

## PERSATUAN GEOLOGI MALAYSIA

# WARTA GEOLOGI

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# CATATAN GEOLOGI (GEOLOGICAL NOTES)

## OCCURRENCE OF A NOT UNEXPECTED DOLERITE IN CENTRAL KEDAH

KHOO, T.T. & TAN, B.K., Jabatan Geologi, Universiti Malaya, Kuala Lumpur

On our way to a brief field visit to Langkawi in September 1981 we found ourselves with a few hours to spare in Alor Star before going to catch the ferry to the island. It was then decided that the extra time available would be well-spent making a visit to the interesting exposure at the 10½ MS Alor Star - Pokok Sena road reported by Stauffer and Haile (1977). The exposure (Fig. 1) at the place mentioned is very accessible and also well-known to a local taxi driver who brought us to the exposure in his taxi. Stauffer and Haile (1977) had reported the occurrence of unexpected rock types at this locality.

The exposure occurs at an earth quarry which has been abandoned and the state of the quarry is hardly any different from the geological sketch map shown in Stauffer and Haile (1977). In the sketch map it is shown that there is a central 'valley' partly underlain by material which appears to be a thoroughly weathered igneous rock. The 'valley' is flanked by steeply dipping chert and red mudstone.

The weathered igneous rock was suspected by Stauffer and Haile (1977) to be serpentinite for which no good evidence could be found and they alternatively suggested that it could be 'a partly serpentinized intermediate rock, or perhaps have a complex origin, as a fault breccia or such'. They also suggested that it could possibly be from a basic or ultrabasic igneous rock.

During our visit to the exposures we found that amongst the weathered so-called igneous materials are thin flaky pieces of the original rock and also there are pieces of small 'corestones' in the material which are too weathered for identification of the original rock. However, strangely, there are also some pieces of fresh-looking rocks which resemble dolerite in handspecimen. In thin-section, the rock is indeed a relatively fresh dolerite consisting mainly of plagioclase (labradorite) and clinopyroxene and some quartz and amphibole (Fig. 2). Secondary white mica and chlorite occur.

If all the weathered igneous material shown in the sketch map of Stauffer and Haile (1977) is from the dolerite, then the rock will form an elongate body about 20 m or so wide and at least 60 m in length. From the weathered and poorly exposed state of the outcrop and the geological sketch map of Stauffer and Haile (1977) it is uncertain whether the body is a dyke, a sill or just an interbedded basaltic lava layer from the central parts of which the dolerite originated. As the trend of the igneous body has not been determined, the possibility of this body being a sill cannot be ruled out. It will be difficult to determine the exact geometry for this dolerite body by surface mapping and perhaps the best means of determining the areal extension of these rocks would be by geophysical means.

We agree with Stauffer and Haile (1977) that the stratigraphy and structure of that part of central Kedah are more complicated than heretofore thought not only from the exposures at 10½ MS Alor Star - Pokok Sena road but also from elsewhere in the west and central Kedah region. The occurrence of chert with red sediments can also be seen at Bukit Besar south of the dolerite locality (Fig. 1). The chert at Bukit Besar is lensoid showing deformed structures and is radiolarian-bearing. The rocks at Bukit Besar are shown to belong to the Upper Palaeozoic Kubang Pasu Formation as well (Gobbett, 1973). Perhaps the association of radiolarian chert and red sediments in central Kedah is another case of 'uneasy bedfellows' like in the Foothills Formation (see Haile and Stauffer, 1973) but unlike in the Foothills Formation the contact of the red sediments and chert in central Kedah is neither an unconformity (see Haile, and others, 1977) nor faulted.

Stauffer and Haile (1977) pointed out that the site at 10½ MS Alor Star - Pokok Sena road is approximately on the extrapolated trace of the Bok Bak fault. If the dolerite body is a dyke then this point will assume some significance.

#### Acknowledgements

The University of Malaya is thanked for providing separate research grants to us for studies in Kedah.

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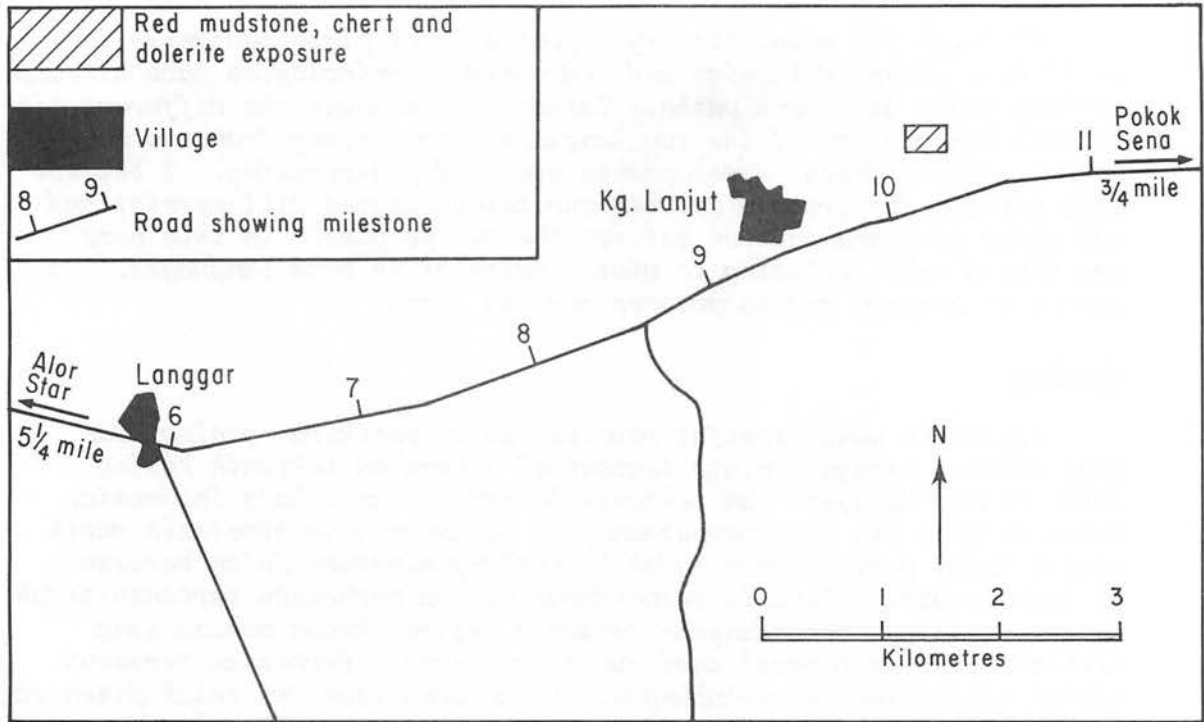


Fig. 1. Locality map.

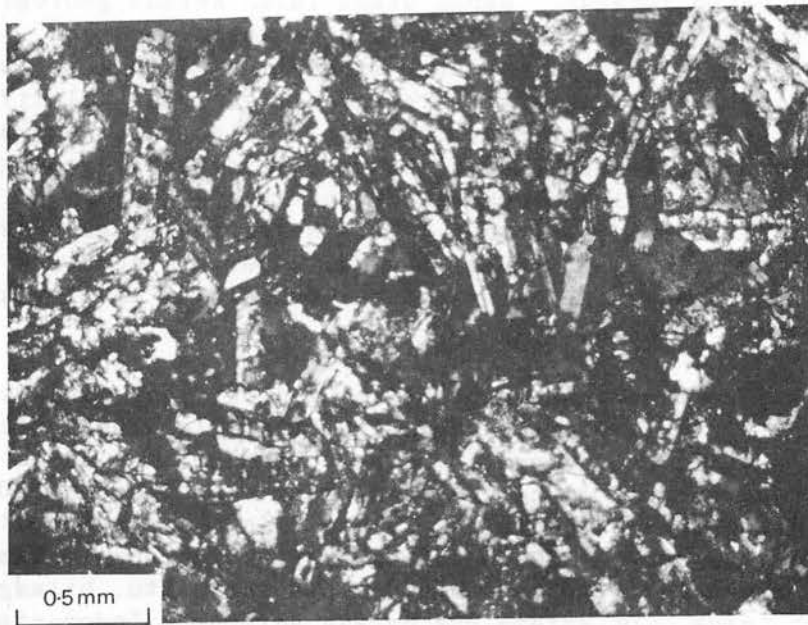


Fig. 2. Photomicrograph of the dolerite (X-polars).

## TEKTONIK KEPING DAN TEKTONIK LEMPENG

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### Abstract

*Although the revolutionary hypothesis of plate tectonics is still very young, Malaysian and Indonesian terminologies have already evolved along different paths. Taking into account the different historical backgrounds of the two languages that sprang from the same source, the different developments are hardly surprising. I believe that certain differences between our terminologies will persist and add spice to communication between the two peoples. In this note are listed terms relating to plate tectonics in both languages. It serves to compare and to propose certain terms.*

### Abstrak

*Hipotesis yang bersifat revolusi dalam pemikiran geologi dan yang dikenal sebagai "plate tectonics" dinamakan tektonik keping dalam bahasa Malaysia dan tektonik lempeng dalam bahasa Indonesia. Bukan setakat itu saja perbedaannya. Walaupun usia hipotesis masih sangat muda, peristilahan sudah berkembang menerusi jalan berbeza di kedua negara. Penulis berpendapat bahawa perbezaan tertentu tidak dapat dielakkan memandangkan pengaruh sejarah kedua bahasa yang berbeza meskipun berasal dari punca yang sama. Perbezaan tersebut bahkan menggairahkan perhubungan. Dalam penulisan ini telah disenaraikan istilah-istilah berkenaan di dalam dua bahasa sebagai perbandingan dan sebagai cadangan.*

Semua penggama bahasa Malaysia yang aktif harus mengakui bahawa peristilahan geologi dalam bahasa nasional seperti juga dalam bahasa Indonesia belum lengkap. Sebab utama ialah kerana geologi atau kaji-bumi bukan merupakan mata pelajaran di sekolah menengah. Lain halnya dengan biologi, fizik, kimia atau matematik. Juga keperluan peristilahan geologi hanya dirasakan oleh segolongan yang relatif sangat kecil di kedua-dua masyarakat tersebut. Salah satu langkah yang memberi dorongan kuat kepada perkembangan peristilahan geologi dalam bahasa Malaysia adalah penubuhan kursus-kursus geologi di Universiti Kebangsaan Malaysia pada tahun 1970. Sejak awal lagi kursus geologi diberikan dalam bahasan kebangsaan dan keperluan mendesak telah memaksakan para penggama, pensyarah dan mahasiswa, menciptakan dan menyelaraskan istilah.

Di antara perbendaharaan istilah geologi yang masih tidak lengkap itu didapati satu kelompok yang paling tidak lengkap, yaitu istilah berkenaan "plate tectonics", hipotesis revolusioner dalam pemikiran geologi yang bermula di pertengahan tahun enam puluhan. Dalam bahasa asing pun, seperti Inggeris dan Jerman (lihat Le Pichon *et al.*, 1973; Uyeda, 1977; Jacoby, 1980) belum didapati kemantapan dalam penggunaan istilah mengenai "plate tectonics". Disamping itu, bilangan istilah bertambah terus. Di antara dua bahasa serumpun, Indonesia dan Malaysia, setakat ini didapati lebih banyak perbezaan dibanding dengan persamaan walaupun hubungan di antara pakar bahasa kedua negara sudah banyak. Agaknya hubungan antara pakar geologi yang masih kurang.

"Plate tectonics" dikenal sebagai tektonik keping di Malaysia dan di Indonesia dikenal sebagai tektonik lempeng. Tetapi di antara institusi yang menggunakan istilah geologi di Indonesia belum ada keseragaman. "Subduction" dikenal sebagai subduksi di kalangan perguruan tinggi, tetapi sebagai tunjaman atau penekukan ke bawah di kalangan pegawai geologi direktorat-direktorat. Saya rasa penekukan ke bawah lebih menggambarkan "downwarping" seperti dikemukakan J.H.F. Umbgrove atau F.A. Vening Meinesz dan tunjaman sudah digunakan untuk "plunge" lipatan. Mungkin kerana kebanyakan tulisan geologi dalam bahasa Malaysia masih berasal dari siswazah dan pensyarah Universiti Kebangsaan Malaysia dan oleh kerana itu masih belum nampak keanekaragaman istilah, terutama mengenai tektonik keping.

Di bawah dibandingkan istilah berkenaan "plate tectonics" yang terdapat dalam tulisan dalam senarai rujukan. Beberapa istilah belum sempat diguna dan diberi tanda (\*) sebagai istilah baru dalam bahasa Malaysia. Tanda (\*) juga dipakai pada istilah bahasa Indonesia yang belum terdapat dalam tulisan rakan-rakan di sana. Perbandingan istilah dan istilah-istilah yang dicadangkan dalam bahasa Malaysia bertujuan memperlihatkan keanekaragaman yang sudah wujud serta diharapkan dapat membangkitkan reaksi dari rakan-rakan yang berkepentingan supaya istilah-istilah yang sesempurna mungkin dapat diciptakan.

#### Senarai Istilah "Plate Tectonics"

##### \*Istilah baru

<u>INGGERIS</u>	<u>INDONESIA</u>	<u>MALAYSIA (cadangan)</u>
accretion(ary) prism	prisma akresi prisma akrasi	prizem akresi*
arc-trench-gap	rumpang busur-parit(an)	rumpang arka-parit*
aseismic ridge	pematang tak bergempa	permatang tak seismik
asthenosphere	astenosfera	astenosfera
back arc basin	cekungan belakang busur	lembangan buritan arka*
back arc opening	pembukaan belakang busur	pembukaan buritan arka*
Benioff zone	jalur Benioff	jalur Benioff
blueschist belt	sabuk sekis biru*	sabuk sekis biru*
consumption, plate	penelanan lempeng*	penelanan keping*
continental break-up	penceraihan benua*	penceraihan benua*
continental crust	kerak (bumi) benua	kulit benua kerak benua
continental drift	apungan benua	hanyutan benua
continental fitting	percocokan benua*	perpaduan benua*
continental margin	tepi benua	tepi benua
continental rifting	peretakan benua	pencelahan benua*
convection current	arus konveksi	arus olakan
convergent motion	pergerakan menumpu*	pergerakan menumpu*
diapirism	diaprisme*	diapirisme*
divergent motion	pergerakan menyimpang*	pergerakan mencapah*

<u>INGGERIS</u>	<u>INDONESIA</u>	<u>MALAYSIA (cadangan)</u>
driving mechanism	mekanisme penggerak*	mekanisme memacu*
Eulerian pole	kutub Euler	kutub Euler
forearc basin	cekungan busur muka cekungan haluan busur*	lembangan haluan arka
foreland basin	cekungan darat-muka, c. tanah-muka cekungan daratan haluan	lembangan daratan haluan*
global tectonics	tektonik dunia tektonik sedunia*	tektonik sedunia*
gravity sliding	peluncuran karena gaya berat	gelansar graviti
hot spot	titik panas*	titik panas*
imbrication	imbrikasi sirapan*, pergentengan	imbrikasi
intraplate tectonics	tektonik intra lempeng*	tektonik intra keping
leading edge	tepi haluan*	sembir haluan*
leaky transform	pergantian bocor*	pergantian bocor*
lithosphere	litosfera	litosfera
magnetic reversal	pembalikan kemagnetan*	pembalikan kemagnetan*
magnetic stripe	jalur magnet*	jalur magnet*
marginal basin	cekungan tepi*	lembangan tepi*
melange	"melange" batuan campur aduk bancuh	melange
mid-oceanic ridge	pematang tengah samudera	permatang tengah lautan
oblique spreading	pemuaian miring*	pemuaian miring*
obduction	obduksi*	obduksi*
oceanic crust	kerak lautan kerak samudera	kulit (bumi) lautan
olistostrom	olistostrom batuan campur aduk	olistostrom
ophiolite	ofiolit	ofiolit
outer arc	busur luar	arka luar
paired metamorphic belts	sabuk metamorf berpasangan*	sabuk metamorf berpasangan*
Pangaea, Pangea	Pangaea	Pangaea
pivot point	titik pangsi*	titik pangsi*
plate descent	penurunan lempeng*	penurunan keping*
plate motion/movement	pergerakan lempeng	pergerakan keping
plate tectonics	tektonik lempeng	tektonik keping
plume trace	kesan jambul*	kesan jambul*



<u>INGGERIS</u>	<u>INDONESIA</u>	<u>MALAYSIA (cadangan)</u>
polar wandering	perpindahan kutub pengembaraan kutub*	pengembaraan kutub*
primordial continent	benua asli*	benua asli*
rotation pole	kutub perputaran	kutub putaran
ridge axis	sumbu pematang sumbu punggung	paksi pematang
ridge flank	sayap pematang sayap punggung	sayap pematang
ridge-ridge transform	pergantian pematang ke pematang pergantian punggung ke punggung	pergantian pematang ke pematang
ridge-trench transform	pergantian pematang ke parit pergantian punggung ke parit	pergantian pematang ke parit
scaly clay	lempung bersisik	tanah liat bersisik
sea-floor spreading	pemuaian dasar laut* pemekaran dasar butan	pemuaian dasar laut
sinking (plate)	penenggelaman (lempeng)*	penenggelaman (keping)*
subduction	tunjaman penekukan ke bawah subduksi	subduksi
suture	sutura	sutura
trailing edge	tepi belakang tepi buritan*	sembir buritan*
transform fault	sesar pergantian*	sesar pergantian*
trapped ocean	lautan/samudera terperangkap*	lautan terperangkap*
trench	parit	parit
trench-trench transform	pergantian parit ke parit*	pergantian parit ke parit*
trench slope break	pematang busur luar	permatang arka luar
triple point	pertemuan simpang tiga*	pertemuan simpang tiga*
triple junction	titik simpang tiga*	titik simpang tiga*
trough	palung	palung
underthrusting	penyesaran bawah (sesar) penyusupan*	(sesar) penyusupan*
upwelling	pemancuran*	pemancuran*
Wilson cycle	daur Wilson*	pusingan/edaran Wilson*

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P E R T E M U A N   P E R S A T U A N  
( M E E T I N G S   O F   T H E   S O C I E T Y )

TECHNICAL TALKS

MALAM BARAT LAUT SEMENANJUNG (NORTHWEST PENINSULA EVENING)

This second 'malam', originally planned as Malam Langkawi (Langkawi Night), was then heralded as the Malam Barat Laut Semenanjung (Northwest Peninsula Evening) when one of the earlier speakers had to withdraw, due to unforeseen circumstances and Mr. J.K. Raj obliged to fill in with a talk on the adjacent mainland.

The Malam Barat Laut Semenanjung (Northwest Peninsula Evening) featured 3 talks:

1. Dr. T.T. Khoo (Univ. Malaya): Northwest extension of the Patani Metamorphics terrane
2. Mr. C.P. Lee (Univ. Malaya): Stratigraphy of the Machinchang and Tarutao Formations
3. Mr. J.K. Raj (Univ. Malaya): Lineaments in granite and the relationship to the distribution of alluvial tin deposits in NW Malaya.

The Society had specially selected the date of Friday, 6th November 1981 to coincide with the 25th Anniversary celebrations of the Geology Department, University of Malaya.

The large turn out of about 50 at the Geology Department, University of Malaya were treated to a most stimulating evening of new data on one of the better studied areas of Malaysian geology. After the talks the scene shifted to the UM Academic Staff Centre, where a special Satay Party was held for 'old boys' of the Geology Department. Among the distinguished guests present for the evening were old boys Datuk Mokhtar Hashim and Prof. C.S. Hutchison.

G.H. Teh

Abstracts of papers presented at Malam Barat Laut Semenanjung  
(Northwest Peninsula Evening)

Northwest extension of the Patani Metamorphics terrane

T.T. KHOO, Jabatan Geologi, Universiti Malaya, Kuala Lumpur

*The terrane of the Patani Metamorphics which forms an elongated northwest trending belt in mainland Kedah truncating at the west Kedah coastal area is believed to reappear further northwest at the Langkawi group of islands and Tarutao, Thailand. Rocks of similar age range (Cambrian - Carboniferous) as the Patani Metamorphics in the Langkawi-Tarutao area such as the Machinchang, Setul and Singa Formations show textures and mineralogies of low grade regional metamorphism mainly that of the chlorite zone. More highly metamorphosed rocks in SE Langkawi island, Pulau Timor, Pulau Tuba and Pulau Dayang Bunting, where the youngest Permian Chuping Formation occurs as well, have been thermally metamorphosed by the Late Triassic Tuba granite. The main Raya granite also superimposed thermal metamorphism on adjacent regionally metamorphosed rocks of Pulau Jemurok and Telaga Tujuh with development of biotite.*

# MALAM BARAT LAUT SEMENANJUNG



T. T. Khoo



C. P. Lee



J. K. Raj



GSM pix G.H.TEH

## Stratigraphy of the Machinchang and Tarutao Formations

C.P. LEE, Jabatan Geologi, Universiti Malaya, Kuala Lumpur

The Cambro - Ordovician Machinchang and Tarutao Formations each consist of about 3000 m of predominantly clastic deposits which are part of the miogeosynclinal shelf sediments of the southern Yunnan-Malayan geosyncline. These two equivalent formations have no known base and each can be differentiated into three informal units (i.e. lower, middle and upper) with the middle unit further subdivided into three subunits.

The lower unit (1620 m in Langkawi; 450 m+ in Tarutao) is a coarsening upward sequence of rhythmically interlayered graded siltstones and mudstones interbedded with thicker fine clayey sandstones. Rare cross-bedding, small load structures, ripple marks, slumped bedding and small burrows are found in this unit which is interpreted as an offshore shelf deposit affected by occasional storms.

The middle unit consists of abundantly cross-bedded, medium to thick beds of coarse to fine sandstones, conglomerates and rare coarse acid tuffs and heavy mineral bands in its lower subunit (575 m in Langkawi; 500 m+ in Tarutao) which is interpreted as estuarine channel lag deposits cutting upper shoreface deposits. The middle subunit (340 m in Langkawi; 700 m+ in Tarutao) is of thin to medium thick, wavy-bedded, medium to fine grained cross-bedded sandstones with occasional pebbly, argillaceous and fine tuffaceous intercalations. It is interpreted as an upper estuarine facies. The upper subunit (700 m+ in Langkawi; 750 m in Tarutao) is of fine to very fine, thick straight-bedded sandstones with thin to thick intervals of very fine acid tuffs and it is increasingly argillaceous upsection. The sandstones are usually parallel laminated or low angle planar cross-bedded with occasional heavy mineral and fragmentary trilobite and brachiopod fossil bands. This subunit is interpreted as upper shoreface to beach deposits belonging to a series of barrier-beach complexes.

The upper unit (420 m in Langkawi; 575 m in Tarutao) is a fining upward sequence of siltstone, mudstone (some tuffaceous) and very fine sandstone with minor thin limestone intercalations. Trilobite and brachiopod fossils of Uppermost Cambrian to Lowermost Ordovician age and various types of shallow-marine trace fossils are present in this unit. It is interpreted as an open back-barrier lagoon deposit. It grades upwards into the shelf limestones of the Setul and Thung Song Formations.

The overall interpretation of the facies sequence is that of a high-destructive, wave-dominated delta which had built over an offshore shelf deposit to produce a series of barrier-beach sands aligned parallel to the shoreline with subdued channel sands cutting across them.

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Lineaments in granite and the relationship to the distribution of alluvial tin deposits in NW Peninsular Malaysia

J.K. RAJ, Jabatan Geologi, Universiti Malaya, Kuala Lumpur

Negative lineaments, in the granitic bedrock drainage areas of Kedah, Perak and Province Wellesley, are interpreted to represent the strikes of fractures that have developed during at least two different

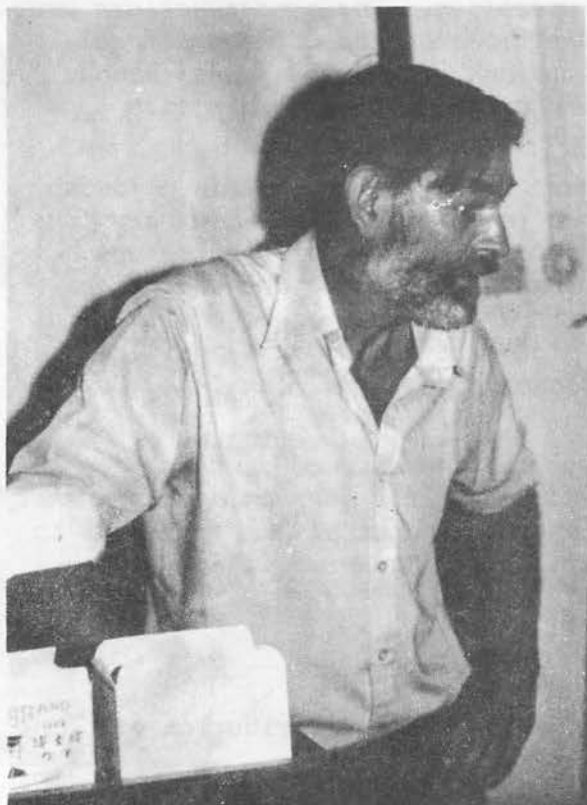
periods of stress. Lineaments, in granite bedrock drainage areas with tin placers, are furthermore interpreted to represent the strikes of fractures that have developed during the early period of stress while the lineaments in the granite bedrock drainage areas without tin placers are interpreted to represent the strikes of fractures that have developed during a later period of stress.

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**E.J. COBBING & D.I.J. MALLICK: Comparison of Peruvian and Malaysian granites**

Dr. E.J. Cobbing and Dr. D.K.J. Mallick of the Overseas Division, Institute of Geological Sciences, Great Britain, jointly gave the talk entitled "Comparison of Peruvian and Malaysian granites" to about 20 members on Tuesday, 10th November 1981 at the Department of Geology, University of Malaya.

They have just completed their fieldwork in collaboration with the Geological Survey of Malaysia, sampling the various granitic plutons in the northern half of Peninsular Malaysia. The essence of their preliminary study is to ascertain whether the granites of Peninsular Malaysia, like the Peruvian ones, can be grouped into different groups or families reflected by different genesis and tectonics.



E. J. Cobbing



D. I. J. Mallick

Dr. Cobbing started off the evening by giving the audience an outline of the Peruvian geology, emphasising on the different types of granitic units, their age, geochemistry and tectonics.

Dr. Mallick, on the eastern belt granites, concentrated his preliminary study on the Lawit granite, the Kapal granite and the Boundary granite and included the Maras, Jong and Jerong-Jerangan granites.

Dr. Cobbing, working on the western belt granites, centred his investigations on the Kledang pluton, the Bubu pluton, the Dindings pluton, the Kulim granite and the Penang Island granite.

From the data on compositional, mineralogical and textural variations, they were able to differentiate and demarcate different types of granites within the various plutons.

The next stage of their study includes further mineralogical studies and dating, putting together their results and seeing if a meaningful interpretation will emerge to warrant more sampling or recommend detailed investigations.

It was only natural that granites, being an evergreen topic in Malaysian geology, attracted an avalanche of questions during discussion time. These included the question of tin granites, age of granites, geochemistry of granites, contamination of granites, granite emplacement and relationships between granites and basic rocks.

G.H. Teh

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## GSM PETROLEUM GEOLOGY SEMINAR 1981 - REPORT

The 1981 Petroleum Geology Seminar was held on 7th - 8th December 1981 at the Hotel Merlin, Kuala Lumpur.

A total of 16 excellent papers (see Seminar programme) were presented by speakers from various oil, consulting and service companies as well as government organisations to about 200 participants at the Seminar.

The Seminar was declared open by Encik Mohd. Nawawi bin Mahmud, Deputy Secretary General to the Ministry of Energy, Posts and Telecommunications on behalf of YB Datuk Leo Moggie, Minister of Energy, Posts and Telecommunications who was unable to officiate at the opening ceremony due to unforeseen circumstances.

In his speech, YB Datuk Leo Moggie stressed that a good understanding of the petroleum geology of Malaysia is necessary in order to increase chances of successful exploration and discovery of further petroleum resources. He also pointed out that continuous exploration work will be necessary even if the Government's policy of energy diversification and conservation in Malaysia is implemented in order to obtain up-to-date information on the available reserves in Malaysia. In closing, YB Datuk Leo Moggie called on the more experienced professionals in the multinational oil companies to share their knowledge with their Malaysian counterparts. He added that their efforts would help groom local students and petroleum explorationists who will become important personnel in the development of the Malaysian Petroleum Industry in the coming years.

The President of the Society, Dr. Mohammad Ayob said in his welcoming address that the Seminar has contributed much in terms of knowledge to the Malaysian Oil Industry and also that the Seminar has gained recognition from many foreign oil, consulting and service companies as well as government organisations through the Society's publications. He also commended the local Malaysian petroleum explorationists for their increasing participation in the Seminar which is an indication of their technical capability and competence.

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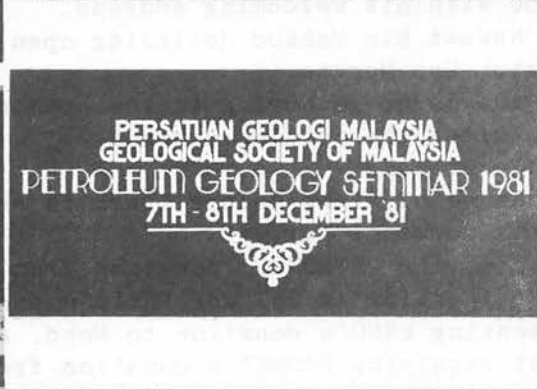
**PROGRAMME - Monday, 7th December 1981**

- 8.00 a.m. : Registration  
 8.40 a.m. : Arrival of invited guests  
 8.50 a.m. : Arrival of YB Datuk Leo Moggie, Minister of Energy, Telecommunications and Posts
- OPENING SESSION
- 9.00 a.m. : Welcoming address by Dr. Mohammad Ayob, President of the Geological Society of Malaysia  
 9.10 a.m. : Opening address of YB Datuk Leo Moggie, Minister of Energy, Telecommunications and Posts  
 9.30 a.m. : Coffee Break  
 10.00 a.m. : Geophysical and Geological Aspects of the Exploration of Carbonate Buildups in Central Luconia, Sarawak: Lim Tee Peng and Goh Leng Siang (Sarawak Shell Berhad, Malaysia)  
 10.45 a.m. : 3D-Marine Seismic Data Recording and Processing: W. Houba (Prakla-Seismos GMBH, Federal Republic of Germany)  
 11.30 a.m. : Cuttings Gas Analysis and its Application in Petroleum Geochemistry: K. Le Tran (Societe Nationale Elf Aquitaine, France)  
 12.15 p.m. : Lunch  
 1.45 p.m. : The Geology and Development of the Bekok Field, Offshore Peninsular Malaysia: Abdullah Haron and S.E. Sabatka (Esso Production Malaysia, Inc., Malaysia)  
 2.30 p.m. : EPMI's Use of the HP-41C for Wellsite Log Analysis: Don M. Murdock (Esso Production Malaysia Inc., Malaysia)  
 3.15 p.m. : Coffee Break  
 3.30 p.m. : Origin and Distribution of Pores in Cenozoic Volcanic Rocks for Potential Hydrocarbon Reservoir: Osamu Sato (Teikoku Oil Co. Ltd., Japan)  
 4.15 p.m. : Extended Baseline of a Modified Hifix/6 Chain: Lee Swee Guan (Petronas-Carigali Sdn. Bhd., Malaysia) and Derek Alder (Racal-Decca Survey (M) Sdn. Bhd., Malaysia)  
 4.45 p.m. : Sedimentary History & Palaeofacies Development of Upper Oligocene to Pleistocene in the Balingian, Southwest and Central Luconia Provinces of Sarawak: Martin J. Brolsma (Sarawak Shell Berhad, Malaysia)  
 7.00 p.m. : Cocktail Party (Host: Schlumberger Overseas SA, Malaysia)

**Tuesday, 8th December 1981**

- 9.00 a.m. : Regional Tectonics and the Neogene Geology of N.W. Sabah: V.P. St. John, Leong Khee Meng and Philip Frank (Carigali-BP, Malaysia)  
 9.45 a.m. : Use of the Lithology Density Tool (LDT) to Improve





Captions to photos: Petroleum Geology Seminar

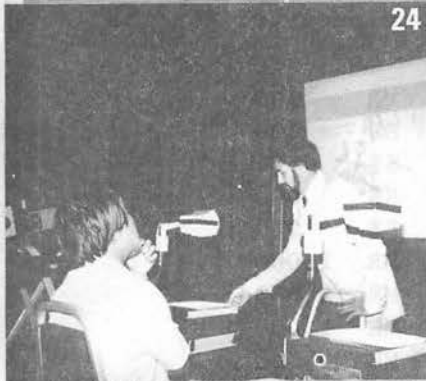
## Page 201

- 1 & 2. Participants registering for the Seminar.
3. The GSM Publications on display attracted much attention.
4. Mohammad Ayob with his welcoming address.
5. Encik Mohd. Nawawi bin Mahmud declaring open the seminar on behalf of Datuk Leo Moggie.
- 6 & 7. Sections of the large gathering at the opening section.
8. Coffee break after the opening ceremony.
9. The main table at lunch.
10. Time for exchange of views before lunch is served.
11. Schlumberger's cocktail party.
12. Mohd. Ayob receiving PETRONAS' donation from PRO Kamariah.
13. The President thanking Ad Bol for SHELL's donation.
14. J. Bubb presenting ESSO's donation to Mohd. Ayob.
15. The President receiving PROMET's donation from Mohamed bin Abdullah.

## Page 203

- 16 & 17. T.P. Lim and L.S. Goh with their joint presentation on Central Luconia.
18. K. Le Tran stressing a point on the screen.
19. A. Haron with his paper on the Bekok Field.
20. S.G. Lee enthusiastically answering a query on his paper.
21. O. Sato receiving a momento from session chairman, B.K. Tan.
22. D. Murdock on the use of HP-41C.
23. M.J. Brolsma confidently answering a question on his paper.
24. V.P. St. John presenting the paper on N.W. Sabah while co-author K.M. Leong handles the projections.
25. A. Bol raising a question for V.P. St. John.
26. C.S. Hutchison with another question.
27. Session chairman, K.F. Ho presenting M. Jennings with a momento.
28. J. Delaplanche stressing a point during his presentation.
29. Session chairman K.M. Leong congratulating W. Houba.
30. K. Hiller receiving his momento from session chairman.
31. Ted Selby with his presentation on marine 3-D data.
32. A. Malek with his presentation.
33. Cl. Poumot with his paper on palynology.

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- Lithology Identification and Gas Detection: B.A. Marchette and M. Jennings (Schlumberger Overseas SA, Malaysia)
- 10.30 a.m. : Coffee Break
- 10.45 a.m. : Seismic Reflection Applied to Sedimentology: J. Delaplanche (Compagnie Generale de Geophysique, France)
- 11.30 a.m. : In-place Hydrocarbon Volume Calculation Techniques: Abdul Malek Rani and Yew Chee Cheong (Esso Production Malaysia Inc., Malaysia)
- 12.15 p.m. : Lunch
- 1.45 p.m. : Quality Control of Navigation: M. James (Racal-Decca Survey (M) Sdn. Bhd., Malaysia)
- 2.30 p.m. : The Search for Hydrocarbons in Bangladesh with German Assistance: Dr. Karl Hiller (BGR, Federal Republic of Germany)
- 3.15 p.m. : Coffee Break
- 3.30 p.m. : Structural and Stratigraphic Interpretation of Marine 3-D Data: Ted Selby (Geophysical Service Inc., Singapore)
- 4.15 p.m. : Application of Palynology to the Stratigraphic Study of Neogene Series, Offshore Sabah: Cl. Poumot (Societe Nationale Elf Aquitaine, France)
- 5.00 p.m. : Closing Remarks

Generous donations totalling about MR 43,000 were received for the Seminar from the following:

1. Antah Holdings Pte. Ltd.	MR	500
2. Marathon Petroleum Expl. Ltd.	S\$	500
3. Cities Service East Asia Inc.	S\$	500
4. Idemitsu Oil Dev. Co. Ltd.	S\$	500
5. Robertson Research (S) Pte. Ltd.	S\$	750
6. British National Oil Corp. (BNOC)	MR	1,000
7. Geophysical Service Inc.	MR	1,000
8. Racal-Decca Survey (M) Sdn. Bhd.	MR	1,000
9. BP Development Ltd.	MR	1,000
10. Amoco Production Co. (Int.)	US\$	1,000
11. Husky Oil International Ltd.	US\$	1,000
12. Promet Berhad	MR	1,000
13. Teikoku Oil Co. Ltd.	MR	1,000
14. Compagnie Generale de Geophysique	US\$	2,000
15. Societe Nationale Elf Aquitaine	US\$	2,000
16. Schlumberger Overseas SA	MR	2,000
17. Digicon Expl. Ltd.	S\$	3,000
18. PETRONAS	MR	3,000
19. Esso Production Malaysia Inc. (EPMI)	MR	6,000
20. SHELL	MR	6,000

Schlumberger Overseas SA, a well logging service company also hosted a cocktail reception for the participants of the Seminar on the night of 7th December 1981. The reception was, without saying, well patronized.

The Organising Committee would like to thank all the organisations and individuals who helped make the 1981 Seminar a roaring success.

Michael Leong

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GSM PETROLEUM GEOLOGY SEMINAR 1981 - ABSTRACTS OF PAPERS  
 GEOPHYSICAL AND GEOLOGICAL ASPECTS OF THE EXPLORATION OF  
 CARBONATE BUILDUPS IN CENTRAL LUCONIA, SARAWAK  
 LIM TEE PENG & GOH LENG SIANG, Sarawak Shell Berhad

The Central Luconia Province forms part of the outer shelf area of offshore Sarawak. It is characterised by the extensive development of Middle Miocene reefal carbonate buildups which constitute attractive hydrocarbon trap possibilities. A large number of these carbonates have been sealed off by transgressive marine shales.

On seismic the carbonate buildups can be easily identified and show to have simple geometries, being either flat-topped tabular bodies or pinnacle features. Internally they have in general a layered appearance on seismic caused by an alternation of tight and more porous rocks types, with clear differences in the respective interval velocities.

Drilling results have shown the Central Luconia Province to be basically a gas province.

The main problems encountered in drilling these carbonate buildups include overpressures and well control, mud losses and sticky hole conditions. From seismic depth predictions had to be made of the levels where possible technical problems could arise. Whilst drilling, the well results had to be quickly evaluated in order to give recommendations about logging, casing depths, etc. and to warn for possible drilling hazards.

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### 3D - MARINE SEISMIC DATA RECORDING AND PROCESSING

W. HOUBA, Prakla-Seismos GMBH, Federal Republic of Germany

3D-surveys have grown to be an intergral part of today's seismic exploration.

For marine 3D-surveys the single boat method is usually employed.

A qualified streamer shape estimation technique resulting in accurate geodetic positions for each individual seismic trace is an indispensable prerequisite for the seismic processing.

An optimal bin adjustment can automatically be arranged to achieve a unique coverage nearly all over the area from a coloured bin coverage map.

Topics in 3D-marine seismic data processing are presented with the help of the results from an area surveyed in the waters of the Far East Region.

The exploration target was to be expected at a travel time of about 1 sec. Field and processing parameters have been properly estimated considering the requirements for resolving the fault pattern of the structure in question.

Extensive velocity studies have been started from analyses data on a grid of 500 x 500 m. The velocities have been areally smoothed along pre-interpreted reflection horizons in order to obtain a velocity field for the stacking process free of random errors. Several maps demonstrate the effectiveness of this procedure. The pre-interpretation enabled

extraction of dip information. This was used in conjunction with the streamer bearings for the conversion of the stacking velocity field into the RMS-equivalent to be applied in 3D-migration.

The reconstruction of true subsurface geometries was implemented by the 3D-downward continuation process, using the finite difference algorithm in the splitted version. The 3D-splitting migration allows - in contradiction to the often used 3D-two step migration - the incorporation of laterally varying velocities while the whole 3D-stacked data volume is recursively continued downwards.

A series of vertical and horizontal sections across the area will demonstrate the high degree of structural refinements geneally obtained by 3D-surveys.

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## CUTTINGS GAS ANALYSIS AND ITS APPLICATION IN PETROLEUM GEOCHEMISTRY

K. LE TRAN, Societe Nationale Elf Aquitaine (Production), France

Gaseous hydrocarbons are ubiquitous in sedimentary rocks. They are generated by organic matter undergoing either bacterial degradation at shallow depths or thermal maturation by combined effect of time and temperature at greater depths. Thermal maturation encompasses the oil generation phase (oil window) and the main gas phase which are the usual stages in the maturation pathway.

Both the quantity of gas and its composition reflect the richness of organic matter and the degree of maturation of the Kerogen. Therefore gas parameters measured on cuttings in exploratory wells are a most useful tool for determining source rock potential for either oil or gas and possible petroleum reservoirs. Furthermore such measurements are relatively rapid and inexpensive.

The analytical procedure developed in our laboratory is based on mechanical extraction of the gas by grinding the rock in water with specially coated blades rotating at high speed. The main parts of the apparatus embody a specially designed blending jar equipped with a rock sampling system and a gas sampling system altogether with a slurry evacuation device. The whole analytical cycle is carried out automatically within sixteen minutes so that adequate conditions are available for good analytical reproducibility. The  $C_1$  to  $C_5$  hydrocarbons are measured by FID gas chromatography.

Analyses are generally performed on unwashed cuttings collected fresh at the well-site and stored wet in cans or plastic bags. The spacing between samples varies from ten metres to fifty metres but is generally twenty metres. Interpretation of the results involves the logging of the gas amount and its composition or wetness and the iso-butane over normal-butane ratio. Plotted versus the depth of burial and in stratigraphic cross section, these parameters help in delineating the most prospective intervals within a basin. Applications of this method in petroleum exploration are presented to illustrate its main features.

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## THE GEOLOGY AND DEVELOPMENT OF THE BEKOK FIELD - OFFSHORE PENINSULAR MALAYSIA

ABDULLAH HARON & S.E. SABATKA, Esso Production Malaysia Inc.

Bekok is the third commercial oil field to be developed offshore Peninsular Malaysia by Esso Production Malaysia Inc. The field was discovered in August 1971 by the Bekok No. 1 well. Five more exploration/delineation wells were drilled between December 1971 and April 1975 prior to installation of the first platform on the northern flank of the field in July, 1978. Bekok No. 7 was drilled on the western flank at about the same time the second platform was installed on the eastern flank of the field in July, 1979 and Bekok No. 8 was drilled in September, 1980 on the southern flank. The third platform was recently installed on the western end of the field and development drilling has just commenced. Twenty-one wells are currently producing and the field's cumulative production through August, 1981 was 17.6 million barrels.

The Bekok structure is an east-west trending anticline with a small subsidiary northern culmination. The structure has nineteen square miles of areal closure and nine hundred and fifty feet of vertical relief. The field is cut by a number of north-south trending faults on the western end in addition to an east-west trending reverse fault on its southern flank. The primary oil-producing reservoirs in Bekok are the sandstones of Group J (Tapis Formation) in which a rim type oil accumulation occurs in the J-18/20 sandstone, the most significant reservoir. The Group J sandstones are of Miocene age and interpreted to be of shallow marine origin. These sandstones are of two main facies, a bar facies which forms good quality reservoir rocks and a bioturbated shoreface facies which forms poorer quality reservoir rocks. The secondary reservoir rocks in Bekok are the sandstones of Group K in which a sheet oil accumulation occurs in K-50/60 and K-70/90 sandstones. These sandstones are of Miocene age and are interpreted to be of fluvial-alluvial origin. Although these K sands appear to have fair to good reservoir quality, to-date production has generally been disappointing.

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### EPMI'S USE OF THE HP-41C FOR WELLSITE LOG ANALYSIS

DON M. MURDOCK, Esso Production Malaysia Inc.

Esso Production Malaysia Inc. explorationists utilize Hewlett Packard's HP-41C hand calculators for on-site log analysis on both exploration and development wells. Over the past year this calculator has proven to be highly reliable and has gained widespread acceptance by wellsite geologists because of its versatility and ease of use.

The main advantages of the HP-41C over other models are its continuous memory and its ability to display alpha characters. With the continuous memory, requisite long analysis programs can be loaded by the geologists in the office prior to departure to the wellsite. The alpha capabilities enable all input data to be prompted so that the user is not required to remember in what order to enter data or where data is to be stored. These features mean that less is required of the wellsite geologist and there are fewer chances for error.

Esso's standard Malay Basin log analysis technique EPMILOG, has been modified to run on the HP-41C as well as on the S-130 Eclipse Mini Computer. To convert EPMILOG to the HP-41C, the porosity calculator

method which utilized density-neutron crossplot has been simplified and allows analysis of only the sand-silt limb of the litho-porosity model. The water saturation calculation technique, which employs the Waxman-Smitz equation, has not been altered except to cut down the number of iterations to speed up processing.

Research will continue as more data is accumulated. Future improvements will be directed towards developing a standard set of parameters for each field so that the calculator can be programmed in advance with the correct parameters for the well to be evaluated.

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## ORIGIN AND DISTRIBUTION OF PORES IN CENOZOIC VOLCANIC ROCKS FOR POTENTIAL HYDROCARBON RESERVOIR

OSAMU SATO, Teikoku Oil Co., Ltd., Technical Research Center, Tokyo, Japan

The so-called "Green Tuff", subaqueous volcanic complex in the middle Miocene, has extensive distribution in Japan. It has excellent potential for hydrocarbon reservoir. The "Green Tuff" which occurs about 3,700 metres below the surface of the Nagäoka Plain in Niigata oil-gas producing province consists mostly of lavas and hyaloclastites of rhyolite with some basaltic rocks. It has estimated pay thickness of more than 500 metres.

In the rhyolite, there are macro and micro pore spaces. Both visual open and micro fractures are especially effective to the permeability. Macro and micro vugs and intercrystal micro pores are important to storage space in the reservoir.

The cores of about 50 metres in total thickness were collected from thick piles of the "Green Tuff". Core analysis on the rhyolites shows 10-15 percent of porosity and 1-10 milli darcy of permeability. The porosity and permeability are affected by the rock facies of the rhyolites and the features of the pore geometries.

The microscopic character of the rhyolite is divided into four types. Three types are related to hydrating reaction in subaqueous volcanic rocks, namely of hyaloclastic rock facies. The other is of centre facies of a lava.

From petrographic research and observation of the rhyolite core, sample cuttings and analyses of electric logs, it is able to recognize what facies in subaqueous volcanic rocks the rhyolite occupy.

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## EXTENDED BASELINE OF A MODIFIED HIFIX/6 CHAIN

LEE SWEE GUAN, Petronas-Carigali Sdn. Bhd., and  
DEREK ALDER, Racal-Decca Survey (M) Sdn. Bhd.

The original Hifix/6 chain installed for Carigali's offshore seismic survey consisted of a master station at Kijal, and two slave stations at Endau and Tapis B. Due to a combination of problems, primarily noise and baseline length, the Kijal-Endau baseline was unstable and totally unusable at night.

An attempt to move the master station to Kuala Pahang improved



the Kijal-Endau baseline but deteriorated the Kijal-Tapis B baseline.

A solution was finally obtained by modifying the timing at Endau station to lock on to Kuala Pahang station. This modification resulted in a much more stable Kijal-Endau baseline through the Kuala Pahang station which acted as a relay.

A much wider implication from this modification, is that master-slave baseline of a chain need not always have all sea path if the geometry allows a relay in-between.

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## SEDIMENTARY HISTORY AND PALAEOFACIES DEVELOPMENT OF UPPER OLIGOCENE TO PLEISTOCENE DEPOSITS IN THE BALINGIAN, SOUTHWEST AND CENTRAL LUCONIA, PROVINCES OF SARAWAK

M.J. BROLSMA, Sarawak Shell Berhad

A more coherent picture of the Upper Oligocene-Pleistocene palaeofacies development in the Balingian, Southwest and Central Luconia provinces has been obtained by the intergration of existing palaeo-environmental and biostratigraphic data.

The results of this stratigraphic data compilation are presented in 11 stratigraphically arranged palaeofacies maps depicting the areal extent of the depositional environments.

The palaeofacies development in the Upper Oligocene-Lower Miocene in the Balingian, Southwest and Central Luconia provinces was very much controlled by the continuous opening-up of the South China Sea since early Tertiary times.

A period of block faulting and differential subsidence at the Lower to Middle Miocene transition in the Central and SW Luconia provinces resulted in the formation of a large number of structural "Highs" and "Lows". Subsequently, carbonate deposition started on these "Highs" during the early Middle Miocene in the form of isolated reefal buildups.

Carbonate deposition came to a halt during and at the end of the Late Miocene in the greater part of the Central and SW Luconia provinces.

A major tilt of the Sarawak Shelf towards the NE during the Late Miocene and well expressed at the Mio-Pliocene boundary had a direct influence on the sedimentary history of the area. The sedimentary processes resulting from this northeastern tilt may have been intensified by a sharp drop in global sea-level during this time interval, followed by a major rise in sea-level during the Early Pliocene.

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## REGIONAL TECTONICS AND THE NEOGENE GEOLOGY OF NORTHWEST SABAH

V.P. ST. JOHN, LEONG KHEE MENG & PHILIP FRANK, Carigali-BP Sdn. Bhd., Malaysia.

A model derived from a consideration of regional gravity and geological data interprets Cretaceous ophiolites outcropping in northern and central Sabah as representing the sea-floor and oceanic crustal

material which forms the basement to the Eocene-Miocene sediments in the northern portion of the Northwest Borneo Geosyncline.

An east-west compressional regime in the late Lower Miocene resulted in massive crustal rupture, with the eastern part of the geosynclinal pile and the underlying Cretaceous oceanic crust being thrust eastwards over oceanic crust and intermediate "Crystalline Basement" consisting of Triassic and older metamorphosed extinct arc systems interpreted as a northern fragmented extension of Sundaland. The extent of the thrusting varies along its north-south strike. Within the area of available data it is most intense in the Banggi Island/Bengkoka Peninsula area and the Labuk Highlands of central Sabah.

The overthrusting and subsequent isostatic readjustments are reflected in the depositional pattern from the late Lower Miocene onwards. In eastern Sabah debris flows triggered off by explosive volcanic activity from the thrust front produced widespread chaotic slump breccias south and east of the Labuk area; the olistoliths are largely composed of ophiolitic detritus. These chaotic deposits are overlain by shallow-water clastics of the Tanjong Formation derived from the uplifted Crocker and younger formations. Deposition to the north and west off the rising upthrust (the Crocker Range) initiated a major regressive framework which has continued through to the Pliocene and which is responsible for the regional pattern of reservoir distribution offshore northwest Sabah. The late Lower Miocene uplift produced broad NNE-SSW folds in the sediments of northwest Sabah. A prominent angular unconformity separates the Lower Miocene and older rocks from the overlying northwesterly prograding sediments.

A later tectonic phase, commencing within the Upper Miocene, has been responsible for the development of the present structural framework of Northwest Sabah. This phase commenced with basement controlled tensional growth-faulting, oriented generally north-south, which is still occurring. Early in the Pliocene east-west oriented compressional structures began to develop, decreasing in intensity from south to north. The simultaneous development of these two trends is consistent with a dextral shear regime oriented in an approximately NW-SE direction across northern Sabah.

The combination of the regressive depositional framework and later orthogonal structural trends has resulted in a favourable regime for hydrocarbon accumulation in northwest Sabah.

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## USE OF THE LITHOLOGY DENSITY TOOL (LDT) TO IMPROVE LITHOLOGY IDENTIFICATION AND GAS DETECTION

B.A. MARCHETTE & M. JENNINGS, Schlumberger Overseas, S.A., Malaysia.

The Litho-Density Tool is the latest generation of Density tools. In addition to an improved density recording, it measures a new lithology parameter.

The new measurement, Photoelectric Absorption Index or  $P_e$ , is strongly related to the nature of the formation matrix. Used alone it is a direct matrix indicator, hence the term "Lithology" in the tool name. In combination with the Density, it is used to analyse two-mineral matrices and to determine porosity. And, with both Density and Neutron measurements, the  $P_e$  leads to a description of more complex lithologies

containing three matrices and a calculation of porosity. The more accurate matrix identification provides an improved distinction between oil and gas.

Direct lithology indication and combination with Density for bi-matrix identification are readily applicable to wellsite interpretation through on-site computer processing. Three-mineral description requires a more complex computation and crossplot analysis that can be integrated into a complete formation analysis at the Kuala Lumpur Computing Center.

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## SEISMIC REFLECTION APPLIED TO SEDIMENTOLOGY

J. DELAPLANCHE, Compagnie Generale de Geophysique - Massy (France)

Seismic data continually improve our picture of stratigraphy, a fact which led eminent specialists to define a special terminology to describe the features observed in seismic stratigraphy. This new science is growing fast in two directions:

The first one, a qualitative direction, lies in seismo-facies characterizing the reflection units i.e. interval velocity, continuity, configuration, amplitude and frequency in terms of lithofacies and depositional environments. Such an interpretation requires a good knowledge of the criteria by which the seismic units are defined.

The second one, a quantitative direction, is based on the synthetic seismogram, the first seismic model derived from a well which gives a close relation of the seismic trace with the stratigraphy. This modelling was extended in two and three dimensions, in order to duplicate time-sections. The seismic traces were inverted into seismo-impedance traces to investigate lateral variations in facies and to localize hydrocarbon occurrences.

Progress in the recording of high frequencies and in wavelet processing now permits the extraction of sedimentological information formerly hidden in the reflected signal. This information concerns the depositional sequence, and may be compared to the information obtained from well logs (electro-facies). However, with well logs, prediction of the environment is made vertically, whereas seismic allows control in two dimensions. Nevertheless calibration of well data is essential, and this requires close cooperation between geologists and geophysicists.

This paper presents examples from land and marine surveys, showing the successive steps of the interpretation.

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## IN-PLACE HYDROCARBON VOLUME CALCULATION TECHNIQUES

ABDUL MALEK RANI & YEW CHEE CHEONG, Esso Production Malaysia Inc.

Four principle techniques are used by Esso Production Malaysia Inc.'s explorationists for the calculation of in-place hydrocarbon volumes. The selection of any one method or combination thereof depends on the number of well control points, vertical and lateral reservoir variability and the geometry of the hydrocarbon accumulations.

The first method is usually used early in the exploration phase of a field or prospect when well control is either absent or limited. Minimum, most likely and maximum values of each of the basic reservoir parameters such as hydrocarbon-bearing area, net pay, porosity, etc., are input into the computer. These are sampled using the Monte Carlo simulation technique to obtain the in-place hydrocarbon in each of a specified number of trials. All the results are then plotted as a curve showing volume of in-place hydrocarbon against the probability of occurrence.

The second method is used when limited well data is available and a quick analysis is required. This procedure utilizes a plot of the areas enclosed by structure map contours of the top and base of the reservoir versus depth, together with the known or estimated fluid contacts, from which is calculated the gross rock volume of the hydrocarbon-bearing part of the reservoir. This is then multiplied by the appropriate average net to gross sandstone ratio, hydrocarbon saturation, porosity and formation volume factor to obtain the in-place hydrocarbon.

The third method is used when well control is good and reservoir quality is relatively uniform both laterally and vertically. In this technique net hydrocarbon sandstone isopach maps are constructed, net rock volumes are then calculated with various formulae and these then multiplied with the field average values of porosity, water saturation and formation volume factor to derive the original in-place hydrocarbon.

The last method, known as the  $\phi \times H \times S_h$  technique, is used when a field is well into the development phase and when there is considerable lateral and vertical variation in reservoir quality. In this method, isoporosity, isopach net sand/pay maps and isohydrocarbon saturation maps are constructed for each reservoir and these are then cross-contoured to obtain the  $\phi \times H \times S_h$  map. If desired, the product of the net pay, average porosity and hydrocarbon saturation of the net pay in the mapped reservoir in each well can be plotted and contoured directly to obtain the  $\phi \times H \times S_h$  map. Various formulae are then used to obtain the in-place hydrocarbon volume.

\*\*\*\*\*

## QUALITY CONTROL OF NAVIGATION

M. JAMES, Racal-Decca Survey (M) Sdn. Bhd.

Navigation during oil exploration forms a very small part of the budget of a very large enterprise. It is, however, fundamental to the success of the enterprise, and quality control of the navigation deserves close attention.

All methods in use for offshore navigation are subject to systematic errors. The business of quality control is to detect these errors, to measure them, and to allow for them when postplotting.

The surest way to detect and control errors is by comparison of two independent positioning systems. Racal-Decca have in service in Malaysia an onboard computer system that carries out such comparison on a continuous, real-time basis.

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## SEARCH FOR HYDROCARBONS IN BANGLADESH WITH GERMAN ASSISTANCE

KARL HILLER, Bundesanstalt für Geowissenschaften und Rohstoffe (BGR)

For and on behalf of the Federal Ministry for Economic Cooperation at Bonn, the Federal Institute for Geosciences and Natural Resources has attached, since January 1977, a Geological Group to Petrobangla, the National Oil Corporation of Bangladesh.

The main tasks of the German Geological Advisory Group are to advise Petrobangla in their own activities, to train counterparts on the job and last but not least to contribute substantially by its own activities, including seismic surveys, in finding hydrocarbons, preferably oil.

The Group consists of a petroleum geologist, a geophysicist, a sedimentologist who also handles the field of seismostratigraphy, a regional geologist cum palynologist and a well monitoring geologist; temporarily attached as short term experts were a petroleum engineer for gasfield evaluation, a gas utilization expert, an energy advisor and 2 seismic parties (during dry season).

\*\*\*\*\*

STRUCTURAL AND STRATIGRAPHIC INTERPRETATION OF MARINE  
3-D DATA

TED SELBY, Geophysical Service Incorporated, Singapore

Three dimensional seismic surveys are usually conducted not for general exploration purposes but over known features with the objectives of providing information for a development programme. These surveys typically provide ten to twenty times as many seismic traces per unit area as a conventional seismic survey. The interpreter thus has a vast amount of data at hand.

Several techniques have been developed to aid interpretation. A well established method is to generate not only vertical seismic sections but also horizontal sections or \*Seiscrops. These sections are often made into 70 mm movies to allow rapid appraisal of the data. Such displays are valuable for the purposes of structural interpretation, but stratigraphic interpretation usually requires a more detailed study of the data volume.

The seismic sections may be additionally processed to provide seismic interval velocity sections by inversion and these sections can help in the recognition of subtle traps. Such processing is not unique to 3-D surveys.

For 3-D surveys presentations have been prepared which attempt to separate structural effects from stratigraphic ones. The key to this separation is a preliminary structural interpretation so that horizons can be flattened to enable displays to be made of horizontal seismic sections with gross structure removed.

The paper presents examples of these various displays made from a 3-D survey collected in the Gulf of Thailand.

\*\*\*\*\*

\* Trademark of Geophysical Service Inc.

## APPLICATION OF PALYNOLOGY TO THE STRATIGRAPHIC STUDY OF NEOGENE SERIES, OFFSHORE SABAH

CL. POUMOT, Societe Nationale Elf Aquitaine (Production), France

In the North East of Sabah, Aquitaine Petroleum Company - South East Asia - (SNEA (P)'s subsidiary) obtained a concession in the off-shore of Dent Peninsula. Since 1970, six wells have been drilled in the Mio-Pliocene series which are essentially composed of terrigenous sediments (Ganduman and Sebahat formations) covered by carbonates (Togopi formation).

Palynological study was the best adapted technique for providing stratigraphical data on such sediments. After some difficulties in freeing the angiosperm pollens off the organic matter, an oxidizing chemical treatment was used to improve the palynological residue. From this adapted method, 157 types of angiosperm pollens, 15 types of spores, 3 types of disaccate pollens and 2 types of fresh water cysts were determined and enabled a range chart of 15 units to be established. With this palynological zonation, a correlation between the six wells was proposed and shows that the limits of the lithological formations do not correspond to the palynological units. This change can be interpreted as a sedimentological process of a prograding deltaic sequence.

\*\*\*\*\*

## BERITA PERSATUAN (NEWS OF THE SOCIETY)

### MALAM KUATER (QUATERNARY EVENING)

There will be a Malam Kuater (Quaternary Evening) on 10 March 1982 in the Department of Geology, Universiti Malaya starting at 5.00 p.m.

The four papers to be presented in the Malam are as follows:

- 5.00 - 5.30 p.m.: Quaternary geology study of Peninsular Malaysia by the Geological Survey Malaysia by T. Suntharalingam (Geological Survey of Malaysia)
- 5.30 - 6.00 p.m.: A soil scientist view of the Quaternary of Peninsular Malaysia by S. Paramanathan (Universiti Pertanian Malaysia)
- 6.00 - 6.15 p.m.: Tea break
- 6.15 - 6.45 p.m.: Quaternary tectonics, Sabah-Sarawak by H.D. Tjia (Universiti Kebangsaan Malaysia)
- 6.45 - 7.15 p.m.: Raised river terraces, Tambunan, Sabah by J.K. Raj (Universiti Malaya)

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## BULETIN PERSATUAN GEOLOGI MALAYSIA

### BULLETIN OF THE GEOLOGICAL SOCIETY OF MALAYSIA

#### KANDUNGAN CONTENTS

- 1 Baram Delta geology and hydrocarbon occurrence**  
E.J.H. Rijks
- 19 The North Palawan block, Philippines: its relation to the Asian Mainland and its role in the evolution of the South China Sea**  
N.H. Holloway
- 59 Beach changes on a monsoon coast, Peninsular Malaysia**  
P.P. Wong
- 75 Gabbroic rocks from the southern Malay Peninsula and their relation to similar rocks of other orogenic zones**  
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- 101 The Tekka tin deposit, Perak, Peninsular Malaysia**  
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- 135 Tourmaline greisenization in Langkawi—a reinterpretation using the available composition model**  
T.T. Khoo
- 143 Use of rice husk ash for soil stabilization**  
M.S. Subrahmanyam. Lee Lih Cheran. Lee So Cheran

Editor  
G.H. TEH



DECEMBER 1981

No. 14

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MALAYSIA

## GSM TO HOST GEOSEA V IN 1984

The Society's bid for GEOSEA V was put forward to Dr. G. Balce, one of the main organizers of GEOSEA IV on 15 November, by Dr. T.T. Khoo, Vice-President of GSM and appointed by the Council to bid for the hosting of GEOSEA V.

At two separate meetings on 20 November, the last day of GEOSEA IV, the bid together with discussions on the future and scope of future GEOSEA meetings were held with heads and representatives of delegations and organisations participating in GEOSEA IV.

Our bid for GEOSEA V was warmly welcomed and supported by those present and the good news was broken to the assembly at the closing ceremony of GEOSEA IV.

There was a good turn out of GSM members at GEOSEA IV, both from Malaysia and elsewhere. Members resident in Malaysia seen at the meeting included:

M.K Choo (Pernas Charter Management); Ahmad Said (Petronas); Chow Kok Tho (Carigali); Lam Sia Keng (Geological Survey Malaysia); Lai Kok Hoong (Geological Survey Malaysia); Ismail Noor (Universiti Kebangsaan Malaysia); H.D. Tjia (Universiti Kebangsaan Malaysia); Tan Boon Kong (Universiti Kebangsaan Malaysia); K.K. Khoo (Geological Survey of Malaysia); A.S. Gan (Geological Survey of Malaysia); Lee Chong Yan (Universiti Sains Malaysia); K.N. Murthy (Geological Survey of Malaysia),

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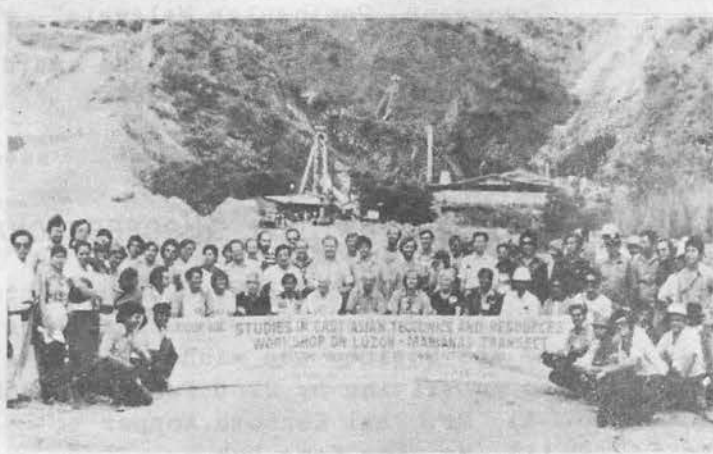
### Captions to photos: GEOSEA '81-Manila

1. T.T. Khoo accepting the honour to host GEOSEA '84 on behalf of GSM.
2. GSM participants at the opening ceremony of GEOSEA IV.
3. GSM participants at the registration area.
4. Spot GSM members on the SEATAR field trip. Handlens anyone?
5. S. Bachman explaining the exposure (photo 6) to be seen across the Cabaluan River, Santa Cruz, Zambales.
6. Exposure of overturned and steeply dipping layers of conglomerate, sandstone and siltstone. Fragments in conglomerate are mainly peridotite and gabbro.

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# GEOSEA '81 - MANILA



Pix G.H. Teh

Jalaludin Ismail (Perangasang Selangor); C.P. Lee (Universiti Malaya); Chandra Kumar (UM); B.K. Tan (UM); C.A. Foss (UM); I. Metcalfe (UM); G.H. Teh (UM); E.V. Gangadharam (UM); E.B. Yeap (UM); Mohd. Ali Hasan (UM); T.T. Khoo (UM); P.H. Stauffer (UM); and C.S. Hutchison (UM).

Out of this group, 11 were supported by UM, 1 UKM, 1 Geoscience Network, 5 companies and other sources, 5 partly by AGID and the rest on their own resources. The Society supported the special registration fees of 5.

After the Conference, a number of members attended the Geothermal Energy Course (Nov. 21-22) organized by AGID, SEEP and NCGS, some the CCOP Remote Sensing Seminar, others joined the SEATAR-IDOE field trip, while a small group went on the various Post-Conference tours.

G.H. Teh

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## YOUNG GEOSCIENTIST AWARD 1981/82

At the recommendations of the Nominations Board for the Young Geoscientist Award 1981/82, the Council has agreed to confer the award on Mr. Chandra Kumar, a tutor at the University of Malaya, for his paper entitled "The gabbroic suite and associated hornfelses of Bukit Kemuning, Trengganu, Peninsular Malaysia", which was published in GSM Bulletin 13.

The presentation of the award will take place during the Society's Annual Dinner in April 1982.

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## AHLI PROFESIONAL (PROFESSIONAL MEMBERS)

The following have been elected as Professional Members of the Society during the 9th Council Meeting on 6th Jan. 1982. Any member of the Society who wishes to raise objections to their election may do so in writing by 22nd February 1982:

- i) Mr. Paul Kenneth Kopper
- ii) Mr. Low Keng Lok.

\*\*\*\*\*

## KEAHLIAN (MEMBERSHIP)

The following persons have joined the Society:

### Full Membership

- 1) Suraphol Phuvichit, Dept. of Mining Engineering, Faculty of Engineering, Chulalongkorn Univ., Bangkok 5, Thailand.
- 2) Zakaria Mohamad, Jabatan Penyiasatan Kajibumi, Perak Utara, Kuala Kangsar, Perak.
- 3) Prema Lata Mehrotra, Exploration Dept., Petronas, P.O. Box 2444, Kuala Lumpur.
- 4) Kho Siak Chung, Exploration Dept., Petronas, P.O. Box 2444, K.L.
- 5) Keith Robinson, U.S.G.S., Box 25046, M.S. 916, Denver Federal Center, Denver, Co. 80225, USA.
- 6) James K. Dato, Exploration Dept., Petronas, P.O. Box 2444, K.L.
- 7) Roy Ismail Sumadiguna, P.T. Timah, Jln. Gatot Subroto, Jakarta, Indonesia.

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*Geological Society of Malaysia*



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- 10) Mohd. Idrus bin Ismail, Petronas, K.L.
- 11) Wong Loke Yee, Petronas, K.L.
- 12) Kenneth J. Jackson, Dept. of Geology & Geophysics, University of California, Berkeley, Ca. 94720, USA.
- 13) Pertram Elishewitz, Petronas, K.L.
- 14) Mohd. Badri Bin Hj. Hassan, Petronas, K.L.
- 15) George Minervini, Esso, K.L.

#### Student Membership

1. Shabri Lebai Din, Universiti Malaya, K.L.
2. Mohd. Shaari Haji Abd. Rahman, UM, K.L.
3. Haron Abd. Ghani, U.M. K.L.
4. Mohd. Zaki Othman, UM, K.L.
5. Tungah Surat, UM, K.L.
6. Mohamad Yusuf Yahaya, UM, K.L.
7. Samsudin Abdul Hamid, UM, K.L.
8. Nor Saawaludin Mohd. Nor, UM, K.L.
9. Kennedy Haji M.K. Aralas, UM, K.L.
10. Noor Azman Yusuff, UM, K.L.
11. Mat Ruzlin Maulud, UM, K.L.
12. Mohamad Noor Abdul Rani, UKM, K.L.

#### Institutional Membership

1. Racal-Decca Survey, 4th Floor, Angkawa Raya, Jln. Ampang, K.L.

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### PERTUKARAN ALAMAT (CHANGE OF ADDRESS)

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

1. Xavier Payre, SNEA (P), Division Geophysique, Tour Generale, 92080, Paris-La Defense, France.
2. J.F. Lambert, 2/40 Dunloe Avenue, Mont Albert North, Vic., 3129, Australia.
3. Lim Tow Ho, 8, Lorong 5/17D, Petaling Jaya.
4. Nor Hisham Hazizi, c/o Malaysia Mining Corp., 4129-A, Jalan Tengku Ismail, Off Jln. Talipot, Kota Bharu, Kelantan.
5. Charles Cofer, 7800 E. Dorado Place, Englewood, Co. 80111, USA.
6. Kingsley Burlinson, P.O. Box 37134, Winnellie, N.T. 5789, Australia.
7. Guo Yeang Yang, No. 22, SS2/9, SEA Park, Petaling Jaya.
8. Mahzan bin Bakar, 548 Hawkeye Court Apt., Iowa City, Iowa 52240, USA.

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### PERTAMBAHAN BARU PERPUSTAKAAN (NEW LIBRARY ADDITIONS)

The following publications were added to the Library:

1. Scripta Geologica, no. 61, 1981.
2. Bulletin du Bureau de Recherches Geologiques et Minieres, Sect. IV, no. 2, 1980/81.
3. Regional Mineral Resources Development Centre, Newsletter, No. 4, 1981.
4. IMM, Transactions A, vol. 90, Oct 1981.

5. Geological Survey of India, News, vol. 11, nos. 10-12, 1980.
6. The University of Kansas, Paleontological Contributions, Paper 104, 1981.
7. IMM Bulletin no. 899, 1981.
8. Acta Palaeontologica Sinica, vol. 20, nos. 3 & 4, 1981.
9. Mem. Nanjing Inst. of Geol. & Palaeont. Acad. Sinica, no. 13, 1981.
10. Palaeontology of Xizang, Book III, 1981.
11. Teknologi, Bilangan 2, Julai 1981.
12. AAPG Explorer, Sept. & Oct., 1981.
13. American Museum Novitates, Nos. 2706, 2709 & 2712, 1981.
14. American Museum of Natural History, Bulletin, vol. 167, articles 3 (1980) and article 5 (1981).
15. Annales Academiae Scientiarum Fennicae, series A, no. 130 & 131, 1981.
16. South Pacific Marine Geological notes, vol. 2, nos. 2-4, 1981.
17. Commonwealth Geological Liaison Office, no. 9, Sept., 1981.
18. Commonwealth Science Council, Oct 1981.
19. National Library Singapore, adult reference collections, accession list, Aug-Oct 1981.
20. National Science Museum, Bulletin, series C, vol. 7, no. 3, 1981.
21. Grondboor & Hamer, nos. 3 & 4 and 5, 1981.
22. Geosurvey Newsletter, vol. 13, nos. 11-14, 1981.
23. Journal of the Geological Society, v. 138, part 6, 1981.
24. Wetenschappelijke Mededelingen K.N.N.V., nr. 147, 1981.

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## BERITA - BERITA LAIN ( OTHER NEWS )

### TECHNOLOGY FROM FINLAND - A REPORT

Technology from Finland - a symposium and an illustrated display, presenting the latest technological advances in Finland's industry was held at Kuala Lumpur Hilton from the 2nd to the 5th November 1981. During these 4 days technology and know-how from Finland were presented and discussed in a number of symposium sections, namely forest and forest industries, mining and metallurgy, construction and construction materials; materials handling and transport and energy.

The symposium has brought together Finnish specialists of the five industries mentioned above and local experts and professionals and provided opportunities for the discussion and viewing of the latest developments and solutions within the mentioned fields. To complete the picture, the organisers, The Finnish Foreign Trade Association and the Embassy of Finland have invited high-ranking local-note speakers to address and highlight current developments and trends in the corresponding industries in Malaysia.

More than 700 participants attended the symposium to hear and discuss five key-note addresses from local speakers, 8 papers on mining and metallurgy, 11 on forestry and forest industries, 8 on construction and construction materials, 7 on materials handling and transport as well as 8 papers on energy. Summaries of all the keynote addresses and a total of 42 papers from Finnish specialists were presented as binded preprints to all registered participants.

A list of topics covered in the mining and metallurgy, construction materials and energy are as follows:

**A. Mining and Metallurgy**

1. Abdul Rahim Aki: The Malaysian Mining Industry: Present and Future Prospects (Keynote Address).
2. Outokumpu: OKUSCOPE - a systematic approach to project mining.
3. Tamrock: Hydraulic drilling.
4. Airam Kometa: Drill steels in tunnelling.
5. Nokia: Spiral pipes: applications and use in mining and manufacturing.
6. Kone: Crushing and materials handling in mining and construction industry.
7. Rauma-Repola: Equipment for mining and concentration.
8. Outokumpu: The Outokumpu flash smelting process.
9. Outokumpu: Transfer of know-how in turnkey projects.

**B. Construction and Construction Materials**

1. Kimarasivam, K.: Construction industry in Malaysia - an overview (Keynote Address).
2. Devecon: Ras Lanuf New Town - urban development case.
3. Partek: Industrialised building with system building.
4. Lohja: Lohja Corporation - over 80 years' experience in building materials production.
5. Rauma-Repola: Crushing and screening plants by Lokomo for the construction industry.
6. Airam Kometa: Drill steels in benching.
7. Nokia: Spiral pipes - applications and use in the building and manufacturing industries.
8. Nokia: Electricity for construction sites.
9. Wartsila: Lock security requirements in modern construction.

**C. Energy**

1. Y.B. Tan Sri Datuk Abu Zarim Haji Omar: Energy trends in Malaysia (Keynote Address).
2. Ekono: An energy alternative concentrating on peat.
3. Ivo: Hydropower in Finland.
4. Ekono: Renewable energy forests.
5. Kone: Bulk terminals and coal handling.
6. Ekono: Utilization of coal in heat and power generation.
7. Wartsila: Medium speed diesel engines for the future.
8. Rauma-Repola: Rauma-Repola wood and bark combustion equipment and plants.
9. Ekono: Co-generation-policy and energy conservation results in Finland.

As a whole the symposium has proved to be very fruitful in its objective in providing the venue for a two-way exchange of information between Malaysian and Finnish concerns.

Mohamad Ali Hasan & Azizan Baharuddin

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**SECOND INTERNATIONAL TUNGSTEN SYMPOSIUM**

Venue: Fairmont Hotel, San Francisco

Date: 1 June to 5 June 1982

**Programme:****Tuesday 1 June**

- 09.00 - 13.00 : Registration  
 14.00 - 14.45 : Opening of Symposium  
 14.45 - 15.30 : Developments in Tungsten supply and demand - Mr. P.T. Stafford, Physical Scientist, Section of Ferrous Metals, U.S. Bureau of Mines  
 15.30 - 16.15 : History and future of tungsten - Mr. J. Foreman, Amax Inc.  
 16.15 - 16.45 : Discussion  
 19.00 for 20.00: Reception and formal dinner in the hotel

**Wednesday 2 June**

- 09.00 - 09.45 : Recycling Systems, with particular reference to the zinc process - Dr. B.F. Kieffer, Group Executive, Teledyne Inc.  
 09.45 - 10.30 : Beneficiation and upgrading of tungsten ores in China - Mr. Wu Weisun, Deputy Chief Engineer of the Metallurgical Bureau, Jiangxi Province  
 10.30 - 11.15 : Coffee  
 11.15 - 12.00 : The role of the trader in the tungsten market - Mr. S.P. Dale  
 12.00 - 12.30 : Discussion  
 12.30 - 15.00 : Lunch  
 15.00 - 15.45 : Beneficiation of low grade tungsten ores - Mr. R. Woolery, Technical Dept. of Union Carbide  
 15.45 - 16.30 : Wear parts related to metal deformation - Mr. B. Kvarnbaeck, Sandvik AB.  
 16.30 - 17.00 : Discussion  
 19.00 - 22.00 : Boat trip around San Francisco Bay and buffet supper (transport will be prearranged to and from the hotel)

**Thursday 3 June**

- 09.00 - 09.45 : Modern methods of APT processing - Dr. E. Lassner, Mittersill  
 09.45 - 10.30 : Chemistry, toxicity and chemical uses of tungsten - Mr. M.B. MacInnis, Engineering Manager - Chemicals, Chemical and Metallurgical Division of GTX Sylvania.  
 10.30 - 11.15 : Coffee  
 11.15 - 12.00 : Risk consideration in the financing of new mining ventures - Mr. W.A. Mulligan, Vice President & Technical Director of the Chase Manhattan Bank.  
 12.00 - 12.30 : Discussion  
 12.30 - 15.00 : Lunch  
 15.00 - 15.45 : Photometric sorting and mining economics - Mr. G. Willey, R.B. Mining Pty. Ltd.  
 15.45 - 16.30 : Use of tungsten in armament related products - Mr. P. W. Jones, Royal Armament Research & Development Establishment, U.K. Ministry of Defence  
 16.30 - 17.00 : Discussion  
 17.00 - : Open forum - panel discussion on Tungsten in the 1990s - and closing address

**Friday 4 June**

- (1) Guided tour of Napa Valley vineyards.  
 (2) Tour of the Climax mine.

Saturday 5 June

Visit to the Bishop mine and mill (Union Carbide) and the Strawberry mine (Teledyne Wah Chang).

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## CIRCUM-PACIFIC ENERGY & MINERAL RESOURCES CONFERENCE, HONOLULU, AUG. 22-28 1982

### TECHNICAL PROGRAM: PRINCIPAL SPEAKERS

Opening Address: The Honorable George Ariyoshi, Governor of Hawaii.

Mexico's Oil and Gas Resources for the 80's: Ing. Jesus Chavarria,  
Director of Exploration, PEMEX, Mexico.

Energy and Mineral Resources of Mainland China: Dr. Luo Zhetan,  
Professor, Chengdu College, Chengda, China.

Resource-Driven Economic Potentials of the Circum-Pacific Region:  
W.F. Kieschnick, President, Atlantic Richfield Company, Los  
Angeles, California.

Indonesian Role in World Energy Markets in the 80's: Drs. Joedo Sumbono,  
President-Director, Pertamina, Indonesia.

Australian Energy Development Policy for the 80's: Allen Woods, Secre-  
tary, Department of National Development and Energy, Australia.

Tectonic Evolution of the Pacific Basin: Dr. N. Bagadanov, Secretary-  
General, International Geological Congress, Geological Institute,  
Academy of Sciences, USSR.

The role of the United States Geological Survey in the Pacific Basin:  
Dr. Dallas Peck, Director, United States Geological Survey.

Chilean Energy and Mineral Resources for the 80's: Dr. Bruno Phillippi,  
Executive Secretary, National Energy Commission, Chile.

Thailand Gas Project - A Cooperative Effort of the World Bank, The  
Government of Thailand and Private Enterprise: Dr. Philippe  
Bourcier, Assistant Director, Energy Department World Bank.

Where Future Oil and Gas will be found: Michel T. Halbouty, Honorary  
Chairman, Circum-Pacific Conference, Consulting Geologist and  
Petroleum Engineer, Houston, Texas.

Developing Canada's Energy Resources in the 80's: J.K. Gray, Executive  
Vice President, Canadian Hunter Exploration, Ltd.

Energy and Mineral Resources in the South Pacific Island Nations:  
Dr. J. McFarland, Chief Geologist, Vanuatu, South Pacific.

Finding the Undiscovered Petroleum of the Circum-Pacific: John M.  
Parker, President, American Association of Petroleum Geologists.

### SPECIAL COURSES/WORKSHOPS

#### Symposium on Petroleum Resource Assessment

Sponsored by the International Union of Geological Sciences, the  
East-West Center, the Circum-Pacific Energy and Mineral Resources Council,  
the US Geological Survey and the Geological Survey of Canada.

Friday, Saturday, Sunday, August 20-22, 1982, Honolulu, Hawaii.



For information contact Dr. C.D. Masters, 953 National Center, U.S. Geological Survey, Reston, VA 22092, (703) 860-6681.

Application of Plate Tectonic Theory to Resource Evaluation

Sponsored by the American Association of Petroleum Geologists.  
Sunday, August 22, 1982, Hilton Hawaiian Village, Honolulu.

**Basin Classification and Subsidence**

Instructor: Albert W. Bally, Shell Oil Co., Houston, Texas.

**Massive Sulfide Deposition along Segments of the Mid-Ocean Ridge**

Instructor: Robert Ballard, Woods Hole Oceanographic Institute, Woods Hole, Massachusetts.

For information contact AAPG, P.O. Box 979, Tulsa, Ok. 74101, (918) 584-2555.

Fractures in Geothermal Reservoirs

Sponsored by The Geothermal Resources Council Workshop  
August 27 & 28, 1982, Honolulu, Hawaii.

First day: Pertinent aspects

**Introduction - Fractures in Geothermal Resources**

Induced Fractures - Reservoir stimulation through fracturing, emphasis on hot water reservoirs and hot dry rock applications.

Well tests in fractured reservoirs - build up and draw down tests.

Fracture locations and structure geometry - emphasis on prediction of fractures.

Modeling fractured reservoirs - fluid flow and heat transfer.

Energy recovery through water injection - possible enhancement of total heat extraction - two view by two speakers.

Determination of fracture history through studies of minerals - use of minerals to determine various reservoir parameters.

Second day: Case Histories

Drilling and completion of wells in fractured geothermal reservoirs.

Fracture studies in the Los Azufres Geothermal Field of Mexico.

Fracture studies in the Mak-Ban or Tongonan Geothermal Fields of the Philippines.

Fracture studies of the Geothermal Fields of Japan.

Fracture studies of the Geothermal Fields of New Zealand.

Fracture studies of a specific geothermal field in the United States.

Fracture studies of a geothermal field in the Valles Caldera of New Mexico, USA.

Fracture studies of geothermal reservoirs in Central and South America.

For further information and registration materials, contact the Geothermal Resources Council, Meetings Department, P.O. Box 98, Davis, CA 95617, (916) 758-2380.

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**INTERNATIONAL SYMPOSIUM ON APPLIED GEOPHYSICS IN TROPICAL REGIONS, September 1-8, 1982, Belem, Brazil.**

The Brazilian Geophysical Society (SBGf) is conducting an International Symposium on Applied Geophysics in Tropical Regions, to be held at the Universidade Federal do Para, Belem, Brazil, on September 1-8, 1982. The purpose of the Symposium is to discuss theoretical and applied problems related to exploration geophysics in tropical regions.

Invited Speakers

- S.H. Ward (University of Utah, USA), on state-of-the-art and perspective for mining geophysics.
- K. McCracken (CSIRO, Australia), on the Australian experience in mining geophysics.
- G. Palacky (Billiton International Metals, The Netherlands), on electromagnetic prospecting in tropical regions.
- J. Behrens (Technische Universitat Berlin, West Germany), on high resolution seismics applied to coal exploration.
- J.S. Lourenco (UFPA, Brazil), on the Brazilian experience in applied geophysics.
- W.A. Pelton (Phoenix Geophysics, Canada), on IP and mineral discrimination.
- C.A. Dias (UFBA, Brazil), on multi-frequency EM method applied to mineral exploration.
- G.H. Hohmann (University of Utah, USA), on mathematical modeling of EM responses.
- L. Rijo (UFPA, Brazil), on mathematical modeling of electrical and electromagnetic data in conductive terrains.
- N.N. Nabighian (Newmount Exploration Limited, USA), on time-domain electromagnetics.
- O. Verma (UFPA, Brazil), on analogic modeling of EM responses.
- K. Vozoff (Macquarie University, Australia), on state-of-the-art of magnetotelluric methods.
- J. Bischoff (Technische Universitat Berlin, West Germany and UFPA, Brazil), on development of geophysical instrumentation for tropical regions.
- A.A.R. Zodhy (USGS, USA), on state-of-the-art of groundwater geophysics.
- W. Sauck (Western Michigan University, USA), on groundwater geophysics in tropical regions.
- O.A.L. de Lima (UFPA, Brazil), on groundwater geophysics in northeastern Brazil.

Workshops

Four workshops will focus on the problems related to applied geophysics in tropical regions:

1. Mining Geophysics
2. Mathematical modeling in Applied Geophysics
3. Development of geophysical instruments for tropical regions
4. Geophysics applied to groundwater.

Among other activities it is planned a visit to the Carajas Mining District, one of the largest of the world.

For further information contact Jose Seixas Lourenco, NCGG-UFPA, Caixa Postal 1611, Belem-Para, 66000 Brazil. Telephone: (091) 2261811.

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IBRAM - THIRD TIN TRAINING COURSE

July 5-27, 1982

Venue - University of Brasilia, Brasilia, Brazil.

Course Programme

1. Lectures and Laboratory
  1. Tin Geology in the world
  2. Brazilian Tin Geology
  3. Petrology and Geochemistry of Tin Mineralization
  4. Geology of Primary Tin Deposits
  5. Geology of Tin Placer Deposits
  6. Tin Mineralogy

7. Tin Exploration
8. Tin Mining Methods
9. Tin Mineral Economics
10. Presentations of Specific Problems and Discussion.

## II. Field Trips

1. Goias
2. Rondonia

The course will consist of lectures, laboratory (practical demonstrations) and field trips to tin mines and deposits in Goias State and Rondonia Territory. The language of the course will be English.

All people wishing to participate in the course should write to the address below and should include a brief curriculum. The fees have not been fixed, but the participants are expected to cover their own expenses.

All communications should be sent to:

Mr. W.S. Fontanelli  
 IBRAM - Instituto Brasileiro de Mineracao  
 Av. Cristovao Colombo, 550-Sala 501, Phone, (031) 226-5977  
 Telex: (031) 2056-IBRM-CEP 30.000, Belo Horizonte, Brazil.

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## TUNNELLING '82

The third international symposium, Tunnelling '82, to be organised by the Institution of Mining and Metallurgy with the cooperation of the British Tunnelling Society, the Institution of Mining Engineers, the Transport and Road Research Laboratory and the International Tunnelling Association, will be held from 7 to 11 June, 1982, at the Metropole Hotel, Brighton.

### Theme and papers

During the symposium some 35 papers on the design and construction of tunnels in the fields of mining and civil engineering will be introduced by world experts. Listed below are the papers from which the final selection will be made. All papers accepted for inclusion in the symposium will be published in the volume Tunnelling '82 and sent to registrants in May, 1982.

- H. Albornoz and G. Krstulovic: Geotechnics for the construction of a chamber for housing an underground crusher in Codelco-Chile's El Teniente mine (Chile).
- Liu Baoshen and Lin Dezhang: Surface movements and deformations due to near-surface tunnelling (People's Republic of China).
- R. Benedik: Rock mechanical outline for new trumpet-like designed underground stations in Stockholm (Sweden).
- D. Clarke, G. Lande, R. Cavin and T.J. Wilton: Controlled tunnel blasting (Sweden, USA and United Kingdom).
- Central Coal Mining Research Institute: Research on the reliability of the anchorage of resin bolts (People's Republic of China).
- S. Cina, N. Innaurato, R. Mancini and A. Sampaolo: Power consumption and metal wear in TBM: analysis of tunnel-boring operation in hard rock (Italy).
- T.N. Cockcroft and R.J. Denne: Construction of a section of Du Toitskloof tunnel with use of ground freezing (South Africa).
- H. Duddeck: Structural design models for tunnels (Germany).
- G.T.G. Emere: Design and installation of tunnel support systems in deep-level South African gold mines (South Africa).

- E.A. Hanafy and J.J. Emery: Simulation of tunnelling in squeezing ground (Canada).
- S.G. Fajardo and M.V. Flores: Computerized model for design optimization of blasting patterns in tunnels (Chile).
- I.W. Farmer and R.A. Snowdon: Potential for full-face tunnelling in coal mines (United Kingdom).
- K. Ferenc and B. Istvan: Waterproof sealing and rock reinforcement in mine construction (Hungary).
- W. Forrest: Selby drifts - ground treatment with particular reference to freezing technique (United Kingdom).
- M. Fujita and A. Kitamura: Report on Seikan undersea tunnel (Japan).
- P.W. Gorman: Improving design of hard rock tunnel borer (USA).
- J.D. Guertin Jr. and R.F. Flanagan: Effect of artesian aquifer on feasibility of Buffalo LRRT project (USA).
- A.B. Hawkins and D.G.M. Roberts: Weymouth and Portland main drainage scheme (United Kingdom).
- P. Hingant and M. Legrand: Ten years of highway tunnelling in France (France).
- D.F. Howarth and F.F. Roxborough: Some fundamental aspects of disc cutter application in hard rock excavation (Australia).
- J.A. Hudson and J.B. Boden: Geotechnical and tunnelling aspects of radioactive waste disposal (United Kingdom).
- M. Karmis, I.M. Eitani, C.S. Desai and C.T. Shaw: Correlation of finite-element results and in-situ measurements around underground openings (USA).
- W.J. Kogelmann and G.K. Schenk: Recent North American advances in boom-type tunnelling machines (USA).
- L.M. Lake and E.H. Norie: Two case records - application of horizontal ground freezing in tunnel construction (United Kingdom).
- P.A. Lindqvist: Energy consumption in disc cutting of hard rock (Sweden).
- H. Magata: Measurements on subsidence associated with shield tunnelling in soft ground (Japan).
- W. Meyeroltmanns: Ventilation system for dust suppression during tunnel construction with roadheaders (Germany).
- E.J. Miana, S.E.D. Monteclaro Cesar and H.A. Santucci: Sanegran sewer tunnels - Barueri system (Brazil).
- N.F. Midea et al.: Analysis of field measurements and several Brazilian tunnels (Brazil).
- J.D. Morton and D.B. Sigismund: Machine tunnelling considerations for oil recovery from tar sands, Alberta (Canada).
- K. Muller, L. Muller and G. Spaun: NATM tunnelling in cohesionless soil (Austria).
- T. Nakamura and K. Fukumitsu: Study of soil properties for tunnelling through volcanic mudflow deposits in the Quaternary (Japan).
- B.M. New: Vibration caused by underground construction (United Kingdom).
- T. Nishida: Excavation of an inclined tunnel by boring machine (Japan).
- T. Ohohira: Initial breakout methods in slurry shield tunnelling (Japan).
- A. Carlsson, S. Fredriksson and T. Olsson: Tunnelling and rock support at Juktan hydro power plant, Sweden (Sweden).
- M.P. O'Reilly and B.M. New: Settlements above tunnels in the United Kingdom - their magnitude and prediction (United Kingdom).
- M. Panet: Analysis of convergence behind the face of a tunnel (France).
- L. Porfino: Long tunnel bored in hard rock under high-pressure water (Italy).
- H. Simons and U. Beckmann: Tunnel-boring machine payment - performance based on actual rock quality (Germany).
- E.M. Tallon: Comparison and application of geomechanical classification in tunnels in construction (Spain).

- Wang Zhongde and Cao Rujie: Bolt-shotcrete support in soft rock roadways (People's Republic of China).
- W.H. Ward and P. Tedd: Kielder experimental tunnel (United Kingdom).
- I.L. Watts, L.F. Palfrey and D.J. Court: Replacement of Oxford's trunk outfall foul sewer by use of wedgeblock and mini tunnels (United Kingdom).
- Wayss & Freytag: Operational experience and development of bentonite shield tunnelling in Europe since 1975 (Germany).
- K.W. Weirich: Completely mechanized tunnelling procedure for 11.5-m diameter Gubrist tunnel, Zurich (Switzerland).
- Y. Zesheng: Drift excavation in China's metal mines (People's Republic of China).
- Central Coal Mining Research Institute: Development and application of rock-bolting and shotcrete technology- in China (People's Republic of China).

### Exhibition

The Tunnelling '82 International Exhibition will run concurrently with the symposium in the Exhibition Centre attached to the Metropole Hotel. The Exhibition includes plant, equipment, materials and services for all types of tunnelling and underground excavation. It will embrace traditional and new developments in design and construction for the mining, civil engineering and construction industries worldwide.

All enquiries in connection with Tunnelling '82 should be addressed to: The Conference Office, Institution of Mining and Metallurgy, 44, Portland Place, London W1N 4BR, England (Telephone 01-580 3082, Telex 261410).

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### KALENDAR (CALENDAR)

A bracketed date, e.g. (Mar-Apr 1981) denotes entry in that issue carried additional information.

#### 1982

- Feb 2 - 12 : Offshore Southeast Asia (OSEA) Conference & Exhibition, Singapore. Contact: Dr. Glenn L. Shepherd, OSEA Program Chairman, P.O. Box 423, Tanglin Post Office, Singapore 9124.
- Mar 1 - 5 : Workshop on Palaeomagnetic Research in Southeast and East Asia. University of Malaya, Kuala Lumpur. Abstracts by 1 August. Full papers by 15 December. Contact A. Johannas. Project Manager, Coordinator CCOP, Bangkok, Thailand. (Jul-Aug 1981 & Sept-Oct 1981).
- Mar 8 - 10 : Underground Works and Special Foundations Regional Symposium, Singapore. Contact: ACTIM, 64, rue Pierre Charron, 75008 Paris, France. (Sep-Oct 1981).
- Mar 29 - Apr 1: High grade metamorphism migmatites and melting, (Joint Meeting Geochemistry Group, Mineralogical Society and Geochemical Society), Glasgow, U.K. (C. Gribble, Department of Geology, University of Glasgow, Glasgow G12 8QQ, U.K.).
- Mar 31 - Apr 2: Computer methods for resource assessment, (International Conference), London, U.K. (M.F. Horder, Geological Society of London, Burlington House, Piccadilly, London W1V 0JU, U.K.).

- Apr 1 - 3 : First international symposium on Soil, Geology and Landforms - impact on land use planning in developing countries, Bangkok. Contact: Dr. Prinya Nutalaya, Symposium Secretary, LANDPLAN 1, Div. of Geotechnical & Transportation Eng., AIT., P.O. Box 2754, Bangkok, Thailand (Jul-Aug 1981).
- Apr 19 - 23 : First International Mine Water Congress, Budapest, Hungary. Languages: English, Hungarian, German, Russian, French, Spanish. (Hungarian Mining and Metallurgical Society, H-1061 Budapest, Anker koz 1-3, Hungary).
- Apr 19 - 23 : 17th Annual International Symposium on Computer Applications in the Minerals Industry, Colorado. Details from Colorado School of Mines, Golden, Colorado 80401, USA.
- Apr 21 - 23 : Low temperature Pb, Zn, F, Ba, vein type deposits, from the European and North African Variscan provinces, (Symposium), Orleans, France. Languages: French and English. (M. Jebrak, BRGM, Departement Gites Mineraux, B.P. 6009, 45060Orleans Cedex, France).
- Apr 25 - 28 : Fifth "Industrial Minerals" International Congress, Melia Castilla Hotel, Madrid, Spain. Contact: Peter Harben, Industrial Minerals, 708 3rd Avenue, New York, N.Y. 10017, USA. (Sep-Oct 1981).
- May 5 - 7 : International Congress on the Environment and Geocancerology, Brussels, Belgium. (E.G. Peeters, Services Generaux de l'Institut Europeen d'Ecologie et de Cancerologie, rue des Fripiers 24 bis, B-1000 Brussels, Belgium).
- May 11 - 12 : Geochronology and the Geological Record, (Symposium), London, U.K. (Dr. A.L. Harris, c/o Geological Society, Burlington House, Piccadilly, London W1V 0JU, U.K.).
- May 11 - 14 : Geothermal Energy, (International Conference), Florence, Italy. (Conference Organizer, Geothermal Energy, BHRA Fluid Engineering, Cranfield, Bedford MK43 OAJ, England, U.K.).
- May 12 - 14 : 9th International Geochemical Exploration Symposium, Saskatoon, Canada. (V.J. Sopuck, Organizing Committee, 9th IGES, Box 432, Sub. P.O. 6, Saskatoon, Saskatchewan, Canada S7N 0W0).
- May 13 - 14 : Sedimentary and Diagenetic Processes in Precambrian Metallogensis, (Meeting), London, U.K. (Dr. H. Clemmy, Dept. of Earth Science, The University, Leeds, LS2 9JT, U.K.).
- May 14 - 16 : Granitic Pegmatites - MAC Short Course. Contact: Dr. P. Cerny, Department of Earth Sciences, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2. (Sep-Oct 1981).
- May 17 - 22 : Remote Sensing and Mineral Exploration, (COSPAR Meeting - Symposium No. 1, IGCP Project 143), Ottawa, Canada. (W.D. Carter, U.S. Geological Survey, 1925 Newton Square East, Reston, Virginia 22090, USA).

- May 24 - 28 : Gold '82 Symposium, University of Zimbabwe. Dr. R.P. Foster, Organising Secretary, GOLD '82, Institute of Mining Research, P.O. Box MP 167, Mount Pleasant, Salisbury, Zimbabwe.
- May 27 - 28 : Hydrothermal phenomena associated with granitic rocks of Europe. (Joint Meeting of the Mineralogical Society, London, and Societe Francaise de Mineralogie et de Cristallographie), London, U.K. (A.H. Rankin, Dept. of Geology, Imperial College, London SW7 2BP, U.K., A. Weisbrod, ENSG, 94 Avenue de Lattre de Tassigny, 5400 Nancy, France).
- May 31 - Jun 4 : World Mining (11th International Congress), Belgrade, Yugoslavia, Pre- and post-congress tours. (Organizing Committee, 11th World Mining Congress, Sava Centar, 11070 Belgrade, Yugoslavia).
- Jun 1 - 5 : 2nd International Tungsten Symposium, San Francisco. Details from M. Maby, Peat Marwick Mitchell & Co., 7 Ludgate Broadway, London EC4 V6DX, U.K.
- Jun 7 - 11 : Tunnelling '82, (International Symposium and Exhibition), Brighton, U.K. Post conference tours. (Secretary, IMM, 44 Portland Place, London W1N 4BR, U.K.).
- Jun 28 - Jul 2 : Geochronology, Cosmochronology and Isotope Geology (Conference), Nikko National Park, Japan. (K. Shibata, Geological Survey of Japan, Higashi 1-1-3, Yatabe, Ibaraki 305, Japan).
- Jul : Lateritization Processes (2nd International Seminar, IGCP Project 129), Sao Paulo, Brazil. Originally scheduled for September 3-13, 1981; tentatively postponed to July 1982. (A. Carvalho, 2nd International Seminar on Lateritization).
- Aug 1 - 9 : XIth INQUA Congress, Moscow, U.S.S.R. Fiftieth anniversary of founding of INQUA in Leningrad. Pre- and Post-Congress excursions. (I.P. Kartashov, Secretary General, XI INQUA Congress, Geological Institute, U.S.S.R., Academy of Sciences, Pyzhevsky 7, Moscow 109017, U.S.S.R.).
- Aug 15 - 22 : Generation of Major Basalt Types (International Meeting, Co-sponsored by IAGC). Reykjavik, Iceland. (G.E. Sigvaldason, Nordic Volcanological Institute, 101 Reykjavik, Iceland).
- Aug 20 - 23 : IV International Symposium on the Ordovician System, Oslo, Norway. One pre-meeting excursion in Norway and three post-meeting excursions in Sweden. (D.L. Bruton, Paleontologisk Museum, Sars gate 1, Oslo, 5, Norway).
- Aug 20 - 21 : Petroleum Resources and their Assessment in the Circum-Pacific, Honolulu, Hawaii, U.S.A. Symposium and Workshop co-sponsored by IUGS, East-West Centre and CPEMRC. (C. Masters, U.S. Geological Survey, Reston, VA 22092, USA. Tel. 703-860-6681).
- Aug 22 - 28 : Circum Pacific Energy and Mineral Resources Conference, Honolulu, Hawaii, USA. M.T. Halbouty, 5100 West-

- heimer Road, Houston, Texas 77056, USA. (Sep-Oct 1981).
- Aug 22 - 28 : International Association of Sedimentologists Congress, Hamilton, Canada. Languages: English and French. (G.V. Middleton, IAS Congress 1982, Dept. of Geology, McMaster University, Hamilton, Ontario, Canada L8S 4M1).
- Aug 30 - Sep 1 : 3rd European Conodont Symposium (ECOS III), Lund, Sweden. Post-symposium field trip. (ECOS III, c/o Paleontologiska avdelningen, Solvegatan 13, S-223 62 Lund, Sweden).
- Aug 31 - Sep 4 : Mesozoic and Cenozoic Geology, (Symposium), Beidaihe, Hebei Province, China. Celebrating the 60th anniversary of the Geological Society of China. Languages: Chinese and English. Excursions. (Wang Zejiu, Secretary General, The Geological Society of China, Fuchengmenwai, Baiwanzhuang, Beijing, China).
- Sep : International Symposium on Archean and Early Proterozoic Geologic Evolution and Metallogenesis (ISAP), Salvador, Brazil. Symposium will precede the 32nd Brazilian Geological Congress. Presymposium field trips. (Augusto J. Pedreira, ISAP Coordinator, CPRM - Rua Barros Falcao, 21, 40,000 Salvador, Bahia, Brazil).
- Sep : Fluids in Metamorphism (Geological Society of London and Metamorphic Studies Group Meeting), Glasgow, Scotland, U.K. Excursions. (M. Brown, Department of Geology and Physical Sciences, Oxford Polytechnic, Headington, Oxford OX3 0BP, U.K.).
- Sep : Kimberlite, (3rd International Conference), Clermont-Ferrand, France. (F. Boudier, Universite de Nantes, Laboratoire de Tectonophysique, 2 rue de la Houssiniere, 44072 Nantes, France).
- Sep 2 - 10 : Volcanic Processes in Marginal Basins, (Volcanic Studies Group Meeting), Keele, England. Field meeting to Ordovician volcanic terrains of SW Wales and Snowdonia. (R.A. Roach, Department of Geology, The University, Keele, Staffordshire ST5 5B6, England).
- Sep 5 - 11 : International Association of Hydrogeologists (6th Congress), Praha, Czechoslovakia. Excursions. Languages: English, French, Russian, Czech, Slovak. (Stavebni geologie n.p. Praha, Gorkeho namesti 7, 11309 Praha 1, Czechoslovakia).
- Sep 6 - 12 : International Association on the Genesis of Ore Deposits, (VI IAGOD Symposium), Tbilisi, U.S.S.R. Languages: Russian and English. (A.G. Tvalchrelidze, Caucasian Institute of Mineral Resources, 85 Paliashvili St., 380030 Tbilisi, U.S.S.R.).
- Sep 9 - 10 : Volcanic Processes in Marginal Basin, (Meeting), Staffordshire, U.K. (Dr. B.P. Kokelaar, Ulster Polytechnic, School of Environmental Sciences, Shore Road, Newtonabbey, Co. Antrim, BT 370QB, N. Ireland).



- Sep 19 - 25 : International Mineralogical Association (13th General Meeting and field excursions), Varna, Bulgaria. (Secretary General, 13th IMA Meeting, University of Sofia, Chair of Mineralogy, Boulv. Russki 15, Sofia, 1000 Bulgaria).
- Oct 17 - 23 : XIV International Mineral Processing Congress, Toronto, Canada. L.J. Vincze, Publicity Chairman XIV IMPC, c/o CE Lummus - Minerals Division, 25 Consumers Road, Willowdale, Ontario M2V 4H4, Canada.
- Nov 17 - 19 : Ophiolites and Oceanic Lithosphere (Meeting), London, England. (S. Lippard, Department of Earth Sciences, Open University, Milton Keynes MK7 6AA, U.K.).
- Nov 24 : Metamorphic Studies: Research in Progress (Joint Geological Society and Mineralogical Society Metamorphic Studies Group Meeting), London, U.K. (M. Brown, Metamorphic Studies Group, Department of Geology and Physical Sciences, Oxford Polytechnic, Headington, Oxford OX3 0BP, U.K.).
- Dec 1 - 6 : 4th International Congress of Engineering Geology, New Delhi. Contact: G. Pant, Geological Survey of India, 47-48 Pragati Bhawan. Nehru Place, New Delhi 110019, India.
- 1983
- Feb 1 - 11 : XV Pacific Science Congress, Dunedin, New Zealand. (Secretary-General, 15th Pacific Science Congress, P.O. Box 6063, Dunedin, New Zealand).
- Feb 1 - 11 : Pacific Neogene Stratigraphy, (3rd International Meeting) Dunedin, New Zealand. Sponsored by the Royal Society of New Zealand and IUGS. (A.R. Edwards, Secretary, N.Z. Geological Survey, P.O. Box 30 - 368, Lower Hutt, N.Z.).
- Mar 6 - 10 : 3rd International Symposium on Hydrometallurgy, Atlanta, Georgia, USA. K. Osseo-Asare, Dept. of Materials, Science and Engineering, 202A Steidle Building, the Pennsylvania State University, University Park, Pennsylvania 16802, USA.
- Aug 7 - 12 : Fossil Corals (Symposium), Washington, D.C. (W.A. Oliver, Jr., U.S. Geological Survey, E-305 Natural History Building, Smithsonian Institution, Washington, D.C. 20560, USA).
- Aug 27 : Krakatau Eruption (Centennial Symposium), Jakarta, Indonesia. (D. Sastrapradja, Indonesian Institute of Sciences, Box 250, Jakarta, Indonesia).
- Sep : 10th International Geochemical Exploration Symposium, Helsinki, Finland. Sponsored by the Association of Exploration Geochemistry. (L.K. Kauranne, Organizing Committee, 10th IGES., The Geological Survey of Finland, Kivimiehentie 1, 02150 Espoo 15, Finland).
- Sep : International Symposium on Engineering Geology and Underground Construction, Lisbon, Portugal. (Sociedade Portuguesa de Geotecnia, c/o L.N.E.C., Av. Brasil, 101, 1799 Lisboa Codex, Portugal).

Sep 12 - 17 : Carboniferous Stratigraphy and Geology (10th International Congress), Madrid, Spain. Languages: English, French, German, and Spanish; English and Spanish preferred for oral presentations. (Comite organizador del X Congreso Internacional de Estratigrafia y Geologia del Carbonifero, Instituto Geologico Minero de Espana, Rios Rosas, 23-Madrid-3, Espana).

1984

Aug 4 - 14 : 27th International Geological Congress, Moscow, USSR. (N. Bogdanov, Secretary General, 27th IGC Secretariat, Lithosphere Institute, 22 Staromonetny per., 109180 Moscow, U.S.S.R., Tel. 238-8588).

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- Bulletin 10 (1978)**, 95 p. A collection of papers on the geology of the Asean region. Edited by C.H. Yeap. Price: **M\$10.00 (US\$5.00)**.
- Bulletin 11 (1979)**, 393 p. Geology of Tin Deposits. A collection of papers presented at the International Symposium on 'Geology of Tin Deposits', 23-25 March 1978, Kuala Lumpur. Edited by C.H. Yeap. Price: **M\$50.00 (US\$25.00)**.
- Bulletin 12 (1980)**, 86p. Papers on Petroleum Geology, Engineering Geology, Structure, Palaeomagnetism & Petrology, edited by G.H. Teh. Price: **M\$20.00 (US\$10.00)**.
- Geological Map of the Malay Peninsula (1:1,000,000 coloured)** compiled by D.J. Gobbett, 1972. Price: **M\$4.00 (US\$2.00)**—folded flat.
- Field Guide for a 7-day, one thousand mile, geological excursion in Central and South Malaya (West Malaysia and Singapore (1973)**, 40 p. by C.S. Hutchison. Price: **M\$5.00 (US\$2.50)**.
- Abstracts of papers**, Regional Conference on the Geology of Southeast Asia, Kuala Lumpur (1972), 64 p. 8 figs., 3 tables, many extended abstracts. Edited by N.S. Haile. Price: **M\$6.00 (US\$3.00)**.
- Warta Geologi** (Newsletter of the Geological Society of Malaysia). Price: **M\$2.00 (US\$1.00)** (for non-members) per bimonthly issue from July 1966.

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