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CATATAN GEOLOGI

Geological Notes

Some Lower Cretaceous Radiolaria from the Serabang Complex, Sarawak

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Abstract: Eleven species of Radiolaria were identified from a slaty shale sample collected from the Lundu-Sematan area. The assemblage consists of *Hemicryptocapsa* sp., *Hemicryptocapsa* cf. *prepolyhedra* Dumitrica, *Archaeodictyomitra lacrimula* (Foreman), *Archaeodictyomitra vulgaris* Pessagno, *Archaeodictyomitra* sp. A, *Archaeodictyomitra* sp. B, *Pseudodictyomitra puga* (Schaaf), *Pseudodictyomitra* cf. *puga* (Schaaf), *Thanarla conica* (Aliev), *Thanarla* cf. *conica* (Aliev), *Thanarla pulchra* (Squinabol), *Parvicingula* sp., and *Xitus* sp. This assemblage is indicative of Valanginian to middle Aptian age, Early Cretaceous.

INTRODUCTION

The Serabang Formation was originally described by Wilford (1955). Liechti *et al.* (1960) have abandoned the name and included the Serabang Formation in the Sejingkat Formation. Haile (1961) has redefined the Serabang Formation. Haile and Wolfenden (in Wolfenden, 1963) have designated and described the type section of the formation. The Serabang Formation consists predominantly of argillaceous rocks with subsidiary arenaceous rocks, chert, conglomeratic and bouldery slate, a few lenses of conglomerate, calc-silicate hornfels, marble, beds of tuffite and a few basic lava flows. Most of the rocks suffered some degree of metamorphism.

The Serabang Formation as re-described by Haile and Wolfenden (in Wolfenden, 1963) contains blocks and fragments of conglomerate, greywacke, chert, tuffite and basalt embedded in slaty matrix. This indicates that at least a part of the Serabang Formation is a *mélange*. The term formation is inappropriate and should be changed to the Serabang Complex.

The age of the Serabang Formation was considered to be Jurassic-Cretaceous based on several radiolarian genera identified from several thin sections by G.F. Elliott (Wolfenden, 1963).

This age determination is not precise. However, Tumanda *et al.* (1993) have identified some radiolarian faunas indicating of Hauterivian to Aptian, Early Cretaceous. A detailed species assemblage was not given.

Recently, several chert and siliceous shale samples were collected from the Lundu-Sematan area. Most of the chert samples were recrystallised and the Radiolaria are completely destroyed. Only one slaty shale sample yielded a moderately well-preserved Radiolaria.

GEOLOGICAL SETTING

The Serabang Complex is composed of predominantly slaty shale, slate, hornfels, greywacke, subgreywacke, chert, conglomeratic and bouldery slate, conglomerate, tuffite, and basalt. The complex was effected by regional metamorphism and thermal metamorphisms by the intrusion of Gunung Gading and Gunung Pueh adamellite. Haile (1961) reported the occurrence of boulders of conglomerate, mylonitic greenstone and fragments of sandstone, chert, volcanic rocks and agglomerate embedded in the slaty matrix. He suggested that the rock might have formed by gravitational sliding down the slope of a eugeosyncline. This debris flow

deposit (Olistostrome) formed a sedimentary mélange. The Serabang Complex was intensely deformed and has undergone regional metamorphism, followed later by thermal metamorphism. The complex was strongly folded, sheared and formed tectonic mélange.

The Serabang Complex exhibits similar features to the Lubok Antu Complex, except the former was highly metamorphosed compared to the latter. Hutchison (1989) considered that the Serabang Complex is a continuation of the Lubok Antu Complex.

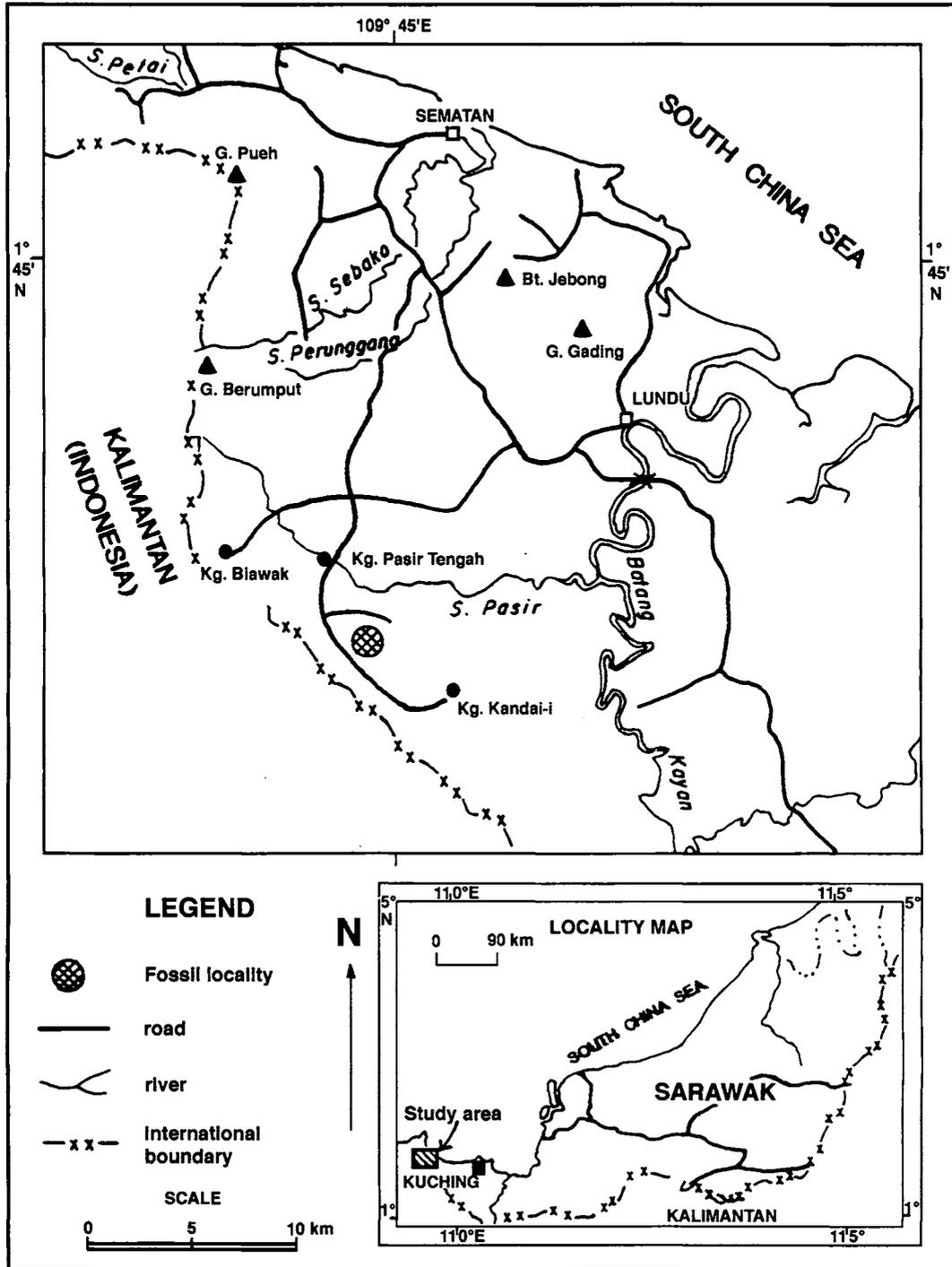


Figure 1. Map of the Lundu-Sematan area showing sample locality.

MATERIAL AND METHOD

Seven radiolarian chert samples and three slaty shale samples were collected from the Lundu-Sematan area. The samples were crushed to chips and were soaked in 10% hydrofluoric acid for 24 hours. The samples were washed through 53 μm sieve. The residues were dried. Only one slaty shale sample yielded some identifiable species of Radiolaria. The Radiolaria were picked by using a fine paint brush. Some of the specimens were photographed by using a scanning electron microscope. The sample locality is shown on map Figure 1.

DISCUSSION

State of Preservation of Radiolaria

Most of the chert samples are recrystallised. Radiolarian skeletons are destroyed except in one slaty shale sample where Radiolaria are fairly well-preserved. The slaty shale is slightly weathered and red in colour. Thin section of the slaty shale shows some radiolarian skeletons are not deformed but slightly recrystallised (Fig. 2). The Radiolaria retrieved by using hydrofluoric acid are moderately well preserved. Some of them are slightly deformed. Most of the external ornamentations are weakly preserved but sufficient for specific identification.

Radiolaria and Age

Eleven species of Radiolaria were identified. They are *Hemicryptocapsa* sp., *Hemicryptocapsa* cf. *prepolyhedra* Dumitrica, *Archaeodictyomitra lacrimula* (Foreman), *Archaeodictyomitra vulgaris* Pessagno, *Archaeodictyomitra* sp. A, *Archaeodictyomitra* sp. B, *Pseudodictyomitra puga* (Schaaf), *Pseudodictyomitra* cf. *puga* (Schaaf), *Thanarla conica* (Aliev), *Thanarla* cf. *conica* (Aliev), *Thanarla pulchra* (Squinabol), *Parvicingula* sp., and *Xitus* sp. (Plate 1). The occurrence of *Archaeodictyomitra lacrimula* indicates that the age of the slaty shale is Valanginian to middle Aptian, Early Cretaceous (Sanfilippo and Riedel, 1985).

The red slaty shale is widespread in the Kandai-i area and it probably forms the matrix of the complex. The slate was weathered to form red shale. If this true, the age of the Serabang Complex is probably Valanginian to middle Aptian, Early Cretaceous. The complex was thermally metamorphosed by the intrusion of Late Cretaceous adamellite of Gunung Pueh and Gunung Gading.

The age of the Serabang Complex was thought to range from Late Jurassic to Early Cretaceous (Haile, 1961; Wolfenden, 1963). There was no reliable record on the occurrence of the Late Jurassic Radiolaria. *Tumanda et*

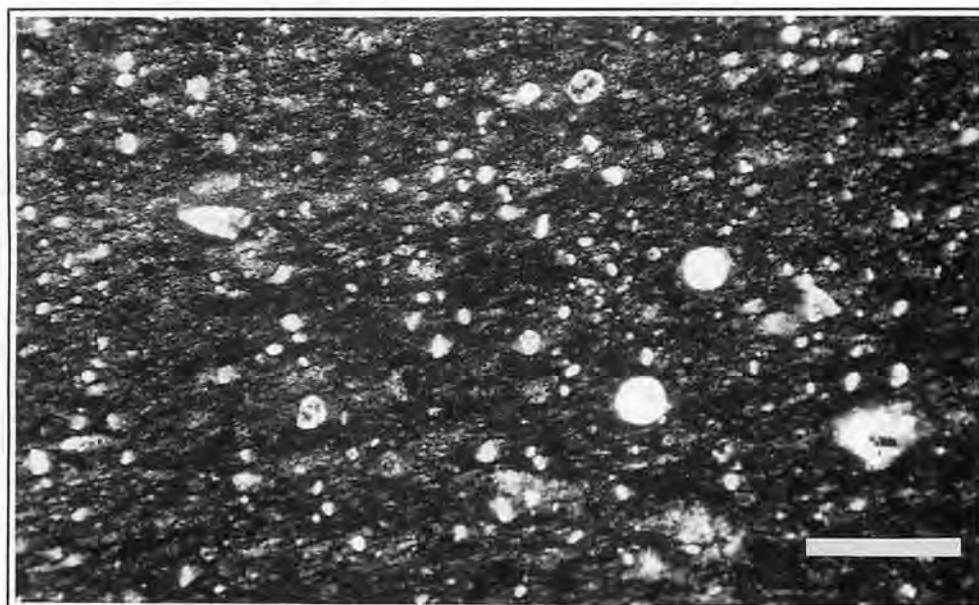


Figure 2. Photomicrograph of slaty shale showing some Radiolaria (Scale bar 0.4 mm).



1



2



3



4



5



6



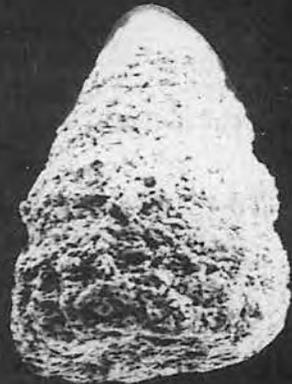
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8



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11



12



13



14



al. (1993) have reported only Early Cretaceous radiolarian faunas from this complex. It is evidence that the Serabang Complex is older than the Lubok Antu Complex. The Serabang Complex was deposited during the Early Cretaceous whereas the Lubok Antu Complex was deposited during the early Tertiary (Tan, 1979). The relationship between the two complexes is not fully understood.

CONCLUSION

Most of the bedded chert in the Serabang Complex are recrystallised to form microcrystalline quartz. Radiolaria in the chert are poorly preserved and cannot be identified. Only one slaty shale sample yielded some identifiable radiolarian faunas. The Radiolaria retrieved from the slaty shale of the Serabang Complex confirm that the age of the complex is Valanginian to middle Aptian, Early Cretaceous. The complex has suffered regional metamorphism and thermal metamorphism during the Late Cretaceous by the intrusion Gunung Pueh and Gunung Gading adamellite. The Serabang Complex is older than the Lubok Antu Complex. The relationship between the two complexes is unclear.

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Manuscript received 14 September 1995

Plate 1. Radiolarian assemblage of the Serabang Complex. Scale bar in μm is indicated in the parentheses.

1. *Hemicryptocapsa* sp. (80 μm)
2. *Hemicryptocapsa* cf. *prepolyhedra* Dumitrica (80 μm)
3. *Archaeodictyomitra lacrimula* (Foreman) (100 μm)
4. *Archaeodictyomitra vulgaris* Pessagno (100 μm)
5. *Archaeodictyomitra* sp. A (100 μm)
6. *Archaeodictyomitra* sp. B (133 μm)
7. *Pseudodictyomitra puga* (Schaaf) (80 μm)
8. *Pseudodictyomitra* cf. *puga* (Schaaf) (80 μm)
9. *Thanarla conica* (Aliev) (67 μm)
10. *Thanarla* cf. *conica* (Aliev) (67 μm)
- 11, 12. *Thanarla pulchra* (Squinabol) (100 μm)
13. *Parvicingula* sp. (80 μm) (deformed specimen)
14. *Xitus* sp. (80 μm)

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CATATAN GEOLOGI

Geological Notes

Note on the Engkilili Formation and the age of the Lubok Antu Mélange, West Sarawak, Malaysia

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INTRODUCTION

The Lupar Valley represents the junction of the huge folded accretionary prism of the turbidite Rajang Group to the north, and the more continental part of West Sarawak to the south. The valley is marked by a narrow belt of mélangé. Unravelling the geology of this area presents fascinating challenges similar to those facing European geologists in the 19th Century, when they tried to make sense of the older rocks that are now known as Paleozoic. Not surprisingly there remain many uncertainties.

A recent paper by Basir Jasin and Taj Madira Taj Ahmad (1995) on planktonic Foraminifera from near Engkilili in the Lupar Valley is a welcome contribution to the geology of this complex area. However, it raises the question of the relationship of the main part of the mélangé belt and the calcareous belt along its southern margin, and, in particular, how far age determinations in the calcareous belt can be applied to the matrix of the mélangé belt as a whole. Based on my observations when mapping the area, revisiting it in 1992, and consideration of the published accounts, I suggest that the calcareous rocks show considerable differences from the 'mélangé proper', and are best considered as a separate formation.

Previous published geological work in the area has been by Molengraaff (1902), Zeijlmans van Emmichoven and ter Bruggen (1935), and (after the establishment of the Geological Survey Department in 1949) by myself (Haile, 1957) and Tan (1973, 1975, 1977, 1978a & b, 1979).

The area was also mapped in 1953 by W. Milroy of the Shell Group, and some of his paleontological results are included in the compilation by Liechti, Roe, and Haile (1960, 54–56). This note is aimed to clarify some aspects of the geology of this important and complex area. The complex early history of the stratigraphic schemes has been reviewed by me (Haile, 1955), and this will not be repeated here, except in so far as it is relevant to the small area of calcareous rocks under discussion.

THE 'ENKILILI FORMATION'

I am using the term Engkilili Formation as defined by Liechti *et al.* (1960, p. 54–56) for the richly fossiliferous calcareous shales with limestone blocks that confined to a small area along the Lupar River, which was mapped by me as a lenticular outcrop 'lower Eocene calcareous facies' distinct from the main 'cherty' facies, now known to be mélangé, to the north (Haile, 1957). From the scattered exposures I mapped this as a belt about 15 km long and up to 3 km wide, extending along the strike parallel to the basal Tertiary beds.

Dutch geologists assigned a Neogene age to the limestones on the basis of the supposed occurrence of *Lepidocyclina* sp. and ?*Discocyclina* sp., (Zeijlmans van Emmichoven and ter Bruggen, 1935), but these were almost certainly mis-identifications. There are very few natural exposures in the Lupar River, but when roads were built in the area from the late 1970s onwards, some further large limestone blocks (up to 3 m across) were exposed.

Paleontologists of the Shell Group and the British Museum identified foraminifera (both planktonic and larger calcareous benthonic forms), corals, and algae from numerous samples of the shale and limestone (Haile, 1957, table 11; Liechti *et al.*, 1960, p. 55); a general Paleocene to lower Eocene age was indicated. Three richly fossiliferous samples of shale collected by Tan from the formation yielded planktonic foraminifera (identified by Sarawak Shell) as indicating lower Eocene (Tan, 1979, table 11), and fossils from limestone blocks indicated definite Eocene and upper Paleocene to middle Eocene, most probably Paleocene (A single limestone — K6880 — yielded doubtful Cretaceous forms).

Nannofossils from three samples of shale from the Engkilili area (identified by Perch-Nielsen) indicated the following ages (Tan, 1979, table 12):

- Sample K6455 : *D. lodensis* zone, upper lower Eocene
 Sample K6456 : Tertiary, probably Oligocene/Miocene
 Sample K6619 : Paleocene-Eocene, probably lowermost Eocene

The recent paper based on planktonic foraminifera (Jasin and Ahmad, 1995) indicates one sample of lower middle Paleocene, and one sample of upper lower to lower middle Eocene (There is no correspondence at species level of the assemblages in this paper and those of previous papers i.e. none of the species of *Globigerina* and *Globorotalia* is the same, and the genus *Morozovella* was not found by previous workers, so a general revision of these faunas would be useful. Only Jasin and Ahmad illustrate their forms).

Thus the paleontological evidence indicates Paleocene and lower Eocene for the limestone blocks, and also for the surrounding shale with the sole exception of the single 'probable Oligocene/Miocene' nannofossil sample (based on only one form, *Braarudosphaera bigelovi*); this age seems unlikely on regional grounds, because the apparently overlying Silantek Formation is upper Eocene. Further sampling and re-examination of samples at Sarawak Shell and the British Museum would be seem to be indicated.

LUBOK ANTU MÉLANGE

Natural exposures in rivers or on land in the Lupar Valley are exceedingly rare, and it was only when the first roads were built in the area in the mid 1970s that Tan was able through painstaking field work to recognise and map, at 1:50,000 scale, a mélange belt, consisting of blocks of radiolarian chert, sandstone and shale, and rare basic and ultrabasic rocks, in a sheared matrix. This he named the Lubok Antu Mélange. To the north it is bounded by the strongly folded but not disrupted Upper Cretaceous turbidites, with interbedded pillow lavas, intruded by sills of gabbro (Haile, Lam and Banda, in press). To the south (except for the Engkilili area, where the calcareous rocks occur) it is overlain along a partly faulted boundary by the upper Eocene and younger clastic sedimentary rocks of the Silantek Formation, which is also moderately folded into a large synclinal basin, the northern rim of which is in places vertical.

The Lubok Antu Mélange was described by Tan (1979) in detail. The main belt (exclusive of the Engkilili Formation) as described by him consists of 'fragments and blocks of mudstone, sandstone, shale, chert, conglomerate, basalt, and gabbro and their metamorphosed equivalents, limestone, and serpentine in a highly cleaved, chloritized, pervasively sheared dark-gray, pelitic matrix'.

Tan considered that the calcareous rocks of the Engkilili area were also mélange, that there was no justification for mapping them separately, and therefore that the term Engkilili Formation should be dropped and the calcareous rocks included in the Lubok Antu Mélange. He therefore considered that the age determinations from the Engkilili shale dated the matrix of the mélange.

Age of the mélange blocks and matrix

Blocks in the mélange include chert which has been dated as probably Valangian to Barremian (Lower Cretaceous: five samples; Pessagno, in Tan, 1979, table 13) and Albian to Cenomanian (uppermost Lower Cretaceous to lowest Upper Cretaceous: one sample, Basir and Haile, 1993). Blocks of sandstone and shale (resembling the Lupar Formation which

crops out north of the mélangé belt) in the mélangé have been reliably dated as Upper Cretaceous, Campanian/Maastrichtian, probably lower Maastrichtian (Tan, 1979, table 8).

Only one sample beyond the area of mapped Engkilili Formation examined by Perch-Nielsen yielded nannofossils, namely a single genus indicating 'Tertiary, younger than Paleocene' (K6036; Mile 135½ Jarak-Saratok Road; Tan, 1979, table 12). This is the sole indication of Tertiary in the main mélangé belt, and the sole dated sample of the matrix of the main mélangé belt.

DISTINCTION OF THE ENKILILI FORMATION FROM THE MÉLANGE

From what I have seen of the mélangé, I agree with Tan's description except:

1. Limestone blocks appear to be confined to the southern calcareous belt or Engkilili Formation; I could find none in the main belt;
2. The calcareous shale of the Engkilili Formation is unlike the 'pervasively sheared' matrix of the mélangé. It is unaltered, unshaped grey shale with some concretions and, at one place, sandy burrows. These characteristics are not found in the matrix of the mélangé north of the Lupar River.

In February 1992, in the company of Robert Tate and S.K. Lam of the Malaysian Geological Survey, I examined the area in question. Along the road south of the bridge over the Lupar River the following exposures were seen:

0.5 km S of bridge, in ditch at W side of road — light grey shale, with cm-thick sandstone beds, and a few inclusions of soft sandstone cobbles. Dip is 80° due north, but indistinct grading indicates that the beds probably young to S (i.e. are overturned).

0.7 km S of bridge, on E side of road, at a small hillock, shale with some concretions, and containing sandy cylindrical burrows 55 mm in diameter. Dip 80° to 190°.

1.0 km S of bridge, interbedded sandstone and soft grey shale, flaser bedding and fine ripple marks. Dip towards 260° at

55°. Youngs to W.

1.2 km S of bridge at the water treatment plant, light grey shale, containing ironstone concretions, rare calcareous sandstone cobbles, veinlets of calcite up to 0.5 cm thick, with irregular steep dip.

3. In the Engkilili Formation there is no trace of blocks other than the few limestone blocks, and in particular, the distinctive blocks of radiolarian chert are lacking.

TIME OF FORMATION OF THE MÉLANGE

In dating the mélangé, it is significant to know the age of the blocks and matrix, and even more the dating of the period or periods when the mélangé formed i.e. when the blocks became disrupted from their parent formations and became incorporated in the matrix. Once a mélangé forms, it remains a very weak belt, which is likely to be further disrupted by any stress.

The age of the main disruption is constrained by the age of the youngest blocks within it (Campanian/Maastrichtian), and by the age of the base of the overlying Silantek Formation, which is moderately to strongly folded, but not disrupted. This is established as upper Eocene (Haile, 1957, tables 13, 14; Tan, 1979, p. 44).

There seem to be two main possibilities:

- A. If the calcareous shales and limestone blocks of the Engkilili Formation are considered part of the main mélangé belt, which is Tan's position, then the main disruption took place after the formation of the youngest elements in the Engkilili Formation (lower Eocene) and pre-dates the Silantek Formation (upper Eocene).

This event would be latest Eocene to early late Eocene, i.e. about mid Eocene, and would equate to the major orogeny of intra late Eocene, established for the Rajang Group from evidence in north and northeast Sarawak. In this case it is necessary to explain the much less disrupted nature and absence of metamorphism of the Engkilili Formation, by postulating that tectonism became rapidly less as the more continental part of Borneo was approached.

B. If, on the other hand, the Engkilili Formation is not part of the mélange, and was deposited after the main disruption and metamorphism of the mélange, then the main disruption can be dated as post-Campanian, pre-Eocene i.e. Maastrichtian to Paleocene. In this case, the Engkilili Formation may have been folded before the deposition of the Silantek Formation, or could conceivably have been overlain by Silantek Formation conformably, and have been folded with it in Miocene or Pliocene.

CONCLUSION

The geology of the Lupar Valley is complex, in part obscure, and not fully understood. The relationship of the calcareous belt sited between the main mélange and the Silantek Formation to the south is not clear, but since it shows significant difference in lithology and is unmetamorphosed and much less tectonically disrupted than the mélange, it is best regarded as a separate unit. I suggest that the term Engkilili Formation be retained for the calcareous belt for the time being. It would be most useful if further field and laboratory studies can be made, especially on any new exposures which may result from new road works in the area.

ACKNOWLEDGEMENTS

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PERTEMUAN PERSATUAN Meetings of the Society

Ceramah Teknik (Technical Talk)

Geophysical logs in stratigraphy

IAN E. PENN

Laporan (Report)

Dr. Ian Penn from the Training, Research and Development section of the British Geological Survey gave an informative talk on 7th March 1996 at the Department of Geology, University of Malaya to about 15 members of the Society including staff from the Petronas Research and Scientific Services Pte. Ltd. (PRSS) and students. One reason for the rather low turnout was the late receipt of notices by Society members. This technical hitch of mailing out notices merits further improvement on the part of the Society's administration.

Abstrak (Abstract)

By uniting geological and geophysical attributes, geophysical well log signatures may be used to describe lithostratigraphic units in a quasi objective manner, regardless of stratigraphical age or national borders. When calibrated with cored sequences, they may be diagnostic of formations.

By study of log profiles rather than log values, such core-calibrated signatures can be shown to carry chronostratigraphic 'finger prints' at zone, stage or higher levels and provide a link between the methods of classical stratigraphy and seismic sequence stratigraphy.

Jimmy Khoo K.K.



Thin bed evaluation — where, when, how

ALAN SIBBIT AND BERNIE RAYNER

Laporan (Report)

The above talk, organised by the Society's Petroleum Geology Working Group and held in collaboration with Schlumberger was held on the 20th March 1996 at the Hotel Istana, Kuala Lumpur.

In their presentation, the Schlumberger experts touched on the geological background of thin bed evaluation, measurement and detection techniques and finally processing and interpretation.

The technical talk proved to be most informative and well-illustrated.

G.H. Teh



Minerals and man

TEOH LAY HOCK

Laporan (Report)

On 30 March, 1996, Mr. Teoh Lay Hock, Head of Corporate Unit, Geological Survey Department, representing Geological Society of Malaysia presented a talk on "*Minerals and man*" at the National Planetarium. The talk, which was well attended by students and the general public was basically to create an awareness amongst the public on the importance of minerals to mankind.

To stress the role of minerals in our daily life, Mr. Teoh described a typical day in the life of a person. From the bed upon waking up, he steps onto the floor made of ceramic tiles. He goes into the bathroom where the basin, toilet bowl and other sanitaryware are made from clay. The toothpaste contains fillers of either kaolin, calcium carbonate or fine grained mineral materials. The light bulb is made from tungsten and glass, and quite likely operates on energy generated from coal. He reads the newspaper which is made from kaolin or calcium carbonate. The talk also touched on the contribution of the minerals in the national economy.

Mr. Teoh's talk was well illustrated with computer graphics which projected very well on the dome-shaped roof. It was certainly an eye opening session for the seventy-odd audience and certainly met the objective of the society to educate the public on the role and importance of minerals in our everyday life.

G.H. Teh



Project KLCC: Geology, soils and foundations

TARIQUE AZAM

Laporan (Report)

Ir. Tarique Azam graduated in Civil Engineering from I.I.T. Madras India in 1974 and completed his Masters in Geotechnical Engineering in 1975 from AIT, Bangkok.

He is presently Head of the Geotechnical Department and a Vice President of Ranhill-Bersekutu Sdn. Bhd., which is one of the largest engineering consultancy firms in the country.

Ir. Tarique has been involved in many small and big projects as geotechnical engineer besides KLCC. Some of which are, Tabung Haji building, Bank Negara, LRT 2, Paka Power Station, 2nd bridge between Singapore and Malaysia.

He is the principal geotechnical design engineer for KLCC.

Abstrak (Abstract)

The Petronas's Twin Towers which are currently under construction in the north-west part of the Kuala Lumpur City Centre development when completed will be 450 meters high above road level when completed.

The 400,000 square meter towers are the first phase of 1.7 million square meter complex planned on a 100 acre site at the junction of Jalan Ampang and Jalan P. Ramlee in the heart of Kuala Lumpur which is currently the largest real-estate development project in the world.

The towers will have 88 occupied stories above road level and 5 levels of basement car park.

Each tower has perimeter columns on a 46 m diameter base with an adjacent 21 meter diameter, 45 storey bustle. The towers stand 55 meters apart and are connected by a bridge at the 41st and 42nd floors.

The site is located in a geologically complex contact zone of Kuala Lumpur Limestone and Kenny Hill Formations.

Detailed geotechnical investigation comprising about 400 deep boreholes up to a maximum depth of 200 m and 200 pressuremeter tests and other relevant field and laboratory tests revealed karstic limestone formation at a depth varying from 20 m to more than 200 m below ground level. Limestone is generally overlain by thick Kenny Hill Formation which in turn underlies Alluvium.

Two full scale 30,000 kN instrumented 1,200 mm diameter bored piles were tested and evaluated to determine design parameters.

The detailed analyses of the sub-surface profile and evaluation of various foundation options resulted in a shift of building location by about 60 meters in order to minimize the differential settlement.

Finally a foundation solution comprising a 4.0 m thick raft supported on post-grouted barrette piles varying in depth from 45 m to 105 m was adopted.

The maximum total settlement of the piled raft is estimated to be about 73 mm whereas the maximum differential settlement is of the order of 25 mm.

The speaker presented the complete geological and geotechnical profile of the site, the foundation loads and rationale for selection of design parameters. Detailed analyses of bearing pressure, settlement and heave due to basement excavation and its effect on performance of the foundation were also outlined.

The construction problems in the installation of barrette piles including the treatment of underlying limestone cavities and overlying slump zones was briefly discussed.

Tan Boon Kong



TARIQUE AZAM



B.W. SELLWOOD



Technical Talks by B.W. Sellwood

Laporan (Report)

Prof. Bruce W. Sellwood from the University of Reading, UK, is the present External Examiner for Geology for the Department of Geology, University of Malaya. Currently, he is the co-editor of the *Journal of Sedimentary Geology*. During his recent visit to the department, he gave two talks to the Society on his current research work. Both talks were well attended by more than 30 participants.

In his first lecture on the use of conceptual climatic models in the prediction of ancient climate systems, the use of movie-like, full-colour animation to show the changes of the global climate through time, was able to thrill the audience.

In his second talk, Prof. Sellwood discusses some new evidences and findings on the delicate question of hydrocarbon migration. These findings are based on his work on the Mesozoic carbonates in S. England.

The abstracts for the two talks by Prof. Sellwood are given below.

Sedimentological evaluation of general circulation model simulations for the "Greenhouse" Earth: Cretaceous and Jurassic case studies

Abstrak (Abstract)

Conceptual climate models, based on the workings of the present-day climate system, provided a first order approach to ancient climate systems. They are potentially very subjective in character. Their main drawback was that they involved the relocation of continents beneath a stable atmospheric circulation modelled upon that of the present. General Circulation Models (GCMs) use the laws of physics and an understanding of past geography to simulate climatic responses. They are objective in character. However, they require super computers to handle vast numbers of calculations. Nonetheless it is now possible to compare results from different GCMs for a range of times and over a wide range of parameterisations. GCMs are currently producing simulated climate predictions which compare favourably with the distributions of climatically-sensitive facies (e.g. coals, evaporites and palaeosols). They have been used effectively in the prediction of oceanic upwelling sites and the distribution of petroleum source-rocks and phosphorites. Parameterisation is the main weakness in GCMs (e.g. sea-surface temperature, orography, cloud behaviour). Sensitivity experiments can be run on GCMs which simulate the effects of Milankovitch forcing and thus provide insights into possible patterns of climate change both globally and locally (i.e. provide predictions that can be evaluated against the rock record). Future use of GCMs could be in the forward modelling of sequence stratigraphic evolution and in the prediction of the diagenetic characteristics of reservoir units in frontier exploration areas. The sedimentary record provides the only way that GCMs may themselves be evaluated and this is important because these same GCMs are being used currently to predict possible changes in future climate.

Refining models of hydrocarbon migration and entrapment using stable isotope and fluid inclusion analysis: Case studies in carbonate reservoirs

Abstrak (Abstract)

Carbonate grainstone successions provide significant reservoir facies for hydrocarbons on a global scale and it is clear that their reservoir potential often depends largely on the interplay between burial cement emplacement and the arrival of hydrocarbons. Mesozoic carbonates in S. England provide insights into the timing of both cementation and hydrocarbon migration that may have more general application. Bathonian carbonate grainstones in the southern UK accumulated as a set of stacked calcitic oolite shoals on a homoclinal ramp. Although they suffered early diagenesis under marine, and more significantly, meteoric conditions, later diagenetic cements such as saddle dolomite and, more particularly, mildly ferroan calcite are volumetrically more important in causing the occlusion of porosity on a regional scale. Maximum burial was achieved in the Cretaceous, the basin undergoing mid-Tertiary inversion and uplift.

We have analysed systematically the late cements employing: standard petrography (including CL and UVL); C and O isotopes; Sr isotopes and fluid inclusion studies. Integration of the results of these approaches constrains both the pore-fluid composition and the temperature regime at the time of cement precipitation. Saddle dolomite was emplaced before the mildly ferroan calcite and at temperatures between 75°–85°C and from highly saline brines (18–19.5 wt. % NaCl equivalents). Mildly ferroan calcite precipitated over a wide temperature range (sometimes overlapping with the dolomites; i.e. 85° to 40°C and from less saline brine (6.5 to 15 wt. % NaCl equivalents). Five types of fluid inclusion have been recognised: (1) monophasic aqueous (liquid); (2) monophasic oil (liquid); (3) two-phase aqueous (liquid-vapour); (4) two-phase oil (liquid hydrocarbon-vapour); (5) three-phase aqueous-oil (liquid hydrocarbon-aqueous liquid-vapour). Dolomites do not contain hydrocarbon inclusions but reflect maximum burial temperatures and precipitation from the densest brines. Mildly ferroan calcite competed for pore spaces with hydrocarbons. Oil-filled pores did not become cemented. Mildly ferroan calcite continued to be precipitated over a wide range of falling temperatures (and falling salinities) during inversion uplift (locally in excess of 1.4 km). The Sr isotopic studies suggest that Early Jurassic shales contributed water to the brine system in the basin. These same shales are the main source rocks for hydrocarbons

Fluorescence responses of hydrocarbon inclusions show that oil was migrating as a distinct phase during cementation of the reservoirs. Fluorescence response identifies a regional trend in source rock maturity with an increase in maturity occurring towards the basin centre. Application of these techniques to other basins could help to refine maturation, migration and porosity modelling.

Abdul Hadi Abd. Rahman

GSM

Seminar and Fieldtrip on Marine Sedimentation and Biota in Malaysian Geological Record

— *Laporan (Report)*

Seminar bertajuk *Marine Sedimentation and Biota in Malaysian Geological Record* telah diadakan di Dewan Persidangan Jabatan Penyiasatan Kajibumi Malaysia Ipoh pada 2 Mac 1996. Seminar tersebut telah dimulakan dengan ucapan Presiden PGM dan telah dirasmikan oleh En. T.S. Suntharalingam yang mewakili Ketua Pengarah Jabatan Penyiasatan Kajibumi Malaysia. Seminar ini dijayakan dengan kerjasama beberapa anggota JPK diketua oleh En. Ibrahim Amnan selaku pengerusi bersama. Ahli jawatankuasa penganjur ingin merakamkan ucapan terima kasih kepada semua yang terlibat secara langsung atau tidak langsung dalam menjayakan seminar ini.

Seminar tersebut telah dihadiri oleh lebih 60 peserta dari pelbagai agensi kerajaan dan swasta. Sebanyak 18 kertaskerja telah diterima untuk pembentangan dalam seminar ini dan sebanyak 2 kertaskerja penuh telah diterima untuk diterbitkan dalam penerbitan PGM. Kertaskerja merangkumi tiga aspek utama iaitu sedimentologi, stratigrafi dan paleontologi. Aspek sedimentologi yang disentuh termasuklah sedimentologi batuan berusia dari Ordovisi hinggalah sedimen Kuaterner. Aspek stratigrafi lebih ditumpukan kepada batuan Juru/Kapur dan sedimen Kuaterner, manakala aspek paleontologi yang dibahaskan berkisar sekitar usia Perm, Trias dan Kuaterner.

Oleh kerana terlalu banyak kertaskerja yang diterima, pihak penganjur terpaksa meminta sebahagian dari kertaskerja tersebut dibentang dalam bentuk poster. Seminar ini telah dijalankan dalam 4 sesi pembentangan (13 kertas oral) dan 1 sesi poster (5 kertas poster).

Ucapan penutup telah diberikan oleh pengerusi jawatankuasa penganjur diikuti oleh satu pertemuan pendek Kumpulan Kajian Sedimentologi dan Stratigrafi PGM.

Dalam pertemuan pendek tersebut, ahli kumpulan kajian Sedimentologi dan Stratigrafi telah menyarankan satu aktiviti pada awal Mac 1997 bertajuk "*Non-marine Environment in Malaysian Geological Record*" dianjurkan di Jabatan Geologi, Universiti Malaya.

Pada 3 dan 4 Mac satu lawatan lapangan telah dilakukan di Negeri Perlis dan Utara Kedah bagi melihat jujukan sedimen marin dan biota yang mencakupi usia dari Ordovisi hinggalah Trias. Lawatan lapangan tersebut telah dipandu oleh Profesor Madya Dr. Azhar Hj. Hussain (salah seorang ahli jawatankuasa penganjur).

Mohd Shafeea Leman

***Ucapan Perasmian* oleh Pengarah Jabatan
Penyiasatan Kajibumi "Seminar on Marine
Sedimentation and Biota in Malaysian Geological
Record" pada 2 Mac 1996, di Pusat Operasi
Semenanjung, Jabatan Penyiasatan Kajibumi, Ipoh**

Yang Berusaha Tuan Pengerusi Majlis, Yang Berbahagia Presiden Persatuan Geologi Malaysia, Ahli-Ahli Majlis Persatuan Geologi Malaysia, Jawatan Kuasa Penganjur Seminar, Pengarah-Pengarah Program Jabatan Penyiasatan Kajibumi Malaysia, Tetamu-Tetamu Jemputan serta Tuan-Tuan dan Puan-Puan Peserta Seminar sekalian. Selamat pagi dan salam sejahtera diucapkan kepada semua.

Terlebih dahulu saya bagi pihak Jabatan Penyiasatan Kajibumi Malaysia dengan sukacitanya mengucapkan selamat datang berseminar di Pusat Operasi Semenanjung Jabatan Penyiasatan Kajibumi Malaysia, Ipoh dalam suasana yang masih meriah selepas menyambut perayaan berganda (double celebration) Tahun Baru Cina dan Hari Raya Aidilfitri. Saya rasa masih tidak terlambat bagi saya mengucapkan Selamat Tahun Baru Cina dan Selamat Hari Raya Aidilfitri kepada Tuan-Tuan serta Puan-Puan yang dihormati.

Saya merasa amat berbangga serta merakamkan ucapan terima kasih yang tidak terhingga kerana diberi penghormatan untuk berucap dan seterusnya merasmikan majlis ini.

Ini adalah merupakan kali pertama seminar seumpama ini diadakan di Pusat Operasi Semenanjung. Ipoh yang sekali gus dianjurkan bersama oleh Persatuan Geologi Malaysia dan Jabatan Penyiasatan Kajibumi Malaysia. Kerjasama yang telah sekian lama dipupuk di antara Jabatan Penyiasatan Kajibumi Malaysia dan Persatuan Geologi Malaysia telah dinyatakan dalam menjayakan bersama seminar seumpama ini. Kerjasama sebegini merupakan sebahagian daripada sifat ketelusan (transparent) Jabatan ini yang telah dan akan diwujudkan dengan agensi-agensi serta badan-badan bukan kerajaan di luar Jabatan ini.

Saya percaya bahawa seminar yang bertemakan "*Marine Sedimentation and Biota in Malaysian Geological Record*" ini akan dapat mencapai matlamat sebagaimana yang direncanakan bagi membolehkan peserta-peserta seminar bertukar-tukar pendapat mengenai data-data serta penemuan-penemuan yang diperolehi hasil penyiasatan atau kajian terkini terhadap sedimen marin (marine sediments) yang telah dijalankan selama ini. Di samping itu peserta-peserta akan dapat mengulas mengenai pemahaman terhadap sekitaran marin kuno di Malaysia pada masa lalu. Ia juga merupakan satu "platform" bagi peserta-peserta berbincang mengenai nilai ekonomi terhadap jujukan marin serta biota yang terkandung di dalamnya. Seminar ini juga dipercayai akan berupaya untuk menjana minat para pengkaji bagi melaksanakan kajian lanjutan terhadap jujukan marin dan paleontologi jujukan batuan tersebut.

Saya juga difahamkan bahawa satu kerja lapangan selepas seminar akan dilakukan di kawasan barat laut semenanjung bagi membuat cerapan serta melakukan perbincangan di lapangan terhadap singkapan-singkapan batuan paleozoik awal serta batuan Permo-Trias. Diharapkan supaya peluang ini akan diambil oleh pegawai-pegawai kajibumi Jabatan ini untuk berbincang dengan rakan-rakan ahli Persatuan Geologi Malaysia lainnya bagi memantapkan lagi pengetahuan masing-masing dalam bidang geologi.

Di akhir kata, saya dengan rasa penuh takzim dan sukacita, merasmikan "*Seminar on Marine Sedimentation and Biota in Malaysian Geological Record*". Selamat berseminar. Sekian terima kasih.

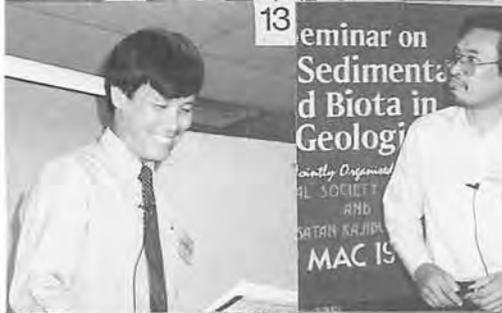
Seminar on Marine Sedimentation and Biota in Malaysian Geological Record

Programme

Saturday, 2nd March, 1996

- 08.00 : Registration
- 08.30 : Address by President Geological Society of Malaysia, Dr. Khalid Ngah
- 08.40 : Opening Address by Director Geological Survey Department, En. T.S. Suntharalingam
- SESSION 1**
- 09.10 : *Lee Chai Peng*
Probable reasons for the paucity of the fossil record in the Kenny Hill Formation
- 09.35 : *Mat Niza Abdul Rahman and Abdullah Sulaiman*
Geologi kawasan Gubir, Kedah Darul Aman — suatu tinjauan awal dari perspektif sekitaran pengendapan
- 10.00 : **COFFEE BREAK**
- SESSION 2**
- 10.20 : *Basir Jasin*
Permo-Triassic Radiolaria from the Semanggol Formation, northwest Peninsular Malaysia
- 10.45 : *Ibrahim Amnan and H. Fontaine*
New paleontological data of the limestones in southwest Kelantan and North Pahang, Peninsular Malaysia
- 11.10 : *Azhar Hj Hussin*
Mesozoic marine basins of West Sarawak: Some thoughts on their evolution and paleogeography
- 11.35 : *Lee Chong Yan*
Seismic stratigraphy of Quaternary sediments offshore northwest Peninsular Malaysia
- 12.00 : *Richard Mani Banda and E. Honza*
Miocene stratigraphy of northwest Borneo Basin
- 12.25 : **LUNCH**
- SESSION 3**
- 14.00 : *Sanudin Hj. Tahir*
Facies association of turbidite sequence in Kota Kinabalu area, Sabah, Malaysia
- 14.25 : *Azmi Mohd Yakzan*
Effects of sieving on palynological records in Tertiary marine sediment
- 14.50 : *Azhari Ahmad and E. Honza*
Shelf sediments in offshore west Sarawak
- 15.15 : *V.R. Vijayan, Ismail Iman and Eiichi Honza*
Continental shelf sediments of the east coast of Peninsular Malaysia
- 15.40 : **TEA BREAK AND POSTER SESSION**
- SESSION 4**
- 16.10 : *Abdul Hadi Abd Rahman*
Shallow marine multiple-event deposits: Core examples from the Upper Cycle V (Late Miocene) of Baram Field, Baram Delta, offshore Sarawak
- 16.35 : *Che Aziz Ali*
Tertiary carbonate sedimentation and response to sea-level changes: A case study from Sarawak
- 17.00 : **CLOSING REMARK**
- 17.10 : **GROUP MEETING**

Seminar on Marine Sedimentation and Biota in Malaysian Geological Record



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Seminar on Marine Sedimentation and Biota in Malaysian Geology



Seminar on Marine Sedimentation and Biota in Malaysian Geological Record



Seminar and Fieldtrip on Marine Sedimentation and Biota in Malaysian Geological Record

— *Captions to photos*

Seminar

- 1, 2. At the registration desk.
3. Khalid Ngah welcoming the participants.
- 4-5. The audience roaring with laughter.
6. Suntharalingam declaring the Seminar open.
- 7, 8. The rest of the audience.
- 9-11. A welcomed coffee-break.
12. Mat Niza being congratulated by Session Chairman Loganathan.
13. Lee Chai Peng with his presentation.
14. Basir Jasin on Permo-Triassic Radiolaria.
15. Kamaludin with a question.
16. Ibrahim Amnan with new paleontological data.
17. Lee Chong Yan on seismic stratigraphy.
18. E. Honza making a query.
19. Azhar Hj. Hussin with his paper.
20. Richard Mani on the NW Borneo Basin.
- 21-23. Lunch at the Survey canteen.
24. Sanudin Hj. Tahir on facies association.
25. Azmi Mohd. Yakzan on the effect of sieving on palynological records.
26. S.K. Yong stressing a point.
27. Azhari Ahmad receiving a token from Session Chairman, Ahmad Tajuddin.
28. Ismail Iman with his joint paper.
29. Abdul Hadi with his presentation.
30. Che Aziz Ali on Tertiary carbonate.
31. Yamin with a question.
32. Kamal Roslan being congratulated by G.H. Teh.
33. Abdullah Sulaiman receiving a token for his poster.

34. Umar Hamzah gets a token for his poster.
35. Organising Co-Chairman Mohd Shafeea with the Closing Remarks.
- 36-41. Keen interest at the poster session.
42. A group photo.

Fieldtrip

43. Dressing-up the bus for the fieldtrip.
44. Fieldtrip Leader Azhar Hj. Hussin on the stratigraphy of Guar Sawar.
45. Looking for fossils in the rocks.
46. Azhar indicating the 2 sedimentation cycles at Bukit Chondong.
47. Studying the outcrop at the foot of Bukit Wang Pisang.
48. A closer look at the fossils at Bukit Manek.
49. Azhar showing the interbedded limestone lenses and sandstone.
50. H.D. Tjia elaborating on the redbed sequence on the road to Wang Kelian.
51. A group photo on the Thai side of the border at Wang Kelian.
52. Azhar showing the dolostones at Kian Giap Quarry.
53. A closer look at the extensive stromatolites.
54. Examining the facies assemblages at Bukit Kecil, Kodiang.
55. Azhar showing the finer details of the Kodiang Limestone.
56. *"That is the bioclastic grainstone."*
57. H.D. Tjia discussing the sea-level changes.
58. Looking at chert nodules in the limestone at Bukit Kodiang.
59. Bidding farewell after the famous Pasembor Kodiang lunch.

Seminar on Marine Sedimentation and Biota in Malaysian Geological Record

Abstracts of Papers

Probable reasons for the paucity of the fossil record in the Kenny Hill Formation

C.P. LEE

Department of Geology
University of Malaya
50603 Kuala Lumpur

The Kenny Hill formation is a widely distributed thick sequence of arenaceous and argillaceous rocks in the general vicinity of Kuala Lumpur and areas south of it. Some bedded cherts from Dengkil have also been included in the formation.

Except for two reported finds of the Lower to Middle Permian ammonoid, *Agathiceras* sp., together with crinoid stems and poorly preserved bivalves and probable brachiopods, fossils are generally not found in the formation. Some trace fossils and Carboniferous to Permian palynomorphs have also been reported. The Dengkil radiolarians are supposedly pre-Carboniferous with Devonian affinities but a probable Triassic age has been suggested by H.Y. Ling (*pers. comm.*).

Absence of fossils in a formation can be due to many reasons including:- the lack of suitable material for preservation, unfavourable preservational environment, post-depositional destruction due to metamorphism, tectonics or weathering and erosion. I had originally thought that the Kenny Hill formation was largely unfossiliferous because most of it was metamorphosed or badly weathered where exposed. However, as more fresh and deep exposures created by the recent construction boom were examined, it became clear that some of them were not too metamorphosed or weathered and one begins to wonder if the absence of fossils is due to the actual non-presence and not non-preservation of the fossils in the first instance. This is not unlikely because the Kenny Hill is a rather thick formation. It could be fossiliferous in its lower part where the ammonoids and crinoids were found but the bulk of the Kenny Hill could be laid down perhaps during Late Permian times where many organisms were becoming or had become extinct. The end of the Permian between about 250 to 255 million years ago was disrupted by what appears to be the most devastating mass extinction of all time in which about half of all families in the marine realm disappeared and vertebrate faunas on land were decimated. This could create a real lack of material to be fossilised and explain the paucity of the fossil record in the Kenny Hill formation apart from or in addition to preservational factors. Additional support comes from the general lack of trace fossils in those parts of the Kenny Hill which are also devoid of body fossils indicating the absence of organisms.

There appears to be a change in depositional environment from deep (Dengkil radiolarian cherts) to shallow deposits where channel sandstones cutting deep red shales have been observed (e.g. in the Puchong area) in the unfossiliferous and most likely younger parts of the Kenny Hill formation. The palaeogeographic significance could be that the lower part of the Kenny Hill formation with *Agathiceras* is marine and correlatable with other Lower to Middle

Permian ammonoid localities in Kampar, Cheroh, Maran and Kuala Betis while the upper unfossiliferous part was deposited in Late Permian time in an increasingly shallow and more continental environment.

Geologi kawasan Gubir, Kedah Darul Aman — suatu tinjauan awal dari perspektif sekitaran pengendapan

MAT NIZA BIN ABDUL RAHMAN & ABDULLAH BIN SULAIMAN

Jabatan Penyiasatan Kajibumi Malaysia
Ipoh, Perak

Kawasan Gubir dibentuk oleh jujukan batuan Formasi Kroh, Formasi Semanggol dan batuan granit. Formasi Kroh yang berusia Ordovisi Awal hingga Devon Awal merupakan unit batuan tertua tersingkap di kawasan ini, terdiri daripada fasies berargilit, fasies kalka silikat, fasies berarenit dan fasies berudit. Fasies berargilit terdiri daripada sabak, filit, batu lodak dan syal. Fasies kalka silikat terdiri daripada hornfels kalka silikat. Fasies berarenit terdiri daripada kuarzit dan batu pasir sementara fasies berudit pula dibentuk oleh metakonglomerat.

Kepelbagaian jenis batuan di dalam Formasi Kroh menyebabkan agak sukar untuk menafsirkan sekitaran pengendapannya. Walau bagaimanapun tafsiran sekitaran pengendapan telah dibuat berdasarkan kepada ciri-ciri litologi, saiz butiran dan struktur sedimen yang dipamerkan oleh setiap fasies yang hadir.

Kepelbagaian fasies di dalam Formasi Kroh menunjukkan berlaku variasi terhadap sekitaran pengendapannya. Perubahan sekitaran pengendapan berlaku dari sekitaran laut cetek ke sekitaran laut dalam. Perubahan ini mungkin disebabkan oleh berlakunya penurunan dan pengangkatan lembangan pengendapan oleh aktiviti tektonik yang berlaku sepanjang tempoh pengendapannya. Kepelbagaian fasies juga boleh disebabkan oleh perubahan kekuatan arus yang mengangkut dan mengendapkan sedimen di samping perubahan ketumpatan/kepekatan serta saiz dan jenis sedimen yang diangkut dan diendapkannya. Walau bagaimanapun, oleh kerana berlaku perubahan yang mendadak daripada satu fasies ke fasies yang lain, menunjukkan perubahan sekitaran pengendapan berkemungkinan besar adalah disebabkan oleh perubahan kekuatan arus serta ketumpatan/kepekatan dan jenis sedimen yang diangkut dan diendapkan. Walaupun begitu, jujukan sebenar unit-unit batuan Formasi Kroh tidak dapat ditentukan secara jelas berikutan sifat kekanta, saling terlapis dan saling menjejari di antara fasies-fasies yang hadir.

Jujukan batuan Formasi Semanggol terdiri daripada unit berkonglomerat dan unit berirama diendapkan di sekitaran marin di cerun benua terutamanya oleh arus turbidit. Unit berkonglomerat terdiri daripada sisipan lapisan/kekanta konglomerat di dalam unit berirama yang terdiri daripada saling terlapis batu lodak, syal dan batu pasir. Perubahan unit batuan yang diendapkan dipengaruhi oleh kekuatan arus turbidit, ketumpatan/kepekatan sedimen di dalamnya serta saiz dan jenis sedimen yang diangkut dan diendapkannya.

Lapisan Saiong terdiri daripada konglomerat atau lapisan berkonglomerat di samping batu pasir dan batu lodak yang keseluruhannya berwarna kemerahan akibat proses pengoksidaan. Pengendapan ditafsirkan berlaku di sekitaran kebenuaan di mana sedimen terdedah terus kepada atmosfera atau berada di bawah permukaan air yang cetek.

Permo-Triassic Radiolaria from the Semanggol Formation, northwest Peninsular Malaysia

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The Semanggol Formation was introduced by Alexander (1959) for the sedimentary rocks exposed in the Semanggol range in north Perak. The name was adopted by Burton (1970, 1973, 1988), Courtier (1974), Abdul Rahim Samsudin *et al.* (1991) and Teoh (1992) to describe similar rocks exposed in north Perak, south Kedah and north Kedah. The formation is gently folded and consists of conglomerate, sandstone interbedded with mudstone and chert. Burton (1973) divided the formation into three informal members namely the chert member, the rhythmite member, and the conglomerate member which were later called units by Teoh (1992). The conglomerates were interpreted to be deposited on submarine fans; the interbedded sandstone and mudstone was deposited by turbidity currents; and the chert was deposited in a deep basin (Ahmad Jantan *et al.*, 1989). The cherts are mainly exposed in south and north Kedah where they are folded and form prominent strike-ridges.

The radiolarian cherts of the Semanggol Formation have been described by Sashida *et al.* (1992, 1993, 1995), Metcalfe and Azhar Hussin (1994), Basir Jasin (1994), Metcalfe and Spiller (1994), Spiller and Metcalfe (1995a, 1995b). Sashida *et al.* (1992, 1993, 1995) recorded Middle and Late Permian Radiolaria from Bukit Barak and Bukit Nyan, north Kedah. Metcalfe and Azhar Hussin (1994) and Metcalfe and Spiller (1994) extend the age of the chert down to *Pseudoalbaillella lomentaria* Zone (Wolfcampian) Early Permian. Basir Jasin (1994) first reported the occurrence of Middle Triassic Radiolaria from Pokok Pauh, Bukit Tembaga and Merbau Pulas areas. Spiller and Metcalfe (1995a, 1995b) indicated that the oldest chert is latest Early Permian based on the poorly preserved specimens which they tentatively assigned to *Pseudoalbaillella longtanensis* ?.

Studies of the radiolarian cherts by Sashida *et al.* and Metcalfe *et al.* were carried out in the north Kedah area. In this study I have collected many chert samples from both south and north Kedah. Several chert samples from seven localities yielded some identifiable radiolarian faunas. Most of the Radiolaria are quite well-preserved. Three assemblages of radiolarian faunas were recognised.

- i. The oldest radiolarian assemblage belongs to *Pseudoalbaillella scalprata m. rhombothoracata* Zone of Ishiga (1990). The assemblage is characterised by the occurrence of *Pseudoalbaillella scalprata m. rhombothoracata* Ishiga, *Pseudoalbaillella scalprata m. scalprata* Ishiga, *Pseudoalbaillella scalprata m. postscalprata* Ishiga, *Pseudoalbaillella elongata* Ishiga and Imoto, *Pseudoalbaillella cf. asymmetrica* Ishiga and Imoto and *Ruzhencevispongus* sp. This assemblage is indicative of Early Permian.
- ii. *Albaillella levis* assemblage: the assemblage consists of *Albaillella levis* Ishiga, Kito and Imoto, *Albaillella triangularis* Ishiga, Kito and Imoto, *Albaillella excelsa* Ishiga, Kito and Imoto, *Follicucullus ventricosus* Ormiston and Babcock, *Nazarovella inflata* Sashida and Tonishi, *Triplanospongus musashiensis* Sashida and Tonishi, *Entactinosphaera pseudocimelia* Sashida and Tonishi, *Nealbaillella cf. ornithoformis* and *Nealbaillella cf. pseudogrypus* Sashida and Tonishi. This assemblage is indicative of Late Permian.

- iii. *Triassocampe deweveri* assemblage: this assemblage consists of *Triassocampe deweveri* (Nakaseko and Nishimura), *Pseudostylosphaera compacta* (Nakaseko and Nishimura), *Pseudostylosphaera japonica* (Nakaseko and Nishimura), and *Eptigium manfredi* Dumitrica. The assemblage indicates Anisian-Ladinian, Middle Triassic.

The chert sequence of the Semanggol Formation now ranges from *Pseudoalbaillella scalprata* m. *rhombothoracata* Zone, Early Permian to Anisian-Ladinian, Middle Triassic. The stratigraphic significance of the Radiolaria will be discussed.

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New palaeontological data of the limestones in southwest Kelantan and North Pahang, Peninsular Malaysia

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Introduction

The Stratigraphy and Palaeontology Section of the Geological Survey Department Malaysia has started a detailed palaeontological studies on limestones exposures in southwest Kelantan and north Pahang in 1992. To date, most of the limestone bodies within the Sungai Betis, Sungai Serau and Sungai Serumbun valleys have been surveyed. The main objective of this study is to palaeontologically date the limestone bodies exposed in southwest Kelantan and north Pahang (WNW of the Central Belt area of Peninsular Malaysia) by using both micro and macro fossils available within or below the limestone beds. In the past, the age of these limestones was considered as Permian only by lithological correlation and many limestone exposures located in remote areas were left undated because they were inaccessible. Based on the observations made during the survey, it is noted that Triassic limestones are found more widespread in the southwest Kelantan and north Pahang areas. This finding contradicts to the earlier thoughts that most of the limestone bodies within these regions are Permian in age (Fontaine and Ibrahim, 1994).

Study area

The study area is demarcated by longitude 101° 43'E to 101° 58'E and latitude 04° 22'N to 04° 49'N. The only access road to the north and northwestern part of this area is through a proposed Gua Musang to Cameron Highlands road, through Merapoh town to the central part, and through Chegar Perah to the south and southwestern; and then connected by networks of narrow timber tracks which have been abandoned for some time. The study area extends from sheet 56 (Gunung Bedong) in the south to sheet 44 (Kuala Betis) in the north and western part of sheet 57 in the east. The area is covered by thick forest and only two settlement areas available (the Orang Asli settlements at Pos Blau and Pos Mering).

Results and Conclusions

Macrofossils are abundant only at a few limestone localities and consist mainly of crinoids. A bed of calcareous shale about 1 m thick, very rich in pelecypods was discovered at the base of limestone body at Gua Senurat. Microfossils are commonly few and they are found everywhere in the limestones of southwest Kelantan. *Tubiphytes* (alga) and *Bacinella* (small foraminifers) are very common with few *Solenopora* (alga). However, these fossils are not good age markers. Other microfossils are relatively few and some of them are index fossils.

This study has confirmed that distribution of Triassic limestones are very widespread in the southwest Kelantan and north Pahang. Moreover, it indicates that fossils may be found in limestone bodies (at least in some areas) near the Bentong line. The limestone bodies within southwest Kelantan area are generally not metamorphosed. They were commonly deposited in quiet, shallow waters. Moreover, the presence of oncolites at some localities and rich pelecypods faunal assemblages at Gua Senurat indicate shallow marine environment. Fossils found in southwest Kelantan do not indicate any Permian or Palaeozoic ages. The occurrence of *Daonella lindstroemi* Mojsisovics and *Plagiostoma beyrichi* Eck (pelecypods) discovered at Gua

Senurat (in southwest Kelantan) is reported for the first time in Malaysia. The presence of *Meandrospira* (small foraminifers), *Daonella lindstroemi*, *Plagiostoma beyrichi* and *Glomospira* (small foraminifers) clearly indicates an Anisian age (lower Middle Triassic).

The limestones in north Pahang are commonly recrystallized or dolomitized. Palaeontological results are obtained by chance. *Tubiphytes* and fragments of shells (bivalves and gastropods) occur in the micstone at Gua Kajang. Foraminifers are very few and poorly preserved; they appear to consist of Duostominidae, *Fronicularia* and *Glomospira*. The Anisian age is possibly inferred for this limestone. Two kilometres northwest of Gua Kajang (samples SP257 to SP 265), the limestone contains *Tubiphytes* and rare tiny foraminifers, occasionally associated with fragments of shells (bivalves and gastropods). Wackestone collected at 300 m west of Gunung Terepai (samples SP241 and SP241A) contain fragments of shells (bivalves and gastropods). At Gua Batu Malim (WNW of Chegar Perah) the limestone is mainly micstone to wackestone, occasionally garinstone with bothryoidal grains. It contains fragments of *Tubiphytes*, bivalves, gastropods and brachiopods, very rare fragments of dasyclad alga and bryozoans. Foraminifers are few and they consist of Duostominidae, *Endothyrella*, *Meandrospira* and *Glomospira* (samples SP216–SP225). These foraminifers indicate an Anisian age. In the south of Merapoh area, some fossils found in the Gua Jibok-Gua Gunung area suggest a Permian age or may be of Late Permian (Dzhulfian-Dorashamian) age especially by the presence of *Colaniella*?. *Claraia*, a Lower Triassic pelecypod, was found in the shale within that area by Tamura in 1968. Triassic conodonts were also recorded.

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Mesozoic marine basins of west Sarawak: Some thoughts on their evolution and paleogeography

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Two phases of Mesozoic marine sedimentation occurred in west Sarawak:

- i. a middle-late Triassic clastic-volcanic phase of the Sadong Formation and Serian Volcanics, and
- ii. a late Jurassic-late Cretaceous clastic-carbonate with subordinate volcanic phase of the Kedadom, Bau and Pedawan Formations. Poorly preserved Jurassic-Cretaceous(?) chert with associated basic igneous rocks of the Serabang and Sejingkat Formations and the Sebanggan Hornstone may represent a deeper marine condition to the present north.

The late Triassic basin was probably marine towards the north with terrigenous and volcanic clasts derived from a southerly source, where fluvial and deltaic deposition preserving several thin coal beds occurred. A basin inversion and folding in the early to middle Jurassic terminated its deposition.

During late Jurassic-early Cretaceous the shallow water Bau Limestone accumulated in several paleohighs in the Bau-Krokong, the fringes Jagoi and Kizam "islands" and the NNW-SSE chain Penrissen-Batang Kayan area. Relative rise in sea level terminated the shallow water limestone deposition in early Cretaceous. In the deeper environment, the thin and thick graded beds of feldspathic sandstone, coarse-tail graded, polymictic extraformational conglomerate sheets and channels and several horizons of mass-flow deposits were sedimented intermittently within black carbonaceous shale. Several lenses of limestone with predominantly packstone texture are found towards the base of the Pedawan Formation.

In the Siniawan area, mass flow deposits are well developed with stratigraphic thicknesses ranging from a meter to very thick, in excess of 80 meters. They occur within a variety of facies association; thinner ones within coarse, thick-bedded sandstone, channel and sheet conglomerate and minor shale sequence.

Blocks of various sizes in the thicker deposits consists of contorted beds of thick turbidite sandstone which exhibits a spectrum soft sediment deformational features resulting in the beds being in coherent, semi-coherent to incoherent state. Closely associated with these contorted beds are shale diapirs, supporting the interpretation that beds were deformed under high pore pressure condition through elastic and plastic behaviour. Minor cobble-sized volcanic and chert fragments are present. The matrix of these deposits consists of mainly of mud, but in some of the thicker beds the matrix are muddy sand.

The sedimentological features suggest that the thicker mass flow deposits originated in the slope and base of slope environments where thick-bedded turbidite and conglomerate were initially deposited. Thinner bedded mass flow deposits could either represent the collapse of the basinal sediments or that they are the distal portion of a much larger mass flow deposits.

Regional consideration suggests that the late Jurassic-late Cretaceous of west Sarawak could have been deposited in several small basins separated by uplifted landmass in the present south and an open marine condition to the present north. The scenario probably ended in the Tertiary with the uplift and erosion of the Mesozoic rocks, resulting in inconformable relationship with the overlying Tertiary sequence, as seen in the south of the Santubong peninsula.

However, if the paleobiogeographical constraints based on work done by previous workers the Triassic Krusin Flora, late Jurassic and early Cretaceous coral and rudists are taken into consideration, a relatively northerly paleoposition may be interpreted for west Sarawak during the Mesozoic. If the post-late Cretaceous counterclockwise rotation of west Borneo based on Paleomagnetism work is correct, then its Mesozoic paleogeography would be a land mass to the west or north and the marine basin to the east and south.

Seismic stratigraphy of Quaternary sediments offshore northwest Peninsular Malaysia

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Several shallow high-resolution marine seismic surveys have been conducted in the Strait of Malacca offshore Kedah, Pulau Pinang (including the Penang Channel between the island and the mainland) and Perak since the mid-1970s. These have been carried out for a variety of

purposes such as reconnaissance mineral exploration, geological mapping, stratigraphic correlation and geotechnical investigations. The surveys were conducted by, among others, Pernas Mining, Geological Survey Department, Universiti Sains Malaysia (separately by Lew, Ryall, van Klinken, Lee and their co-investigators) and private firms (for reclamation works, cable and pipe laying and bridge construction). These studies have yielded a wealth of data on the offshore sediments, their environments of deposition and paleodrainage in the area.

The stratigraphic framework of the sediments in the area is well established. Onshore, Quaternary alluvium covers the coastal plains and valleys. According to Suntharalingam and others, this alluvium consists of marine, fluviomarine and fluvial unconsolidated to semi-consolidated muds, clays, sands and gravels. They can be grouped into four major formations. The Gula Formation of Holocene age consists of clay, silt, sand, gravel and peat deposited in a mainly fluvial environment during the Holocene. The Simpang Formation consists of clay, silt, sand, gravel and peat deposited in a terrestrial environment before the most recent major low sea-level, in the Late Pliocene to Pleistocene. The Kempadang Formation is made up of clay, silt and sand laid down in a marine environment in the Pleistocene. Sea-level fluctuations in the Holocene have played a major role in the depositional history of the whole region.

Seismic sections acquired in the various surveys in the offshore areas under discussion are remarkably consistent even though they are of differing data quality, resolution and penetration. Water depths vary from a few metres to over 50 m. Penetration up to approximately 160 m below the seabed was achieved in the survey offshore Perak and Pulau Pinang. Closer to shore, significant portions of the sections are acoustically opaque due to the presence of biogenic gas from decaying organic debris, in the uppermost layers of sediment, discharged by the many rivers draining into the area.

In general, four major regional seismic reflectors can be identified. From top to bottom they have been designated Reflectors A, B, C and D. Reflector A is generally continuous throughout the area. Reflectors B and C are more discontinuous but can still be correlated through most of the area. The deep Reflector D was detected only in limited localities in the deep-penetration survey offshore Perak and Pulau Pinang. Nevertheless it appears to be regional in character. Various minor reflectors of more local extent are seen in the seismic sections, especially in the upper portions.

The sediments between the seabed and Reflector A consist mainly of fine sand and clayey sand with marine mud on top. Shells are abundant in certain localities. The thickness varies between 0 and 25 m. Cut-and-fill structures evident in most parts of the seismic sections indicate an active erosional regime before this layer was deposited. This sequence is interpreted to be marine in origin and can be correlated with the Holocene Gula Formation. In the nearshore areas around major river mouths, this layer tends to be gas-charged in the upper portions. The top surface of this layer, the seabed, is generally flat on gently undulating. Locally however, sedimentary structures such as sand waves have been detected.

Between Reflectors A and B are found complex sequences of clay and sand, in varying proportions, about 10 m to 45 m thick. Prominent and complex channels are seen in this layer, suggesting a very active fluvial environment. Channel-fills of coarse sand and gravel are evident. Locally, there are indications of a more fluviomarine environment. This layer can be correlated with the Beruas Formation.

Located between Reflectors B and C is another complex sequence of clay and sand, though more compact and homogeneous than the layer immediately above.

Its thickness varies between 5 m and 60 m. Below this layer, between Reflectors C and D is a sequence of semi-homogeneous sediments, predominantly sandy clay with locally coarser materials. This layer is of the order of 100 m in thickness. Stratigraphically, these two layers

of probable terrestrial origin are equivalent to the Simpang Formation of Pliocene-Pleistocene age. Below Reflector D not many details are evident but the sediments appear to be compact, semi-consolidated terrestrial deposits of clay with local sand and gravel, of probable Tertiary age.

Offshore Kedah, bedrock of mainly granite and metasediments was encountered from a few metres to about 60 m below sea-level. Offshore Perak, no bedrock was detected in the seismic sections because the profiles were a considerable distance from shore. In the Penang Channel granite bedrock was detected between 30 m and 70 m below sea-level near both shores.

This integration of the various seismic data sets acquired in this wide area presents an overall picture which is generally consistent with the known geology of the adjacent onshore areas.

Miocene stratigraphy of northwest Borneo Basin

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The Regional Mapping Programme of Geological Survey of Malaysia, Kuching, Sarawak, undertook the detailed mapping of Miocene sediments in northwest Sarawak at 1:50,000 scale. The results presented here are based on the sedimentological, structural and biostratigraphic analyses. Four formations are defined in this area. They are the Miri Formation in the Mid to Late Miocene, the Lambir Formation in the early Mid Miocene, the Sibuti Formation in the mid Early Miocene and the Suai Formation from early Early Miocene. Additional member is the Subis Limestone Member in the lower part of the Sibuti Formation which is located along the central anticlinorium of the Sibuti Formation. The former Belait Formation in the south wing of the Subis Anticlinorium is correlated to the same horizon as the Lambir Formation. The Suai Formation is newly proposed here instead of the former Setap Formation. Setap Village locates within the Sibuti Formation in our compiled geological map. Therefore, we cannot use that name for the formation older than the Sibuti Formation. The major trend of the Miocene formations is the NNF-SSW anticlinorium associated with minor foldings within them. They are blocked by the faults trending NNW-SSE. We could define several faults blocking approximately perpendicular to the trend of the formations. Displacement of most faulted blocks is not so prominent that we can correlate sedimentary units to the next block. However, there are two faults which have vertical and horizontal displacement components more than several kilometers. The southern Suai Fault trending approximately N-S associated with the secondary fault has great displacement to form the formation boundary between the Suai and the Sibuti Formations. Some sediments supply directions are also discussed on the basis of paleocurrent analysis of turbidites within these formations.

Facies association of turbidite sequence in Kota Kinabalu area, Sabah, Malaysia

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Detailed lithologs and other data obtained from field studies were used to construct the facies association of the turbidite sequence (Crocker Formation) of the area. North-northeast-flowing paleocurrents in the turbidite sequence of the formation record the major flow of the system. This turbidite sequence of the area developed in a large northward dipping basin. The sequence is interpreted as deposits of largely channelled-lobe region of a large non-confined marine basin. Diverse facies associations, which can be correlated both across and along strike, record the development of extensive channel complexes, deposition lobe and fan-fringe facies. These sedimentary associations represent part of the out building of large prograding fans that probably extended at least most of the western part of Sabah. Paleocurrent pattern and inferred onlap relationships reflect strong lateral confinement by structurally controlled slopes. The sediment source was probably a large delta located on the uplifting southern basin margin.

Effects of sieving on palynological records in Tertiary marine sediment

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In routine palynological preparation, samples are macerated with strong reagents and undergo several physical treatments to concentrate the organic matter. One of the physical treatments of sample involves the sieving process using mesh ranging in size from 5 μ to 150 μ . The residue retained from the sieving process is either discarded or preserved for microscopic analysis. Sieving using 5 μ mesh size resulted in about 90% lost in *Rhizophora* pollen, 98% lost in Myrtaceidites and a total loss of *Pandanus* pollen. *Rhizophora* pollen, a brackish water taxa, shows a direct relationship with sea level changes, being represented in higher proportion during highstand phases and vice versa, is important for sequence evaluation and intrabasinal correlation. Myrtaceidites show an increase in abundance and are used to demarcate a stratigraphic datum in the Lower Miocene. *Pandanus* pollen are produced by riparian vegetation commonly found along rivers, beyond the limit of brackish tidal influence. They are particularly useful for correlating stratigraphic sections where deposition occurs principally on the upper delta/coastal plain environment. These pollen types, if loss through sieving resulted in loss of important information. On the contrary, the sieving exercise resulted in over representation of the large size palynomorphs. The data obtained therefore necessitates careful evaluation in the light of the processing methods. The conclusion reached is that, no sieving technique in the palynological preparation method, though a time consuming exercise because the whole spectrum of the organic matter need to be studied, produced more accurate palynological datasets to work with.

Shelf sediments in offshore west Sarawak

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Marine geological investigations were carried out by the Geological Survey of Malaysia (GSM) during August 1992 and April 1995 in southwestern offshore Sarawak. It was part of a continuing programme by the department to investigate the occurrence of potential economic mineral deposits and construction material in the coastal and offshore areas of Malaysia.

Survey area and coverage

The survey area is located between Tanjung Datu on the west and Kuala Igan on the east (latitudes 1°35' and 3°N and longitudes 109°35' and 111°40'E). A total of 1,918 line-kilometres of high resolution seismic profiling, side-scan sonar and echo sounding data had been acquired covering an area of 16,000 km². A Van Veen Grab Sampler and gravity piston corer were used to sample the seabed top soil and sub-bottom sediments. The coring system is assembled with a maximum core length of six metres. A total of 274 locations were sampled either by grab and/or gravity methods during the 1992 operation while 177 locations were sampled by piston coring.

Result

Seismic stratigraphy

Seismic stratigraphy analysis results show that the unconsolidated sediment are divided by two dominant reflectors and three stratigraphic units are distinguished. Units 1 and 2 are suggested to be of younger Quaternary sediments and Unit 3 consists of the basement. A remarkable erosional surface can be observed between the upper two units. Thickness of Unit 1 varies at different localities and the sediments could be categorised into four seismic facies. The chaotic facies, deposited in high energy environment are located in the bay area between Tanjung Datu headland and Tanjung Sipang Ridge which show relatively gentle seafloor gradient. Opaque facies, implying gassified sediments with high organic content, are observed in the vicinity of the river mouth between Sarawak River and Batang Rajang and on the eastern side of the survey area where depths are not more than 10 m. Parallel stratified facies which mainly constitute sand/silty clay are observed in the prograding part of Proto-Lupar valley and Rajang delta. The transparent feature which is inferred to consist of homogeneous and very fine grained sediments is interpreted forming the deepest part of the Proto-Lupar valley and is also noted at the small eastern end of the survey area. Unit 2 shows hummocky pattern occasionally with cross-bedding and complex parallel patterns. Some channel fills are observed with complex sediments fillings. These features suggest that its surface had been remarkably eroded and sub-aerially exposed during some periods. No data were obtained to correlate the sediment units with ages. However, these erosional features suggest that Unit 1 is possibly of Holocene age and Unit 2 of late Pleistocene.

Sea bed sediment

Two bars are observed in the western margin of the sea. Thick sandy sediment (4.5 metres maximum) are observed in the core samples from the bars. The sands are composed of fine to coarse grain quartz (80% to 90%) and small amount of shell fragments and foraminifera. Some traces of heavy mineral are also observed. Apart from the bar, muddy sediments are dominant in most of the western area and central to western half of the eastern area. Some sand columns

are observed as patches at the northern side of Talang-Talang Besar Island and around Satang Besar Island. Around Tanjung Pho, sandy sediments gradually change to muddy facies toward offshore. Sediment distributions in the eastern margin show a little different pattern. Muddy sediments are dominant in the near shore zone and sand distributes at water depth between 25 to 40 metres, a little offshore. The sand in the eastern margin of the survey area contained 95% to 98% of fine grain quartz and small amount of shell fragment. Some of the quartz grains are partly iron-stained.

Continental shelf sediments of the east coast of Peninsular Malaysia

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Marine geological sampling and geophysical survey over the shallow continental shelf area of the South China Sea off the east coast of Peninsular Malaysia have been carried out from June to October 1993, as part of the Sixth Malaysian Plan. A total of 2,475 km of survey line with 232 core and 241 grab samples were collected from 25,000 sq. km survey area covering from Tanjung Sedili, Johor to Kuala Terengganu, Terengganu.

Preliminary results show that the bathymetry in the northern part of the continental shelf is relatively steeper and the gradient becomes progressively gradual toward the south. Sand ridges, prominent in the central part of the area, vary in height from 4–5 m in average with maximum of 10–12 m. Spur-like features are observed in some areas. Surface depressions or tidal channels are less widespread, with more channels found in between and close to islands in the southern part.

Surface sediments in the southern part are composed of slightly gravelly muddy sand with significant patches of gravelly muddy sand, particularly around the islands. In the central part, the sediments show varied grain size distribution ranging from sand to muddy sand, slightly gravelly sand to gravelly muddy sand. In the northern part, large areas is covered by gravelly mud and with lesser amounts of muddy gravel which is observed around and south of the islands. Apart from muddy sandy gravel, small patches of slightly gravelly sandy mud and sandy gravel are also observed in the north. There is no distinct trend of grain size with water depth. However, the occurrence of gravel is observed more dominant in the north. The gravels however contain considerable amount of corals materials. A high percentage of sand content is observed in the central part. The sediment type in the study area is attributed to the sediment supply from rivers draining the east coast and its distribution is governed by the tidal current and seasonal monsoon wind driven waves. It is considered that the direct impact of northeast monsoon, lack of sediments supply and net littoral current moving southward could have caused a steeper continental shelf slope in the north region. Sediments supply from the major rivers and the trend of the littoral drifts could have caused the accretion of sediments perpendicular to the coast resulting in shallower and more gradual slope toward the south. The spur-like features are suggested to be formed by sediment transportation by littoral current.

The unconsolidated sediment section between the sea-floor and the bedrock surface is divided into different units characterised by internal seismic reflection patterns and separated by distinct reflection horizons. Four dominant reflectors (Reflectors A–D) and subsequently four sedimentary sequences (Units I–IV) were distinguished in the survey area. Although these

reflectors tend to have essentially unconformable patterns, in the deeper waters, at more 60 m, they appear to be conformable. Unit I is a transparent layer in the uppermost horizon and in a thicker part at shallower area along the coast, the unit is further subdivided into three subunits (Ia, Ib and Ic). Subunits Ia and Ic have transparent features and Ib has alternated pattern. Unit II is also subdivided into two patterns of transparent and thinly alternated patterns and dominantly observed in depressions as channel fill deposits. Unit III is divided to two patterns of the upper chaotic hummocky pattern and the lower transparent pattern, in some places this two patterns are in interfingered relation. Unit IV displays alternate horizontal patterns and the uppermost boundary is commonly eroded to form rough relief and channels. Unit V is only noticeable in a non-continuous manner along the profile since the depth of its upper boundary is close to the limit of maximum penetration of the seismic source. This unit is unconformably overlain by Unit IV and wherever seen, its stronger reflections indicate that this unit is harder than the overlying Unit IV.

Shallow marine multiple-event deposits: Core examples from the Upper Cycle V (Late Miocene) of Baram Field, Baram Delta, offshore Sarawak

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The Baram field is a small oil field situated in the north-eastern side of the Baram Delta Province, offshore Sarawak. The cored intervals of the Upper Cycle V (Late Miocene) of Baram field display reservoir successions dominated by thick swaley cross stratified (SCS) sandstones and other associated wave- and storm-dominated, shallow marine facies. The vertical facies organisation of a genetic unit of upward-coarsening, upward-shallowing SCS-dominated successions suggest deposition during shoreface progradation associated with fall of relative sea level.

The dominant SCS sandstones display complex internal stratification and heterogeneity, which is the product of several different sedimentological and depositional events. The thick SCS units essentially consist of fine to very fine grained swaley cross stratified sandstone; however, this apparent 'homogeneity' is punctuated by several hierarchical orders of boundary surfaces and thin intervals of minor sub-facies termed here as "heterogeneity elements".

The different heterogeneity elements recognised within the thick SCS units are the *first-order scoured bases, second order truncation surfaces, third-order laminar surfaces, mudstone intraclasts conglomeratic horizons, bioturbated sandstone and siltstone, sideritised sandstone horizons, medium-grained massive sandstone and collapse structures.*

A first-order scoured base is the basal, erosive contact surface of a single SCS bed with the underlying strata. Second-order truncation surface is the boundary that define the swaley lamina set. Small-sized mudclasts may sometimes occur along this surface. Third order laminar surfaces define the individual laminac within an SCS bed.

Mudstone intraclasts conglomeratic horizons commonly occur immediately above first order scoured bases, indicating the reworking of older clay beds and laminae. Intense bioturbation in sandstone and siltstone is the result of the long time available for biogenic activity per unit accumulation of sediment. This suggests long periods of quiescence in areas below storm wave

base. Stable isotope studies have shown that the diagenetic siderite cement in the sideritised horizons formed at very shallow level below the sediment water interface; however, the rate of the siderite precipitation cannot be determined. The medium-grained massive sandstone horizon are all bounded by a basal first order scoured base, indicating a different storm event for its deposition. Collapse structures are closely related to vertical *Ophiomorpha nodosa* escape races, suggesting periods of deposition within an environment with relatively high velocity currents.

The presence of the heterogeneity elements within the thick SCS units indicates multiple-event deposition, separated in time, by discontinuities, in the order of hours, days, weeks or years. The stratigraphic stacking pattern of these shoreface sand units suggests that the depositional environment remained at a stable sea level (highstand) or/and at regressional lowstand for a long period of time. In summary, the offshore mudstone and silty layers represent continuous single- or multiple-event deposition at very low rate of sedimentation. On the contrary, the thick, amalgamated shoreface sandstones are produced by multiple-event deposition at high rates of sedimentation; however, discrete sand packages were deposited in discontinuous fashion by temporally different wave and storm-events.

Tertiary carbonate sedimentation and response to sea-level changes: A case study from Sarawak

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Central Luconia Province is the largest carbonate province in Malaysia. As a result of extensional tectonics at the end of the early Miocene, submarine topographic highs were formed, whereupon reef growth took place. The period of prolific carbonate production corresponds with local and global sea-level rise in the mid- and late Miocene.

Sedimentological studies of a selected reef buildup in the province has been carried out to in order to understand the controlling factors that were involved in the reef development. Extensively cored intervals, and a wealth of well data have allowed a detailed study of the carbonate buildup to be undertaken. Based on seismic characters and well data, the buildup has been subdivided into four units (Units I to IV) which are interpreted to reflect sea-level changes. Deposition of each unit commenced with accumulations of argillaceous carbonates during the initial deeper phase (transgressive period). As the rate of sea-level rise decreased and reef growth caught up with sea-level, an aggradational growth developed. In an almost static and shallow sea-level setting (during the highstand period), the reef prograded laterally and formed an 'expansion reef'. A subsequent drop in sea-level subjected large parts of the reef to subaerial exposure. The demise of both the buildup was caused by an influx of terrigenous clastic sediments.

As in modern reef sediments, the bulk of the carbonate sediments of the buildup was composed of metastable aragonite and Mg-calcite. Diagenetic changes into stable calcite and dolomite, occurred at an early stage in the diagenetic history under surface-related physico-chemical conditions. Investigation of the textures and geochemical analyses of the carbonate suggest the following sequence of early diagenetic events:

1. **Early marine diagenesis:** This process involved micritization and early marine cementation that was dominated by the formation of fibrous/bladed circumgranular and circumvoid rim cements.
2. **Fresh water stabilization:** This process occurred predominantly during periods of emergence. This involved stabilization of carbonate comprising dissolution of metastable grains and precipitation of stable calcite cements.
3. **Dolomitization:** Dolomitization predominantly affected reef and protected facies. The process developed within regressive sequences. Although dolomite is associated locally with anhydrite and halite (recognized here for the first time in the Malaysian Miocene), some dolomitization was a by product of evaporite formation. Geochemical data suggest that dolomitization was mainly caused by the mixing of fresh and marine waters.

These early diagenetic processes were of utmost importance for the development of porosity in the buildup. Diagenetic processes which affected the buildup during the burial stage were less effective and occurred primarily within the present water zone in the buildup.

**Seminar on Marine Sedimentation and Biota in
Malaysian Geological Record**
Abstracts of Posters

**Geologi kawasan pengkalan Hulu-Baling, Kedah Darul Aman —
Suatu tinjauan awal dari perspektif persekitaran pengenapan**

ABDULLAH SULAIMAN & MAT NIZA ABD. RAHMAN

Jabatan Penyiasatan Kajibumi
Ipoh

Pendahuluan

Pemetaan geologi dan persampelan geokimia kawasan Pengkalan Hulu-Baling, sebahagian Syit 18 (Baling) telah dimulakan pada bulan Ogos 1994 dan selesai pada bulan September 1994. Program pemetaan ini merupakan sebahagian daripada Projek Pemetaan Geologi Kawasan Sempadan Malaysia-Thailand (IMT-GT).

Secara amnya kawasan kajian dibatasi oleh garis lintang 5°45'N hingga 5°49'N dan garis bujur 100°47'E hingga 100°04'E (utara Syit 18) manakala di bahagian timurnya dibatasi oleh garis lintang 5°27'N hingga 5°45'N dan garis bujur 100°59'E hingga 101°04'E. Keluasan kawasan yang telah dipetakan adalah kira-kira 384 km² iaitu 35% dari keluasan Syis 18, Baling. Selebihnya telah dipetakan oleh C.K. Burton pada tahun 1970 dengan liputan 616 km² (55%) dan D.B Courtier pada tahun 1974 dengan liputan 110 km² (10%).

Litologi

Formasi Kroh yang berusia Ordovisi Awal hingga Devon Awal (Burton, 1986) merupakan unit batuan tertua di kawasan kajian. Ianya meliputi hampir 65% dari keluasan keseluruhan kawasan yang dipetakan. Unit batuan ini mempamerkan perubahan fasies secara berperingkat, sifat kekanta, saling terlapis, saling menjejari dan menunjukkan struktur yang rencam. Enam fasies dominan yang telah dikenal pasti iaitu fasies berargilit, fasies berarenit, fasies berkapur, fasies kalka-silikat, fasies berudit dan sedikit fasies piroklas.

1. **Fasies berargilit** membentuk jujukan batuan paling dominan dan terdiri daripada filit, sabak dan hornfel. Terdapat juga lapisan atau kekanta batu pasir, batu lodak dan cert dalam fasies ini.
2. **Fasies berarenit** hanya terdapat di bahagian tenggara kawasan kajian dan merupakan kesinambungan kepada fasies berarenit yang tersingkap di kawasan Kerunai (Syit 19) dan sedikit di bahagian utara kawasan kajian. Fasies ini terdiri daripada metarenit iaitu protokuarzit dan ortokuarzit.
3. **Fasies berudit** hanya tersingkap di utara kawasan kajian. Ianya terdiri daripada batuan metakonglomerat dengan klas-klas kuarza, sabak, filit, kuarzit dan cert. Terdapat juga kekanta kuarzit dan filit dalam fasies ini.
4. **Fasies berkapur** yang kelihatan ujud sebagai lensa-lensa terdiri daripada batu kapur tidak tulen berwarna kelabu yang mengandungi bahan berargilit dan sedikit marmar pada lokality tertentu.

5. **Fasies kalka-silikat** yang terdiri daripada batuan hornfel berwarna kelabu kehijauan tersingkap secara meluas di bahagian utara kawasan kajian dan sedikit di baratdaya Kelian Intan serta Kg. Pong.
6. **Fasies piroklas** hanya terdapat sedikit di bahagian tenggara kawasan kajian dan merupakan kesinambungan kepada fasies piroklas yang tersingkap di kawasan Kerunai (Syt 19). Ianya terdiri daripada batuan tuf yang berkomposisi riolit (Badzran *et al.*, 1993).

Sekitaran pegenapan

Kepelbagaian jenis batuan dalam Formasi Kroh menyebabkan agak sukar untuk mentafsirkan sekitaran pegenapannya. Kehadiran fasies berargilit dengan bahan berkarbon yang meluas menunjukkan pegenapan berlaku dalam persekitaran marin euksinik. Kewujudan bahan berbutir halus dan bahan organik menunjukkan jarak angkutannya jauh dan pegenapan dipercayai berlaku dalam persekitaran tenang melalui proses ampaian tanpa pengaruh ombak. Ketiadaan fosil bentos dan 'bioturbation', kehadiran mineral pirit dan kandungan bahan organik mencadangkan pegenapan berlaku di sekitaran laut dalam.

Kehadiran fasies berkalka dalam Formasi Kroh sebagai lensa-lensa yang terpencil dalam fasies berargilit mencadangkan ia telah diangkut dari kawasan lain di mana bekalan sedimen yang tidak berterusan. Pegenapan bahan karbonat berlaku pada masa-masa tertentu dan mungkin dari terumbu-terumbu karbonat. Terumbu-terumbu ini mungkin terdedah pada ribut menyebabkan ia runtuh dan diempakan ke kawasan lebih dalam. Kehadiran fasies piroklas menunjukkan berlakunya aktiviti vulkanik dalam lembangan pegenapan. Aktiviti yang berterusan menyebabkan perkayaan air laut dengan bahan vulkanik bersilika memungkinkan berlakunya pegenapan batuan bersilika dalam Formasi Kroh.

Bagaimanapun kehadiran fasies berudit, berarenit dan berkapur menunjukkan jujukan batuan Formasi Kroh ini juga diempakan dalam sekitaran laut cetek.

Kepelbagaian fasies yang terdapat dalam Formasi Kroh menunjukkan batuan batuan formasi ini diempakan dalam suatu variasi sekitaran pegenapan. Perubahan persekitaran yang berlaku iaitu dari sekitaran laut cetek hingga ke sekitaran laut dalam oleh proses regresi serta penurunan dan pengangkatan lembangan pegenapan akibat aktiviti tektonik yang berlaku sepanjang tempoh pegenapan unit-unit batuan tersebut.

The occurrences of brachiopods from pebbly mudstone near Kilim, Langkawi: Their age, paleobiogeography and paleoclimatic implication

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The Singa Formation of Langkawi Islands is unique in the presence of pebbly mudstone which resembles diamictite of glacial origin. The glacial diamictite occurs abundantly in the Kentut and the Selang Members (Ahmad Jantan, 1973; Stauffer and Mantajit, 1981; Stauffer and Lee, 1986). Although trace fossils are commonly associated with the glacial diamictite, no body fossils has yet been found from the same bed in Langkawi Islands. In Thailand, pebbly mudstone at Ko Muk contains some Lower Permian cold water brachiopod fauna (Waterhouse, 1982, revised by Shi and Archbold, 1995).

In the upper part of the Singa Formation, fossils has been discovered from Pulau Jong (Sakagami, 1963) and from Kilim area in main Langkawi Island (Basir Jasin *et al.*, 1992). The fauna discovered by these authors are mainly made of bryozoans with very few brachiopod remains. These bryozoan fauna are found in bryozoan limestone.

During a recent visit to the site at Kilim earth quarry described previously by Basir Jasin *et al.* (1992), the author discovered another fossiliferous locality about hundred meters south of the bryozoan limestone locality. The fauna was found in moderate to thickly bedded mudstone with rare small scattered pebbles overlying a more massive sandstone. The pebbles are rounded to angular in shape, sometimes reaches 10 cm in size. They are of various origin including quartz, mudstone, sandstone, limestone and igneous rocks (?granite). The actual stratigraphic relationship between the bryozoan limestone (Basir Jasin *et al.*, 1992) and this new fossil locality is not exactly known due to the existence of several faults in between them.

The fauna is mainly made of brachiopods, with some bryozoans *Fenestella* sp. and *Polypora* sp. Eight species of brachiopods were discovered from this locality. They are *Spirelytha buravasi* (Hamada), *Sulcipleca thailandica* (Hamada), *Bandoproductus monticulus* (Waterhouse), *Lamnipleca sapa* (Waterhouse), *Rhynchopora culta* Waterhouse, *Striatifera* sp., *Arctitreta* sp. and *Trigonotreta* sp. All the brachiopod found here were also found by Waterhouse (1982) from the pebbly mudstone of Ko Muk, Thailand, except for *Striatifera* sp and *Trigonotreta* sp. *Jakutochonetes solita* (Waterhouse) and *Elasmata retusus* (Waterhouse) which were found in Ko Muk was not found in Kilim area. All brachiopods found are either of Permian or Permo-Carboniferous age. According to Waterhouse (1982), the Ko Muk's *Cancrinelloides monticulus* (now *Bandoproductus monticulus*) is very similar to *Lyonia lyoni* (Prendergast) of Lower Permian (Upper Asselian) age from Western Australia. Therefore, the age of the Kilim pebbly mudstone fauna is early Lower Permian. Basir Jasin *et al.* (1992) suggested that the age of the bryozoan limestone is of late Early Permian.

The brachiopod fauna studied shows a very close affinity with other Gondwanan cold water fauna. Table 1 shows that 62.5% of the fauna were only endemic to the south temperate region, peripheral to the Gondwanaland. All genera except *Striatifera* were recorded in the past from the south temperate region.

Table 1. Distribution of brachiopod genera in Permian latitude

Genera	Polar (N)	Temperate (N)	Tropical	Temperate (S)	Polar (S)
<i>Spirelytha</i>				@	@
<i>Sulcipleca</i>				@	@
<i>Bandoproductus</i>				@	@
<i>Lamnipleca</i>				@	@
<i>Rhynchopora</i>	@	@	@	@	
<i>Striatifera</i>			@		
<i>Arctitreta</i>	@	@		@	@
<i>Trigonotreta</i>				@	@
Total	2	2	2	7	6
Percentage	25%	25%	25%	87.5%	75%

The above comparison imply that the Kilim brachiopod fauna belongs to the Gondwana fauna. Although the brachiopod fauna belongs to the Gondwana fauna, the presence of bryozoan thicket indicated that the paleolatitude in which this brachiopod-bryozoan assemblage flourished was probably not very high. The maximum Lower Permian glaciation has affected

a very large area, and perhaps most of the subtropical area was frozen during the Asselian time. On the other hand, the very large iceberg could have been rafted very far away and melted in a subtropical area.

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Pemendapan sedimen lautan di jalur tengah Semenanjung Malaysia

(Marine sedimentation in central belt of Peninsular Malaysia)

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Jalur Tengah Semenanjung Malaysia terletak di antara Garis Bentong di sebelah barat dan Sesar Lebir di sebelah Timur. Jalur Tengah ini menganjur utara-selatan bermula daripada sempadan Thailand di utara hingga Johor di selatan. Jalur Tengah ini kebanyakannya terdiri daripada batuan sedimen Permo-Trias, Trias Tengah-Akhir dan juga Jura-Kapur.

Batuan sedimen lautan yang terdapat di Jalur Tengah ini terdiri daripada beberapa unit atau formasi batuan. Unit ini mempunyai berbagai jenis litologi dan fasies sedimen yang terdiri daripada berbagai usia, daripada Karbon?, Perm hingga Trias. Secara umumnya, batuan sedimen lautan yang ada ini boleh dibahagikan kepada;

- Batuan Permo-Trias yang terdiri daripada Formasi Gua Musang dan formasi-formasi lain yang setara dengannya
- Batuan Paleozoik Atas di bahagian selatan
- Batuan Trias Tengah-Akhir yang terdiri daripada Formasi Semantan dan formasi-formasi lain yang setara dengannya
- Batuan Trias Tengah-Akhir yang terdiri daripada Formasi Kaling dan formasi-formasi lain yang setara dengannya

Batuan Permo-Trias banyak tertabur di kawasan utara, iaitu di Kelantan dan Pahang utara, dan terdiri daripada Formasi Gua Musang, Formasi Aring, Batu Kapur Merapoh, dan berbagai nama yang lain. Kamal Roslan Mohamed & Mohd Shafeea Leman (1995) mencadangkan unit-unit batuan ini dikumpulkan ke satu unit stratigrafi yang dikenali sebagai Kumpulan Gua

Musang. Batuan yang ada dalam kumpulan ini terdiri daripada berbagai fasies, dan di antaranya ialah fasies batu kapur, fasies syal, fasies batu pasir, fasies rijang, fasies volkanik serta fasies konglomerat. Kesemua fasies-fasies yang ada ini boleh ditemui dalam julat usia Perm (atau mungkin lebih tua — Karbon?) hinggalah Trias Akhir. Dari segi sedimentologi, fasies-fasies ini terendap di sekitaran laut cetek, dan juga laut dalam. Jika kita lihat peta taburan fasies-fasies ini, kita akan dapati fasies-fasies yang ada terletak di sebelah menyebelah. Terdapat fasies batu kapur (laut cetek) terletak di sebelah fasies Rijang atau syal (mungkin laut dalam), walaupun usianya sama. Secara umum juga, kita akan dapati taburan fasies adalah utara-selatan. Ini mungkin disebabkan pada masa tersebut, berlaku pemendapan di beberapa struktur 'host & graben', selain daripada pemendapan di kawasan pelantar.

Formasi Semantan dan formasi yang setara dengannya (Formasi Gemas, Formasi Jelai, Formasi Kerdu dan sebagainya) tersebar meluas di bahagian tengah dan juga selatan Jalur Tengah Semenanjung Malaysia. Unit batuan yang terdapat dalam formasi-formasi ini ialah selang lapis syal dengan batu pasir bertuf, serta konglomerat, kekanta batu kapur dan juga rijang. Bivalvia seperti *Posidonia*, *Daonella* serta *Halobia* dan juga ammonoid banyak ditemui dalam jujukan sedimen Formasi Semantan. Data sedimentologi dan paleontologi yang diperolehi daripada formasi ini mencadangkan pemendapan sedimen berlaku di kawasan laut dalam. Walau bagaimanapun, terdapat beberapa fasies batuan yang dikatakan terbentuk di sekitaran laut cetek, contohnya fasies batu kapur oolit (Kamal Roslan Mohamed & Ibrahim Abdullah, 1994).

Formasi Kaling mempunyai usia yang setara dengan Formasi Semantan, tetapi mempunyai perbezaan yang jelas dari segi unit litologi, serta fosil. Taburan Formasi Kaling tidak meluas, cuma terdapat di kawasan Karak, Temerloh, Kuala Lipis dan juga Bahau. Unit litologi utama yang ada ialah batu pasir serta syal dan juga konglomerat. Fosil bivalvia bercangkang keras seperti *Myophoria*, *Neoshizodus* dan *Costatoria* banyak ditemui. Daripada analisis fasies dan bukti paleontologi, Formasi Kaling ini terendap di sekitaran laut cetek.

Jika kita perhatikan taburan Formasi Gua Musang, Formasi Semantan dan Formasi Kaling, kita akan dapati Formasi Gua Musang tertabur di sebelah utara, manakala Formasi Semantan dan Formasi Kaling pula di sebelah selatan. Kesemua formasi-formasi ini terbentuk dalam lembangan Jalur Tengah yang sama. Jika kita perhatikan sekitaran pengendapan mengikut masa, kita akan dapati pada masa mula-mula terbentuknya lembangan Jalur Tengah ini, sekitaran yang ada ialah laut cetek. Di sekitaran ini, terendapnya sedimen seperti lumpur, pasir, kelikir dan di pelantar yang cetek ini juga berkembangnya pertumbuhan sedimen karbonat. Akibat daripada terbentuknya struktur host & graben, sekitaran lautan menjadi dalam di dalam graben, manakala di bahagian host pula terendap sedimen atau bahan karbonat laut cetek. Keadaan ini berterusan hingga ke masa Trias Akhir.

Lembangan Jalur Tengah ini telah miring atau makin dalam ke arah selatan pada masa Trias Tengah-Akhir. Ini menyebabkan di bahagian selatan, terbentuk sekitaran laut dalam, dan sedimen yang terendap akhirnya membentuk jujukan Formasi Semantan. Walaupun secara umum sekitaran di selatan ini merupakan laut dalam, terdapat juga beberapa kawasan sekitaran laut cetek. Sekitaran cetek ini terbentuk di bahagian tepi lembangan, dalam graben dan juga di kemuncak volkano bawah laut. Di kawasan ini, sedimen akhirnya membentuk Formasi Kaling.

Di sepanjang masa Permian hingga Trias Akhir, lembangan Jalur Tengah ini merupakan suatu kawasan yang sangat aktif dengan aktiviti volkano. Letusan volkano (samada dari dalam lembangan ataupun luar lembangan) membekalkan sedimen tuf ke dalam lembangan.

Aktiviti penerobosan granit pada masa Trias Akhir telah mengangkat lembangan Jalur Tengah ini, dan akibatnya daratan telah terbentuk selepas masa Trias Akhir. Endapan lautan terhenti pada masa Trias Akhir dan mulai masa Jura, endapan daratan pula terbentuk dalam Jalur Tengah ini.

English Summary

In the Central Belt, marine sedimentary rocks of the Permian-Triassic age is widely distributed. This rock unit consists of a variety of lithology and facies. In general, this rock unit can be divided into;

- Permo-Triassic rock of Gua Musang Formation
- Late Paleozoic rock
- Middle-Late Triassic rock of the Semantan Formation
- Middle-Late Triassic rock of the Kaling Formation.

The Gua Musang Formation which is Permo-Triassic in age, is the oldest formation in Central Belt. Since this formation covers a large area in north Central Belt and contain several mappable rocks units, the status formation can be upgraded to group status (Kamal Roslan Mohamed & Mohd Shafeea Leman, 1995). Gua Musang Group deposited in relatively shallow marine, during Late Permian (may be older — Carboniferous age?) to Middle or Late Triassic time. The Semantan, Kerdau, Jelai, Gemas, Jurong, Telong and Gunung Rabung Formations are thought to be similar and are therefore all referred as the Semantan Formation. The Semantan is comprised of a rapidly alternating sequence of carbonaceous shale, siltstone and rhyolite tuff with a few lenses of chert, conglomerate and recrystallised limestone. The shale and tuff make up the bulk of the sequence. Based on sedimentary structure, this formation deposited in deep marine fan. The Semantan Formation is diachronous to the Kaling Formation, and may be interfingering with the Gua Musang Group. The Kaling Formation which is Middle-Late Triassic in age, is composed predominantly orthoquartzite and subgraywacke, with subordinate amounts of conglomerate, siltstone, shale and rhyolite tuff.

During Permian time, shallow marine cover a large area of the Central Belts, especially in the north. Shale, sandstone, limestone and volcanoclastic sediments were deposited in this basin. Shallow marine basin continued into the Early Triassic in the north, but there was no evident of shallow marine deposits in the south. The basin was tilted to the south during the Middle-Late Triassic, and as the result, the Semantan Formation was deposited in this deep marine environment in the south. However, some shallow marine deposits were also deposited in basin's margin (Kaling Formation). The basin was uplifted as a result of the granite emplacement during Late Triassic time. There was no marine sediments deposited after Late Triassic time.

Cretaceous and Paleogene sequences, Bukit Batu Tiban area, Sarawak

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The Bukit Tiban area bordering with Kalimantan Indonesia, located in the eastern part of central Sarawak where a systematic geological mapping project was carried out at the scale 1:50,000 as part of the Geological Mapping Programme of Geological Survey of Malaysia. The area is underlain by Cretaceous and Paleogene sediments and Miocene volcanics. The formational names of these lithologic units are the Layar Member and Kapit Member, both of the Belaga

Formation and the Mentulang Volcanics respectively. This paper, however, presents the detail results of the survey of a small area in the northern part where the formational contact of the Cretaceous and the Paleocene sediments is exposed along the timber roads.

Based on sedimentological and structural analyses the sediments are shown to consist of massive sandstone, alternation and shale sequences trending NEE-SSW. The thickness of the Cretaceous and Paleocene sediments in the described area is approximately 5,000 metres each amounting to 10,000 metres in the total thickness. The Paleocene sediments are only distributed in the Sungai Buong and Seranai areas and their shale beds change colour from blackish to reddish brown in the boundary area between the Cretaceous sediments. The Paleocene sedimentary sequence is well known by its reddish brown color on account of worldwide dry climate during its depositional time. The Cretaceous sediment on the other hand, are rich in sandstone beds particularly in turbidites. Both Cretaceous and Paleocene sequences are strongly deformed to form overturned and faulted features. Many minor faults developed especially in shaly parts could not be traced for long distances. Faulting had resulted in a wider variation of dips and strikes of shaly units. To understand these sedimentary textures and structures, detailed observations were carried out in some outcrops which are being presented as detailed column sections. The paleocurrents directions of the Cretaceous are from SSW and swinging to from SW in the Paleocene sediments.

Stratigrafi seismos di kawasan Bachok, delta Kelantan

UMAR HAMZAH, ABD RAHIM SAMSUDIN & ABD. GHANI RAFEK

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Satu survei seismos pantulan telah dilakukan di Bachok, Kelantan untuk mengkaji akuifer-akuifer air tanah di dalam endapan kuaterner. Satu garis seismos sepanjang 600 meter telah dirakamkan 50 meter ke arah barat lubang gerudi BH 25. Data diperolehi dengan menggunakan punca tukul dan seismograf ABEM 24 saluran. Punca dan geofon disusun untuk menghasilkan data titik tengah sepunya (CMP) 12 lipatan. Keratan rentas seismos masa tertimbun yang dihasilkan mempamerkan bentuk akuifer ke 2 dan ke 3 yang terletak pada kedalaman melebihi 30 meter. Tafsiran yang dibuat berdasarkan lubang gerudi BH 25 juga menunjukkan bahawa akuifer pertama yang berkedudukan lebih cetek daripada 30 meter tidak dapat dikesan melalui survei seismos ini. Pemantul pertama pada 50 milisaat dan kedalaman 29 meter bertepatan dengan lapisan atas akuifer kedua. Pemantul kedua pada 70 milisaat dan kedalaman 41 meter ialah lapisan bawah akuifer tersebut. Pemantul ketiga pada 100 milisaat pada kedalaman 55 meter mewakili akuifer ketiga. Ketebalan akuifer ini ialah diantara 30–40 meter. Di antara kedua-dua akuifer ini terdapat lapisan lempung setebal 15 hingga 20 meter. Batu dasar granit dianggarkan pada kedalaman 85–120 meter. Akuifer pertama sehingga kedalaman 6 meter. Akuifer pertama sehingga kedalaman 6 meter terdiri daripada pasir halus dan lempung kelabu bercangking adalah berkemungkinan terdiri dari aluvium jenis samudera. Akuifer kedua terdiri dari pasir kasar hingga sederhana juga bercampur dengan lempung kelabu. Akuifer ketiga terdiri daripada pasir kasar dan kelikir halus. Akuifer kedua dan ketiga berkemungkinan berasal dari aluvium samudera atau sungai. Struktur isian palung dapat diperhatikan daripada keratan seismos berpusat di nombor CDP 5860.

AGM & Annual Dinner 1996 — Report (Laporan)

The Society's Annual General Meeting 1996 was held on Saturday 20th April 1996 at the scenic surroundings of the Kelab Golf Perkhidmatan Awam Malaysia, Jalan Damansara, Kuala Lumpur.

With the quorum for an AGM amended to 30 Corporate Members, it took sometime and discussions before the Chairman, Dr. Khalid Ngah, could call the meeting to order at about 6.30 p.m. The AGM went on smoothly with the reports of the President, Secretary, Editor and Treasurer accepted after the usual discussions. In the end, a list of items for the new Council to look into was drawn up and it included, among other things, a calendar with award winning entries from the Society's photographic competitions will be printed and distributed for 1997, certificates will be sent to Life Members, steps to promote better interaction between GSM and IGM (Institute Geologi Malaysia) and the question of the quorum and proxies for the AGM. The Honorary Auditor was retained and the Chairman concluded the AGM at 7.45 p.m. with the announcement of the new 1996/97 Council.

The crowd for the Annual Dinner 1996 had already gathered outside the restaurant and everyone was busy chit-chatting away. The 9-course halal Chinese dinner attracted 12 tables and by tradition Schlumberger being most supportive took up 4 tables.

It was a healthy sign, seeing members and their spouses or guests from the Government, the oil companies, the services companies, the mining sector and others from the private sector getting together for a nice evening of food, drinks and friendly discussions.

G.H. Teh

Captions to photos for AGM 1996

- 1, 2. Tea/coffee and discussions before the AGM at the scenic Kelab Golf Perkhidmatan Awam Malaysia.
3. GSM President Khalid Ngah, chairing the AGM
- 4-7. The turnout at the AGM, busy scrutinising the Minutes.

Captions to photos for Annual Dinner 1996

- 1, 2. The lively, noisy crowd outside the restaurant.
3. MC Ahmad Tajuddin starting the night's proceedings.
4. GSM President, Khalid Ngah, with his speech.
- 5-15. The various tables and the crowd at dinner.
- 16-19. A final word or two after dinner.

Annual General Meeting 1996



Annual Dinner 1996



Minutes of the 29th Annual General Meeting held on 22 April, 1995

Minutes of the 29th Annual General Meeting held at the Tapis Room, Petroleum Club, Dayabumi Complex, Kuala Lumpur at 6.15 p.m. on the 22nd April, 1995.

Present:

Fatch Chand (Chairman)	Charles S. Hutchison
A. Tajuddin Ibrahim (Secretary)	Leong Lap Sau
Ali Md. Shariff	Abdul Rahim Samsudin
Khalid Ngah	Liew Kit Kong
Mohd. Shafeca Leman	Teh Guan Hoe
Mustafa Abdullah	Abdul Ghani Rafek
Tan Boon Kong	Ibrahim Komoo
Chin Lik Suan	Jimmy Khoo Kay Khean
Lee Chai Peng	S.P. Sivam
Choo Mun Keong	Sia Hok Kiang
Mathew Raja	Teoh Lay Hock
Effendy Cheng	Liaw Kim Kiat
J.J. Pereira	Chen Shick Pei
Ng Tham Fatt	T. Suntharalingam

1. Confirmation of the minutes of the previous AGM (1994)

The minutes of the 28th AGM were passed on the proposal of Dr. Leong Lap Sau and seconded by Dr. C.S. Hutchison without any correction or amendment.

2. Confirmation of the minutes of the EGM held on the 17.2.95

The minutes of the EGM were passed on the proposal of Dr. Abdul Ghani Rafek and seconded by Dr. C.P. Lee.

3. Matters Arising

- 3.1. Winning entries for the last photographic competition — the Council has agreed to present duplicates to various organisations/universities for permanent display purposes.
- 3.2. Geologist's Act — the President informed that a meeting was held with the Ministry. The Ministry's legal advisor suggested a few changes and also accompanying explanatory notes to go with it. IGM will act on this and also seek further meetings to make this act a reality as soon as possible.
- 3.3. Professional Members — the RM50.00 processing fee has already been refunded.
- 3.4. Certificate for all Life Members — the certificates are ready. They will be given out soon.
- 3.5. Exchange of publications with Dewan Bahasa & Pustaka — this is being done.

- 3.6. Young Geoscientist Award — the committee set up to review the standard to be set and the terms of reference for the Award presented their findings to the Council. The Council decided that there is no necessity to change the TOR.
- 3.7. Cooperation with other professional bodies — the Society have already organised activities with IEM, IKRAM and IGM. Programs with the Planetarium Negara is also being organised.
- 3.8. Annual Conference in Sabah and joint conference with Geological Survey Department — Conference in Sabah in 1995 was not possible for technical reasons. At the moment joint conference with GSD is not possible but this possibility will always be looked into for future conferences.

4. Amendments of Article VI and VII of the Constitution

1) Article VI, Section 4, Para 2 amended to:

The Council may suspend any office bearer of the Society from his post for failure to perform his duties, for failure to abide by Council decisions and for contesting Council decisions. The council may then appoint another Corporate Member to act in this post for the remainder of the term of office concerned. Such action shall require the concurrence (either by vote at the meeting or in writing) of not less than two thirds of the total membership of the Council.

Balloting:	For:	20 votes
	Against:	1 vote
	Abstention:	7 votes

2) Article VII, Section 3 amended to:

The Council may, and at the request of not less than one-fifth of the Corporate Members or twice the number of the Council Members, whichever is less, shall call an Extraordinary General Meeting at any time during the year; notice and agenda of such Extraordinary General Meeting shall be sent out normally at least 1 month before the meeting but, in case of urgency may be sent out not less than 7 days before the meeting. Only those items placed on the agenda shall be discussed.

Balloting:	For:	22 votes
	Against:	1 vote
	Abstention:	5 votes

3) Article VII, Section 6 amended to:

The quorum for an Annual General Meeting or Extraordinary General Meeting shall be thirty (30) Corporate Members. If a quorum is not present half an hour after the time appointed for a General Meeting, the meeting shall be postponed to a date to be decided by the Council; and if a quorum is not present half an hour after the time appointed for the proposed meeting, the Corporate Members shall have power to proceed with the business of the day but they shall not have power to alter the by-laws of the Society.

Balloting:	For:	12 votes
	Against:	9 votes
	Abstention:	7 votes

5. President's Report

Mr. Fateh Chand presented his report for the 1994/95 session. He highlighted the Annual Conference '94 and the 1994 AAPG-GSM International Conference & Exhibition which were successfully held with good attendances and high quality papers. The Society is financially sound. *Warta Geologi* is up to date. He expressed gratitude to the YAB Menteri Besar Terengganu, Malaysia Mining Corp. and Mamut Copper Mining Sdn. Bhd. for their generous support ensuring the success of the Annual Conference, and to PETRONAS, Shell Group of Companies and Esso Production (Malaysia) for the successful 1994 AAPG-GSM International Conference and exhibition.

He informed that the Society is taking steps to uplift its image. A dialogue with MPKSN was held and suggestions for promotion activities for earth sciences have already been forwarded to them.

The Society was also represented by Dr. Hamzah at the GEOSEA conference in Manila, 14–18 February, 1995.

The President's Report was passed on the proposal of Mr. S.P. Sivam and seconded by Dr. Abdul Ghani Rafek.

6. Secretary's Report

Dr. Ahmad Tajuddin presented his report for the 1994/95 session. He reported that the Council met 11 times during the session. Total memberships of the Society remains stable. Besides the usual technical talks, two forums were also held which were well attended.

He also reported that an EGM was held on 17.2.95 to discuss "Whether the Society should send the President, or his representative, to GEOSEA conference in Manila, 14–18 February '95, with all expenses to be borne by the Society". The decision of the Council to send a representative to Manila was upheld by the members at the EGM.

Dr. C.S. Hutchison suggested that the Society aggressively campaign for new members especially from oil and services companies.

The Secretary's Report was passed on the proposal of Mr. Mathew Raja and seconded by Mr. S.P. Sivam.

7. Editor's Report

Dr. G.H. Teh in his report stated that the *Warta Geologi* had been brought up to date. Bulletins 35, 36 and 37 should be ready before the end of 1995.

The Meeting thanked Schlumberger for their generous support. Dr. C.S. Hutchison congratulated the Editor on the new format for the Bulletins.

The Editor's Report was passed on the proposal of Mr. Teoh Lay Hock and seconded by Dr. Abdul Ghani Rafek.

8. Treasurer's and Honorary Auditor's Reports

Dr. C.P. Lee reported that the financial positions of the Society continued to grow in strength with nett assets of RM516,443.00 as compared to RM417,114.00 in 1993.

The Society also express gratitude as well as extend its deepest condolences to the family of the late Mr. Law Jack Foo, our Honorary Auditor who passed away on 4.1.95. The Meeting unanimously endorsed the appointment of Mr. Lee Siew Fatt as the Honorary Auditor to replace Mr. Law Jack Foo on the proposal of Dr. C.P. Lee. The Treasurer's Report and Honorary Auditor's Report were passed on the proposal of Dr. Abdul Rahim Samsudin and seconded by Dr. Leong Lap Sau.

9. Election of Honorary Auditor 1995/95

The meeting elected Mr. Lee Siew Fatt of S.F. Lee & Co., on the proposal of Dr. C.P. Lee and seconded by Mr. Mathew Raja as Honorary Auditor for the 1995/95 session.

The meeting was adjourned at 7.30 pm.

President's Report

The Society continued its efforts to add values to the Malaysian geological sciences through publications, conferences and technical talks, workshops and field trips, and recently, a lecture series. Based on the response from the members and geological fraternity, it is no doubt that these efforts have been well received. I wish to thank all parties concerned, particularly the Council members and the organisers for making these events successful.

In recent years, there has been an apparent decline of interest in sciences, and choosing science as a career, and fewer still chose geological sciences as their preferred careers. We are aware of this situation and the Council participated in a dialogue organised by Majlis Penyelidikan Kemajuan Sains Negara (MPKSN) in the middle of 1994 to improve the situation. At the last Society's Annual Conference in Melaka on May 27–28, 1995, this issue was re-emphasised with the President reminding its members to intensify their role in promoting the sciences, and in creating awareness on the importance of the sciences in day-to-day activity, by citing examples from the simplest geological observations to the most complex geo-political issues, such as environment. I am very pleased to report that our effort to promote these geosciences has shown good progress. Through the arrangement with MPKSN, the lecture series at the National Planetarium was well attended, attracting both young and old audiences. A total of 2 lectures were organised and another one pending, covering a wide spectrum of topics: from volcanicity to fossil records. For 1996, this activity will be intensified to generate a wider impact. Not only will the series at the Planetarium be continued, but it will also be expanded to include a road show to other strategic towns or cities. To achieve this, the Society will require the good co-operation of the regional and/or state Geological Survey Department (GSD) officers and university lecturers. Other awareness programs such as Essay Contest and Exhibitions on geological subjects will also be introduced.

Similarly, a series of workshops and dialogues with the engineers have been organised and such issues on landslides and slope stability were discussed. These series of workshops and discussions formed the platform for mutual respects and understanding for each other's professions, which in essence, benefited both parties. I would hope that in future, the Society and the engineering fraternity will join forces to examine issues that warrant collective collaborations.

Equally important to the Society, as the country moves forward into the 21st century, is the concern for environment. I wish to quote a statement made by the Deputy Prime Minister at one important occasion some months back, "*that in the process to enrich ourselves materially, we should not do so at the expense of our environment — the ecosystems that we are in*". The Society has responded to this call and the Council have agreed that a working committee on Environment be created, and this committee chaired by Dr. Nasiman Sapari would soon develop a program for implementation.

As you all are aware, four other working committees: 1. Petroleum Geology, 2. Tectonics and Structural Geology, 3. Economic Geology and 4. Stratigraphy and Sedimentology contributed their share of the promotion of geological knowledge in their own way successfully: by organising technical talks, seminars and field trips. One seminar which warrants mentioning, which attracted a large participants, is "Marine Sedimentation and Biota in Malaysian Geological Record". Conducted jointly with the universities (UM and UKM), Geological Survey Department (GSD) and Petronas Research

and Scientific Services (PRSS). The seminar attracted 68 professionals and academicians. My special congratulation goes to the committee which organised this seminar. Well done. But really, if one examines the basis of the success, one can relate to a possibly strong correlation between success and organisation, and it appears that success comes if a seminar is organised as a joint project, involving more than one party. I should like to see that future seminars could follow this simple format.

I am also pleased to report that the Society's two main events in 1995: the Annual Geological Conference and the 18th Petroleum Seminar or the First Petroleum Geology Conference, have been organised successfully, with 112 participants attending the Annual Geological Conference and 432 participants attending the First Petroleum Conference. Again, I wish to thank both the chairmen of the organising committees: Dr. Ibrahim Komoo and En. Hoh Swee Chee, and their committee members for the job well done. As always a special thanks goes to the Melaka State Government for sponsoring the dinner at the Malacca Village Paradise Resort. Equally, the success of the First Petroleum Conference would not have been achieved had it not been due to the continued generous support by the numerous oil and services companies operating in Malaysia. I would like to acknowledge our sincere gratitude to them.

This year, the Society's annual event will be held for the first time ever in Kota Kinabalu, Sabah on June 8-9, 1996. Encik Jimmy Khoo Kay Khean is the Organising Chairman for the event. The committee which he is chairing has been working very hard to ensure its success, and based on the responses and sponsorships so far received, the meeting in Kota Kinabalu should turn out to be a successful one. As for the Second Petroleum Geology Conference, Encik Ali M. Shariff has just been appointed to organise the meeting, and the Council was informed that the same members of the organising committee which organised the First Petroleum Conference will constitute the members of his committee.

The Society's financial position is sound, with RM496,787.78 in fixed deposits as at December 31, 1995. Although, this figure keeps growing from year to year, its purchasing power keeps shrinking. To better manage the fund, the Council has requested Dr. Nik Ramli to re-visit the proposal to acquire a "landed property" as its long term investment.

The membership of the Society generally remains stable, with some ups and downs, with a total of 567 at the end of March 1996. Out of this number, 86% are Malaysians or members with the Malaysian addresses. It is hoped that with the continued awareness of the Society's activity, more professionals would become members. I wish to encourage that all members should also do their part to bring in new members.

On behalf of the Society, I would like to thank everyone present here today. I would also like to thank University of Malaysia, Universiti Kebangsaan Malaysia, Geological Survey Department Malaysia, PETRONAS, Esso Production Malaysia Inc., Shell Malaysia, Schlumberger Malaysia and numerous other organisations for the kind and generous financial support that they have given to the Society, and also to many other individuals who keep supporting the activities of the Society.

Finally, I wish to thank all the Councillors and members of the Society who have given me their support and kind co-operation during my year as the President of the Society, without whom the society would not have performed so well.

Thank you.

Khalid Ngah
President
20 April, 1996

Secretary's Report

1. The Council

Members of the Council of the Geological Society of Malaysia for the period 23rd April, 1995 to the 20th April 1996 are as follows:

President	:	Khalid Ngah (PRSS)
Vice-President	:	Ibrahim Komoo (Universiti Kebangsaan Malaysia)
Secretary	:	Ahmad Tajuddin Ibrahim (University of Malaya)
Assistant Secretary	:	Nik Ramli Nik Hassan (FORAD)
Treasurer	:	Lee Chai Peng (University of Malaya)
Editor	:	Teh Guan Hoe (University of Malaya)
Councillors (2-years)	:	Khoo Kay Khean (Geological Survey Department Malaysia) How Swee Chee (PETRONAS) Ibrahim Abdullah (Universiti Kebangsaan Malaysia) Mohd Shafeea Leman (Universiti Kebangsaan Malaysia)
Councillors (1-year)	:	Abdul Ghani Rafek (Universiti Kebangsaan Malaysia) Abdul Rahim Samsudin (Universiti Kebangsaan Malaysia) Effendy Cheng Abdullah (PETRONAS) Tan Boon Kong (Universiti Kebangsaan Malaysia)
Immediate Past President	:	Fateh Chand (Geological Survey Department Malaysia)

2. Council Meetings

Council meetings were held almost every month throughout 1995/96 session. A total of 11 Council Meetings have been held. Attendance of Council Members at these meeting are very good as shown in Appendix 1.

3. Membership

The total membership of the Society as at 31st December, 1995 is at 579 showing a slight decline from the previous year's total of 619. Both local and foreign members have decreased to 262 and 74 respectively. Life members have however increased to 84. Details of the various classes of memberships and their geographical distributions are shown in Appendix 2.

4. Society Activities

The Annual Geological Conference 1995 was successfully held at the Malacca Village Paradise Resort, Air Keroh, Malacca on the 27-28th May, 1995 with 112 participants. The Conference was preceded by two one-day field trips held on the 25th and 26th May studying sedimentology, stratigraphy, igneous rocks and mineralisation around Malacca, Negeri Sembilan and Johore.

The Annual Petroleum Geology Seminar was upgraded to a Conference and was successfully held at the Concorde Hotel on the 11-12th December 1995 with a record number of 432 participants attending. This event was generously supported by the petroleum and petroleum services companies.

The Society also jointly organised the '*Persidangan Geologi di Abad ke 21*' with the Geology Department, Universiti Kebangsaan Malaysia and the Seminar and fieldtrip on '*Marine Sedimentation and Biota in Malaysian Geological Record*' with the Geological Survey Department of Malaysia. Two public lectures were also held at the Planetarium Negara which are part of the Society's plan to initiate informative programs for the general public.

The Working Group on Engineering Geology/Hydrogeology have been very active and have successfully organised forums, site visits and technical talks. The other working groups have also been active, each have at least managed to organise one activity for this session and activities for the coming session have also already been initiated. The Society have also formed a new working group on Environmental Geology under the chairmanship of Dr. Nasiman Sapari (Universiti Pertanian Malaysia) to deal with this subject which is of relevance and importance to the nation.

The Society will be responsible for organising GEOSEA 9 which is scheduled for the middle of 1998. For this purpose Dr. Hamzah Mohamad (Universiti Kebangsaan Malaysia) who is one of our past president has been appointed to chair the organising committee.

A total of 21 technical talks were held during the 1995/96 session. Details of the Society's activities are shown in Appendix 3 while future activities for which planning is already in progress are shown in Appendix 4.

5. Publication

Publication sales remain as slow as in previous years. However we managed to sell all the remaining copies of Bulletins 10, 12 and 14 and Field Guide 1. The remaining stock and sales made during 1995 is as shown in Appendix 5. The Society continued to maintain a publication exchange with various professional bodies and libraries from various parts of the world. The Society have also agreed to finance the publication of a book entitled '*Geological Evolution of Southeast Asia*' by C.S. Hutchison with permission from Oxford University Press. This book was available for sale from the end of January 1996.

6. Acknowledgements

The Society would like to acknowledge with thanks the generous cooperation and sponsorships received from local and overseas companies, professional societies, universities and institutions; the Head of the Department of Geology, University of Malaya where the Society is housed and where most of the activities were held and the numerous individuals and Councillors who have contributed in one way or another to the Society's activities.

Ahmad Tajuddin Ibrahim
Secretary

ATTENDANCE AT COUNCIL MEETINGS 1995/96

MEETING NO.	1	2	3	4	5	6	7	8	9	10	11
Khalid Ngah	X	X	O	X	X	X	X	X	X	X	X
Ibrahim Komoo	X	O	X	X	X	X	O	O	X	X	O
Ahmad Tajuddin Ibrahim	X	X	X	X	X	X	X	X	X	X	X
Nik Ramli Nik Hassan	X	O	X	X	X	O	X	X	X	O	X
Lee Chai Peng	O	O	X	X	X	X	X	X	X	X	X
Teh Guan Hoe	X	O	X	X	X	X	X	X	X	X	X
Khoo Kay Khean	X	X	X	X	X	X	X	X	X	X	X
Hoh Swee Chee	X	X	X	X	X	O	X	O	X	O	X
Ibrahim Abdullah	O	X	X	X	X	X	X	O	X	X	X
Mohd Shafeea Leman	X	X	X	O	X	X	X	X	X	X	X
Abdul Ghani Rafek	X	X	O	X	X	X	X	X	X	X	X
Abdul Rahim Samsudin	X	X	X	X	X	X	X	X	X	X	X
Effendy Cheng Abdullah	X	X	X	O	X	O	X	O	X	O	O
Tan Boon Kong	X	X	X	X	X	X	X	X	X	O	X
Fateh Chand	O	O	O	X	X	X	O	O	O	X	O

X — Present

O — Absent with apology

APPENDIX 2

**MEMBERSHIP OF THE SOCIETY
as at 31.12.1995**

	Honorary	Full	Life	Student	Institutional	Associate	Total
Australia		17	5		4		26
Brunei		1	1		1		3
Canada		2					2
China		1					1
Europe	1	14	5	2	4	2	28
Indonesia		4	1		1		6
Japan	1	4	1				6
Jordan		1					1
New Zealand		4					4
Philippines		2	1				3
Singapore		5	3		3	2	13
Thailand		1	1				2
U.S.A.		18	4	1	1		24
Malaysia	4	262	62	111	14	7	460
Total	6	336	84	114	28	11	579

APPENDIX 3

SOCIETY ACTIVITIES 1995/96

NO.	DATE	EVENT/SPEAKER/VENUE
1.	6 May 1995	Technical Talk: Geochemical Exploration for Gold Mineralisation in Malaysia by Dr. A.G. Gunn of the British Geological Survey at the Geological Survey Department, Kuala Lumpur.
2.	11 May 1995	Technical Talk: Exploration Geochemistry in SE Asia: Soils, Sediments and Potential for Anthropogenic Effects by Prof. K. Fletcher of the University of British Columbia at the Geology Department, University of Malaya.
3.	17 May 1995	Technical Talk: Geotechnical Engineering Investigations of the Highland Tower Condominium Collapse, Hulu Kelang by Dr. Nik Ramlan Nik Hassan of the Institut Kerja Raya Malaysia (IKRAM) at the Geology Department, University of Malaya.
4.	22 May 1995	Technical Talk: When is a Bivalve not a Bivalve?: Tube Linings and Accessory Plates in Boring Lineages by Siân Evans of the Imperial College, London at the Geology Department, University of Malaya.
5.	25 May 1995	Pre-Conference Fieldtrip: Sedimentology and Stratigraphy of the Northwest Johore and Malacca.
6.	26 May 1995	Pre-Conference Fieldtrip: Igneous Rocks and Mineralisation of the Southwest Negeri Sembilan and Malacca.
7.	27-28 May 1995	Annual Geological Conference 1995 at the Malacca Village Paradise Resort, Air Keroh, Malacca.
8.	16 June 1995	Technical Talk: On-the-job Training in Geotechnical Engineering Office, Hongkong — A Brief Experience by Chow Weng Sum of the Geological Survey Department Malaysia at the Geology Department, University of Malaya.
9.	20 July 1995	Technical Talk: Evolution of Starfish: A Success Story by Dr. Andy Scott Gale of the Natural History Museum, London at the Geology Department, University of Malaya.
10.	2 August 1995	Technical Talk: University of London Gravity Work in South East Asia by Dr. John Milsom of the University of London at the Geological Survey Department, Kota Kinabalu.
11.	8 August 1995	Technical Talk: University of London Gravity Work in South East Asia by Dr. John Milsom of the University of London at the Geology Department, University of Malaya.
12.	23 August 1995	Technical Talk: EIA Bakun: Aspek Geologi dan Hidrogeologi by Prof. Ibrahim Komoo, Dr. Che Aziz Ali, Dr. Kamal Roslan Mohamed and Dr. Juhari Mat Akhir of the Geology Department, Universiti Kebangsaan Malaysia Bangi at the Geology Department, Universiti Kebangsaan Malaysia, Bangi.

APPENDIX 3 (cont'd)
SOCIETY ACTIVITIES 1995/96

NO.	DATE	EVENT/SPEAKER/VENUE
13.	28 August 1995	Technical Talk: Mesozoic Fossils (Dinosaurs) by V. Suteethorn of the Geological Survey Division, DMR, Thailand at the Geology Department, University of Malaya.
14.	28 August, 1995	Technical Talk: Cainozoic Fossils (Mammals) by Prof. Jean-Jacques Jaeger, Montpellier University, Paris at the Geology Department, University of Malaya.
15.	15 September 1995	Technical Talk: Stratigraphy, Structure and Tectonic Evolution of the Australia-Banda Arc Collision Zone by Dr. A.J. Barber of the Royal Holloway College, University of London at the Geology Department, University of Malaya.
16.	16-17 September 1995	Site Visit to the Pergau Hydroelectric Project, Kelantan organised jointly by the Engineering Geology/Hydrogeology and Tectonic/Structural Geology Working Groups.
17.	23 September 1995	Public Lecture: Geological History of the Earth's Crust: the Malaysian perspective by Dr. Hamzah Mohamad at the Planetarium Negara, Kuala Lumpur.
18.	5 October 1995	Technical Talk: Some Aspects of Modern Rock Slope Engineering by Dr. Raymund Spang of Geoplan, Witten, Germany at the Geology Department, Universiti Kebangsaan Malaysia, Bangi.
19.	24 October 1995	Forum on Environmental Geology and Geotechnics organised by the Engineering Geology/Hydrogeology Working Group at the Geology Department, University of Malaya.
20.	22 November 1995	Technical Talk: Applications of Surface Penetrating Microwave (SPM) Technique by N. Narendranathan and Toe Hlaing of the AL Technologies (S) Pte. Ltd., Singapore at the Geology Department, University of Malaya.
21.	28 November 1995	Technical Talk: Using Subsurface Pressures & Fluids Data as an Exploration Tool by Hugh W. Reid of the Dexcel Sdn. Bhd. Kuala Lumpur at the Geology Department, University of Malaya.
22.	2 December 1995	Site Visit to Karak Highway & Tunnel organised by the Engineering Geology/Hydrogeology Working Group.
23.	11-12 December 1995	Petroleum Geology Conference 1995 held at the Concorde Hotel, Kuala Lumpur.
24.	13-14 December 1995	Persidangan Geologi di Abad Ke 21 jointly organised with the Geology Department, Universiti Kebangsaan Malaysia Bangi held at the Kelab Rekreasi Universiti, Universiti Kebangsaan Malaysia.

APPENDIX 3 (cont'd)
SOCIETY ACTIVITIES 1995/96

NO.	DATE	EVENT/SPEAKER/VENUE
25.	19 January 1996	Technical Talk: Project LRT II: Engineering Geology by Muhinder Singh of the Pengurusan LRT, Kuala Lumpur at the Geology Department, University of Malaya.
26.	9 February 1996	Technical Talk: Gondwana dispersion and Asian accretion by Dr. I. Metcalfe of Department of Geology & Geophysics, University of New England, Armidale NSW 2351, Australia at the Geology Department, University of Malaya.
27.	10 February 1996	Technical Talk: Expert System: Possible Applications in Research and Teaching of Geology by Dr. Sahibin Abdul Rahim of Universiti Kebangsaan Malaysia Sabah at the Geology Department, Universiti Kebangsaan Malaysia, Bangi.
28.	2-4 March 1996	Seminar and Fieldtrip ' <i>Marine Sedimentation and Biota in Malaysian Geological Record</i> ' organised by the Stratigraphy and Sedimentology Working Group. Seminar was held at the Geological Survey Department Malaysia, Ipoh and fieldtrip to the Northwest Peninsular Malaysia.
29.	7 March 1996	Technical Talk: Geophysical Logs in Stratigraphy by Dr. Ian Penn of the British Geological Survey at the Geology Department, University of Malaya.
30.	20 March 1996	Technical Talk: Thin Bed Evaluation — Where, When, How by Alan Sibbit and Bernie Rayner of the Schlumberger Regional Office, Kuala Lumpur at the Hotel Istana, Kuala Lumpur organised by the Petroleum Geology Working Group.
31.	30 March 1996	Public Lecture on ' <i>Sumber Mineral and Manusia</i> ' by Teoh Lay Hock of the Geological Survey Department Malaysia held at the Planetarium Negara, Kuala Lumpur.
32.	31 March 1996 (closing date)	Second Photographic Competition
33.	12 April 1996	Technical Talk: Project KLCC: Geology, Soils and Foundations by Ir. Tarique Azam, Vice President, Ranhill-Bersekutu Sdn. Bhd. at the Geology Department, University of Malaya.
34.	17 April 1996	Technical Talk: Sedimentological Evaluation of General Circulation Model Simulations for the "Greenhouse" Earth: Cretaceous and Jurassic Case Studies by Prof. B.W. Sellwood of the Reading University, United Kingdom at the Geology Department, University of Malaya.

APPENDIX 4

SOCIETY ACTIVITIES 1996/97
Activities already scheduled/being planned

DATE	EVENT/VENUE	ORGANISER/SPEAKER
24 April 1996	Technical Talk on ' <i>Refining Models of Hydrocarbon Migration and Entrapment using Stable Isotope and Fluid Inclusion Analysis: Case Studies in Carbonate Reservoirs</i> ' at the Department of Geology, University of Malaya.	Prof. B.W. Sellwood, the University, Reading, United Kingdom.
27 April 1996	Public Lecture at the Planetarium Negara, Kuala Lumpur.	Dr. Lee Chai Peng, Department of Geology, University of Malaya.
3-5 May 1996	Seminar and Fieldtrip on Murau conglomerate at the Geology Department, Universiti Kebangsaan Malaysia, Bangi.	Working Group on Tectonic and Structural Geology. Chairman: Ibrahim Abdullah
8 May 1996	Technical Talk on ' <i>Fate of Toxic Pollutants in Contaminated Soils and Sediments: Threat Assessment and Abatement</i> ' at the Department of Geology, University of Malaya.	Prof. R.N. Yong, McGill University, Montreal, Canada.
9-11 May 1996	Seminar and Fieldtrip on Industrial Minerals and Rocks at University of Malaya.	Working Group on Economic Geology Chairman: E.B. Yeap
8-9 June 1996	Annual Geological Conference 1996 at Shangri-La's Tanjung Aru Resort, Kota Kinabalu.	Chairman: Jimmy K.K. Khoo
17-18 September 1996	Seminar ' <i>Geologi dan Sekitaran</i> ' at the Kelab Rekreasi Universiti, Universiti Kebangsaan Malaysia, Bangi.	Jointly organised with the Department of Geology, Universiti Kebangsaan Malaysia, Bangi.
9-10 December 1996	Petroleum Geology Conference at the Renaissance KL Hotel, Kuala Lumpur.	Chairman: Ali Shariff
August 1998	GEOSEA 9 (Actual date and venue still to be decided).	Chairman: Hamzah Mohamad

APPENDIX 5
STOCK OF PUBLICATIONS

BULLETIN NO.	SALES 1995	STOCK REMAINING
2	3	298
3	3	308
4	3	168
5	3	70
6	3	600
7	4	346
8	4	24
11	5	102
13	5	139
15	4	60
16	5	81
17	5	145
18	7	130
19	6	661
20	6	508
21	6	254
22	6	316
23	7	316
24	4	487
25	6	265
26	5	310
27	8	191
28	7	188
29	6	184
30	10	288
31	6	198
32	8	238
33	8	368
34	8	168
35	625*	175
Abstracts (Bulletin 6)	–	5
Stratigraphic Correlation	3	329

* inclusive of free copies distributed to Members

Editor's Report 1995/96

The Society's newsletter, the *Warta Geologi*, continues to come out regularly. The latest, Vol. 22 No. 1 (Jan-Feb 1996), is with the printers. It is hoped that more members will come forward to contribute articles, reports or write-ups.

Bulletin 35 was available in October 1995. *Bulletin 36* is now with the printers and *Bulletin 37 (GSM-AAPG-Proceedings)* is scheduled for the printers at the end of April 1996.

A soft-cover edition of "*Geological Evolution of SE Asia*" by C.S. Hutchison was published by the Society in January 1996 with the permission of the author and Oxford University Press. The aim is to make this popular book within the reach of local students and members.

The poster on *Rocks of Malaysia* and the *History of the Society* brochure are also due for the printers at the end of April 1996.

The Society is grateful to the many authors for their valuable contributions, the donors and advertisers for their valuable financial contributions to the Society's Funds.

Special thanks are due to Ng Tham Fatt and A.K. Fan for assistance in the various editorial processes. The contributions of members of the Editorial Subcommittee and reviewers and advice of members of the Editorial Advisory Board are greatly appreciated.

G.H. Teh
Editor

Treasurer's Report 1995

The Society's nett assets have increased to RM585,305.99 in 1995 from RM516,342.00 in 1994 with an excess of income over expenditure of RM63,462.50. A major contribution towards our income was RM97,576.18 from AAPG for our contribution in the organising of the AAPG-GSM Conference in 1994.

The relative large drop in income compared to 1994 is mainly caused by the anomalous injection funds in 1994 from our closing of the CPCEMR account and a reduction in interest on fixed deposits due to timing of maturity dates. The large drop in comparative expenditure is mainly due to the timing of payments for printing the Bulletin.

The Society is most grateful and expresses its sincere thanks to our faithful supporters who have continued to contribute generously to the Society. We would also like to thank our Honorary Auditor, Mr. Lee Sin Fatt for auditing our accounts.

Lee Chai Peng
Treasurer

**Auditors' Report
to the Council of Persatuan Geologi Malaysia
(Geological Society of Malaysia)**

We have audited the accounts set out on pages 2 to 3 in accordance with approved auditing standards.

In our opinion, the accounts give a true and fair view of the state of affairs of the Society as at 31st December, 1995 and of its income and expenditure and receipts and payments for the year ended on that date.

Signed

S.F. LEE & CO.
(AF: 0670)
Public Accountant

Signed

LEE SIEW FATT
(1179/9/96J)
Public Accountant

Kuala Lumpur
Date: 17/4/1996

PERSATUAN GEOLOGI MALAYSIA
(Geological Society of Malaysia)

Balance Sheet as at 31st December, 1995

	1995	1994
	RM	RM
FIXED ASSET	28,406.24	26,663.00
CURRENT ASSETS		
Fixed Deposits with licensed banks	496,787.78	433,017.00
Deposit and prepayment	1,401.39	15,809.00
Cash and bank balances	59,210.58	41,453.00
	<u>557,399.75</u>	<u>490,279.00</u>
CURRENT LIABILITY		
Other creditors & accruals	500.00	600.00
	<u>556,899.75</u>	<u>489,779.00</u>
NET CURRENT ASSETS	<u>585,305.99</u>	<u>516,342.00</u>
FINANCED BY:		
ACCUMULATED FUND		
Balance brought forward	505,294.66	417,114.00
Surplus for the year	63,462.50	88,180.00
Young Geoscientist Award	3,442.83	3,443.00
Student Loan Fund	3,405.36	7,605.00
Petroleum Geology Seminar '95	9,700.64	
	<u>585,305.99</u>	<u>516,342.00</u>

PERSATUAN GEOLOGI MALAYSIA
(Geological Society of Malaysia)

Income And Expenditure Account
For the Year Ended 31st December 1995

INCOME	1995	1994
	RM	RM
Advertisement	—	9,000.00
AAPG-GSM	97,576.18	17,058.00
Entrance fees	920.00	930.00
EIA workshop	—	1,927.00
Interest on fixed deposits	16,471.32	50,927.00
Subscriptions	22,110.37	22,789.00
Sales of publications	11,589.55	10,044.00
PGS '93: Donation	—	1,072.00
Fax	—	82.00
Transfer from CPCEMR	—	124,378.00
Xerox	1,241.16	2,260.00
Study groups	432.83	—
	<u>150,341.41</u>	<u>240,467.00</u>
 EXPENDITURE		
Audit fee overprovided in prior year	(100.00)	
Audit fee	500.00	600.00
Annual dinner	3,020.00	2,166.00
Annual Conference	16,737.99	15,761.00
AAPG	—	885.00
Bank charges	195.76	451.00
Honorarium	9,679.00	10,234.00
Postage	8,319.10	9,802.00
Professional fees	—	300.00
Printing and Stationary:		
• Miscellaneous	2,068.55	2,411.00
• Bulletin	19.90	81,020.00
• Warta Geologi	10,999.10	16,404.00
Refreshments	1,259.67	975.00
Refund: Professional Membership	160.00	400.00
Study groups	—	1,494.00
Sundry expenses	3,283.10	2,482.00
Speakers' account	3,918.41	2,743.00
Subscription: Professional bodies	122.57	234.00
Sirim meeting	—	165.00
Telephone	784.40	797.00
Telefax	229.50	—
Depreciation of fixed assets	3,156.25	2,963.00
Batik shirts	4,542.00	—
Souvenirs	9,957.00	—
Geosea: Manila	976.61	—
Academy of Sciences	1,900.00	—
Air-conditioner	4,150.00	—
Seminar Geologi Abad	1,000.00	—
	<u>86,878.91</u>	<u>152,287.00</u>
 EXCESS OF INCOME OVER EXPENDITURE:		
Transfer to capital fund	<u>63,462.50</u>	<u>88,180.00</u>

PERSATUAN GEOLOGI MALAYSIA
(Geological Society of Malaysia)

Council for 1996/97

- President** : Khalid Ngah
(PRSS)
- Vice-President** : Ibrahim Komoo
(Universiti Kebangsaan Malaysia)
- Secretary** : Ahmad Tajuddin Ibrahim
(University of Malaya)
- Assistant Secretary** : S. Paramanathan
(Consultant)
- Treasurer** : Lee Chai Peng
(University of Malaya)
- Editor** : Teh Guan Hoe
(University of Malaya)
- Councillors (2-years)** : Abdul Ghani Rafek
(Universiti Kebangsaan Malaysia)
Abdul Hadi Abd. Rahman
(University of Malaya)
Abdul Rahim Samsudin
(Universiti Kebangsaan Malaysia)
Tan Boon Kong
(Universiti Kebangsaan Malaysia)
- Councillors (1-years)** : Khoo Kay Khean
(Geological Survey Department Malaysia)
Hoh Swee Chee
(PETRONAS)
Ibrahim Abdullah
(Universiti Kebangsaan Malaysia)
Mohd Shafeea Leman
(Universiti Kebangsaan Malaysia)
- Immediate Past President** : Fateh Chand
(Geological Survey Department Malaysia)

BULETIN

PERSATUAN

GEOLOGI

MALAYSIA



GEOLOGICAL
SOCIETY OF
MALAYSIA

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Sazali Yaacob, Yeap Ee Beng and Hashim Abdul Razak
- 15-23 Geology and related activities in the construction of Batu Dam, Kuala Lumpur
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- 25-35 Kinematic analysis of striated fractures in Titiwangsa granitoid, Karak Highway — Selangor side
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Sidibe Yaya Tiemoko, Tan Teong Hing and Ahmad Jantan
- 97-112 The sedimentology and tectonics of the Temburong Formation — deformation of early Cenozoic deltaic sequences in NW Borneo
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- 145-155 Geology of the Gunung Danum conservation area: Geochemistry and soil aspects
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- 157-168 Joint spacing of granitic rocks in the eastern Kuala Lumpur area, Peninsular Malaysia
Ng Tham Fatt
- 169-174 Kajian geofizik di Kuala Betis, Kelantan
Abdul Rahim Samsudin, Kamal Roslan Mohamad, Ibrahim Abdullah dan Ab. Ghani Rafek

Editor: G.H. Teh

Bulletin of the
GEOLOGICAL SOCIETY OF MALAYSIA

JULY 1994

No. 35

PRICE: RM35.00

Cheques, Money Orders or Bank Drafts must accompany all orders. Orders will be invoiced for postage and bank charges. Orders should be addressed to:

The Hon. Assistant Secretary
GEOLOGICAL SOCIETY OF MALAYSIA
c/o Dept. of Geology, University of Malaya
50603 Kuala Lumpur, MALAYSIA

BERITA-BERITA PERSATUAN News of the Society

KEAHLIAN (Membership)

The following applications for membership were approved:

Full Members

1. Steven Lee Garwin
c/o Newmont Western Pacific Exploration,
Wisma Standard Chartered Bank, 14th
Floor, Jln. Sudirman KA433A, Jakarta 10220.
2. John Caldwell
Landmark Graphics (Malaysia), 22nd
Floor, Suite 22-04, Menara Tan & Tan,
Kuala Lumpur.
3. Yap Poh Onn
6A Lorong Datuk Sulaiman Satu, Taman
Tun Dr. Ismail, 60000 Kuala Lumpur.
4. Husaini Omar
Jabatan Kejuruteraan Awam dan Alam
Sekitar, UPM, 43400 UPM Serdang.
5. Zaidi Daud
Tingkat 19, Bangunan LUTH, Jalan Tun
Razak, 50736 Kuala Lumpur.
6. Aziz Ejan
No. 17, Jalan U1/23, Section U1, Hicom-
Glenmarie Industrial park, 40000 Shah
Alam.
7. Yusoff Che Muda
Tingkat 19, Bangunan LUTH, Jalan Tun
Razak, 50736 Kuala Lumpur.

Student Members

1. Mohan Dass Thangavalu
Jabatan Geologi, Universiti Malaya, 50603
Kuala Lumpur.
2. Kamarudzaman Lokeman
Jabatan Geologi, Universiti Malaya, 50603
Kuala Lumpur.
3. Abd. Bashid Mohd Rashid
Jabatan Geologi, Universiti Malaya, 50603
Kuala Lumpur.
4. Wan Salmi Wan Harun
Jabatan Geologi, Universiti Malaya, 50603
Kuala Lumpur.
5. Morina Timah
Jabatan Geologi, Universiti Malaya, 50603
Kuala Lumpur.
6. Andrus AK Mula
Jabatan Geologi, Universiti Malaya, 50603
Kuala Lumpur.
7. Ros Fatimah Hj. Muhammad
Jabatan Geologi, Universiti Malaya, 50603
Kuala Lumpur.
8. Norasrifah Abdul Fuad
Jabatan Geologi, Universiti Malaya, 50603
Kuala Lumpur.
9. Nordin bin Mat
Jabatan Geologi, Universiti Malaya, 50603
Kuala Lumpur.

Associate Member

1. Yap Lee Chor
Jurutera Konsultant, 435 Jalan Ipoh,
51200 Kuala Lumpur.

Institutional Member

1. Brunei Shell Petroleum Co. Sdn. Bhd,
Seria 7082, Brunei Darussalam.

PETUKARAN ALAMAT (Change of Address)

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

- | | |
|--|---|
| 1. Abdul Halim Abdul
537 Jalan Jasmin 17, Taman Jasmin, 43000
Kajang, Selangor D.E. | 4. Mohd Redzuan b. Mohd. Ramli
Kuari 2, APMC S.B., Lot 4222, RTFA,
48000 Rawang, Selangor D.E. |
| 2. Robert A. McTavish
9 Braefoot Grove, Dalgety Bay KY11 5YS,
Fife, Scotland. | 5. Lawrence P. James
c/o MIM Exploration, 1658 Cole Blvd., Suite
16-210, Golden, Co. 80401-3304, USA. |
| 3. Mark Webster
Fletcher Challenge Petroleum Inc., Suite
2300, 300 Fifth Avenue S.W., Calgary,
Alberta, Canada T2P 3C4. | 6. Engku Nasir Bin Syed Mohamad
H. Rosen Engineering GmbH, 5948, Taman
Geliga Baru, 24000 Kemaman,
Terengganu. |

GSM

PERTAMBAHAN BAHARU PERPUSTAKAAN (New Library Additions)

The Society has received the following publications:

- | | |
|--|--|
| 1. AAPG Explorer, Jan & Feb 1996. | 11. Geological Survey of Japan, vol. 46, nos. 7-
10, 1995. |
| 2. Mineralogica Polonica, vol. 25, nos. 1 & 2,
1994. | 12. Tin International, vol. 68, no. 11, 1995. |
| 3. AAPG Bulletin, vol. 80, no. 1 & 2, 1996. | 13. American Museum Novitates, no. 3159
(1996); no. 3156 (1995). |
| 4. SOPAC, vol. 12, nos. 3/4, 1995. | 14. Bulletin of the American Museum of
Natural History, no. 227, 1995. |
| 5. Scripta Geologica, nos. 109, 110, 111 (1995). | 15. Monthly statistics on mining industry in
Malaysia, Dec. 1995. |
| 6. Bulletin of the National Science Museum,
vol. 21, nos. 3 & 4, 1995. | 16. U.S. Geological Survey Water Supply
Paper: 1995: no. 2419. |
| 7. Geological Bulletin of Turkey, vol. 38, no.
1, 1995. | 17. U.S. Geological Survey Circular: 1995: no.
1120-F. |
| 8. Bulletin: Centres Rech. Explor-Prod elf
aquitaine vol. 19, no. 2, 1995. | 18. U.S. Geological Survey Bulletin: 1995:
nos. 2135, 1988-K, 2000-I, 2121-A, 1989-H. |
| 9. Explanatory notes for the metamorphic
facies map of Taiwan, 2nd ed., 1995. | 19. U.S. Geological Survey Professional Paper:
1995: nos. 1564, 1409-D, 1357. |
| 10. Books about Singapore, 1996. | |

GSM

BERITA-BERITA LAIN Other News

Local News

Petronas strikes gas deal with Thais

National oil corporation Petronas and its Thai counterpart have agreed to deliver natural gas from the Malaysian-Thai continental shelves to Thailand.

The agreement, involving the supply of gas from the Joint Development Authority (JDA), would augment the natural gas supply of the Petroleum Authority of Thailand (PTT) to meet fast growing demand for power generation in Thailand.

Petronas and PTT will sign a memorandum of intent here next Tuesday for an accord for the gas supply from JDA, the "Bangkok Post", quoting industry sources, reported yesterday.

The sources said that the reserves are substantial enough to ensure delivery of as much as 1,000 million cubic feet per day (MMcfd), a rate equivalent to the output of all gas fields in

the Gulf of Thailand.

Gas from this area generates some 35 per cent of all Thai electricity.

So far, an effort to prove gas reserves on the JDA in the South China Sea has produced promising results from three exploratory wells, with exploratory well Muda 1 becoming the third significant discovery.

The discovery, which led to earnest exploration in early 1995, has not only lived up to expectations about the gas potential but further strengthened the possibility of commercial development of sizeable gas fields in the JDA.

Two exploratory wells drilled earlier last year in the JDA also yielded promising results, the report said.

NST, 2.3.1996

Shell brings gas field on stream

Sarawak Shell Bhd. brought on-stream the second gas field for Malaysia Liquefied Natural Gas (MLNG)-Dua Development, M1, which started producing export quality gas yesterday.

The M1 field, together with M3, which is already producing gas to the MLNG-Dua plant since last December, has been developed on a 50:50 joint venture arrangement between Sarawak Shell and Petronas Carigali, with the former as the operator.

Under Phase 1 of the development, Sarawak Shell is entrusted to build two gas processing complexes at the M1 and M3 fields, which lie 200 km to 250 km northwest of Bintulu; lay a 400 km pipe-line network connecting the fields to Bintulu

via a new platform at the E11 complex; and construct new condensate stabilisation and export facilities at its existing Bintulu plant.

Sarawak Shell said M1 and M3 were the first two fields being developed out of a total of 11 offshore gas fields meant for the MLNG-Dua project.

The facilities have been designed to process 1.4 billion cubic feet of gas and 80,000 barrels of condensate per day at an estimated cost of some RM3.5 billion.

The total cost for the entire upstream project over the next 20 years is estimated to be over RM10 billion.

NST, 2.3.1996

Drilling of Viet oil well completed

Petronas Carigali (Vietnam) Sdn. Bhd. has completed drilling and testing Topaz-1, which was spudded on Oct 25, 1995, and drilled to a depth of 3,472 metres below the seabed, it was announced yesterday.

A Petronas statement said the Topaz prospect was located 175 km east of Vung Tau in Block 01, off the shores of Vietnam.

"The well encountered several zones with hydrocarbon shows within the Miocene and Oligocene clastics. Two production tests were conducted with a flow of 325 barrels of oil per day

and 9.5 million cubic feet gas per day," it added.

Topaz-1 was plugged and abandoned on Feb 2, and the structure is currently being evaluated for its commercial viability.

Topaz is the third significant hydrocarbon discovery made by Petronas in Vietnam after the Ruby and Emerald prospects discovered in 1994 and 1995 respectively. The company has been involved in petroleum exploration in Vietnam since September 1991.

To date, it has recorded 24,000 km of seismic data and drilled seven wildcat wells.

NST, 7.3.1996

3 more gold mines in Sarawak by 1998

Three more gold mines are expected to be operational by 1998 to boost gold production in Sarawak, Sarawak/Sabah Mines director Shahar Effendi Abdullah said yesterday.

"Three mining companies, namely Syarikat Tabai Sdn. Bhd., Gladioli Enterprise Sdn. Bhd. and Southern Gold Mining Development Sdn. Bhd. will carry out mining operations in Bau," he told Bernama at his office here.

Shahar said Southern Gold Mining Development Sdn. Bhd., a company owned by Kumpulan Rimbunan Hijau, is still waiting for approval from the Natural Resources and Environmental Board after submitting an Environment Impact Assessment report late last year.

Shahar said so far, the preliminary mining operations in Bau by the two other companies were showing positive and promising results.

Shahar said the exploration for potential gold mines was also being undertaken in Pedawan, Lundu, Sri Aman, Kapit, Simunjan and Sarikei.

In terms of gold production, Sarawak produced a total of 712,873 gm of "dore" gold (non-monetary bullion) worth RM12,878,857 last year, a drop of 511,169 gm when compared with 1994's total when production stood at 1,224,042 gm worth RM28,170,139.

"For pure gold, Sarawak produced a total of 460,068 gm worth RM12,878,857 last year, a drop of 445,943.5 gm compared with 1994's 906,011.5 gm worth RM29,617,941," he added.

Besides gold, Shahar said 3 mines, one each for coal, silica and antimony would be open between this year and 1998, he said.

The areas identified for such mining are Silantek, Kapit and Mukah/Balingian for coal, Nayalau for silica and Bau for antimony.

From 1990 to 1995, the overall total of various mineral production in Sarawak such as gold, silica sand, coal and silver was worth RM264,547,742.

He said the mines department had approved 59 exploration applications since 1991 covering about 2,444,249 ha or 19.26% of Sarawak.

Star, 7.3.1996

Converting ex-mining land to forest plantations

The Perak Government is planning to convert several pieces of ex-mining land in the State into forest plantations, Menteri Besar Tan Sri Ramli Ngah Talib said today.

He said the State Government was undertaking a study to determine if it could turn ex-mining land into something economically viable rather than leaving them idle.

He also said the State was studying whether the planting of rubber or *acacia mangium* was suitable on ex-mining land.

The move, he said, was in response to the call made by the Forestry Department's Forest Plantation Unit that State Governments should promote forest plantations on idle land.

Ramli was speaking after handing over house keys to the first 40 recipients of the State Foundation for the Development of the Poor resettlement project at Titi Gantong, Bota, 65 km from here.

Ramli said the State Government wanted to

concentrate development on ex-mining land as there were about 40,000 ha of such land compared to the 8,000 ha of idle land in Perak.

To date, he said, forest plantations in the State ranged between 2,000 ha and 2,400 ha in Trolak, Slim River and in Chikus, Teluk Intan.

"The State Government has decided that ex-mining land located at the fringes of towns be used for other types of development while those in rural areas will be used for forest plantations," he said.

He added multi-integrated developments, such as residential housing schemes and theme parks, which are economically viable for the State, would be planned on ex-mining land near towns.

For examples, he said, the Tronoh Sports Complex in Bandar Seri Iskandar and the proposed theme park in Tambun, were on ex-mining land and were close to town.

NST, 8.3.1996

Ruby field has 2000 million barrels of oil, says Petronas

Petronas has discovered that its Ruby field off Vietnam's coast has an estimated petroleum reserve of 200 million barrels, its president Datuk Mohd Hassan Marican said yesterday.

He said although the first discovery of oil in the area was in 1994, further exploration and studies had indicated huge reserves and Petronas would undertake development of the Ruby field in two phases.

Mohd Hassan, who was briefing Prime Minister Datuk Seri Dr. Mahathir Mohamad who visited the Petronas office in Hanoi, said phase one of the development would start by year's end and was targeted to produce, 95,000 barrels per day or 0.48 million tonnes per annum by the end of next year.

Phase two development of the field is scheduled to be completed by the year 2003 and the field is expected to produce 85,000 barrels of oil per day or 4.25 million tonnes per annum.

Mohd Hassan said Petronas was also a partner in the development of Dai Hung oil field

located in the Con Con basin, about 250 km southeast of Vung Tau in Southern Vietnam.

The oil corporation has also formed a joint venture with Vietgas, the marketing arm of PetroVietnam, to construct a Liquefied Petroleum Gas terminal and bottling facility in Hai Pong. Petronas holds 49 per cent equity in the project with Thang Long LPG holding the rest.

Last Tuesday, Petronas together with PetroVietnam, Conoca Asia, LG Chemical, South and Webster International Corporation and Chima Investment and Development Co. Ltd signed an agreement to undertake a feasibility study on Vietnam's first refinery project. The refinery is proposed to be built at Dung Quat Bay, 130 km south of Danang.

Mohd Hassan said to date Petronas had committed US\$417 million (RM1.063 billion) in both upstream and downstream sectors in Vietnam and added that prospects for further expansion and more joint ventures were bright.

NST, 9.3.1996

Petronas Twin Towers tallest in the world

The Petronas Twin Towers are now the tallest buildings in the world following the installation of their pinnacles to house the aviation lights.

At 451.9 m above street level, the Towers surpass Sears Towers in Chicago by 8.9 m, KLCC (Holdings) Sdn. Bhd. said in a statement yesterday.

It said even before they were completed, the twin towers have been acknowledged by the Council of Tall Buildings and Urban Habitat as the tallest buildings in the world.

Construction of Tower One was undertaken by the Mayjaus joint venture, a consortium led by Hazama Corp comprising J.A. Jones Construction Co, MMC Engineering Services Sdn. Bhd., Ho Hup Construction Co. Bhd. and Mitsubishi Corp.

Tower Two's construction was led by the

SKJ joint-venture, a consortium led by Samsung Engineering & Construction Co. Ltd. comprising Kuk Dong Engineering & Construction Co. Ltd. and Syarikat Jasatera.

The Petronas Twin Towers were topped-out on February 13 this year by Prime Minister Datuk Seri Dr. Mahathir Mohamad, a milestone which marked the completion of the superstructures of the 88-storey twin towers, KLCC said.

The Petronas Twin Towers are owned by Midciti Resources Sdn. Bhd. Petronas, which will occupy Tower One, has more than 75% interest in Midciti Resources via its direct 51% interest in Midciti Resources and its 51% interest in KLCC (Holdings) holds the remaining equity of Midciti Resources.

The Towers will be ready for occupancy end of this year.

Sun, 12.3.19

Another 1,000 km of roads for Sarawak

Sarawak aims to construct another 1,000 km of roads with a RM2 billion allocation under the Seventh Malaysia Plan, said Deputy Chief Minister and Minister for Infrastructure Development and Tourism Tan Sri Dr. Wong Soon Kai.

He said priority would be given to the construction of coastal roads that would link villages to urban centres to facilitate development in the coastal areas.

The state now has 4,620 km of road under

the Public Works Department as compared to 607 km in 1963.

"An additional RM300 million will be spent on road maintenance under the Seventh Malaysia Plan," Dr. Wong told reporters after opening a seminar on pavement evaluation and rehabilitation of road pavement using the recycling technique here yesterday.

Dr. Wong said the government would privatise the construction of more roads to speed up road development.

Star, 13.3.1996

Only 40 pc of state's roads in good shape

About 14 percent of the paved roads in Sarawak are poorly maintained.

Public Works Department state director Michael Ting said only 42 per cent of the roads were in good condition.

"The average cost of maintaining the 4,620 km of Sarawak roads (under PWD) is RM26,000 per km per year or about RM120 million annually," he said at a seminar on pavement evaluation and rehabilitation of road pavement

using the recycling technique here yesterday.

The lack of funds and other constraints had hampered road maintenance work.

The department only got about RM64 million or half of the amount needed in road maintenance last year, he said.

The department is considering several options to increase private sector participation in road maintenance.

Star, 13.3.1996

Firms win Sarawak road deals

Two Peninsular Malaysia-based companies — Limbongan Setia Bhd and Trans Resources Corp (TRC) — have been awarded two of the five packages of the proposed Tubau-Bakun Road in Sarawak.

Setia was awarded the RM79-million Package 5 and TRC the RM98-million Package 4, said Sarawak Public Works director Michael Ting yesterday.

He said the project sites for the 40-month contracts were handed over to the companies late last month.

Contracts for the other three packages worth about RM200 million were awarded to PPES Works (Sarawak) Sdn. Bhd., a member of the Cement Manufacturers Sarawak Bhd. group.

The Tubau-Bakun Road, which will also be linked to Bintulu and Miri, will be the only link to the RM15-billion Bakun hydro-electric dam project.

PPES Works managing director Peter Wong said half of the first 10 km from the Bakun side had been completed and the remaining stretch would be ready in three months.

Another 70 km would be ready in two years, he added.

PPES Works, which has completed about 100 km stretch of road since it was set up in 1991, has been awarded a pilot project by the Public Works Department to rehabilitate Jalan Istana and Jalan Matang, Kuching

Star, 13.3.1996.

Study finds Bakun dam is safe

An independent review of the Bakun dam project has concluded that the design is "inherently safe", said Energy, Telecommunications and Post Ministers Datuk Leo Moggie.

When releasing the report yesterday, he said the review board comprising independent local and foreign experts had also found the hydrology, geology and site topography favourable for a major hydro development.

He said the Bakun review board was set up by the Government to study and monitor the safety of the dam project, stressing that its members were selected based on their individual track records in dam building.

Among other matters, the 23-page report also concurred with the selection of the concrete face rockfill dam for Bakun stating that "the design is based on experience and is rather standard".

The consultants also found the project layout and selection of structures conformed to current practice and provided for a satisfactory power project.

Moggie said the construction contract for the dam would be awarded by the middle of the year and actual work would start by the end of the year.

Refuting criticisms that the project was not cost-effective, Leo Moggie reiterated that "Bakun

is still the least costly power generating development."

"The advantage of hydro power is the low operating cost compared to thermal power, which incurs high fuel costs.

"You cannot compare because the power purchase agreement has not been signed yet," he said.

To a question, Moggie denied that there were problems in the negotiations of the power purchase agreement between Ekran and Tenaga Nasional Berhad.

"The details have not been agreed upon yet. The price per unit is still being negotiated," he said.

On the laying of submarine cables to Peninsular Malaysia, he also dispelled fears of any risks, saying that three sets of cables would be laid.

"We have reduced the risk because if something goes wrong with one (cable) we still have two more," he said adding that the cables would also be buried in the seabed.

Moggie said transmission loss in the submarine cable was not a problem because it was minimal at seven per cent compared to eight or nine per cent for Tenaga Nasional's land lines.

"Technology has improved and indications are that the percentage might even be lower," he said.

He said the release of the report yesterday reflected the government's openness but added that it was not possible to release all feasibility studies as requested by non-governmental organisations.

Besides the three foreign consultants from

the United States and Venezuela, the other members of the review board were Public Works Department director of water supply Datuk Mohd Haris Abas and Irrigation and Drainage Department director of planning and evaluation Liew Chin Loong.

Star, 15.3.1996

Disused mining land in PJ to be turned into tropical rainforest

Thirty-two hectares of disused mining land at the Sunway Lagoon theme park in Petaling Jaya, Selangor, will be turned into a RM40 million man-made tropical rainforest.

Over 3,000 species of shrubs, plants and trees will be planted as well as transplanted there.

The project is part of the Sungei Way Group's contribution to the environment, its president, Datuk Dr. Jeffrey Cheah, said.

Dr. Yap Son Kseong, assistant general manager of Sunway Nursery and Landscape Sdn. Bhd., the project developer, said it would be difficult to recreate a rainforest environment at the former mining land.

For starters, soil condition was extremely

poor and there was a need to match trees with the terrain and also to bring back as much of the natural elements.

"The first stage involves improving the soil condition, adding lots of topsoil to initially allow the hardier plants to establish themselves and return nutrients into the soil."

"Then species of trees from the forest with potential for growth will be introduced. This is the present stage of development."

Yap said that it would take time for the forest to mature. Bandar Sunway Sdn. Bhd. is involved in and has been asked to be partners in developing 540 ha of the Tambun Resort hot springs into a health centre.

NST, 30.3.1996

Road to Camerons proposed

The Pahang state government is proposing to build a new road from Kuala Lipis to Cameron Highlands under the 7th Malaysia Plan (1996–2000) to shorten the travelling time from Pahang to here by 4½ hours.

Pahang Menteri Besar Tan Sri Khalil Yaakob said today the proposed 110 km road would shorten the journey from six hours now to only 90 minutes.

The state government had submitted a proposal to the federal government on the road estimated to cost RM270 million, he told reporters after launching the Cameron Highlands Structural Plan drawn up by the Cameron Highlands District Council, here.

He also said the state government would only allow new development projects to be carried out in seven areas in the district in efforts to

develop and promote Cameron Highlands as a leading tourist haven.

Ringlet, Brinchang, Tanah Rata and Bertam Valley were among the places slated for new projects to be implemented under the nucleus growth centre concept aimed at retaining the natural environmental habitat in this district, he said.

Khalil said the state government will take stern action and would not give in to groups indulging in illegal land clearing.

The state government's firm stand is to curb adverse effects to the environment and water catchment areas in the district, he said.

He also said Cameron Highlands district officer Razali Haji Ahmad has been asked to keep a close watch on projects in the district and ensure farmers build water bunds for agricultural

activities according to specifications to prevent soil erosion.

Khalil also said the state government will encourage eco-tourism by encouraging the people to open up forest areas in the district which had

not been gazetted under the permanent forest reserve.

He said 46,147 ha of forest are not under permanent forest reserve cover.

Sun, 2.4.1996

Petronas Carigali finds gas in Bergading

Petronas wholly-owned subsidiary, Petronas Carigali Sdn. Bhd., has discovered gas in the Bergading prospect about 175 km off the coast of the peninsula.

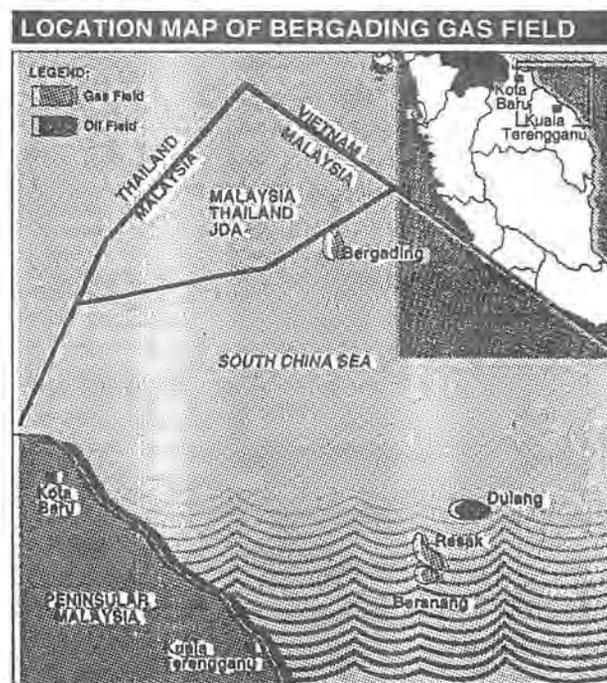
The prospect lies in a gas prone area about 160 km north-west of the Dulang oil field, Petronas said in a statement.

It said the Bergading Deep-1 well, drilled to a final depth of 3,149 metres under the sea, flowed at a cumulative daily rate of 131 million cubic feet of gas and 3,680 barrels of condensate from six production test zones.

"The Bergading gas discovery would add significantly to the nation's gas reserves," it added.

Petronas Carigali now produces about 240 million standard cubic feet of gas per day from the Duyong gas field and is developing the Resak-Beranang gas field, scheduled to come on stream in late 1999.

NST, 4.4.1996



Location map of Bergading gas field.

Study on Penang's third link begins

A local construction giant has started a feasibility study on the proposed third link between Penang island and the mainland.

The project, expected to cost between RM2 billion and RM3 billion, may be in the form of a "chunnel" or a combination of tunnel, bridge and reclaimed land.

Mekar Idaman managing director Dr. Azman Firdaus said the study on the technical and commercial viability of the project began this week.

"We hope to complete the study in six months and submit it to the state government by end of the year," he told *The Star*.

Mekar Idaman, a subsidiary of UEM Engineering and operator of the Penang Bridge, is one of several parties that have shown interest in the project.

Another leading contender is Hazama Corporation, which has submitted a technical proposal to the state government to build a RM2.4 billion "undersea expressway" spanning 6.6 km.

Penang island is now linked to the mainland by the ferry and the 13.5 km Penang Bridge.

Dr. Azman said the feasibility study would take into account the timing of the long-term project in view of the proposed expansion of the Penang Bridge in 1998.

He said the third link would become necessary when the bridge could no longer be expanded.

Dr. Azman said the company had identified three possible link points between George Town and Butterworth.

Star, 6.4.1996

Petronas signs second deal with Sarawak Shell

Petronas yesterday signed a production sharing contract with Sarawak Shell Bhd. for the exploration and development of its sixth deepwater block, about 100 km off the coast of Miri.

The block is the second to be awarded to Shell. Petronas signed the first PSC with Shell in January last year for the deepwater block G offshore Sabah.

Petronas chairman and chief executive Datuk Mohd Hassan Marican said the exploration would involve at least RM30 million.

The block is relatively unexplored with limited geological and geophysical data, he said at the signing in Kuala Lumpur.

The block, known as Block E, is in water depths ranging from 200 m to two km offshore Sarawak, with about 80 per cent of the block more than a kilometre deep.

Under the PSC agreement, Sarawak Shell will have a 80 per cent interest while the remaining will be held by Petronas's wholly-owned subsidiary, Petronas Carigali Sdn. Bhd. Sarawak Shell will operate the block.

The contractors will acquire and process about 3,000 line-kilometres of new quality 2D seismic data and drill one exploration well, said Mohd Hassan.

He added that the contractors would also undertake a comprehensive study on new hydrocarbon potential covering the entire Baram Delta Province, including deepwater block E.

The improved terms of the deepwater PSC, which was introduced in 1993, would extend the exploration period to seven years, the development period to six years and the production period to 25 years.

The shallow water PSC terms, for efforts in waters fewer than 200 m deep, provide five years for exploration, four years for development and 15 years for production.

Meanwhile, Sarawak Shell chairman Megat Zaharuddin Megat Mohd Nor said the company would spend RM150 million in the next four to five years for exploration.

He said there were good indications of substantial hydrocarbon accumulations in Malaysia's deepwater.

A seismic study jointly conducted by Petronas Carigali and Sabah Shell Petroleum Co Ltd. on block G last year indicated good prospects for oil and gas, he added.

The company plans to quicken the exploration in block G with the drilling of an exploration well next year, two years ahead of its original schedule.

NST, 6.4.1996

Two oil companies to buy gas from JDA

Petronas and the Petronas Authority of Thailand plan to buy gas from the Malaysia-Thailand Joint Development Authority for their proposed downstream activities in Songkhla.

The national oil corporation president and chief executive Datuk Mohd Hassan Marican said yesterday negotiations would soon start with the JDA for a purchase agreement, which would see the gas used in a new development corridor in Songkhla.

The JDA is exploring and developing the gas reserves in the joint-development area about 260 km off the coast from Songkhla and about 180 km from Kota Baru.

The area is said to have more than 10 trillion cubic feet of gas reserves, enough to ensure delivery of one billion cubic feet of gas per day,

equivalent to the total outputs of all gas fields in the Gulf of Thailand.

Mohd Hassan said if the negotiations go through, the gas would be bought from the JDA's production well head and piped to Songkhla, located about 100 km from the Malaysian-Thai border.

Petronas and PTT last month signed a memorandum of intent to jointly develop value-added down-stream gas and petrochemical projects in Thailand, creating an alliance between the two national oil corporations.

Under the memorandum, a joint-venture company would be set up to buy gas from the JDA and its production sharing contractors.

It would also provide Petronas with the opportunity to participate in the downstream

gas and petrochemical projects in Thailand, including power generation.

Speaking after signing a deepwater production sharing contract with Sarawak Shell Bhd. in Kuala Lumpur, Mohd Hassan said plans for the down-stream activities were too preliminary to be disclosed.

"What is more important is that they would

be undertaken by two national oil corporations."

He also did not discount the possibility that the Songkhla gas pipeline may be connected to Petronas Peninsular Gas Utilisation III pipeline project at the Perlis-Thai border.

However, Mohd Hassan added that these plans should be viewed from a "long-term horizon" and would not materialise soon.

NST, 6.4.1996

Shell brings M1 gas field onstream

Shell's exploration and production unit brought onstream the second gas field for the MLNG-Dua development, M1 which produce export quality gas since March 1.

Shell's newsletter *Sesama Kita* for March, released in Kuala Lumpur yesterday said the M1 field, together with M3, which had been producing gas to the MLNG-Dua plant since December 1995 was developed on a 50:50 joint venture arrangement between Sarawak Shell Bhd. and Petronas Carigali with Shell as the operator.

Under Phase 1 of the development, Shell was entrusted with building two gas processing complexes at the M1 and M3 fields.

The complexes, which lie 200 km to 250 km north-west of Bintulu, have a 400 km pipeline network connecting the fields to Bintulu via a new platform and new condensate stabilisation

and export facilities at its existing Bintulu plant.

M1 and M3 were the first two fields being developed out of a total of 11 offshore gas fields meant for the MLNG-Dua project.

The facilities have been designed to process 1.4 billion cubic feet of gas and 80,000 barrels of condensate per day at an estimated cost of some RM3.5 billion.

The total cost for the entire upstream project over the next 20 years is estimated to be over RM10 billion.

The M fields have a total reserve of 3.7 trillion cubic feet of gas.

With the two fields coming onstream, Malaysia's liquified natural gas production capacity is expected to double to some 16 million tonnes per annum, mainly to cater for Korean, Taiwanese and Japanese markets.

NST, 9.4.1996

RM150 m bridge to be built across Sarawak river

A local company, Ayu Bistari Sdn. Bhd., has formed a joint venture with an Australian partner to build a RM150 million bridge over Batang Baram in Miri division, Sarawak.

The joint venture company, Transfield-Ayu Bistari JV, will undertake the project — the first privatised bridge in Sarawak — under the build, operate and transfer concept.

The company has also been given 2,000 ha near the proposed bridge to be developed into an industrial park over a period of 20 years at a cost of RM2 billion.

The bridge, which will span 750 metres, will have four lanes and will replace the existing

ferry service crossing the Baram River.

Chairman of Transfield Australia Franco Belgiorno-Nettis said the joint venture had been granted 30 years to operate the bridge and collect toll from users.

The toll rates will be reviewed after 15 years.

"The toll rates, which have yet to be fixed, will not be higher than the fare charged for ferry service," he said after witnessing the ground breaking ceremony by Chief Minister Tan Sri Abdul Taib Mahmud in Kuching yesterday.

Currently, a motorist is charged RM6 for using the ferry to transport his car.

Construction work on the bridge is expected

to be completed within three years. The bridge will allow easier access to the Miri port and border post at the Sarawak-Brunei border.

The bridge project is managed by Cambridge Alliance Sdn. Bhd., a subsidiary of Transfield Group of Australia, engaged in dam, bridge and port construction in Malaysia.

Ayu Bistari is involved in housing and

property development.

Belgiorno-Nettis said Transfield-Ayu Bistari would take six months to finalise the bridge's design, conduct a soil study and complete an Environmental Impact Assessment study.

The Transfield group is also involved in the construction of a bridge in Kalimantan, Indonesia.

NST, 13.4.1996

Gamuda associate wins expressway deal

Lingkaran Trans Kota Sdn. Bhd. (Litrak), an associate company of Gamuda Bhd., has been awarded the concession for the privatisation of the 40 km Damansara-Puchong-Putrajaya Highway.

Gamuda said in a statement to the KLSE that the project, estimated to cost RM1.3 billion, was expected to be completed by 1999.

The project involves the construction of a six-lane free-flow expressway, new interchanges and ancillary facilities comprising petrol station, rest and service areas and computerised traffic information and monitoring systems.

Littrak, registered last year, is 49 per cent-owned by Gamuda and 51 per cent by Irama Duta Sdn. Bhd.

Gamuda said the concession would be on a build-operate-transfer basis.

It said that Littrak would design, build and subsequently operate, manage and maintain

the expressway for 33 years.

On expiry of the concession period, the expressway would be handed back to the government.

The statement said as part of the concession agreement, the government would also make an advance of RM98 million to cover land acquisition cost for the project.

The proposed highway forms the western part of the government's Middle Ring Road 2 project to disperse traffic in greater Kuala Lumpur. It will start from the proposed interchange at Sri Damansara in the north and extend south to the new administrative centre of Putrajaya.

The highway will serve as an important urban connection, linking the western part of the Federal Territory with Kepong, Petaling Jaya, Puchong and Putrajaya.

Star, 17.4.1996

MTD gets to build RM282 m East-West Highway II

MTD Capital Bhd. has been awarded a RM282 million contract by the government to build the East-West Highway II to link Post Selim in Perak to Kampung Raja in Pahang.

Executive chairman Datuk Nik Hussein Abdul Rahman said the 35 km highway project will start once it obtained the green light from the government.

"The highway will be built across virgin jungles and mountains as high as 250 metres and we are confident we can handle the project," he said after the company's AGM yesterday.

The highway will also enable the public to enter Terengganu and Kelantan. MTD has been given 35 months to complete the project. He said MTD has also been invited by the government to participate in another privatisation project to build a 300 km highway from Karak to Terengganu. The RM2.9 billion project will be a joint venture with United Engineers (M) Sdn. Bhd. (UEM) and Malaysian Mining Corp. Bhd. (MMC). MTD and UEM will hold a 30% stake each and MMC 40%.

Sun, 19.4.1996

Highway works affecting water quality in rivers

Expansion works on the Karak Highway has affected the quality of water in Sungai Benus, Sungai Bentung and Sungai Semantan.

Deputy Menteri Besar Datuk Hasan Arifin told the State Legislative Assembly that the contractor, MTD Prime Sdn. Bhd., however had taken steps to control the pollution by stabilising the slopes with grass using the "hydroseeding" method.

"In addition, the State Government has asked the contractor to use plastic sheets to cover areas where grass cannot grow, to check soil erosion," he said.

Replying to question by Hoh Khai Mun (BN-Bilut), Hasan said these steps were taken following a discussion between the State Housing and Environment Committee and the contractor last month.

"The contractor has also been told to build

drains near the hills," he said, adding that roadworks which involved the cutting of hills would be carried out after geo-technical and engineering studies in the affected areas were completed.

"We have also directed the contractor to strengthen the slopes by way of ground anchoring, turfing and construction of retaining walls."

Hasan said work on the highway, which would be carried out in stages, was expected to be completed by July 1999.

"The section between Karak and Genting Sempah will be completed by July next year while the Genting Sempah to Bentong stretch is expected to be ready by September 1998."

The stretch between bentong and Sungai Dua should be ready by July 1999, he added.

Hasan said toll rates for the highway would be decided by the Federal Government.

NST, 24.4.1996

Micro-piling must now be used in town projects

Developers carrying out construction projects in town areas must now use micro-piling to minimise vibration to protect surrounding buildings.

Penang Island Municipal Council president Dr. Teng Hock Nan said the council had also stopped allowing the use of diesel piling on construction sites due to the fumes emanated.

These requirements, Dr. Teng said, were part of the conditions stipulated in the building plans.

"Developers must follow these conditions otherwise their plans will not be approved," he said.

Dr. Teng said the council was aware of the

problems caused by piling work, especially on old buildings.

He added that those who flouted the regulations would be asked to stop work immediately.

"We want development but it should not be at the expense of causing inconvenience to others."

He was commenting on the damage caused to Hardwick mansion, a heritage building, in Jalan Sultan Ahmad Shah following piling work carried out around to the mansion.

Wide cracks, easily visible to passers-by, have appeared on the walls of the mansion which was built in the last century.

NST, 27.4.1996

Pahang starts to tap its water resources

Pahang's plan to turn its massive water resources into the state government's main revenue earner took a step closer to reality as it has already started selling water to Negri Sembilan.

Deputy Menteri Besar Datuk Hasan Arifin said talks for the sale of water were also under way with neighbouring states — Perak and Selangor — and even Singapore.

"In fact, talks with the Singapore government are in the preliminary stages.

"According to studies conducted by a consultant, water could be supplied to the republic via the Rompin river situated in the southern tip of Pahang.

"This would be possible if huge pipes were built from Rompin via Mersing and connected to the Johor-Singapore main pipes," he added.

Hasan said the studies also showed that Pahang had great potential in interstate water transfer scheme.

"The consultant also concluded that the state

had at least 35,000 sq km of water catchment area with a capacity of generating at least 90,000 million litres per day," he added.

On the sale of water to Negri Sembilan, Hasan said a formal agreement would be signed next month with the Negri Sembilan Government.

"We have started supplying water to the Felda schemes in the Jempol district since early this year after new pipes had been laid to the Felda Serting settlements.

"It was informally agreed that the water would be sold at 33 sen per cubic metre," he told reporters at his office here yesterday.

He said the agreement, at the moment covers areas at the Pahang and Negri Sembilan border.

"But eventually the water would also be channelled to the whole state," he added.

Hasan said the water would be sold according to the needs of the Negri Sembilan Government and no volume or time frame had been set.

Star, 24.4.1996

Massive oil survey off Miri coast

A massive underwater operations is to start later this year off the coast of northern Sarawak in an attempt to unearth what has long been believed to be rich untapped oil and gas reserves.

The survey, which will be concentrated mainly off the coast of Miri town, will be conducted jointly by Shell and Petronas.

The survey operations would include a seismology study of the seabed to determine the feasibility of drilling activities, Saperi Rambli, acting head of public affairs and communication for Sarawak Shell Bhd./Sabah Shell Petroleum Co. Ltd., said yesterday.

"Plans are already being drawn up for the survey which will be started during the second half of this year. However, the exact month and date has yet to be fixed.

"The area for the survey has already been identified. It is located in a new deep water zone about 100 to 150 kms from the shores of Miri," he told The Star.

Sarawak Shell has several oil and gas production pipelines off the coast of Bintulu, about 220 kms south of here, and several oil fields off Kuala Baram about 30 kms north of here.

Elaborating on the latest survey to be carried out, Saperi yesterday said Shell would work closely with Petronas on a joint-venture basis.

"A ship equipped with the latest technology and equipment on seismic survey will be used. With the help of this ship, we can confirm our plans for the new drilling areas."

Saperi however said the finer details of the joint venture between Shell and Petronas for the new operations were still being worked out.

He said the cost and the period of the entire survey could not be ascertained yet.

Asked about the estimated amount of oil or gas that might be in the new potential areas, he said the projection could only be ascertained after the survey.

Star, 29.4.1996

First Announcement and Call for Papers

THE 18th NEW ZEALAND GEOTHERMAL WORKSHOP

6–8 November 1996

CALL FOR PAPERS

The Geothermal Institute and the New Zealand Geothermal Association will host the 18th NZ Geothermal Workshop at the University of Auckland on 6, 7, 8 November 1996. The meeting will be a forum to exchange information on all aspects of the exploration, development and use of geothermal resources worldwide. All accepted papers will be published in the Proceedings of the Workshop which are widely distributed.

The workshop is open to papers on all aspects of geothermal technology including:-

- | | |
|---------------------------|---|
| Exploration: | Geophysics, Geology, Geochemistry, Site Investigation, Epithermal Mineralisation. |
| Field Development: | Drilling, Reservoir Engineering, Reinjection, Mineral Deposition. |
| Utilisation: | Electric, Non-electric, Optimisation, Environmental Consequences, Preventive Maintenance. |
| Applications: | Materials, Standards, Environmental, Economic, Legal. |
| Case Studies: | Geothermal Field or Plant; for example, Make-up Drilling and Reinjection strategies. |

THE CONVENORS

c/o Geothermal Institute
The University of Auckland,
Private Bag 92019, Auckland,
New Zealand.

Fax: 64-9-373 7436

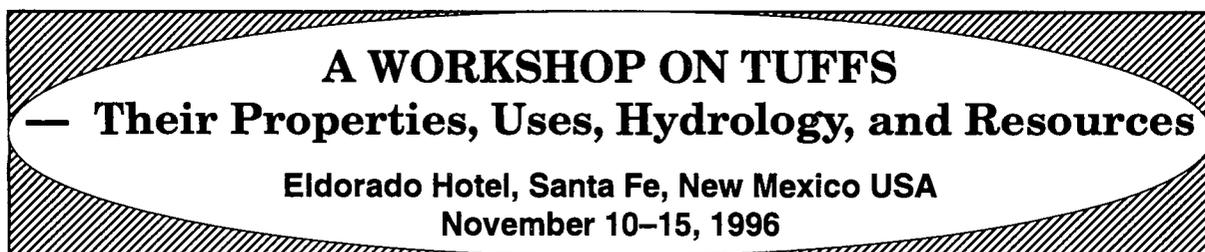
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The University of Auckland,
Private Bag 92019, Auckland, N.Z.

Ph: 64-9-373 7599 Ext. 7050

Fax: 64-9-373 7419

E-mail: professional.courses@auckland.ac.nz



A WORKSHOP ON TUFFS
— Their Properties, Uses, Hydrology, and Resources
 Eldorado Hotel, Santa Fe, New Mexico USA
 November 10–15, 1996

Second Announcement

Tuffs have been part of man's environment for thousands of years and underlie some of the Earth's largest cities. There are 41 large industrial cities in 24 nations (including two megacities) that are underlain or partly underlain by tuffs. These tuffs, composed of volcanic ash and pumice particles, which are bonded by natural cements or are naturally welded, make excellent building materials and have been proposed as a medium for industrial and nuclear waste storage. Tuffs have unique hydrologic properties; these properties must be considered when evaluating both water resources and industrial contamination.

Tuffs deposits are often hundreds of meters thick and cover hundreds to thousands of square kilometers. The most common tuffs used for building stone are *ignimbrites* (pyroclastic flow deposits), in which the pumice and glass shards are sintered by heat or bonded by natural cements precipitated from fluids percolating through the deposits. When used for building stone, ignimbrite is sawn or broken away from a quarry face along natural cooling joints, and then fashioned into blocks by hand or with power saws. These blocks, with enough strength for multiple-story buildings, stone walls, and other structures, are resistant to weathering, are light-weight, and have good insulating properties — better than most other natural building stones.

Many large cities in volcanic regions have serious problems with industrial waste that require an understanding of tuff hydrology. Determining the extent and location of wastes in tuff and locating the pathways along which they flow rely on an understanding of the medium. Unfortunately, there is little published information on the hydrology of tuff deposits, applied either to evaluation of water resources or to the remediation of wastes.

Purpose of the Workshop

The purpose of this workshop is to bring together a multidisciplinary group of scientists and engineers to integrate academic and applied research on tuffs and to initiate new collaborations. At this time, most of the appropriate data and publications on the physical, geological, hydrologic, and engineering properties are scattered through journal articles and government reports; there has been very little integrated work on tuffs.

Those attending the workshop will include volcanologists, hydrologists, civil engineers, architects, environmental chemists, and archeologists. They will be from industry, academia, international organizations, and government. One of the products of the workshop will be a low-cost handbook, distributed to users in every country where tuffs are an important part of the infrastructure. A handbook will be prepared by participants at the workshop and published within the year.

The workshop will not have the traditional format of a professional society meeting. One-and-one-half days will be devoted to invited speakers from "tuff cities" and general overviews of workshop topics. These talks will provide a focus for discussions and exchanges of information.

The Workshop Will Cover the Following Topics:

- Distribution, physical and chemical variations of tuff deposits, related to their genesis and deposition (Geology and Volcanology)
- Physical and chemical properties of tuff as a building stone and quarrying tuffs (Civil Engineering and Architecture)

- Cost-effective and earthquake-resistant construction in tuff and using tuff; indigenous housing in developing countries. This topic matches one of the goals of the International Decade for Natural Disaster Reduction (Architecture, Civil Engineering)
- Tuff as a medium for industrial and nuclear waste storage, which includes drilling in tuffs (Mineralogy, Chemistry, Nuclear Engineering)
- The hydrology and groundwater quality of tuffaceous aquifers (Hydrology, environmental aspects)
- Uses of tuff in the past (Anthropology, Archeology)
- Health problems associated with tuffs (Biological, geochemical, and mineralogical aspects)
- Case studies of infrastructure problems in cities located on tuff deposits (engineering, geology, hydrology, architecture, quarrying, and environmental problems)

Preliminary Schedule and Format

The format of the workshop will encourage interaction between the different disciplines, with the eventual goal of new collaborations and a publication. No abstracts are required for the workshop, but all participants will be asked to bring reference materials — such as reprints, preprints, etc. for the purpose of working group discussions and writing assignments.

The Working Groups

During the workshop, the participants will break up into at least seven working groups, each with the responsibility of integrating what we know about the subjects into chapters. During the workshop, most of the time will be dedicated to discussion and allocation of writing assignments. Although encouraged to bring materials for the book to the workshop, it is not possible that the writing could be completed in three days.

Working Groups and Tentative Categories for Book Chapters

1. Genesis, Distribution, and Physical and Chemical Variations of Tuff Deposits
2. Tuff as a Construction Material
3. The Hydrology of Tuffs — The Environment, Water Supplies and Industrial Waste
4. Tuffs in the History of Man
5. Health Problems Associated With Tuffs
6. Case Studies of Cities Located on Tuffs

Registration

In order to establish your participation at the workshop, the enclosed registration form and fee of \$225.00 (U.S.) dollars must be received in the Conference and Visit Management Office by October 1, 1996.

Workshop fee received by October 1, 1996	—	\$225.
Workshop fee received after October 1, 1996	—	\$250.

The workshop fee includes all supplies, audio visual needs, refreshments, meeting space, the banquet on Thursday, November 14, 1996. It also includes tours, transportation, and boxed lunch on Wednesday, November 13, 1996, to Los Alamos and Bandelier National Monument.

Information

Organizing Committee
Tuff Workshop
c/o Grant Heiken, MS D462
Los Alamos
NM 87545 USA



CALL FOR PAPERS

The "Legends" are coming! Come join them in "Big D" for the annual convention of the American Association of Petroleum Geologists (AAPG) and the SEPM (Society for Sedimentary Geology), to be held in Dallas, Texas, April 6-9, 1997, and hosted by the Dallas Geological Society. Historically, our industry was created by legendary oil finders, legendary discoveries, and legendary technology that have laid the foundation for our emerging "high-tech" trek into the 21st century! In keeping with the theme of the meeting, AAPG will sponsor special sessions, by invitation, which will examine not only past legends and the lessons they hold for our future, but also those exploratory, developmental and technological concepts that have the potential to become our "Legend of the Future".

Along with the AAPG's Division of Environmental Geosciences (DEG), Division of Professional Affairs (DPA), and Energy Minerals Division (EMD), the AAPG and SEPM have put together an exciting program featuring emerging trends and technology. **The 1997 AAPG/SEPM technical program will stress a particularly strong series of specialized sessions on:**

- Modern structural geology
- Emerging worldwide exploration/development plays
- Emerging exploration/development technology and future concepts
- Syn-sedimentary tectonics

Also included is a wide range of topics on reservoir characterization and formation evaluation, petroleum systems, basin modeling, geochemistry, diagenesis, sequence stratigraphy/geophysics, and depositional systems.

Poster sessions will add additional breadth and depth to these topics and will include topics

such as 3-D workstation technology, use of geographical information systems, and CD and internet resources for the geoscientist, as well as an update on joint industry/Department of Energy projects and K-12 educational programs.

The Technical Program Committee cordially invites you to contribute to these sessions and become a part of the "FUTURE LEGENDS"!

INFORMATION FOR PRESENTERS

Authors are invited to submit new and original work for either oral or poster sessions outlined in this call for papers. Selection of abstracts will be based on geologic significance, application to the session topics listed, and quality.

Abstracts are due by **September 16, 1996**. Authors will be notified of a acceptance or rejection after October 16, 1996. Speaker and poster kits will be mailed to all presenters in November.

Oral sessions will be 20 minutes per speaker. Speakers are strongly encouraged to pay close attention to the preparation of the slides, as good visuals go a long way to making a quality presentation.

INFORMATION

AAPG Convention Department
P.O. Box 979
Tulsa, OK 74101-0979 USA

or

1444 S. Boulder Ave.
Tulsa, OK 74119-3604 USA

GEODYSSEA

(GEODYnamics of S. and S.E. Asia)

A Joint EC-ASEAN Project to Investigate Plate Motions and Crustal Deformations
from Space Geodetic Measurements for the Assessment of Related Natural Hazards
in South East Asia

First Announcement and Call for Papers for the Concluding International Symposium

to be held in

Penang, Malaysia
14th to 18th April, 1997

under the sponsorship of the

GeoForschungsZentrum Potsdam, Germany
Laboratoire de Géologie de l'École Normale Supérieure, Paris, France

supported by the

Commission of the European Communities, Brussels, Belgium
Association of South East Asian Nations, Jakarta, Indonesia

and hosted by the

Department of Survey and Mapping Malaysia, Kuala Lumpur, Malaysia

GEODYSSEA is the acronym for a multi-disciplinary research activity designed to make a systematic preliminary investigation of currently ongoing geodynamic processes and an assessment of the related hazard risk in the countries of the ASEAN. Space geodesy (GPS) is the primary technique employed in the investigation, but the interpretation of the results has been supported by seismic tomography, remote sensing and field studies of active faults. Work on the Project was initiated in October

1991 at a joint EC-ASEAN Workshop held in Jakarta, Indonesia. The Project involves the cooperation of active participants from 21 different organisations, more than half of which are located in the host countries. The Coordinating Agency for the Project is the **GeoForschungsZentrum Potsdam (GFZ)**. Project activities have been funded jointly by the participating agencies and the **European Commission**. The Project has been funded for the period from March 1994 through February 1997.

At the request of the GFZ, the **Department of Survey and Mapping Malaysia** in Kuala Lumpur has graciously accepted the responsibility for hosting the **Concluding International Symposium** at a venue in the resort city of **Penang**, on the North East coast of Malaysia. The Symposium will be held during the week from **14th to 18th April, 1997**. The programme will address the geodetic, geological and geophysical results produced and the conclusions reached by GEODYSSSEA and offers the opportunity to bring these into the overall context of geoscientific research in the greater region. Approximately half of the time available for papers will be devoted to the presentation of results achieved in the GEODYSSSEA Project. The remaining time will be available for reporting other results and for initiating future cooperative efforts.

Call for Papers ---

Papers are invited from authors reporting on research activities addressing the geodynamics of the Western Pacific, South East Asia and the Austro-Indian plate. Abstracts may be submitted by e-mail, FAX or regular mail, to arrive at the GFZ not later than 15th November, 1996. In order to facilitate the preparation of a book of abstracts, those submitting by FAX or regular mail are requested to follow up their submission with an ASCII copy on diskette. The abstracts should be addressed to:

Dr. Peter Wilson,
GeoForschungZentrum Potsdam,
Telegrafenberg A17,
D-14473 Potsdam,
Germany
Fax: (49)-331-288 1111
e-mail: wilson@gfz-potsdam.de

A limited number of invited papers will be presented. It is anticipated that the finally accepted papers will be reviewed and published in book form.

Registration Fee ---

A registration fee will be charged for attending the meeting. For those registering before 15th October 1996 the registration fee will be US\$100.00. For registrants between the 15th October 1996 and 1st February 1997 the fee will be raised to US\$120.00. Late registrants will be charged a fee of US\$150.00. The registration fee will include morning tea, lunch and afternoon coffee.

Accommodation and Meals ---

Accommodation is available in different categories from approx. RM200.00 per night downwards. Meals will be available in the hotel, if required with evening dinner costing about RM65.00 plus the cost of any alcoholic beverages. The exchanges rate is approx. RM2.55 to US\$1.00.

Tectonic Evolution of Southeast Asia

Edited by R. Hall and D.J. Blundell (Royal Holloway London University, UK)

SE Asia is probably the finest natural geological laboratory in the world yet is still not geologically well known. It is a spectacular region in which the manifestations and processes of plate collision can be observed at present and in which their history is recorded. It is a region that must be understood if we are to understand mountain belts, arc development, marginal basin evolution and, more generally, the behaviour of the lithosphere in collision settings. Furthermore, the region is developing rapidly on the economic front, and a major part of this rapid development is built on natural resources. The geological reasons for the distribution of these resources are therefore of major importance for the inhabitants of the region and for any attempts to discover and exploit them.

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KALENDAR (CALENDAR)

1996

May 6-9

OFFSHORE TECHNOLOGY (Conf.), Houston, by American Association of Petroleum Geologists. (AAPG Convention Dept., Box 979, Tulsa, Okla, 74101. Phone: 918/584-2555)

May 13-16

TIDAL SEDIMENTOLOGY (Int'l Conf.), Savannah, Ga. (V.J. Henry Jr., Coastal Research Laboratory, Georgia Southern University, 10 Ocean Science Circle, Savannah, 31411. Fax: 912/598-2366; E-mail: henry@skio.peachnet.edu)

May 14-18

PALEOGENE OF SOUTH AMERICA (Congress), Santa Rosa, La Pampa, Argentina. (Dr. S. Casadio, Dpto. Ciencias Naturales, Universidad nacional de La Pampa, Uruguay 151, 6300 Santa Rosa, La Pampa, Argentina. Phone: 54 954 33093; Telefax: 54 954 33408; E-mail: rpmelcho@arcriba)

May 19-21

INDUSTRIAL MINERALS (Ann. Forum), Laramie, Wyo., by Wyoming State Geological Survey. (Ray E. Harris, Wyoming State Geological Survey, Box 3008, University Station, Laramie, 82071. Phone: 307/766-2286. Fax: 307/766-2605)

May 19-22

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (Annual Conference), San Diego, California, USA. (AAPG Convention Department, P.O. Box 979, Tulsa, OK 74101, USA. Phone: (918) 584-2555)

May 27-29

GEOLOGICAL ASSOCIATION OF CANADA and MINERALOGICAL ASSOCIATION OF CANADA (Joint Annual Meeting), Winnipeg, Manitoba, Canada. (G.S. Clark, Department of Geological Sciences, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2. Phone: (204) 474-8857; (204) 261-7581)

May 27 - June 2

PEAT (10th International Congress), Bremen, Germany. (Dr. J.D. Becker-Platen, Deutsche Gesellschaft für Moor and Torfkunde e. V., P.O. Box 510153, D-30631 Hannover, Germany. Phone: 511 643 2459; Telefax: 511 643 2304)

June 2-6

4TH CONFERENCE ON PETROLEUM GEOCHEMISTRY AND EXPLORATION IN THE AFRO-ASIAN REGION, Arusha-Tanzania. (The 4th AAPG Conference Secretariat, Tanzania Petroleum Development Corporation, P.O. Box 5233, Dar Es Salaam, Tanzania, East Africa. Phone: 255-51-29661/2 & 36086; Fax: 255-51-29663/20775; Telex: 41219 Oil Exp. Attn: Mr. Y.S. Mwalyego, Ms. F.K. Mpanju, Mr. E.A. Kilembe)

June 3-7

EUROPEAN ASSOCIATION OF EXPLORATION GEOPHYSICISTS and EUROPEAN ASSOCIATION OF PETROLEUM GEOLOGISTS (EAEG 58th Annual Assembly and EAPG 8th Annual Congress), Amsterdam, Netherlands. (EAPG, Attention of Mr. E. van der Gaag, P.O. Box 298, NL-3700 AG, Zeist, Netherlands. Telefax: 31 30 696240)

June 6-8

ASIAN CONFERENCE ON X-RAYS AND RELATED TECHNIQUES IN RESEARCH AND INDUSTRY, Tronoh, Malaysia. (The Secretariat, ACXRI '96, School of Materials and Mineral Resources Engineering, Universiti Sains Malaysia, Perak Branch Campus, 31750 Tronoh, Perak, Malaysia, Attn: Dr. Zainal Arifin Ahmad. Tel: (605) 3676901 ext. 5545/5501; Fax: (605) 3677444; E-mail: mrzainal@kcp.usm.MY)

June 8-9

ECONOMIC GEOLOGY AND TECTONICS OF MALAYSIA AND THE SOUTHEAST ASIAN REGION (Annual Geological Conference '96), Kota Kinabalu, Sabah, Malaysia. (The Organising chairman, Annual Geological Conference 1996, Geological Society of Malaysia, c/o Department of Geology, University of Malaya,

50603 Kuala Lumpur, Malaysia. Phone: (603) 757 7036; Fax: (603) 756 3900)

June 9-12

NORTH AMERICAN PALEONTOLOGICAL CONVENTION (6th). Washington, DC, USA. (NAPC-VI, c/o Department of Paleobiology, Mail Stop 121, National Museum of Natural History, Washington, DC, 20560, USA)

June 10-12

ENVIRONMENTAL GEOTECHNOLOGY (Int'l Symposium), San Diego. (Eleanor Nothelfer, Fritz Engineering Lab., Lehigh University, Bethlehem, Pa. 18015-3176. Phone: 610/758-3549; Fax: 610/758 4522; E-mail: esno@lehigh.edu)

June 15-20

THE CLAY MINERALS SOCIETY (Ann. Mtg.), Gatlinburg, Tenn. (Patricia Jo Ebert, The Clay Minerals Society, Box 4416, Boulder, Colo. 80306. Phone: 303/444-6405; Fax: 303/444-2260)

June 17-21

LANDSLIDES (7th International Symposium), Trondheim, Norway. (Norwegian Geotechnical Society, P.O. Box 40, Taasen N-0801, Oslo, Norway)

June 22-27

CARBONATES AND GLOBAL CHANGE (Mtg.), Wildhaus, Switzerland. (Maria Mutti, Geological Institute, ETH, Sonneggstrasse 5, CH-8092, Zurich. Phone: 41-1 632-3673; Fax: 632-1080; E-mail: maria@erdw.ethz.ch)

June 22-29

INTERNATIONAL PALYNOLOGICAL CONGRESS (9th), Houston, Texas. (Dr. Vaughn M. Bryant, Department of Anthropology, Texas A & M University, College Station, TX 77843, USA. Phone: 409 845 5242; Telefax: 409 845 4070; E-mail: glwrenn@lsuvm.sncc.lsu.edu)

June 24-27

INTERNATIONAL AIRBORNE REMOTE SENSING (Mtg. and Exhibit), San Francisco. (Robert Rogers, ERIM, Box 134001, Ann Arbor, Mich. 48113-4001. Phone: 313/994-1200, ext. 3234; Fax: 313/994-5123. Internet: raeder@erim.org)

June 27-28

MINERALISATION IN THE CALEDONIDES (The Mike Gallagher Memorial Meeting), Royal Museum of Scotland, Edinburgh. (The Conference Office, The Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR. Phone: +44-(0)171-580 3802; Fax: +44-(0)171-436 5388)

June 30 - July 5

INTERNATIONAL ORGANIZATION OF PALEOBOTANY (Conf.), Santa Barbara, Calif. (Bruce H. Tiffney, Dept. of Geological Sciences, University of California, Santa Barbara, 93106. Fax: 805/893-2314; E-mail: tiffney@magic.ucsb.edu)

July 7-13

EXTENT AND FOSSIL CHAROPHYTES, Madison, Wisconsin, USA. (Colloque Charophytes, Laboratoire de Paléobotanique, UM2, 34095 Montpellier Cedex 05, France. Telefax: 33 6704 202; E-mail: mofeist@isem.univ-montp2.fr)

July 8-13

GEODYNAMICS OF LITHOSPHERE AND EARTH'S MANTLE (Workshop), Trest, Czech Republic, by the Geophysical Institute of the Czech Academy of Sciences and the Center for High Pressure Research. (Jaroslava Plomerova, Geophysical Institute, Czech Academy of Sciences, Bocni II, 14131 Praha 4, Czech Republic. Phone: 42-2-67-103-049; Fax: 42-2-76-15-49; E-mail: jpl@ig.cas.cz)

July 15-19

EROSION AND SEDIMENT YIELD: GLOBAL AND REGIONAL PERSPECTIVES (International Symposium), Exeter, UK. (Professor D. Walling, Department of Geography, University of Exeter, Rennes Drive, Exeter EX4 4RJ, UK. Phone: 44 392 263345; Telefax: 44 392 263342)

July 22-28

GEOCHEMISTRY OF THE EARTH'S SURFACE (Int'l Symposium), likely, Yorkshire, England. (GES-IV Conference Secretariat, Dept. of Continuing Professional education, Leeds University, Leeds LS2 9JT, England. Phone: 01132-333-241; Fax: 01132-333-240)

July 29 - August 2

PAN PACIFIC HAZARDS '96 (Int'l Conf.), Vancouver, British Columbia, Canada. (Program Committee, Pan Pacific hazards '96 Conf., The University of British Columbia, Disaster Preparedness Resources Centre, Fourth Floor, 2206 East Mall, Vancouver, V6T 1Z3. Phone: 604/822-5518; Fax: 604/822-6164; E-mail: dprc@unix.ubc.ca)

August 4-9

THE SILURIAN SYSTEM (2nd International Symposium), Rochester, New York, USA. (Markes Johnson, Department of Geology, Williams College, Williamstown, MA 01267, USA. Phone: 413 597 2329; Telefax: 413 597 4116; E-mail: markes.e.johnson@williams.edu)

August 4-14

INTERNATIONAL GEOLOGICAL CONGRESS (30th), Beijing, China. (Prof. Zhao Xun, Deputy Secretary General, 30th IGC, P.O. Box 823, Beijing 100037, P.R. China. Phone: 86 1 8327772; Telefax: 86 1 8328928)

August 7-9

COASTAL ENVIRONMENT '96 (Environmental Problems in Coastal Regions, Conf.), Rio de Janeiro, by Federal University of Rio de Janeiro and Wessex Institute of Technology. (Sue Owen, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton England SO40 7AA. Phone: 44/1703-293223; Fax: 44/1703-292853; E-mail: cmi@ib.rl.ac.uk)

August 10-11

MINERALISATION AND ALKALINE MAGMATISM IN THE DECCAN IGNEOUS PROVINCE AND IN OTHER PARTS OF THE WORLD (Workshop WB03 of 30th IGC), Beijing, China.

August 12-17

INTEGRATED MANAGEMENT AND SUSTAINABLE DEVELOPMENT IN COASTAL ZONES (Coastal Zone Canada '96, International Conference), Rimouski, Quebec, Canada. (Professor M El-Sabh, GREC, Université du Québec, 310 allée des Ursulines, Rimouski, Québec, Canada G5L 3A1. Phone: 418 724 1701; Telefax: 418 724 1842; E-mail: mohammed_el_sabh@uqar.uqubec.ca)

August 13-15

INTERNATIONAL CONFERENCE ON GROUND CONTROL IN MINING, Golden, Colo., by Colorado School of Mines and others. (Colorado School of Mines, Office of Special Programs and Continuing Education, Golden, 80401. Phone: Colo. residents, 303/273-3321; outside of Colo., 800/446-9488, ext. 3321; Fax: 303/273-3314)

August 18-24

CRETACEOUS OF BRAZIL (4th Symposium), Rio Claro, Brazil. (Organizing Committee, CP 178, Departamento de Geologia Sedimentar IGCE-UNESP Campus de Rio Claro, 13506-900 Rio Claro, Brazil. Phone and telefax: (0195) 34 0327; E-mail: dgs@geo001.uesp.ansp.br)

September 2-5

PREDICTION AND PERFORMANCE IN ROCK MECHANICS AND ROCK ENGINEERING (Eurock '96 International Symposium), Tyrin, Italy. (c/o AGI Associazione Geotecnica Italiana, via Baglivi 5, 00198 Rome, Italy. Telefax: 39 6 44249274)

September 2-8

DIATOM RESEARCH (Mtg.), Tokyo, by International Society of Diatom Research. (Hiromu Kobayashi, Tokyo Diatom Institute, Honcho, 3-8-9-813, Koganei-shi, Tokyo 184, Japan. Phone: +81-423-84-7795; Fax: +81-423-84-7495; E-mail: mayama@u-gakugei.ac.jp)

September 3-6

MINERALS, METALS AND THE ENVIRONMENT (2nd International Conference), Prague, Czech Republic. (Conference Officer, Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, UK. Phone: 44 171 580 380-2; Telefax: 44 171 436 5388)

September 4-11

AGE AND ISOTOPES OF SOUTH AMERICAN METALLOGENIC PROVINCES (Final Meeting of IGCP Project 432), Salvador, Bahia, Brazil. (Aroldo Misi, IGEO, Univ. Fed. Da Bahia, Rua Caetano Moura, 123 Federacao, Salvador, Bahia 40210-340 Brazil. Phone: 55 71 2356789; Telefax: 55 71 2473004; E-mail: misi@ufba.br)

September 8-12

CONTAMINATED LAND AND GROUNDWATER, FUTURE DIRECTIONS (32nd Annual Conference of the Engineering Group of the Geological Society), Portsmouth, UK. (D.N. Lerner, Department of Civil and Environmental Engineering, University of Bradford, Bradford BD7 1DP, UK. Phone: 01274 3854; Telefax: 01705 842 244)

September 9-12

MINEXPO INTERNATIONAL '96 (Conf.), Las Vegas, by National Mining Association. (MINExpo, 5420 LBJ Freeway, Suite 410, Dallas, 75240. Phone: 800/693-3216; Fax: 214/702-1042)

September 10-20

KARST WATERS AND ENVIRONMENTAL IMPACTS (Mtg.), Beldibi, Turkey, by the International Association of Hydrological Sciences, and others. (Gultekin Gunay, UKAM, Hacettepe University, 06532 Beytepe, Ankara, Turkey)

September 15-20

DEEP SEISMIC PROFILING OF THE CONTINENTS (Int'l Symposium), Asilomar, Calif., by Stanford University, and U.S. Geological Survey (Simon Klemperer, Dept. of Geophysics, Mitchell Building, Stanford University, Stanford, Calif. 94305-2215. Phone: 415/723-8214; Fax: 415/725-7344; E-mail: klemp@pangea.stanford.edu)

September 16-20

COMPUTER APPLICATIONS IN THE MINERAL INDUSTRIES (26th International Symposium, APCOM '96), Pennsylvania, USA. (K. Henry, Dept. of Mineral Engineering, Pennsylvania State University, 104 Hosler Building, University Park, PA 16802-5000 USA)

September 17-19

ANDEAN GEODYNAMICS (3rd International Symposium, ISAG '96), St. Malo, France. (D. Gapais, Géosciences Rennes, Université de Rennes 1, 35042 Rennes cedex, France. Phone: 33 99 28 67 36; Telefax: 33 99 28 61 00; E-mail: isag96@seth.univ-rennes1.fr)

September 22-24

PETROLEUM GEOLOGY AND HYDROCARBON POTENTIAL OF THE

BLACK SEA AREA (2nd symposium), Sile, Turkey. (S. Derman, TPAO Turkey. Phone: 90 312 286 9040; Telefax: 90 312 286 9049)

September 22-25

EARTH SCIENCE EDITING (30th Annual Meeting of the Association of Earth Science Editors), Sudbury, Ontario, Canada. (c/o MNDM, B4-933 Ramsey Lake Rd., Sudbury, Ontario, Canada P3F 6B5. Phone: (705) 670 5765; Telefax: (705) 670 5770)

September 25-27

CALIBRATION AND RELIABILITY IN GROUNDWATER MODELLING (International Conference, CARE '96), Golden, Colorado, USA. (International Groundwater Modelling Center, Colorado School of Mines, Golden, Colorado 80401, USA. Phone: 303 273 3103; Telefax: 303 273 3278; E-mail: igwme@mines.colorado.edu)

September 25-29

CHARNOKITE AND GRANULITE FACIES ROCKS (International Symposium), Madras, India. (Dr. V. Ram Mohan, Dept. of Geology, University of Madras, AC College Campus, Madras, India PIN 600 025. Phone: 091 44235 1137; Telefax: 091 44 235 2870)

September 29 - October 3

SCIENTIFIC DATA IN THE AGE OF NETWORKING (15th International CODATA Conference), Tsukuba, Japan. (Codata '96, Express Co., Ltd., Daiichi Shibuya Shimizu Building, 1-11-8 Shibuya, Tokyo 150, Japan. Phone: 81 3 54851200; Telefax: 81 3 54851266; E-mail: kayo@express.co.jp)

September 30 - October 3

GROUND PENETRATING RADAR (6th International Conference), Sendai, Japan. (Dr. M. Sato, Dept. of Resources Engineering, Tohoku University, Sendai 980-77, Japan)

October 7-11

ENVIRONMENTAL ISSUES AND WASTE MANAGEMENT IN ENERGY AND MINERAL PRODUCTION (4th International Symposium), Cagliari, Italy. (R. Ciccu, Dipartimento di Geoingegneria et Tecnologie Ambientali, Università degli Studi di Cagliari, Piazza d'Armi, 09 123 Cagliari, Italy. Phone: 39 7022 2317; Fax: 39 7027 2031)

October 9-12

NATURAL HAZARDS AND DISASTERS (2nd Caribbean Conference), Kingston, Jamaica. (Dr. B. Carby, Dept. of Geology, UWI, Mona, Kingston, Jamaica)

October 16-19

MINERAL DEVELOPMENT IN ASIA PACIFIC — CHALLENGES IN THE 21ST CENTURY, Jakarta, Indonesia. (Indonesian Mining Association (IMA), Jl. Prof. Dr. Supomo SH. No. 10, Jakarta 12870, Indonesia. Phone: (62-21) 830 3632, 828 0763; Fax: (62-21) 830 3632, 828 0763).

October 28-31

GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Denver, Colorado, USA. (Jean Kinney, GSA Headquarters, Box 9140, 3300 Penrose Place, Boulder, CO 80301, USA. Phone: 303/447-2020; Fax: 303/447-1133)

November 6-8

THE 18TH NEW ZEALAND GEOTEHRMAL WORKSHOP, Auckland, New Zealand. (Professional Courses, Centre for Continuing Education, The University of Auckland, Private Bag 92019, Auckland, N.Z. Phone: 64-9-373 7599 ext. 7050; Fax: 64-9-373 7419; E-mail: professional.courses@auckland.ac.nz)

November 10-15

A WORKSHOP ON TUFFS — THEIR PROPERTIES, USES, HYDROLOGY, AND RESOURCES, Santa Fe, New Mexico. (Grant Heiken, Earth and Environmental Sciences Division, EES-1, Los Alamos National Laboratory, Los Alamos, New Mexico, 87545 USA. Phone: 505-667-8447; Fax: 505-665-3285; E-mail: heiken@lanl.gov)

November 17-22

HYDROLOGY IN THE HUMID TROPICAL ENVIRONMENT (International Symposium), Kingston, Jamaica. (A.I. Johnson, Water and Soils Consulting, 7474 Upham Court, Arvada, CO 80003, USA. Phone and telefax: 303 425 5610)

1997

ASSOCIATION OF EUROPEAN GEOLOGICAL SOCIETIES (10th Meeting), Karlov Vary, Czechoslovakia. (Geological Society, Burlington House, Piccadilly, London W1V 0JU, UK. Phone: +44 (0) 71 -434 9944)

CANADIAN INSTITUTE OF MINING, METALLURGY AND PETROLEUM (99th annual general meeting), Vancouver, British Columbia, Canada. (John Gaydos, Meetings Manager, Canadian Institute of Mining and Metallurgy, 1 Place Alexis Nihon, 1210-3400 de Maisonneuve Boulevard West, Montreal, Quebec H3Z 3B8, Canada. Phone: (514) 939-2710; Telefax: (514) 939-2714)

January

DROUGHT, GROUNDWATER POLLUTION AND MANAGEMENT (International Workshop), Dindigul, India. (Managing Director, Tamilnadu Water Supply and Drainage Board, TWAD House, Chepauk, Madras 600 005, India)

January 6-8

INTERNATIONAL CONFERENCE ON LAND MANAGEMENT, London, UK. (Dr. Richard K. Bullard, School of Surveying, University of East London, Longbridge Road, Dagenham, Essex, RM8 2AS, UK. Tel: +44 (0181) 590 7722; Fax: +44 (0181) 849 3618; E-mail: Bullard@UEL.AC.UK)

April 6-9

1997 AAPG ANNUAL MEETING — FUTURE LEGENDS (Annual Convention), Dallas, Texas. (AAPG Convention Department, P.O. Box 979, Tulsa, OK 74101-0979 USA or 1444 S. Boulder Ave., Tulsa, OK 74119-3604 USA.)

April 14-18

GEODYSSSEA (GEODYNAMICS OF S. AND S.E. ASIA) (International Symposium), Penang, Malaysia. (Dr. Peter Wilson, GeoForschungZentrum Potsdam, Telegrafenberg A17, D-14473 Potsdam, Germany. Fax: (49)-331-288 1111; E-mail: wilson@gfz-potsdam.de)

May 25-30

GEOCHEMICAL EXPLORATION (18th International Symposium of AEG), Jerusalem, Israel. (IGES Secretariat, P.O. Box 50006, Tel Aviv, 61500 Israel. Telefax: 972 3 5140000; E-mail: iges@mail.igs.gov.il)

June 15-21

CLAY CONFERENCE, Ottawa, Canada. (J.B. Percival, Geological Survey of Canada, 601 Booth St., Ottawa, Ontario, K1A 0E8. Phone: 613/992-4496; Fax: 613/943-1286; E-mail: percival@gsc.emr.ca)

June 23-27

ENGINEERING GEOLOGY AND THE ENVIRONMENT (International Symposium of IAEG), Athens, Greece. (Symposium Secretariat, P.O. Box 19140, GR-117 10 Athens, Greece. Telefax: 301 381 3900; 301 924 2570)

August 28 - September 3

GEOMORPHOLOGY (4th International Conference of International Association of Geomorphologists), Bologna, Italy. (Planning Congressi, srl Via Crociali 2, I-40138 Bologna, Italy)

September 1-5

GEOLOGY AND ENVIRONMENT (50th Geological Congress of Turkey), Istanbul, Turkey. (Secretary GEOENV '97, PK 464, Kizilay, 06424 Ankara, Turkey. Phone: 90 312 4343691; Telefax: 90 312 4342388; E-mail: jdogan@et.cc.hun.edu.tr)

September 2-6

GEOLOGY AND ENVIRONMENT (Int'l. Symposium), Istanbul, Turkey, by the Chamber of Geological Engineers. (I. Yilmazer, GEOENV '97, P.K. 464 Kizilay, 06424 Ankara, Turkey. Phone: 9-0-312-4343601; Fax: 9-0-312-4342388; E-mail: jdogan@et.cc.hun.edu.tr)

September 21-27

GROUNDWATER IN THE URBAN ENVIRONMENT (27th IAH Congress) (Professor J.D. Mather, Geology Dept., Royal Holloway and Bedford New College, Egham, Surrey TW20 0EX, UK. Telefax: 784 471780)

September 30 - October 3

CONCEPTS AND MODELS FOR SUSTAINABLE WATER RESOURCES MANAGEMENT (FRIEND '97 Conference on Regional Hydrology), Postojna, Slovenia. (Dr. M. Brilly, FGG Hydraulics Division, Hajdrihova

28, 6100 Ljubljana, Slovenia. Phone: (386) 61 1254 333; Telefax: (385) 61 219 987; E-mail: mitja.brilly@uni-lj.si)

1998

CANADIAN INSTITUTE OF MINING, METALLURGY AND PETROLEUM (100th annual general meeting), Quebec, Canada. (John Gaydos, Meetings Manager, Canadian Institute of Mining and Metallurgy, 1 Place Alexis Nihon, 1210-3400 de Maisonneuve Boulevard West, Montreal, Quebec H3Z 3B8, Canada. Phone: (514) 939-2710; Telefax: (514) 939-2714)

10TH IAGOD SYMPOSIUM, Australia. (Professor I.R. Plimer University of Melbourne, Parkville, VIC 3052, Australia. Phone: 613 3446520; Telefax: 613 3447761)

June 29 - July 18

8TH INTERNATIONAL PLATINUM SYMPOSIUM (IAGOD/CODMUR), Johannesburg, South Africa. (Dr. C.A. Lee, P.O. Box 68108, Bryanston, South Africa. Phone: 2711 411 2253; Telefax: 2711 692 3693)

August 9-15

INTERNATIONAL MINERALOGICAL ASSOCIATION: IMA '98 (17th General Meeting), Toronto, Canada. (Professor A.J. Naldrett, Department of Geology, University of Toronto, Canada M5S 3B1. Phone: (461) 978 3030; Telefax: (416) 978 3938; E-mail: ima98@quartz.geology.utoronto.ca)

August 17-19

GEOSEA '98 (Ninth Regional Congress on Geology, Mineral and Energy Resources of Southeast Asia), Kuala Lumpur, Malaysia. (The Organising Secretary, GEOSEA '98, Geological Society of Malaysia, c/o Department of Geology, University of Malaya, 50603 Kuala Lumpur, Malaysia. Phone: +(603) 757 7036; Fax: +(603) 759 3900; E-mail: geologi@po.jaring.my)

October/November

PHYSICAL, CHEMICAL AND BIOLOGICAL ASPECTS OF AQUIFER-STREAM SEDIMENT INTERRELATIONS (28th IAH Congress) (Dr. J. Rosenschein, USGS MS 414, National Center, Reston Va 22092, USA; Telefax: 703 648 5722)

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Scripts must be written in Bahasa Malaysia (Malay) or English.

Two copies of the text and illustrations must be submitted. The scripts must be typewritten double-spaced on paper not exceeding 210 x 297 mm (or 8.27 x 11.69 inches, A4 size). One side of the page must only be typed on.

Figure captions must be typed on a separate sheet of paper. The captions must not be drafted on the figures. The figure number should be marked in pencil on the margin or reverse side.

Original maps and illustrations or as glossy prints should ideally be submitted with sufficiently bold and large lettering to permit reduction to 18 x 25 cm: fold-outs and large maps will be considered only under special circumstances.

Photographs should be of good quality, sharp and with contrast. For each photograph, submit two glossy prints, at least 8 x 12.5 cm and preferably larger. Use of metric system of measurements (SI) is strongly urged wherever possible.

An abstract in English which is concise and informative is required for each paper.

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HAMILTON, W., 1979. Tectonics of the Indonesian region. *U.S. Geological Survey Professional Paper 1078*, 345p.

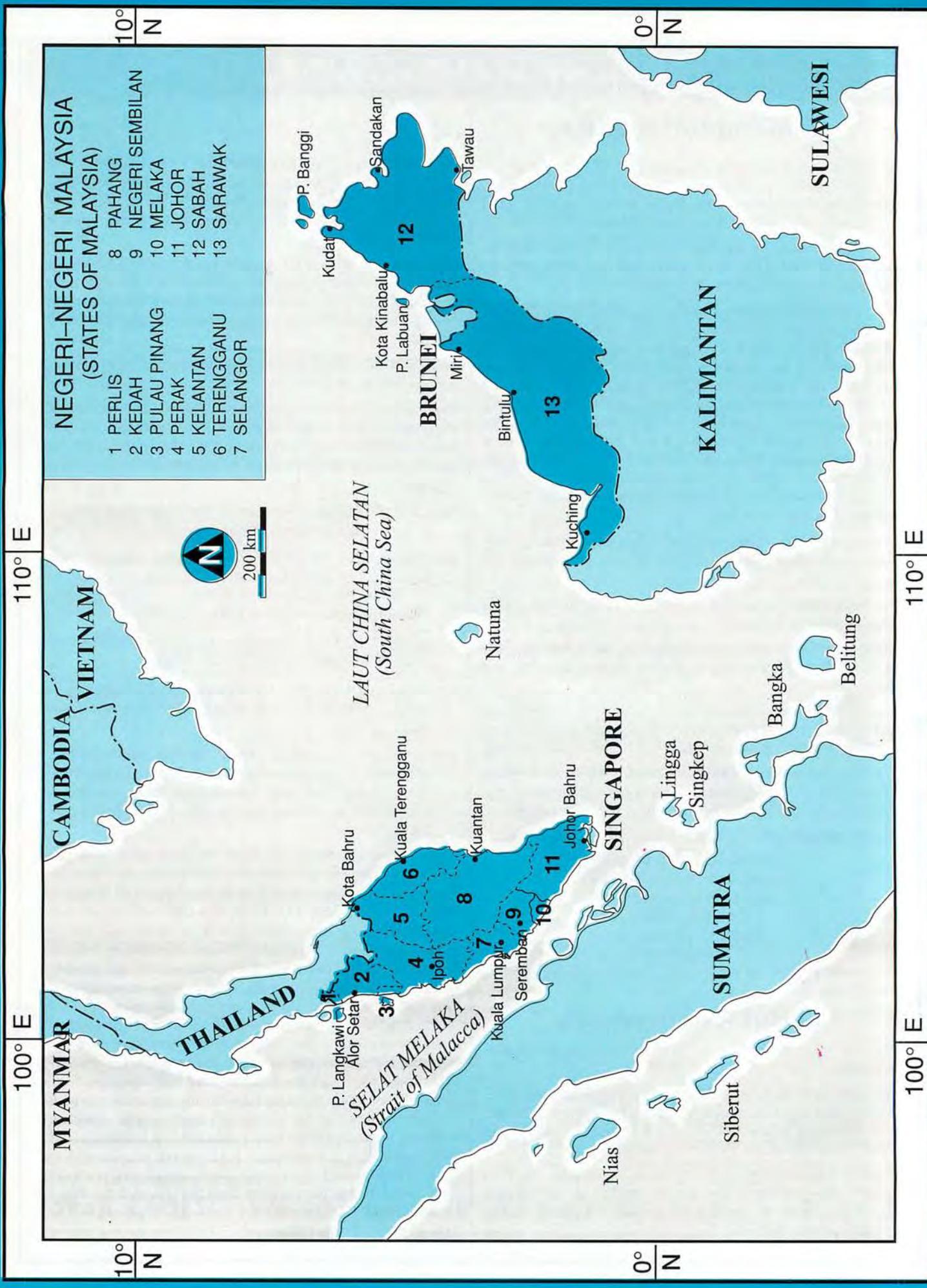
HOSKING, K.F.G., 1973. Primary mineral deposits. In Gobbett, D.J. and Hutchison, C.S. (Eds.), *Geology of the Malay Peninsula (West Malaysia and Singapore)*. Wiley-Interscience. New York, 335-390.

HUTCHISON, C.S., 1989. *Geological Evolution of South-east Asia*. Clarendon Press, Oxford. 368p.

SUNTHARALINGAM, T., 1968. Upper Paleozoic stratigraphy of the area west of Kampar, Perak. *Geol. Soc. Malaysia Bull. 1*, 1-15.

TAYLOR, B., AND HAYES, D.E., 1980. The tectonic evolution of the South China Sea basin. In: D.E. Hayes (Ed.), *The Tectonic and Geologic Evolution of Southeast Asian Sea and Islands, Part 2. Am. Geophy. Union Monograph 23*, 89-104.

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