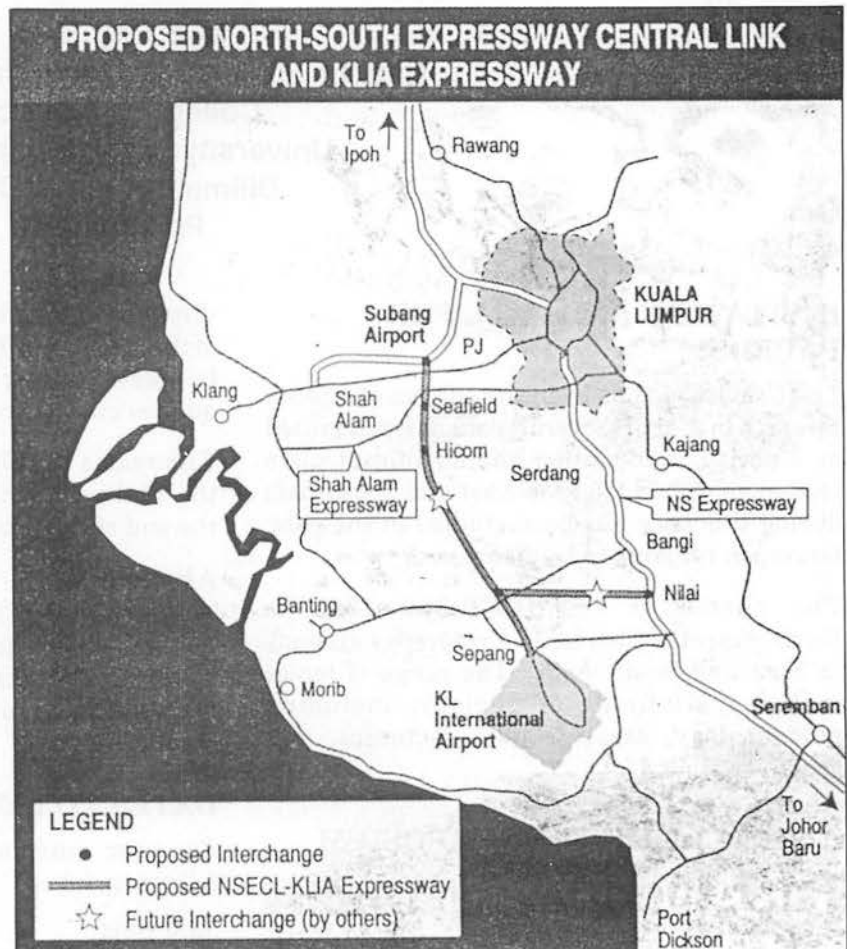
The 48 km stretch is the final link of the highway stretching from Bukit Kayu Hitam in the north to Johor Baru in the south.

With the completion of the central link, motorists using the highway can avoid entering Kuala Lumpur city.

According to Expressway Lingkarang Tengah Sdn. Bhd., the company given the concession to build the link, the stretch would begin from a new interchange on the existing New Klang Valley Expressway near Shah Alam.

Its chairman, Tan Sri M. Yusuff M. Yunus, said the link would cut across the Federal Highway and head towards the proposed Kuala Lumpur International Airport in Sepang.

"From Sepang town, one stretch of about 2.5 km will lead to the new airport and the another stretch will link the NSE via the interchange at Nilai," he said.



Yusuff said the central link would be a dual carriageway with three lanes in each direction.

Expressway Lingkarang Tengah, a subsidiary of United Engineers Malaysia, was awarded the concession to build, maintain and collect toll until April 2018. It will have a closed toll system.

Star, 27.7.1994

HDA: Make geological study a must

KUALA LUMPUR: The Housing Developers' Association (HDA) wants mandatory geological reports for all major development projects.

HDA secretary-general Datuk Alan Tong said in a statement on Wednesday that geological input was necessary for infrastructural developments like high-rise buildings.

Tong was commenting on the release of three appendices to the Ampang Jaya Municipal Council's report on the Highland Towers tragedy.

"Exhaustive soil investigations and remedial works should be carried out before a project is implemented.

"Consulting engineers for high rise buildings on flat land or hillslopes should also exercise more care when carrying out preparatory works," he said.

Tong said the role of a geotechnical engineer was also important in ensuring greater building safety as he could study the mechanical strengths of soils and rocks.

A geotechnical engineer, he added, could also provide a structural engineer with information on faults and sheared zones.

"Technically, the construction of buildings on hillslopes should not pose problems if proper and professional methods are employed," Tong said.

This was evident in countries where land was scarce such as Hong Kong where development had to be carried out on hillslopes.

"Structural engineers have to conduct various tests on the condition of the soil."

Tong said in complicated cases geotechnical experts should be called in for advice.

The HDA has agreed in principle to the MPAJ report and welcomed the government's concern over the construction of hillslope projects and the need to submit geotechnical reports.

"The Highland Towers tragedy should awaken everyone in the construction industry and be regarded as a costly lesson," he added.

Star, 23.8.1994

Restricting EIA jobs to registered consultants

KUALA LUMPUR, Wed. — The Science, Technology and Environment Ministry is looking into the possibility of allowing only registered environmental consultants to prepare environmental impact assessments.

Its Deputy Minister Peter Chin Fah Kui said the Department of Environment began registering the consultants in July, and so far, 76 have been registered.

He said the Ministry would study the availability of expertise and if necessary, would require the consultants to be registered before they can prepare EIAs.

"This would ensure the reports are of high standard and only those with the necessary qualifications, expertise and experience are allowed to carry out assessment," he told reporters after opening the Malaysia Consult '94 seminar.

The one-day seminar themed *"Computerisation of the Engineering Consultancy Industry"* was organised by the Association of Consulting Engineers Malaysia.

Chin said out of the 997 registration forms distributed, 275 individuals and firms have responded.

A total of 148 applications have been processed and 51.4 per cent or 76 approved. The

rest were rejected for not meeting the criteria.

Of the 76 approved, 57 were individuals and 19 were firms. The DOE is still processing 127 applications.

The registration of the consultants was in accordance with one of the nine recommendations by the Malaysian Modernisation and Management Planning Unit to improve EIA implementation.

The recommendations, endorsed by the Cabinet in December 1992, include simplifying EIA report format, preparing specific guidelines for respective prescribed activities and setting up a one-stop agency for EIA approval.

DOE has outlined certain criteria for the registration of consultancy firms:

- The firm must have at least one permanent expert with at least three years of experience in preparing local or overseas EIA;
 - It must have been involved in preparing three EIAs, approved by DOE; or,
 - Three permanent experts who have experience in preparing EIAs locally or overseas, and had been members in at least three EIA review panels approved by DOE.
- For individual consultants, DOE imposed the following conditions:

- Qualified with a degree or equivalent, in specific and relevant fields;
- Has experience in preparing EIAs locally or overseas;
- Has been a member of at least three EIA review panels approved by DOE; and,
- Individuals with professional qualifications such as engineering, architecture, accountancy or chemistry, will have to be

registered with the respective professional bodies.

Chin said there was no time barrier for the registration and those which have been rejected may apply again when they meet the criteria.

He said registration would give the public faith in the consultants.

NST, 8.9.1994

Goldfield with huge deposits found in Pahang

KUANTAN, Wed. — A goldfield, possibly containing the country's largest top-quality deposits, has been discovered in Pahang.

Menteri Besar Tan Sri Mohamad Khalil Yaakob announced here today the discovery of the motherlode was made in Penjom, Lipis — with a production capacity worth RM200 million within the next five years alone.

It is envisaged that Penjom, with a 126,000 ha area of gold content, could become the nation's largest top-quality (999 category) gold producer beating the Bau mine in Sarawak and even Lubuk Mandi in Terengganu.

Khalil said Specific Resources Sdn. Bhd., a subsidiary of the Canadian-based Ivocet Venture, has been given the approval to start prospecting.

He said a study conducted jointly by Specific Resources and the State Economic Development Corporation concluded that Penjom could produce up to 150 kg of gold a month for up to 20 years.

The study commissioned in 1990 found 2.5 million tonnes of ore with 2.7 grammes of gold per tonne in five zones in the area.

"Initially, the company (Specific Resources) will only carry out prospecting 75 metres below the surface. However, their study showed that there are more gold 200 metres below," he told a Press conference at his Wisma Sri Pahang office

after chairing the weekly State Executive Council meeting.

Khalil said Specific Resources had 100 per cent investment in the gold mining project in Penjom.

"The State Government's revenue will be through land lease, a five per cent tax on the total gold produced and another two per cent royalty," he said.

He added that the company had spent RM7.2 million for the study and for the purchase of equipment.

"They are expected to spend another RM10 million next year when prospecting begins," he said adding that the company would set up its own gold refining plant in the area.

Khalil said there was no major environmental risk when the mining project begins as mining would be restricted to that area along.

The only risk is the use of cyanide solutions to separate the gold.

However, the standard industry technique to impound the solution would be observed. This is provided for in the Environmental Impact Assessment carried out by the company.

NST, 8.9.1994

Mapping offshore deposits, minerals

THE Primary Industries Ministry will undertake a study in near and offshore areas for deposits of construction raw materials and heavy minerals in a bid to tap the full potential of the country's offshore resources.

Minister Datuk Seri Dr. Lim Keng Yaik said it is necessary for the country to explore both land-based and offshore areas to meet the demand for such resources.

An initial study revealed that Malaysia's offshore deposits include gold, sand, gravel, coal and industrial minerals like limestone, kaolin and granite.

Dr. Lim was speaking to reporters after opening the 31st annual session and the 24th steering committee meeting of the Coordinating Committee for Coastal and Offshore Geoscience Programmes in East and Southeast Asia (CCOP)

in Kuala Lumpur yesterday.

"Given the increasing competition between alternative land uses besides mining, the offshore prospects for mineral and construction materials offer significant promise."

Dr. Lim said in some industrialised countries, a large portion of their sand used as raw material for construction comes from offshore resources.

The Ministry, together with the Geological Survey Department is undertaking a study to geologically map the deposits located in the near and off-shore areas.

He said although Malaysia has well established, diversified and technologically advanced private sector operations to service off-shore activities, the technology and industry for the mineral sector is limited.

Dr. Lim also urged CCOP to make regional databases on oil and gas and mineral available to not only member countries but also to potential investors which will spur development of the resources for sustainable development.

On the National Mineral Development Policy which has been passed by Parliament, he said it is now up to the respective State Governments to pass the enactments in their State Assemblies.

"The move will make our mineral policies transparent and attractive for companies to venture into the industry."

Dr. Lim also urged the State Governments to undertake a geological report on the mineral potential of all its limestone hills before giving them out for quarrying purposes.

NST, 19.10.1994

Shell's new oilfield goes on-stream

SARAWAK Shell Bhd.'s newest offshore oilfield located about 125 km northwest of Bintulu, Sarawak, has gone on-stream.

The D35 complex has a design capacity of 60,000 barrels of crude and 2.38 million standard cubic metres of associated gas per day. It is the first integrated oil and gas development by the company with both production and gas compression facilities on a single platform.

The field was discovered in 1983 and has estimated reserves of 177 million barrels of crude and 16.98 billion standard cubic metres of associated gas. Production will initially come

from 14 wells.

The oil will be pumped via a 50 km flowline to the Bayan production complex and then delivered to the Bintulu crude oil terminal while gas will be transported via a 50 km line from D35 to the Bayan complex and hence to the liquefied natural gas plant in Bintulu.

D35, which boasts special features like the state-of-the-art distributed control system, comprises living quarters, a combined oil and gas processing platform, a drilling platform and a riser platform.

NST, 19.10.1994

Ancient find spurs talk of a lost city

KUANTAN: Construction workers recently recovered some artifacts, including a chest and porcelain, which have again stirred speculation of a sunken Khmer city at the bottom of Tasek Chini.

Evergloss Watermasters personnel working at the mouth of Chini river to construct a RM7 million dam discovered an ancient plate dating back to an unconfirmed Chinese dynasty.

A spokesman said one of their suction machines snared a piece of porcelain while cleaning work was being carried out.

The treasure chest was also discovered northwest of the lake close to a rakit house.

Several English divers attempted to unravel and legend in the 1980s but failed to find anything.

State Museum Board director Datuk Mohamed Mokhtar Abu Bakar confirmed a team of archeologists had been sent there to investigate.

The teams were collecting information on the find from the Evergloss workers and locals.

The discovery of the artifacts was also disclosed to State Culture Arts and Tourism Committee chairman Datuk Omar Othman at a recent meeting.

Omar said that efforts must be made to salvage the artifacts carefully as they might be linked to the legendary city.

He said the Government was willing to help anyone trying to solve the mystery of the lake.

Star, 19.10.1994

KALENDAR (CALENDAR)

1995

January 18-19

SOUTH EAST ASIAN SYMPOSIUM ON TUNELLING AND UNDERGROUND SPACE DEVELOPMENT, Bangkok Thailand. (SEASTUD Secretariat in Thailand, c/o M. Sugimoto (Dr.), Division of Geotechnical and Transportation Engineering, Asian Institute of Technology, G.P.O. Box 2754, Bangkok 10501, Thailand. Phone: +66-2-5245517; Fax: +66-2-5245509; Telex: 84276TH)

February 13-24

MINERAL DEPOSIT EVALUATION, South Kensington, London. (Sally Verkaik, Continuing Education Centre, Imperial College, Room 558 Sherfield Building, South Kensington, London SW7 2AZ, UK. Tel: +44 (0) 171 594 6882 or 6881, Fax: +44 (0) 171 594 6883, email: s.verkaik@ic.ac.uk)

February 14-18

GEOSEA '95, Mandaluyong, Metro Manila, Philippines. (Dr. Guillermo R. Balce, GEOSEA '95 Secretariat, National Institute of Geological Sciences, University of the Philippines, Diliman, Quezon City 1101, Philippines. Phone: 97 60 46, 97 60 47 Fax: (632) 711 3077, (632) 712 4656, (632) 95 1635, (632) 99 85 44)

February 20-25

SOUTH ASIA GEOLOGICAL CONGRESS, COLOMBO, SRI LANKA. (N.P. Wijayananda, GEOSASS II Secretariat, NARA, Crow Island, Mattakkuliya, Colombo 15, Sri Lanka. Phone: 941 555008. Fax: 941 522932)

March 5-8

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS, ann. mtg., Houston. (AAPG, Box 979, Tulsa, Okla. 74101. Phone: 918/584-0469)

March 6-9

SOCIETY FOR MINING, METALLURGY, AND ENGINEERING, ann. mtg., Denver. (SME, Box 625002, Littleton, Colo. 80162-5002. Phone: 303/973-9550. Fax: 303/979-3461)

April 2-5

5TH CONFERENCE SINKHOLES, ENGINEERING AND ENVIRONMENTAL IMPACTS IN KARST, Gatlinburg, TN. Abstracts deadline: September 2, 1994. B.F. Beck, P.E. Lamoreaux & Associates, Inc., Box 4412, Oak Ridge, TN 37831-4412

April 10-13

GEOLOGY AND ORE DEPOSITS OF THE AMERICAN CORDILLERA, mtg., Reno/sparks, Nev. (Bob Hatch, Geological Society of Nevada, Box 12021, Reno, 89510. Phone: 702/323-4569. Fax: 702/323-3599)

May 8-12

CRETACEOUS ENVIRONMENTAL CHANGE IN EAST AND SOUTH ASIA, 3rd Symposium, IGCP Project 350, Quezon City, Philippines. (Dr. Priscilla J. Militante-Matias, Regional Coordinator, IGCP 350 Philippines, National Institute of Geological Sciences College of Science, University of the Philippines, Diliman, Quezon City 1101 Philippines. Phone: (632) 97-60-46, (632) 97-60-06 to 69 ext. 7117, 7445. Fax: (632) 97-60-47, (632) 97-12-66)

May 15-19

EXPLORING THE TROPICS, int'l mtg., Townsville, Queensland, Australia. (Russell Myers, 171GES, National Key Centre in Economic Geology, James Cook University, Townsville, 04814. Phone: 077-814486. Fax: 61-77-815522)

May 16-18

INTERNATIONAL SYMPOSIUM ON SEQUENCE STRATIGRAPHY IN SOUTHEAST ASIA, Jakarta, Indonesia. (International Symposium on Sequence Stratigraphy in Southeast Asia, Indonesia Petroleum Association, Jl. M. Ikhwan Ridwan Rais 3, Jakarta 10110, Indonesia. Fax: (62-21) 375228)

May 29-June 2

EUROPEAN ASSOCIATION OF EXPLORATION GEOPHYSICISTS (57th Annual Meeting and Exhibition), Glasgow, UK. (Evert van der Gaag, European Association of Exploration Geophysicists, Utrechtseweg 62, NL-3704 HE Zeist, The Netherlands. Phone: (03404) 56997; Telefax: (03404) 62640; Telex: 33480)

June 5-12

XVIII PACIFIC SCIENCE CONGRESS: POPULATION, RESOURCES AND ENVIRONMENT — PROSPECTS AND INITIATIVES, Beijing China. (Mr. XIAO Jianzhang, Dept. Exhibition, China International Conference Center for Science and Technology, No. 44 Kexueyuan Nanlu Rd., Shuangyushu, Haidian District, Beijing 100086, China. Tel: (+86)-1-2575672 Fax: (+86)-1-2575691/2546498)

June 11-16

AMERICAN NUCLEAR SOCIETY, ann. mtg., Atlantic City, N.J. (ANS, 555 N. Kensington Ave., La Grange Park, III. 60525. Phone: 312/352-6611)

June 12-16

ORDOVICIAN SYSTEM, int'l. mtg., Las Vegas, Nev. (Margaret Rees, Dept. of Geosciences, University of Nevada, Las Vegas, 89154-4010. Phone: 702/739-3262. Fax: 702/597-4064)

June 18-22

RAPID EXCAVATION AND TUNNELING, mtg., San Francisco. (Society for Mining, Metallurgy, and Engineering, Box 625002, Littleton, Colo. 80162-5002. Phone: 303/973-9550. Fax: 303/979-3461)

June 18-23

INTERNATIONAL ASSOCIATION OF GEOMORPHOLOGISTS SOUTHEAST ASIA CONFERENCE ON GEOMORPHOLOGY, Singapore. (Dr. GOH Kim Chuan, Division of Geography/NE Nanyang Technological University, 469 Bukit Timah Road, Singapore 1025. Fax: 65 469 8433)

July 2-14

INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS, mtg., Boulder, Colo. (IUGG General Assembly, c/o American Geophysical Union, 2000 Florida Ave. N.W., Washington, D.C. 20009)

August 28-September 1

TECTONIC AND METALLOGENY OF EARLY/MID PRECAMBRIAN OROGENIC BELTS: AN INTERNATIONAL CONFERENCE, Montreal, Canada. (J.A. Percival, Geological Survey of Canada, 601 Booth St., Ottawa, Ontario, Canada, K1A 0E8. Phone: (613) 995-4723; Fax: (613) 995-9273)

August 28-September 2

ORIGIN OF GRANITES, Hutton Symposium, College Park, Md. (Michael Brown, Dept. of Geology, University of Maryland, College Park, 20742. Phone: 301/405-4082. Fax: 301/314-9661)

October 10-14

PALEOCEANOGRAPHY, int'l mtg., Halifax, Nova Scotia. (Larry Mayer, Ocean Mapping Group, Dept. of Surveying and Engineering, Box 4400, Fredericton, New Brunswick, Canada E3B 5A3)

November 4-6

GEOLOGY OF SOUTHEAST ASIA AND ADJACENT AREAS, Joint Meeting of IGCP Projects 306, 321 & 359, Hanoi, Vietnam. (Prof. Dang Vu Khuc, Geological Museum, 6 Pham Ngu Lao, Hanoi, Vietnam. Phone: 84.4.266.802, Fax: 84.4.254.734)

November 6-9

GEOLOGICAL SOCIETY OF AMERICA, ann. mtg., New Orleans. (Vanessa George, 3300 Penrose Place, Boulder, Colo, 80301. Phone: 303/447-2020. Fax: 303/447-1133)

1996**August 4-14**

30TH INTERNATIONAL GEOLOGICAL CONGRESS, Beijing, China. (Prof. Zhao Xun, Deputy Secretary General, 30th IGC, P.O. Box 823, Beijing 100037, P.R. China)

October 28-31

GEOLOGICAL SOCIETY OF AMERICA, ann. mtg., Denver. (Vanessa George, 3300 Penrose Place, Boulder, Colo, 80301. Phone: 303/447-2020. Fax: 303/447-1133)

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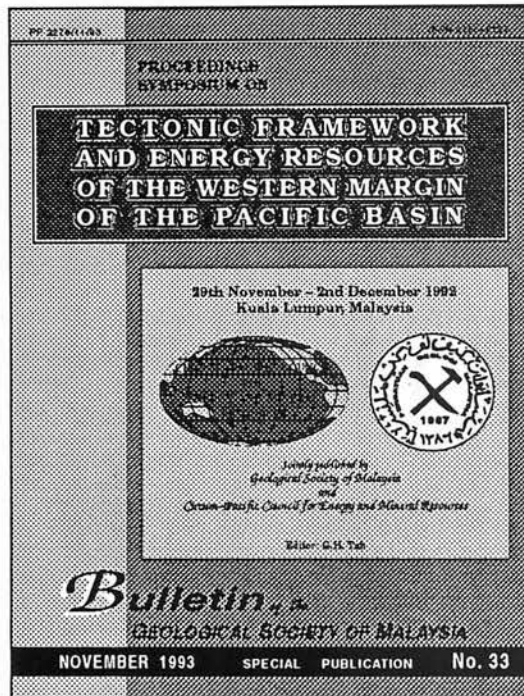
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(Bulletin Geological Society of Malaysia No. 33)



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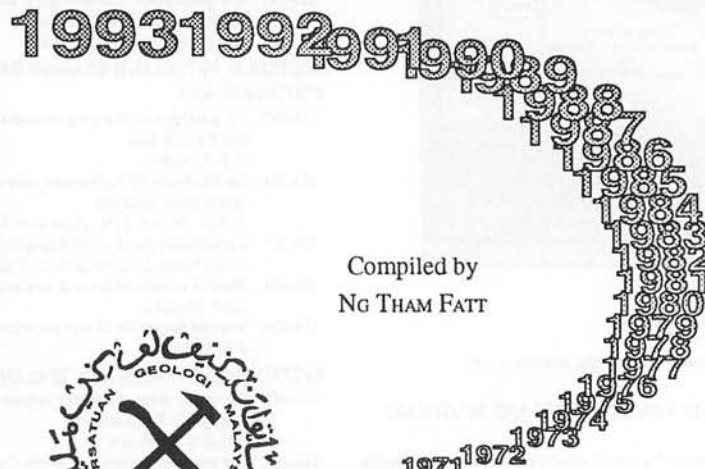
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