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

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CATATAN GEOLOGI
Geological Notes

Clay mineralogy and sandstone diagenesis of turbidite deposits from the Crocker Formation, Sabah, East Malaysia

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Abstract: The Crocker Formation in the Tenom-Pangi Area can be classified into three different turbidite facies. X-ray diffraction analysis of the shale beds from the various turbidite facies in the Crocker Formation show that illite, chlorite and kaolinite are the most common clay minerals. There is no relationship between clay type and facies. The sandstones in the thick bedded facies are classified as sublithe arenite and as quartz arenite in the thin bedded facies. These sandstone have undergone a high degree of diagenetic modifications such as compaction, silica overgrowth, precipitation of authigenic chlorite and kaolinite, and carbonate cementation. The diagenetic modifications have reduced the porosity of the sandstones and their potential as hydrocarbon reservoirs.

INTRODUCTION

Shales and sandstones from the various turbidite facies in the Crocker Formation were selected for detailed mineralogical investigation. The sandstone from the various facies were studied to determine the mineralogy and diagenesis to evaluate the reservoir properties of these rocks.

Clay minerals in various shale beds from the Crocker Formation were investigated using X-ray diffraction techniques. Shale samples from the thick bedded sandstone facies, the thin bedded sandstone facies and the mudstone facies were selected for clay analysis.

Clay minerals in sedimentary rocks are widely used as a geothermometer to measure the thermal history of the basins and environment of deposition. With increased activity in hydrocarbon exploration offshore of Sabah, there is great interest in facies analysis, mineralogy and diagenesis of Crocker sediments. Similar studies to the present investigation can be used as a tool to interpret offshore sedimentary sequences for understanding basin history.

GENERAL GEOLOGY AND STRATIGRAPHY

The Crocker Formation belongs to the Rajang Group of rock which were deposited from late Cretaceous to Tertiary in the North West Borneo Geosyncline (Haile, 1961). The Rajang Group extends in an arcuate belt about 200 km wide eastward from central Sarawak into western Sabah. The Crocker Formation in the study area is exposed in the Padas Valley area.

The stratigraphy of the Padas Valley and Labuan area is described by Wilson (1964). The Crocker Formation is underlain by the Sapulut Formation (Paleocene), which consists of conglomerate, sandstone, siltstone and mudstone with small lenses of limestone and overlain by the Meligan Formation (Oligocene-Lower Miocene). The Meligan Formation consists largely of cross bedded sandstone with thick layers of shale and is overlain by the Belait Formation (Upper Miocene to Pliocene) which consists of estuarine and shallow marine deposits of sandstone, shale and coal beds. The Liang Formation (late Pliocene and Pleistocene) overlies unconformably the Belait Formation

and consists mainly of marine sediments and marine and alluvial terraces. The stratigraphy of the Padas Valley area shows an upward progression from deep water turbidite deposits to shallow water deposits.

The Crocker Formation in the Tenom-Pangi area consists of Cenozoic turbidite deposits forming a thick succession of sandstone shale alternations. The deposits can be divided into thick bedded sandstone facies, thin to medium bedded sandstone facies and mudstone/shale facies (Sivalingam, 1984).

MATERIALS SELECTED FOR ANALYSIS

Shale samples from the mudstone/shale facies, and from shale layers interbedded with the thick and thin sandstone facies were collected for clay analysis (Fig. 1). Ten shale samples were analyzed for clay mineralogy; three samples from the mudstone/shale facies (S1a, S1b and S9), six samples from the thin bedded sandstone facies (S2, S4, S11a, S11b, S12 and S15), and one sample from the thick bedded sandstone facies (S8). Five sandstone thin sections were selected for point counting for rock classification purpose, two from the thick bedded sandstone facies and three from the thin bedded sandstone facies.

METHODS OF STUDY

Thin sections of sandstones were examined using a petrographic microscope equipped with a camera. The sandstones were classified using point counting methods according to McBride (1963). The less than 2 micron clay fraction was separated from the shale through simple gravity sedimentation techniques and the powdered sample was suspended in deionized water in a test tube. Clay slides were prepared based on the procedures of Hutchison (1974). Thirty oriented clay mounts were prepared on glass slides and analyzed using a Philips X-ray diffractometer. Each sample was analyzed under three separate conditions. The first slide was untreated and air dried, the second slide was glycolated using ethylene glycol and the third slide was heated to 500°C for an hour in order to decompose any kaolinite present in the clay fraction.

Copper K-alpha radiation with a nickel filter was used. A divergence slit of 1/2 mm, receiving slit of 0.1 mm, anti-scatter slit of 1 mm and a time constant of 2 second with goniometer speed at 1° per minute were selected for the X-ray diffractometer settings. The instrument was operated at a voltage of 40 kilovolts and 20 milli-amperes. All the slides were scanned from 2 to 35 degrees under the same instrument conditions. Clay minerals were identified based on published data and diffractograms (JCPDs Files; Thorez, 1975). Illite/smectite mixed layers and % illite were determined based on Weaver (1955), and Reynolds and Hower (1980).

RESULTS

Thick Bedded Facies

The thick bedded sandstone facies consists largely of sandstone interbedded with siltstone and shale. Sandstone bed thickness generally ranges from 0.3 m to 2 m with amalgamated beds as thick as 15 to 20 m. Shale beds are absent where the sandstone beds are amalgamated. The basal contacts of these beds are abrupt, planar, or irregular. Internally, the sandstone beds are structureless and Bouma sequences (1962) cannot be recognized.

Sandstone Petrology

The thick sandstone beds are coarse to medium grained, poorly sorted, and strongly cemented. The sandstones are composed largely of quartz, feldspars, matrix and rock fragments. Detrital quartz makes up about 60%, feldspars about 5%, rock fragments about 4 to 9%, and matrix about 25%. Under McBrides's scheme of sandstone classification, these rocks are sublitharenites.

Clay Mineralogy

Sample number (S8) from the interbedded shale layer at Diversion Weir was analyzed for clay components. The shale bed was olive green in color. Figure 2 shows the diffractograms of the air dried, glycolated and heated slides. The peaks at 10.16 Å, 5.01 Å and 3.33 Å in the untreated clay slide is identified as illite. Illite shows a broad 10 Å reflection, asymmetrical towards low angle side with prominent higher

order reflections at 5 Å (002) and 3.33 Å (003). The basal reflection appears sharper in the heated clay slide and symmetrical in the glycolated slide, denoting the presence of small numbers of expandable smectite layers interstratified as illite/smectite mixed layers. Minor amounts of kaolinite and chlorite were identified by the 7 Å and 3.35 Å peaks. A low angle peak at 14.10 Å which expanded very slightly upon glycolation may be chlorite/smectite mixed layers.

Thin Bedded Facies

This facies consists mainly of thin sandstones with shale interbeds. The sandstone beds show a range of thickness from 2-5 cm, 10-15 cm and 10-20 cm. The sandstone beds have an erosive base with a variety of sole markings including flutes, load structures, tool marks, and trace fossils. Slumping is also common within this facies. The sandstones beds show internal structures, such as graded bedding, parallel lamination and convolute lamination. The most commonly found Bouma sequence is Ta\c\e.

Sandstone Petrology

The sandstones are fine to medium grained and moderately well sorted. The sandstones are composed largely of quartz, feldspars, matrix and rock fragments. Detrital quartz makes up about 70 to 75%, feldspars about 1%, rock fragments about 1 to 3% and matrix about 24%. Under McBrides's classification, these sandstones are quartz arenites.

Clay Mineralogy

Figure 3 shows the X-ray diffractograms for the clay slides. The clay mineralogy is

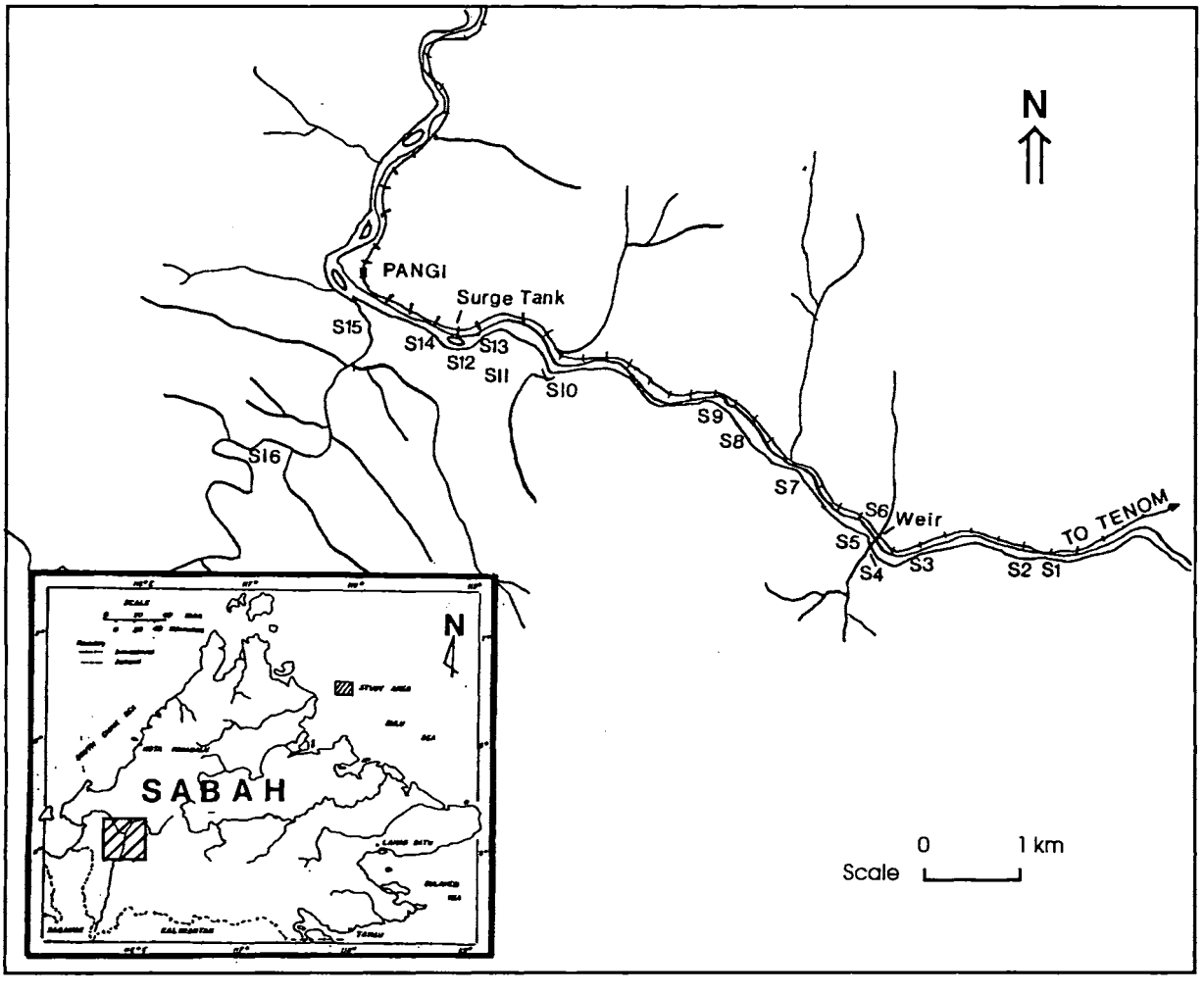

Figure 1: Map of Tenom-Pangi area showing study area with sample locations.

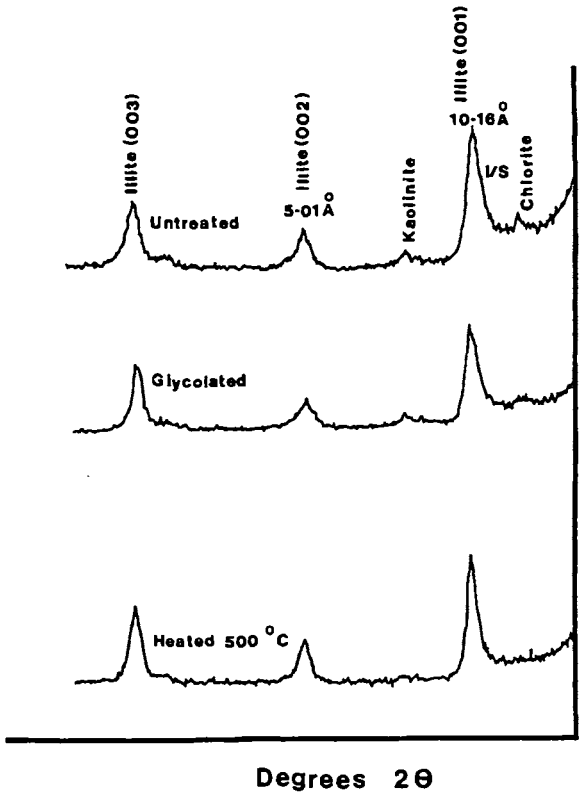

Figure 2: X-ray diffractogram of clay minerals in shale sample S8 from thick bedded facies.

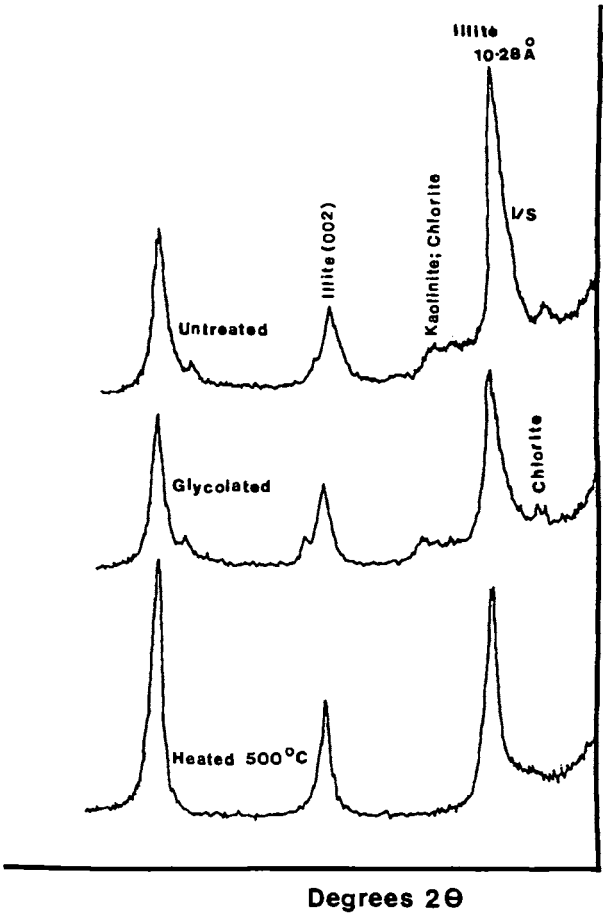

Figure 3: X-ray diffractogram of clay minerals in shale sample S11 from thin bedded facies.

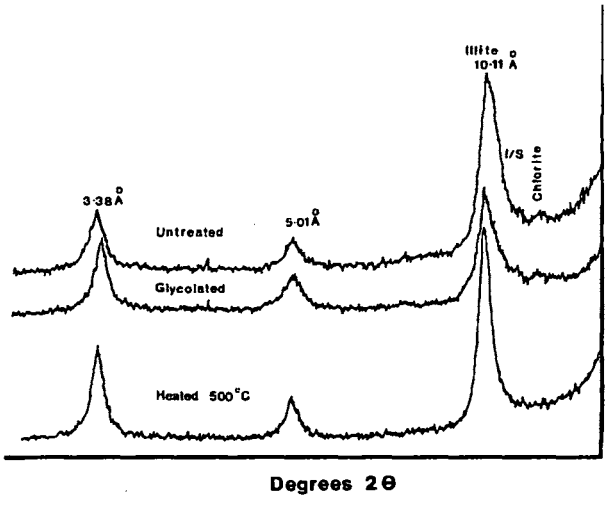

Figure 4: X-ray diffractogram of clay minerals in shale sample S9 from the thin bedded facies.

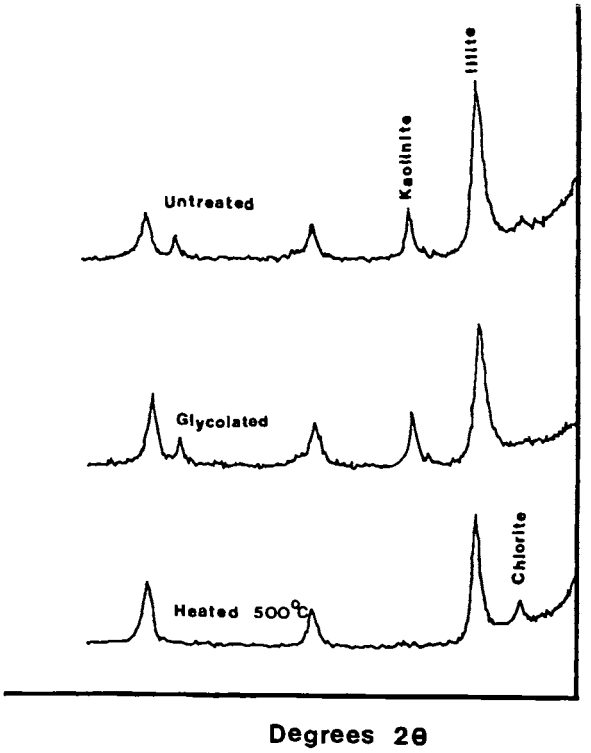

Figure 5: X-ray diffractogram of clay minerals found in sample S1a from the mudstone facies.

similar in composition to the shales from the thick bedded facies. Illite, chlorite, and kaolinite are the common clay minerals in these shales. However, the illite from sample S15 has a larger asymmetrical low angle peak, indicating a higher number of smectite interstratification. In sample S12 illite was the only clay mineral identified in the olive green shale.

Mudstone Facies

This facies consists of massive layers of shale/mudstone with occasional siltstone beds. The color of the shale varies from red to grey to olive green.

Clay Mineralogy

Figure 4 and 5 shows the X-ray diffractograms of the various clay slides from the red mudstone facies (sample 9 and sample 1a). Illite was the most abundant clay type identified in this sample. In samples S1a and S1b illite, kaolinite and chlorite were identified.

Sandstone Mineralogy

The types of quartz grains identified were unstrained single grains with straight extinction, strained single grains showing undulatory extinction and composite or polycrystalline grains, including chert. Strained single grains of quartz were the most common. Acicular inclusions, such as rutile and chlorite were also observed within some quartz grains. Feldspars makes up about 2 to 3% of the total grains. Plagioclase is the most common variety, followed by alkali feldspars. Dissolution, alteration and replacement are commonly observed in feldspars.

Rock fragments are sedimentary, metamorphic and igneous in origin. The metamorphic rock fragments are quartz mica schist. The most common sedimentary rock fragments identified are chert and mudstone. Volcanic rock fragments identified are tuff fragments characterized by disoriented laths of plagioclase and quartz in a matrix of devitrified glass. The matrix component refers to all material finer than 50 microns in size. It includes clays, which may be detrital or diagenetic, silt size mica, quartz, feldspar, and cements.

Sandstone Diagenesis

The common diagenetic modifications observed in sandstones from the Crocker Formation in thin sections are compaction, precipitation of diagenetic clays, silica overgrowth, and carbonate cementation.,

A high degree of compaction has altered the original grain shapes and created different grain contacts and pressure points. Four distinct types of grain contacts are observed; tangential, concavo-convex, long, and sutured contacts (Taylor, 1959). The sutured contacts result from the local dissolution of quartz grains at pressure points and reprecipitated as overgrowth or as cements in tension cracks. The stresses that caused solution at grain contact were the result of deep burial or tectonic deformation during the Miocene uplift. Squeezing and bending of ductile minerals and soft rock fragments between two adjacent hard grains has caused the fragments to bend and fill up the pore spaces. Quartz overgrowth on sand grains are separated by a layer of ferri-argillans on the parent grain (Fig. 6). Chlorite and kaolinite are the most abundant diagenetic clay minerals identified within the intergranular pore spaces in the sandstones.

The last stage of diagenesis observed in the sandstones is carbonate cementation. Calcite and rhombohedral dolomite are commonly observed as pore filling, replacement of feldspars, and as vein fillings (Fig. 7).

DISCUSSION

Illite, chlorite and kaolinite are the most common clay minerals identified in the shales, using X-ray diffraction techniques. The illite is interpreted as originating from disordered or degraded mica because of its rather broad 10 Å (001) reflection, often asymmetrical towards the low angle side. In sample S15 in which the asymmetry is largest towards the low angle side, illite is interpreted as R3 type, interstratified illite/smectite clays with about 10% smectite layers (Weaver, 1955; Reynolds and Hower, 1980).

The illite/smectite mixed layers were not formed by burial diagenesis as in the Tertiary

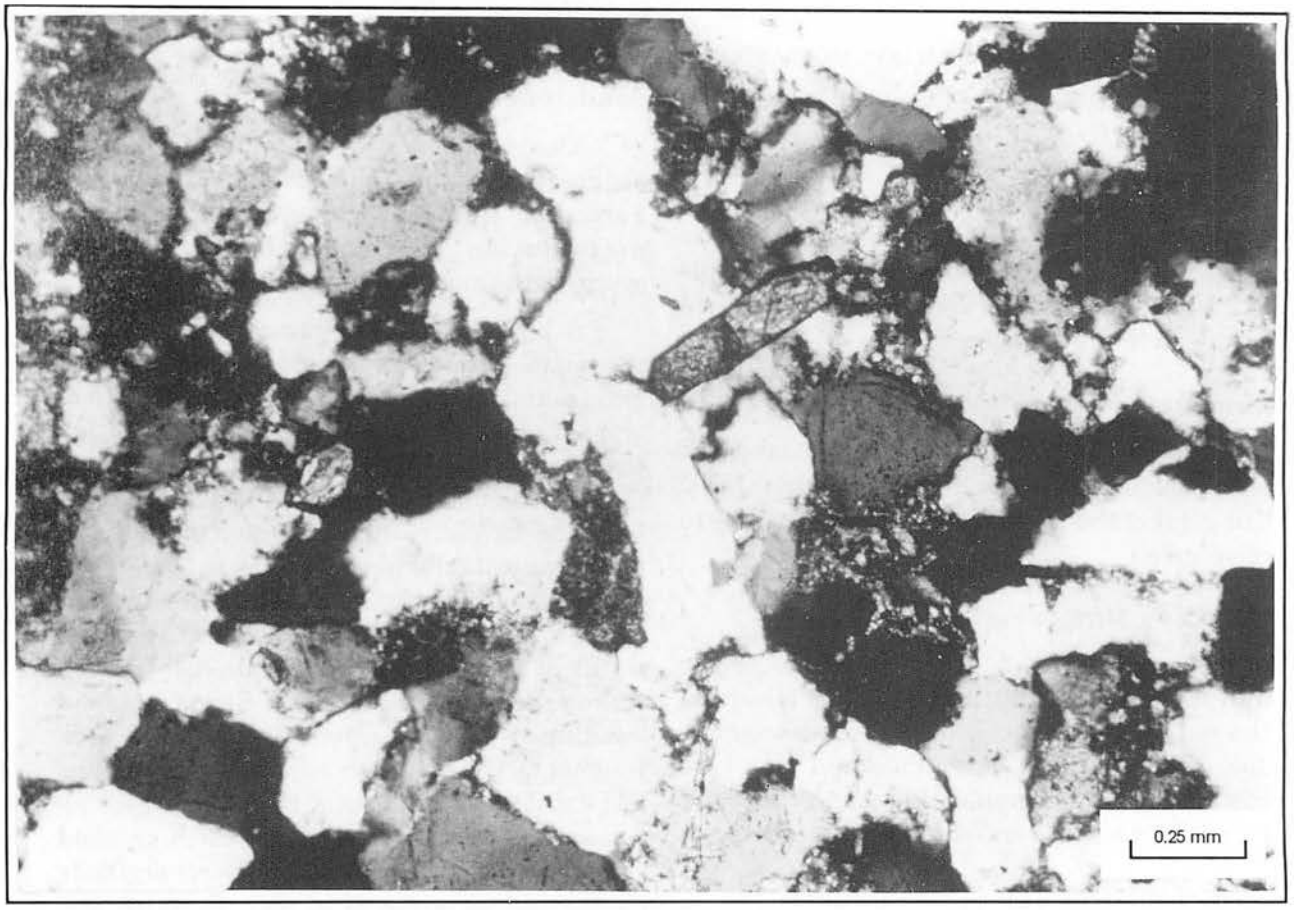

Figure 6: Micrograph to show ferri-argillans and quartz overgrowth, note the lack of intergranular pore spaces.

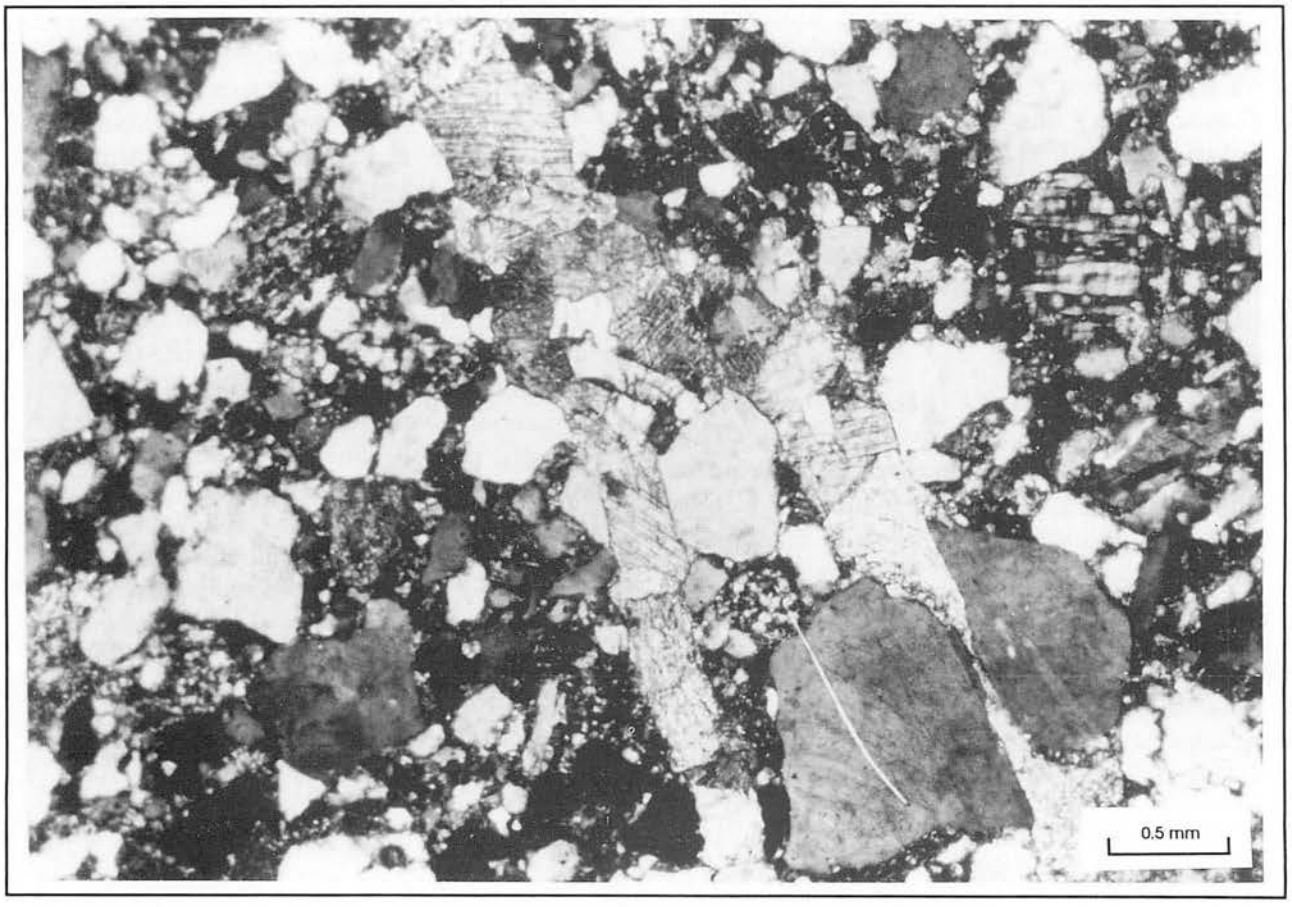

Figure 7: Micrograph to show late stage calcite and dolomite cementation in thin bedded sandstone facies.

deposits in the Gulf Coast region where smectite transformed into illite/smectite mixed layers due to burial diagenesis. These clays in the Crocker Formation were deposited as detrital illite or degraded mica derived from older rocks.

Kaolinite and chlorite are more difficult to distinguish. The presence of a shoulder at the 7 Å peak and the doublets at the 3.5 Å peak indicate the presence of kaolinite and chlorite mixtures. In the heated slides the 14 Å peak showed an increase in intensity, which indicates the presence of chlorite. There was no distribution trend of these clay minerals in the various turbidite facies. The sandstones are immature, both texturally and mineralogically. Textural immaturity is based on the angular shape of the grains and poor sorting. Mineralogical immaturity is based on the presence of feldspars, rock fragments, and high percentage of matrix.

Turbidite sandstone beds which have undergone little diagenetic modification are important petroleum reservoir rocks (Normark, 1978; Walker, 1978; Casnedi, R., 1983; Shanmugam and Moiola, 1991). However, the sandstone beds in this area have undergone a high degree of diagenetic modification. High stresses due to compaction and regional tectonic deformation have caused pressure solutions and sutured grain contacts, and even tension cracks in quartz grains. Silica overgrowth, authigenic precipitation of kaolinite and chlorite, and carbonate cementation have reduced the primary intergranular porosity, and the secondary and tertiary porosity within the sandstones. Turbidite deposits offshore Sabah would have little hydrocarbon reservoir potential if those rocks have undergone similar trends in burial diagenesis.

SUMMARY AND CONCLUSIONS

Illite, kaolinite and chlorite are the most common clay minerals identified in the shales from the Crocker Formation in the Tenom-Pangi area. The distribution of clays is not specific to facies and, therefore, to the environment of deposition.

The sandstones are classified as sublitharenite in the thick bedded facies and as quartz arenites in the thin bedded facies. The sandstones are immature both texturally and mineralogically. Diagenetic modification such as compaction and precipitation of clays, quartz, and carbonate minerals within the sandstones have greatly reduced the porosity and reservoir potentials.

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CATATAN GEOLOGI
Geological Notes

Uniaxial compressive strengths of Tertiary sedimentary rocks from the Batu Arang area, Selangor Darul Ehsan

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Abstract: In the Batu Arang area are found Tertiary sedimentary rocks consisting of silty to sandy shales with thin, structureless clay layers, fine to coarse grained sandstones and a number of lignite seams. Laboratory compression tests on air dried blocks of the silty to sandy shales show them to be weak rock materials with mean uniaxial compressive strengths of 15.671 MPa, and 9.999 MPa, perpendicular, and parallel, to bedding, respectively. Similar tests, perpendicular to bedding, on air dried blocks of lignite from the Upper Seam show it to be a very weak rock material with a mean uniaxial compressive strength of 3.098 MPa. It is concluded that the Tertiary sedimentary rocks have been subject to low overburden pressures and will need external support in order to maintain strata stability in underground openings.

INTRODUCTION

The uniaxial compressive strength is the most commonly determined strength property of rock material and is determined by loading a cylindrical or prismatic specimen to failure in a compression machine. The uniaxial compressive strength (Co) is then given by Co = Fc/A, where Fc is the applied compressive load at failure and A is the cross-sectional area of the specimen. Although the concept of the test is deceptively simple, there are several factors that significantly affect the test results, including the flatness of the bearing surfaces, the specimen shape and size, the rate of loading, the moisture content of the specimen and the alignment of the swivel head (Obert and Duvall, 1967). The effects of these factors cannot be eliminated, though they can be minimized through adoption of standard testing procedures as described in Lama and Vutukuri (1978) or ISRM (1981a).

Apart from the test procedures and conditions, inherent features of test specimens can also significantly influence determination of the uniaxial compressive strength. These inherent features mainly involve the homogeneity, isotropy and continuity of the rock material of the test specimens. Homogeneity is a measure of the physical continuity of a material, whilst isotropy is a measure of its directional properties and continuity can be considered to refer to its content of fracture and pore space (Farmer, 1968).

In this paper are presented results of uniaxial compression tests that have been carried out on Tertiary sedimentary rocks outcropping in the Batu Arang area of Negeri Selangor Darul Ehsan. Although a variety of rock materials is present, the tests were only carried out on samples of silty to sandy shales, and lignite, as the other materials could not be sampled due to their friability and non-consolidation.

STUDY AREA — GENERAL GEOLOGY

The Tertiary sediments at Batu Arang (Fig. 1) form a roughly triangular basin, encompassing an area of about 15 km^2 and lie

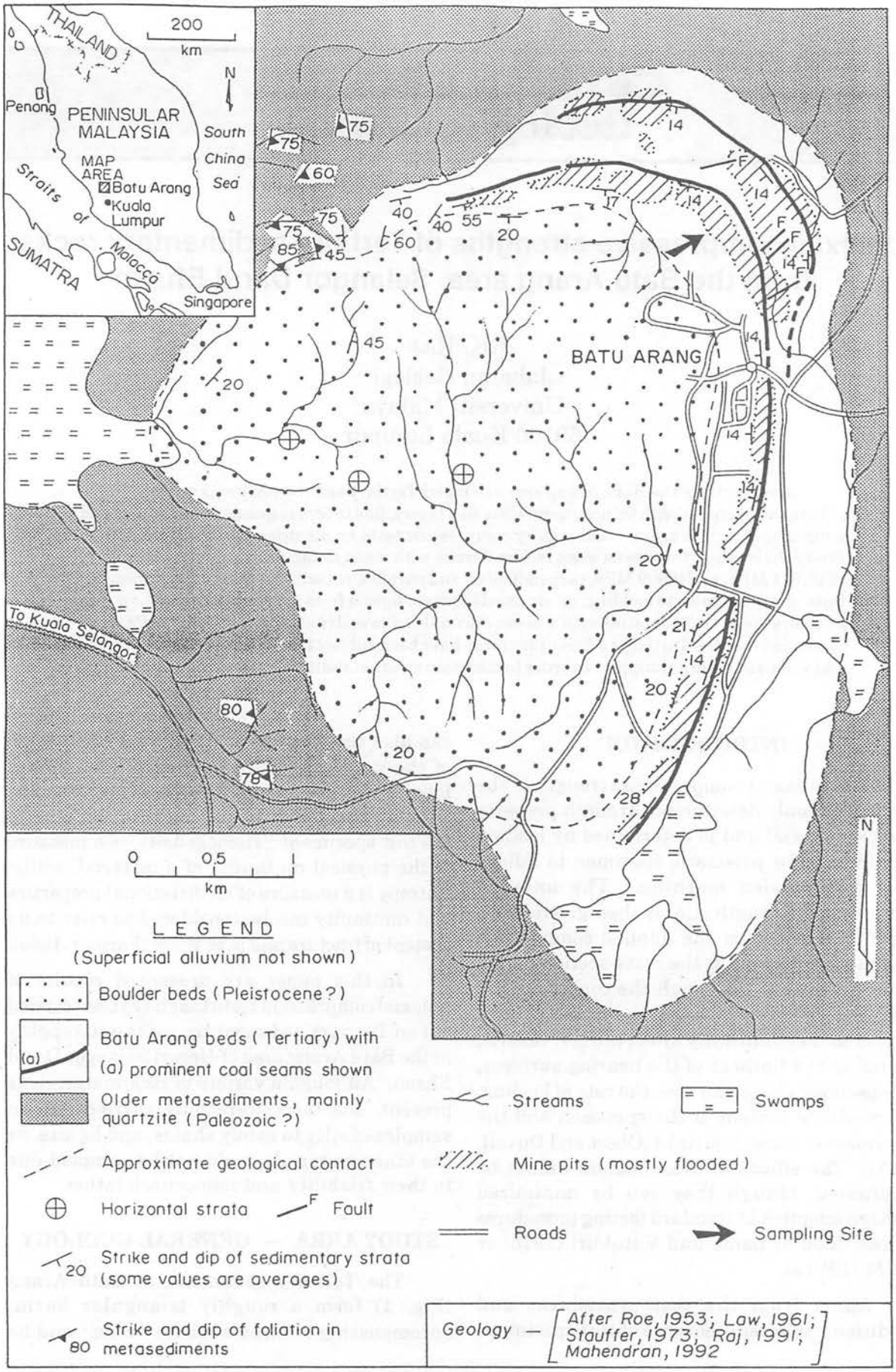


Figure 1: Geological sketch map of the Batu Arang area.

with marked unconformity on much older and steeply dipping meta-sediments, mainly quartzites (Renwick and Rishworth, 1966). They are also unconformably overlain by a thick sequence of semi-consolidated, sandy to gravelly and bouldery sediments of a probable Pleistocene age. The Tertiary sediments proper, called the Batu Arang Beds (Stauffer, 1973) or the Coal Measures (Roe, 1951), have a maximum recorded thickness of 265 m in the centre of the basin, but where the beds outcrop along the eastern and northern sides, the sequence is some 183 to 244 m thick. These sediments consist mainly of silty to sandy shales that are commonly carbonaceous, structureless clay layers and fine grained sandstones as well as thin beds and lenses of coarser grained sandstones and some lignite seams.

The fine grained sediments range from stiff, structureless clays to well laminated and fissile shales, with abundant carbonaceous matter, both in finely disseminated form and as discrete plant fragments. The shales are also often silty and even sandy and grade into clayey sandstone in places. The interbedded sandstones are mostly fine grained, though ranging up to coarse grained, and even pebbly with colours of white to various shades of brown depending upon the amount of carbonaceous matter. Small-scale cross-bedding is very common, while pebbly beds sometimes contain rounded clay pebbles.

The coal occurs mostly as thin laminae or streaks in dark shales, but also builds thicker layers of more than 30 cm thick. In the eastern part of the basin, two thick coal seams are found as well as some thin beds of coal and coaly shale. The two seams are some 65 m stratigraphically apart; the Upper Seam attaining a thickness of up to 15 m, and the Lower Seam averaging 8 m in thickness. The coal, which appears to be intermediate between high-grade lignite and sub-bituminous coal, is a hard, black rock with a reisinous lustre.

Fossil leaves and other plant fragments within the coal-bearing sediments indicate a possibly Late Tertiary or younger, age, (Roe, 1951), whilst palynomorph assemblages indicate that the coals are of a probable Oligocene to Eocene age and deposited in a lacustrine environment under somewhat seasonal climatic conditions (Ahmad, 1993).

The Tertiary sediments show a synclinal structure that plunges southeastwards, though this is considered to reflect the basin of deposition, rather than tectonic activity. Two to three sets of joints are found in the silty to sandy shales; the two more prominent sets showing steep dip angles and striking perpendicular to bedding with variable spacings. Joints (cleats) are also present in the coal seams, though their orientations are more variable and their spacings closer.

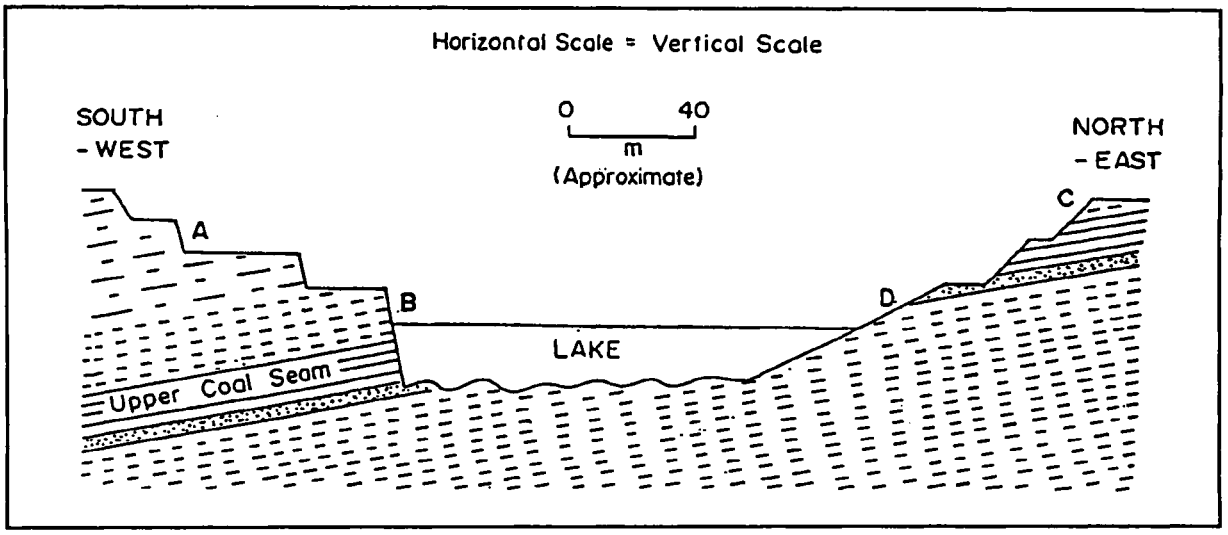
METHOD OF STUDY

In connection with a study on the subsidence problems resulting from the former coal mining operations (Raj, 1991), laboratory tests were carried out to determine the uniaxial compressive strengths of outcropping strata. Sampling points were, however, restricted to accessible sites within an open-cast shale pit, where excavation was actively being carried out. Blocks of exposed bedrock materials were thus only collected from a limited number of sites (Fig. 2).

These large blocks were brought to the laboratory where they were air dried for some three weeks, before being hand-sawn into smaller blocks of approximately square cross-sections, and height to width ratios of between 2 and 2.5. The sizes of these small blocks were somewhat restricted as problems of splitting along bedding planes were frequently encountered. These blocks were then tested (ISRM, 1981a) with a Wykeham Farrance 50 kN Tritech Load Frame at a constant strain rate of 0.5 mm/min. Densities and porosities of the sampled rock materials were also determined following the suggested saturation and buoyancy technique of ISRM (1979) (for the silty to sandy shales), and the method of 'hydrostatic weighing with preliminary paraffinization' of Belikov *et al.* (1967) (for the lignites) (Table 1).

RESULTS AND DISCUSSION

Results of compression tests on the air-dried, silty to sandy shales (Tables 2 & 3)



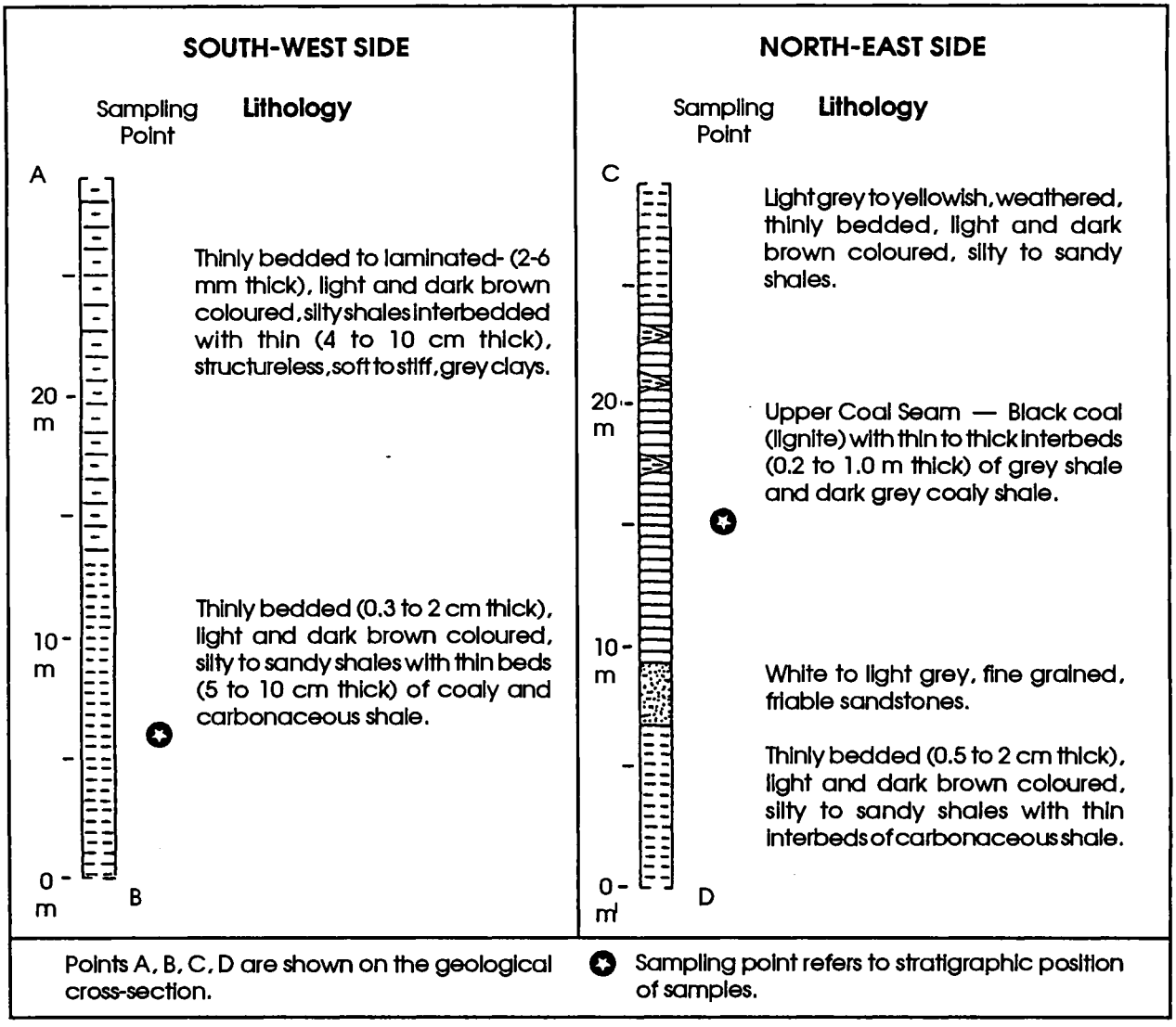


Figure 2: Geological cross-section and stratigraphic position of sampling points.

Table 1: Physical properties of Tertiary sedimentary rocks from Batu Arang.

SAMPLE NUMBER	DRY DENSITY kg/cu.m.	SATURATED DENSITY kg/cu.m.	POROSITY %	ROCK TYPE
A–1	1,503	1,868	34.6	Silty to
A–2	1,459	1,802	36.6	Sandy Shales
A–3	1,474	1,819	35.9	
A–4	1,581	1,918	31.3	
A–5	1,582	1,909	31.2	
A–6	1,550	1,876	32.6	
C–1	1,289			Upper Coal
C–2	1,289			Seam Lignite
C–3	1,288			
C–4	1,281			

Table 2: Results of uniaxial compression tests on silty to sandy shales (Tested perpendicular to bedding).

SAMPLE NUMBER	HEIGHT mm	CROSS-SECTIONAL AREA sq. mm	UNIAXIAL COMPRESSIVE STRENGTH MPa	TYPE OF FAILURE (After Hawkes & Mellor, 1970)
B–1	53.0	791.0	15.273	Shear
B–2	40.0	530.0	15.363	Shear
B–3	45.0	569.0	16.288	Shear
B–4	45.0	604.0	15.016	Shear
B–5	40.0	480.0	16.413	Shear
MEAN			15.671	

Table 3: Results of uniaxial compression tests on silty to sandy shales (Tested parallel to bedding).

SAMPLE NUMBER	HEIGHT mm	CROSS-SECTIONAL AREA sq. mm	UNIAXIAL COMPRESSIVE STRENGTH MPa	TYPE OF FAILURE (After Hawkes & Mellor, 1970)
D–1	44.0	627.0	10.027	Slabbing
D–2	39.0	528.0	9.706	Slabbing
D–3	41.0	418.0	11.083	Slabbing
D–4	42.0	411	10.465	Slabbing
D–5	40.0	465.0	9.254	Slabbing
D–6	41.0	504.0	9.456	Slabbing
MEAN			9.999	

Table 4: Results of uniaxial compression tests on upper coal seam samples (Tested perpendicular to bedding).

SAMPLE NUMBER	HEIGHT mm	CROSS-SECTIONAL AREA sq. mm	UNIAXIAL COMPRESSIVE STRENGTH MPa	TYPE OF FAILURE (After Hawkes & Mellor, 1970)
E–1	68.0	2040.0	3.002	Cataclasis
E–2	64.0	2297.0	3.170	Cataclasis
E–3	45.0	2077.0	3.060	Cataclasis
E–4	64.0	2297.0	3.161	Cataclasis
MEAN			3.098	

clearly show the influence of bedding anisotropy, with blocks tested perpendicular, and parallel, to bedding yielding mean uniaxial compressive strengths of 15.671 MPa, and 9.999 MPa, respectively. In terms of standard strength classifications, as the ISRM Scheme (1981b), these silty to sandy shales would be classified as WEAK rock materials. The results are comparable with published data on similar materials, as Onodera and Duangdeun (1981) who quote mean uniaxial compressive strengths of 10.8 MPa (perpendicular to bedding) and 10.9 MPa (parallel to bedding) for oven-dried Late Tertiary mudstones from north Thailand, and Zhao and Li (1991) who quote uniaxial compressive strengths of 18.168 MPa (perpendicular to bedding) and 12.576 MPa (parallel to bedding) for fresh sandy mudstones (with a moisture content of 5.46%) from the Caoyulin area of China. Upper Cretaceous mudstones and siltstones in the Canadian Plains Region show compressive strengths ranging from 0.79 to 20.98 MPa (Jeremic, 1981).

The blocks of silty to sandy shales tested perpendicular to bedding furthermore, failed by shearing with one or more diagonal shear planes, whilst the blocks tested parallel to bedding failed by slabbing or vertical splitting (Hawkes and Mellor, 1970). This variation of behaviour in compression, as well as the influence of bedding anisotropy on strength is to be expected and has been reported by other writers, including Jeremic (1981), Onodera and Duangdeun (1981), and Zhao and Li (1991).

Results of compression tests on the air-dried blocks of the Upper Coal Seam (Table 4) show that the lignite, with a mean uniaxial strength of 3.098 MPa, perpendicular to bedding, would be classified as a VERY WEAK rock material in terms of any rock strength classification as the ISRM Scheme (1981b). There is, however, little published data with which to compare these results, except for some low grade coals from Belgium which show uniaxial compressive strengths of 2.50 to 6.00 MPa, and brown coals from Bulgaria which show a mean uniaxial compressive strength of 6.65 MPa (Lama and Vutukuri, 1978). The lignite blocks furthermore, crumbled into several small pieces during the compression tests (cataclasis — Hawkes and Mellor, 1970).

It is important to note that the uniaxial compressive strengths just described have been determined on air-dried blocks; the silty to sandy shales having a moisture content of 0.8%, and the lignite a moisture content of 12.0%. These values can be considered to represent the maximum compressive strengths of these materials, for sedimentary rocks show a gradual deterioration of strength with increasing moisture content (Lama and Vutukuri, 1978; Jeremic, 1981; Zhao and Li, 1991). Such a deterioration of strength with increasing moisture content is in fact shown by Point Load Tests on the Tertiary rocks of the Batu Arang area (Raj, in prep.). The low strengths of the silty to sandy shales, which overlie the Upper Coal Seam also indicates that they do not have the ability to be reinforced by internal support (as rock bolts) and would require external support (such as steel ribs or wooden supports) in any underground opening (Jeremic, 1981). These low strengths, as well as the very low strength of the Upper Coal Seam, can therefore be considered to be one of the contributing factors to the present-day problems of subsidence in the Batu Arang area.

Published work on the weak (mainly sedimentary) rocks of other areas of the world furthermore, shows that there is a relationship between diagenetic effects and rock strength; strengths increasing with increased depths of burial (Jeremic, 1981; Hoshino, 1981). The low strengths of the sampled Tertiary rocks of the Batu Arang area thus indicates that they have only experienced limited diagenetic effects due to low overburden loads which mainly caused compaction, decreases in pore space and lower moisture contents. Comparision of the present compression tests with published data also suggests that the tested blocks have been collected from strata that has not been buried much deeper than 200 m (Jeremic, 1981). This is not unlikely in view of the fact that the sampling points are located on the eastern side of the basin in which the Tertiary sediments accumulated.

CONCLUSIONS

Arising from the above discussion, it is concluded that the Tertiary silty to sandy shales are weak rock materials with mean uniaxial compressive strengths of 15.671 MPa, and 9.999 MPa, perpendicular, and parallel, to bedding, respectively, whilst the lignite of the Upper Coal Seam is a very weak rock material with a mean uniaxial compressive strength of 3.098 MPa perpendicular to bedding. In view of the low strengths, it is further concluded that external support will be needed for any underground openings made in the Tertiary strata. It is finally concluded that the strata at the sampling points have only experienced shallow depths of burial (not exceeding 200 m).

ACKNOWLEDGMENTS

This study forms part of an on-going research project supported by IRPA Grant 04-07-04-172 from the Malaysian Government. Equipment used for the tests was purchased with a grant provided by Projek Lebuhraya Utara-Selatan Sdn. Bhd. (PLUS). Mr. Roshdy drafted the figures.

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Manuscript received 24 January, 1994

PERTEMUAN PERSATUAN
Meetings of the Society

Ceramah Teknik (Technical Talk)

Recent advances in tectono-sedimentary models and paleogeography of Gondwana Basins of peninsular India

R.C. TEWARI

Laporan (Report)

Dr. R.C. Tewari, Senior Lecturer, Department of Geology, D.S. College, Aligarh, 202001, U.P., India, has worked on the Gondwana Basins of India for the last 18 years. He gave the above talk on Wednesday 2 March 1994 at the Department of Geology, University of Malaya, to an audience of 14.

Abstrak (Abstract)

The late Paleozoic-Mesozoic intracratonic Gondwana Basins of India represent about 5,500 m thick sediments lying unconformably upon Upper Archean/Middle Proterozoic basement. These sediments are largely clastic assemblages characterised by the glacial and glacigene rocks at the base followed by a coal-bearing sequence and finally by red beds. Besides minor marine invasion in the early Permian, there is no direct evidence of marine influence throughout the Gondwana sedimentation.

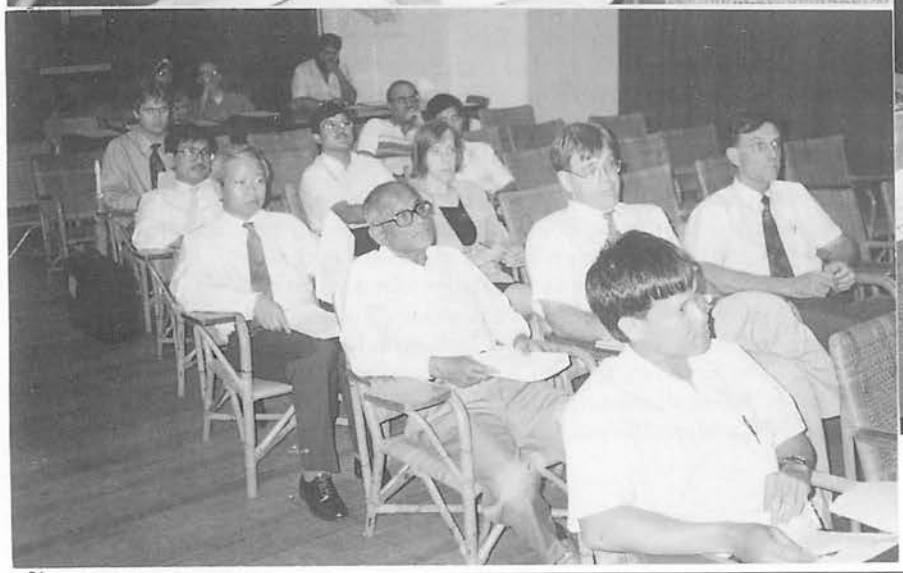
Integrated analysis based on geological and tectonic setting, lithofacies characters and dispersal and paleoflow attributes in different sedimentary formations through space and time suggest that Gondwana sedimentation commenced in reactivated Proterozoic lineaments and rifts in the Early Permian. Initially narrow linear Gondwana basins were filled by Upper Carboniferous glacigene Talchir and Early Permian braided alluvium of the Karharbari-Barakar Formations, and expanded areally as sedimentation progressed through Middle-Upper Permian Barren Measures and Raniganj Formations and Early Triassic Panchet Formation without any marked break in sedimentation. A minor tectonic uplift is, however, observed close to the Permian-Triassic boundary in the Satpura basin of central India. The Middle Triassic Epoch witnessed non-deposition in the Koel-Damodar, Satpura and Son-Mahanadi Basins of eastern and central India, whereas the sedimentation went on uninterruptedly in the Pranhita-Godavari Basin of south-central India. The reappearance of graben facies in the Upper Triassic Mahadeva and Early Jurassic Kota Formations suggest rejuvenation of braided stream deposition style, which in turn implies riftogenesis.

The Gondwana sedimentation in peninsular India took place in the northwesterly sloping paleo-valleys of Koel-Damodar, including Rajmahal, Son-Mahanadi and Pranhita-Godavari and Satpura Basins, which were drained by respective river systems from southeast to northwest. The paleogeography established at the onset of Gondwana sedimentation in Upper Carboniferous remained practically unchanged throughout Permian, Triassic and Early Jurassic times. In the Late Jurassic/Early Cretaceous the Indian subcontinent fragmented from eastern Gondwanaland. The Permian-Triassic Basins were overlain by small isolated intracratonic and pericratonic basins characterised by alluvial fan facies and a reversal in paleoslope towards the southeast and southwest.

G.H. Teh

R.C. TEWARI

Discussion after the talk.



ROBERT J. WEIMER

Sequence stratigraphy — Historical perspective of concepts, problems and challenges in exploration

ROBERT J. WEIMER

Laporan (Report)

Dr. Robert J. Weimer gave the above talk at the Geology Department, University of Malaya on the 13th April 1994 at 5.00 pm. Dr. Weimer is Professor Emeritus — Colorado School of Mines, Consultant at Golden, Colorado and AAPG Foundation's Roy M. Huffington Distinguished Lecturer.

Abstrak (Abstract)

Sequence stratigraphy was originally defined by Sloss as the study of genetically related strata that are bounded by unconformities. A sequence was regarded as a lithostratigraphic unit. The definition has since been expanded to include strata "bounded by unconformities or their correlative conformities" (Mitchum *et al.*), and a sequence is now a chronostratigraphic unit.

Using this broadened definition, a new hierarchy of chronostratigraphic terms has been introduced to subdivide depositional sequences (i.e., the Exxon model). Contrary to this proposed usage, I believe that the new terms are still lithostratigraphic in content. I regard them as unnecessary because they largely duplicate current terminology that has been in part formalized by the stratigraphic code of the North American and International Commissions of stratigraphic nomenclature. These codes have the flexibility both for use by all workers using stratigraphic terms and for change as needed. Moreover, the nomenclature allows for separation of objective observational data from interpretations, a goal essential to all scientific studies but not achieved by the Exxon model.

When viewed within the historic framework of stratigraphic analyses, sequence stratigraphy in a strict sense is a specialized study of lithostratigraphy that emphasizes unconformities or key surfaces, condensed sections and related facies associations. In a broad sense, sequence stratigraphy is the same as stratigraphy but with more emphasis on explaining sedimentary cycles caused by relative sea level changes, syndepositional tectonics, or autocyclic depositional processes. However, without recognition of unconformities, a sequence stratigraphic study would not differ from a traditional stratigraphic analysts in describing and interpreting sedimentary cycles on all scales.

In some basins, e.g., Mesozoic and Cenozoic continental margin basins, subsurface stratal patterns derived from multifold seismic profiles are also used in establishing sequences. However, such expensive seismic data are not always available to stratigraphers for analysis and interpretation. Furthermore, cratonic basins and some foreland basins seldom exhibit stratal patterns on seismic sections to identify sequences. For these reasons, stratigraphic terminology derived from seismic data should not be established to guide other types of stratigraphic analysis.

In petroleum exploration within shelf areas of foreland and continental margin basins and cratonic basins, two types of unconformities are particularly important. Both relate to sea level changes. The first type, a subaerially exposed lowstand surface of erosion (LSE, or sequence boundary), is caused by relative sea level lowering. The boundary is recognized by incised paleovalleys, paleosls and missing facies. The second type is a transgressive surface of erosion (TSE, sometimes called a ravinement surface), and occurs where shoreface erosion moves over coastal plain deposits during a relative sea level rise.

Examples of subtle stratigraphic traps for petroleum in siliciclastic rocks associated with unconformities are discussed for foreland and cratonic basins of the Western Interior, USA and Mid-Continent region. Also reviewed are the problems of applying the new sequence stratigraphic terminology in relation to established terminology.

G.H. Teh

Structural history as a clue to crustal evolution

K. NAHA

Laporan (Report)

Professor K. Naha gave the above talk on the 26th April 1994 at the Geology Department, University of Malaya. Prof. Naha who is Emeritus Professor at the Indian Institute of Technology at Kharagpur India, as well as a CSIR Emeritus Scientist, is presently in Malaysia as External Examiner for Geology, University of Malaya.

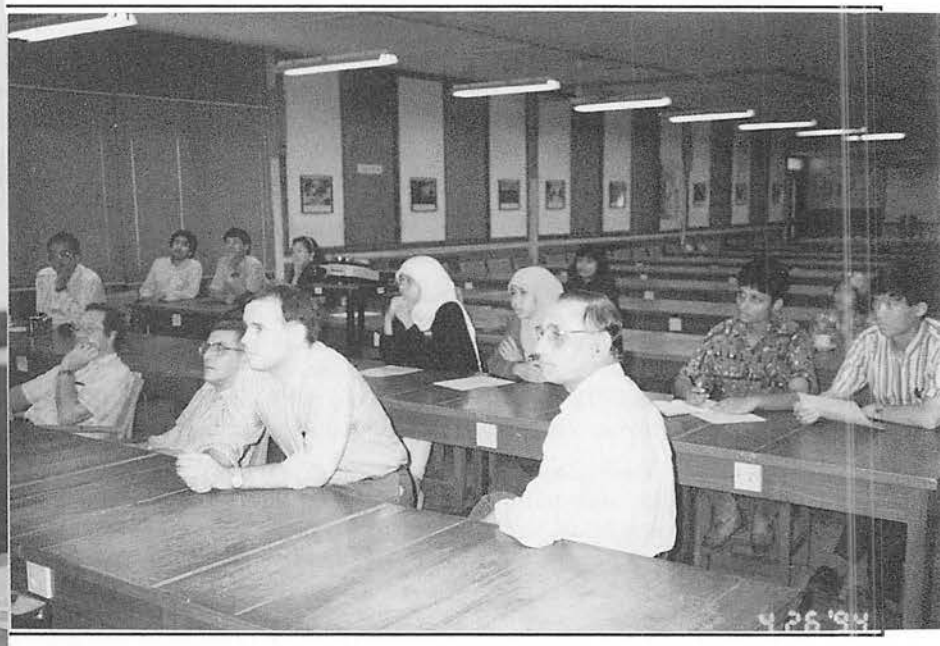
Abstrak (Abstract)

The interrelation between the supracrustal and the gneissic rocks in the Precambrian terranes all the world over has been a contentious issue for a long time. Detailed structural studies in association with other investigations can solve this problem and thus help in tracing the history of crustal evolution. The gneiss — supracrustal relations as gleaned from structural history in the Precambrian of southern and western India provide such an example.

Granitic gneisses covering a large tract in the Precambrian terranes of Karnataka in southern India and Rajasthan in western India bear ambiguous relationship with the metamorphic suite of rocks. Foote considered the Peninsular Gneiss of Karnataka to be the basement on which the supracrustal Dharwar rocks lie unconformably, whereas Smeeth thought the gneisses to be younger. Likewise, Heron took the Banded Gneissic Complex of Rajasthan to be the basement of the supracrustal rocks of the Aravalli Group, while the gneisses were believed by Crookshank to be the migmatized product of the Aravalli-Raialo rocks. Analysis of structures of all scales has shown that in both these terranes the supposed gneissic basement has reacted by ductile deformation during the earliest folding of the cover rocks. The basement-cover contact is marked by conglomerate at some places, particularly in Rajasthan, but this interface is extensively blurred by migmatization synkinematic with the first deformation of the supracrustal rocks. Identical style and orientation of structures due to superposed folding in the gneisses and the cover rocks, presence of a fabric truncated by and earlier than the structures of the first phase in the cover rocks within small enclaves in the gneisses, and wide range of radiometric dates of the Peninsular Gneiss and the Banded Gneissic Complex, can be best explained if the gneisses **in their present state** are taken to form an extensively remobilized basement.

K. NAHA

G.H. Teh



Seminar and fieldtrip on Permo-Triassic of Malaysia and Associated Mineralization — Laporan (Report)

The Seminar on Permo-Triassic of Malaysia and Associated Mineralization was held on the 14th of April 1994 at the Universiti Kebangsaan Malaysia. The seminar was declared open by Prof. Dr. Anuwar Ali who represented the Vice Chancellor of the Universiti Kebangsaan Malaysia.

Despite the rather short notice during the universities' examination periods and the very specific topic, the seminar turned out to be very successful. It managed to attract more than 60 participants. 12 papers on various aspects of the Permo-Triassic of Malaysia and their associated mineralization were presented during the seminar. The seminar was closed by Dr. Azhar Hussin on behalf of the President of the Geological Society of Malaysia.

The seminar was followed by a three-day fieldtrip from 15th to 17th April 1994 to visit the Permo-Triassic outcrops of northwest Pahang. This fieldtrip, which included a visit to Kim Chuan Gold Mine, Selinsing Gold Mine and Buffalo Reef gold prospect, jungle trekking to the foothills of the Tahan Range in Taman Negara Relau and roadcut geological investigations along the Gua Musang-Kuala Lipis highway, was participated by 28 local geologists.

On behalf of the Society, I would like to thank all those who have participated and contributed in various ways to the success of this event, especially the speakers, Universiti Kebangsaan Malaysia, Universiti Malaya, Jabatan Perlindungan Hidupan Liar dan Taman Negara (PERHILITAN), S.E.D.C. Pahang, Kim Chuan Gold Mine and Selinsing Gold Mine.

Mohd Shafeea Leman
Organizing Chairman

Permo-Triassic of Malaysia & Associated Mineralization Seminar

Captions to Photos

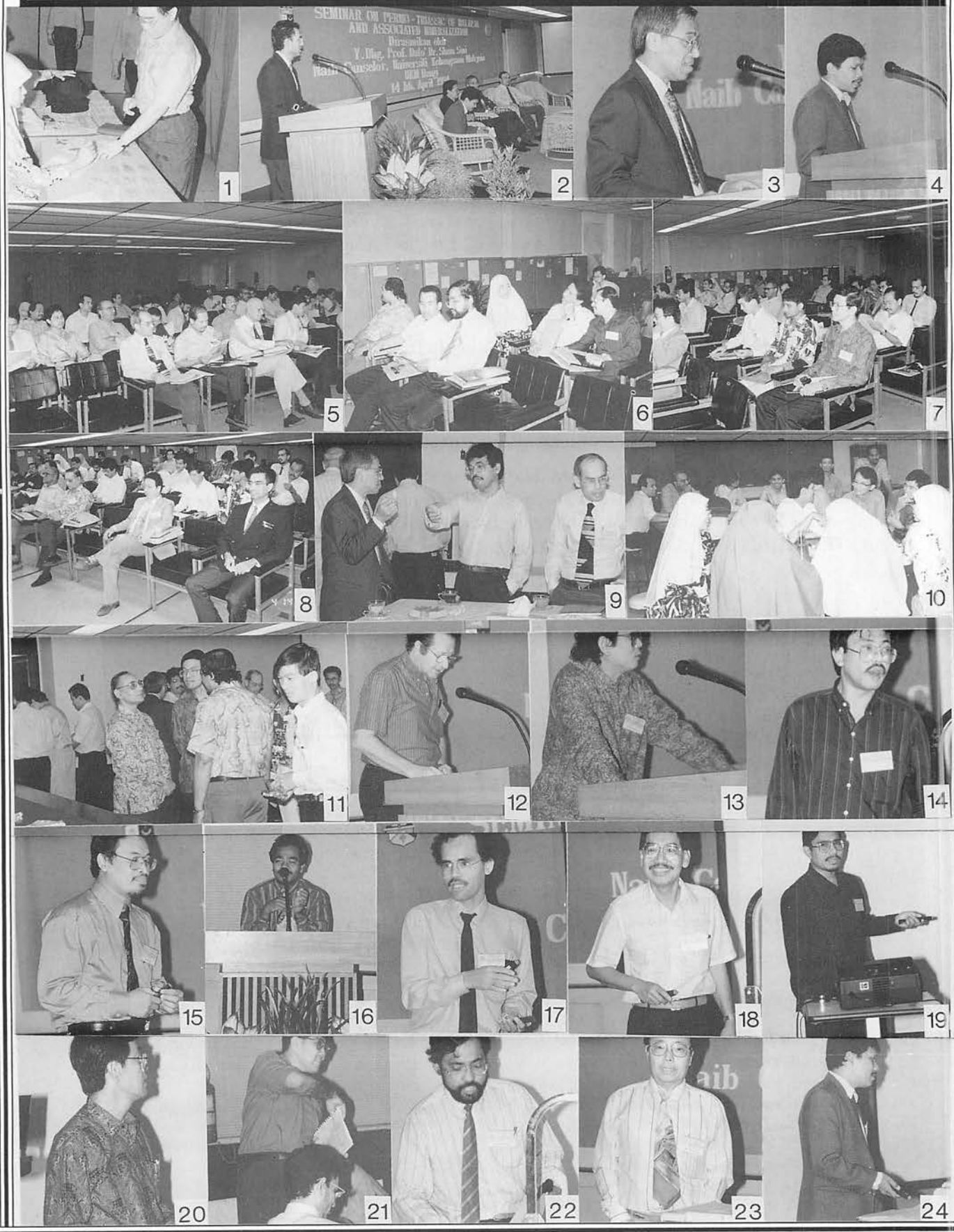
1. At the registration desk.
2. MC Syed Sheik Almashoor getting things going.
3. Prof. Dr. Anuwar Ali with the Opening Address.
4. The Organizing Chairman, Mohd. Shafeea Leman with his address.

5-8. The good turnout.

9-11. The coffee break.

12. Session Chairman C.S. Hutchison getting the technical sessions started.
13. Azhar Hj. Hussin with a joint paper.
14. Mustaffa Kamal Shuib with his paper.
15. Basir Jasin on Early Permian radiolarian.
16. Askury Abd. Kadir on the Eastern Granites.
17. Kamal Roslan on the Gua Musang Formation.
18. Ahmad Jantan with a joint paper.
19. Zakaria Husin on the Permo-Triassic at Labis.
20. G.H. Teh on barite and associated mineralization.
21. Session Chairman H.D. Tjia with a question.
22. Ibrahim Amran on Kinta Valley biostratigraphy.
23. E.B. Yeap on Permo-Triassic gold and tin mineralization.
24. Mohd Shafeea with his presentation.

Permo-Triassic of Malaysia and Associated Mineralization Seminar



Ucapan Dr. Mohd Shafeea Leman, Pengerusi, "Seminar on Permo-Triassic of Malaysia and Associated Mineralization" pada 14hb April 1994 di Universiti Kebangsaan Malaysia

Yang Berbahagia Prof. Dr. Anuwar Ali,
TNC Hal-Ehwal Akademik, Universiti Kebangsaan Malaysia

Prof. Madya Dr. Basir Jasin,
Ketua Jabatan Geologi, Universiti Kebangsaan Malaysia

Dr. Ahmad Tajuddin Ibrahim,
Wakil Ketua Jabatan Geologi, Universiti Malaya

Tuan-tuan dan Puan-puan para hadirin yang saya hormati sekelian.

Assalamu'alaikum warahmatullahi wabarakatuh dan salam sejahtera.

Bagi pehak Persatuan Geologi Malaysia, saya ingin mengambil kesempatan ini bagi mengucapkan terima kasih atas kesudian para hadirin sekelian menghadiri Majlis Peresmian Seminar *Permo-Triassic of Malaysia and Associated Mineralization* ini, dan khusus untuk Yang Berbahagia Prof. Dr. Anuwar Ali, Timbalan Naib Canselor Hal-Ehwal Akademik Universiti Kebangsaan Malaysia, jutaan terima kasih saya ucapkan atas kesudian Yang Berbahagia Profesor hadir untuk meresmikan Seminar ini.

Tujuan utama seminar ini dianjurkan adalah untuk mempertingkatkan lagi tahap pengetahuan di kalangan ahli geologi tempatan berhubung dengan batuan berusia Permo-Trias di Malaysia, iaitu batuan yang mempunyai banyak perkaitan dengan pelbagai jenis pemineralan yang telah menjadi sumber penting dalam perkembangan ekonomi negara pada masa lampau dan masa kini. Diharapkan seminar ini akan merupakan satu forum bagi para ahli geologi tempatan mengetengahkan dan membincangkan data baru berkenaan batuan berusia Permo-Trias dan kepentingannya dari segi ekonomi dan dari segi korelasi secara rantau. Mungkin lebih penting lagi adalah untuk menimbulkan atau menambahkan minat di kalangan para ahli geologi tempatan untuk menjalankan kajian lanjutan mengenai subjek yang dibincangkan.

Jawatankuasa penganjur amat terharu dan berterima kasih atas sokongan padu yang diberikan oleh para peserta yang datang dari pelbagai agensi kerajaan, badan berkanun dan pehak swasta bagi menghadiri seminar ini. Jutaan terima kasih khusus saya tujukan untuk para pembentang kertaskerja yang telah memberikan kerjasama mereka walaupun hanya diberikan tempoh yang singkat bagi menyiapkan kertaskerja mereka.

Melalui kesempatan ini, terima kasih yang tak terhingga saya ucapkan atas sumbangan tenaga semua ahli jawatankuasa dan kumpulan sokongan dalam menjayakan seminar ini. Tidak ketinggalan juga diucapkan terima kasih kepada Jabatan Geologi, Universiti Kebangsaan Malaysia yang telah membenarkan penggunaan ruang seminar ini, dan Pejabat Perhubungan Awam, Universiti Kebangsaan Malaysia yang telah menyumbangkan pelbagai bentuk cenderahati untuk seminar ini. Ucapan terima kasih juga saya tujukan untuk beberapa banyak pehak lain lagi yang telah memberi pelbagai bentuk bantuan dalam menjayakan seminar ini.

Akhirnya, saya sekali lagi mengucapkan terima kasih kepada Yang Berbahagia Prof. Dr. Anuwar Ali, Timbalan Naib Canselor Hal-Ehwal Akademik Universiti Kebangsaan Malaysia yang sudi datang untuk meresmikan seminar ini.

Sekian, Wassalamu'alaikum warahmatullahi wabarakatuh.

Ucapan Pembukaan YB Prof. Dr. Anuwar Ali, Timbalan Naib Canselor Hal-Ehwal Akademik Universiti Kebangsaan Malaysia, di "Seminar on Permo-Triassic of Malaysia and Associated Mineralization" pada 14hb April 1994

Saudara Pengerusi Majlis, Dr. Mohd. Shafeea Leman,

Prof Madya Dr. Basir Jasin, Ketua Jabatan Geologi, Universiti Kebangsaan Malaysia,

Dr. Ahmad Tajuddin Hj Ibrahim, Wakil Ketua Jabatan Geologi, Universiti Malaya,

Ahli-ahli Fakulti Sains Fizis dan Gunaan, Universiti Kebangsaan Malaysia dan peserta seminar sekelian.

Assalamu'alaikum, salam sejahtera dan saya ucapkan selamat datang ke kampus Universiti Kebangsaan Malaysia.

Saya amat berterima kasih kepada Pengerusi dan ahli-ahli Jawatankuasa seminar ini kerana diberi kesempatan untuk mengucapkan sepatah dua kata sempena seminar "Permo-Triassic of Malaysia and Associated Mineralization" yang julung kalinya diadakan di negara ini. Sukacita saya mengambil kesempatan ini juga untuk mengucapkan terima kasih kepada Persatuan Geologi Malaysia sebagai penganjur yang telah memberikan kepercayaan kepada Universiti Kebangsaan Malaysia untuk menjadi tuan rumah seminar ini. Tahniah saya ucapkan atas kejayaan Jabatan Geologi Universiti Kebangsaan Malaysia, Jabatan Geologi Universiti Malaya dan Persatuan Geologi Malaysia yang bekerjasama untuk menjayakan seminar ini.

Saya diberitahu bahawa sejak awal abad ini lagi, batuan berusia Permo-Trias telah mula dikenali dan kajian demi kajian mengenainya telah dilakukan. Kepentingan batuan ini semakin ternyata apabila Malaysia mula menggantung harapan kepada hasil pemineralan yang berkaitan dengannya. Pada suatu ketika dahulu bijih timah telah menjadi teras kepada daya ekspot negara ke seluruh dunia. Begitu juga bijih emas, bijih besi dan beberapa jenis bijih lain yang turut menyumbang kepada perkembangan ekonomi negara.

Bagaimanapun, kejatuhan harga bijih timah pada awal dekad 1980an telah menyaksikan satu perubahan mendadak serta kemuncupan industri ini. Pada masa kini hanya tinggal perlombongan secara kecil-kecilan yang dijalankan bagi mengeksploit mineral-mineral tersebut.

Walaupun industri bijih timah telah terjejas kedudukannya dalam ekonomi, kita harus bersyukur kerana negara ini juga kaya dengan berbagai-bagai mineral lain yang tidak kurang penting dari segi nilai ekonominya. Kini, dalam usaha negara untuk memperkuatkan asas industri, industri-industri yang berasaskan mineral khususnya dititikberatkan sebagai penggerak kepada usaha tersebut. Hal ini seperti yang kita telah ketahui ditekankan dalam Pelan Induk Perindustrian (1986-95).

Beberapa mineral sampingan seperti zirkon, monazit, ilmenit, xenotim dan sebagainya kini dieksploit bagi penghasilan barangan berteknologi tinggi untuk kegunaan pelbagai industri termasuk industri kapalterbang, televisyen dan sebagainya. Mineral-mineral lempung berkualiti tinggi dan silika yang banyak terhasil akibat luluhawa batuan berusia Permo-Trias juga kini telah dieksploit secara meluas. Mineral lempung untuk industri seramik yang sedang berkembang pesat dan silika untuk industri kaca dan cip silikon. Banyak lagi contoh-contoh yang boleh saya perkatakan; tetapi saya percaya tuan-tuan di sini lebih arif mengenai perkara ini.

Apa yang jelas kepada saya sebagai seorang ahli ekonomi ialah potensi ekonomi batuan berusia Permo-Trias adalah amat luas untuk kita terokai. Soalnya, adakah kita mempunyai kemampuan modal dan teknologi yang diperlukan.

Kajian mengenai batuan berusia Permo-Trias dan pemineralan pada awalnya hanyalah dilakukan oleh para ahli geologi dari negara-negara Barat. Walau bagaimanapun, sejak beberapa dekad kebelakangan ini semakin ramai para ahli geologi tempatan tampil menyumbangkan hasil penyelidikan mereka di peringkat kebangsaan, serta di peringkat antarabangsa. Perkembangan seperti ini amatlah membanggakan kita semua.

Tidak boleh dinafikan bahawa kerjasama erat antara para ahli geologi di institusi pengajian tinggi, institusi penyelidikan, badan berkanun dan swasta berperanan penting dalam memastikan kejayaan keseluruhan masyarakat geologi di negara ini. Saya berasa gembira bahawa dalam hal ini Persatuan Geologi Malaysia telah berjaya merapatkan hubungan antara para ahli geologi dari berbagai disiplin di rantau ini, walaupun saya kira potensi untuk sektor swasta atau industri merapatkan diri dengan universiti masih belum mencapai tahap yang optima.

Saya turut berbangga kerana Universiti Kebangsaan Malaysia memang aktif dalam penyelidikan geologi dan penganjuran seminar-seminar seperti ini. Saya harap seminar ini akan dijadikan sebagai forum terbaik untuk para peserta dari pelbagai disiplin dan jabatan berinteraksi di samping mengeratkan lagi jalinan kerjasama antara satu sama lain. Seminar seperti ini saya percaya boleh diperkembangkan hingga ke tahap yang lebih tinggi untuk penyertaan masyarakat geologi yang lebih luas.

Tidak kurang penting dalam konteks perkembangan akademik di universiti ialah: interaksi seperti ini dapat memperluaskan peluang bagi penyelidik-penyelidik yang baru muncul atau yang memerlukan pengalaman untuk mencedok ilmu dan contoh dari mereka yang lebih arif dan banyak pengalaman. Saya percaya seminar ini akan menghasilkan interaksi yang positif serta perbincangan yang bermanfaat kepada semua yang hadir.

Akhir kata, saya dengan lafaz Bismillah merasmikan pembukaan seminar ini. Terima kasih.

Seminar and fieldtrip on Permo-Triassic of Malaysia and Associated Mineralization — Programme

14th April 1994

SEMINAR VENUE: **Universiti Kebangsaan Malaysia, Bangi, Selangor**

0800-0830	**Late Registration**	
0830-0845	**Arrival of Guests**	
0845-0910	**Opening Ceremony**	
0910-0930	**Tea**	
0930-1000	**Lecture 1:**	Implications of new biostratigraphic data for stratigraphic correlation of the Permian and Triassic in Peninsular Malaysia. ***Ian Metcalfe and Azhar Hussin***
1000-1030	**Lecture 2:**	Interference of compressional and strike-slip related structures in the Semanggol Formation strata, North Kedah. ***Mustaffa Kamal Shuib***
1030-1100	**Lecture 3:**	Early Permian Radiolaria from Ulu Kelantan ***Basir Jasin***
1100-1130	**Lecture 4:**	Granit Jalur Timur di Sektor Selatan: Tinjauan Petrokimia dan Pemineralan ***Askury Abd. Kadir***
1130-1200	**Lecture 5:**	Formasi Gua Musang: Satu Pemikiran Semula ***Kamal Roslan Mohamed and Mohd Shafeea Leman***
1200-1230	**Lecture 6:**	The Nature of Permian-Triassic Junction in the Rock Sequence in Central Pahang ***Ahmad Jantan, Uyoh Said and Mohamad Md. Tan***
1230-1300	**Lunch**	
1300-1330	**Lecture 7:**	Potensi, Ekonomi Batuan Permo-Trias Labis, Johor ***Zakaria Husin***
1330-1400	**Lecture 8:**	Massive sulphide, barite and related mineralization of the Central Belt of Peninsular Malaysia ***Teh Guan Hoe***
1400-1430	**Lecture 9:**	Biostratigraphy of the Kinta Valley, Perak ***Ibrahim Amnan***
1430-1500	**Lecture 10:**	Preliminary micro-facies analysis of Bukit Biwah Limestone, Tasik Kenyir, Trengganu ***Azhar Hussin***
1500-1530	**Lecture 11:**	Permo-Triassic Tin and Gold Mineralization Patterns of Peninsular Malaysia ***Yeap Ee Beng***
1530-1545	**Tea**	
1545-1615	**Lecture 12:**	Permo-Triassic Geology and Paleontology along the Dada-Kering-Merapoh Highway, Pahang ***Mohd Shafeea Leman***
1615-1630	**Closing Ceremony**	

Fieldtrip: 15th to 17th April 1994

Seminar on Permo-Triassic of Malaysia and Associated Mineralization — Abstracts of Papers

Implication of new biostratigraphy data for stratigraphic correlation of the Permian and Triassic in Peninsular Malaysia

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Recent biostratigraphic work necessitate revision of the ages of several Permo-Triassic formations and units within Peninsular Malaysia. The Chuping Limestone in Perlis is now known to extend up to the Late Triassic. Cherts which have been assigned to the Semanggol Formation in Kedah have various ages ranging from Lower Permian to Upper Triassic. This extended age range for these cherts has implications for regional Permian palaeogeography and tectonics. Newly determined Permian ages of clasts in mélange and Lower and Upper Permian ages of bedded cherts along the Raub-Bentong suture zone suggest a latest Permian or Triassic closure of the Palaeo-Tethys in this region. The presence of previously unknown tracts of Lower Triassic limestones in the Central Belt (Jerus Limestone) and subsurface Triassic limestones in the basement of the Malay basin, offshore Trengganu also have regional stratigraphic and tectonic implications. A correlation chart for sedimentary rock units in Peninsular Malaysia, incorporating the new biostratigraphic data is presented.

Interference of compressional and strike-slip related structures in the Semanggol Formation strata of N. Kedah

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The Semanggol Formation strata of N. Kedah have been said to have undergone a single phase of deformation resulting in open to slightly asymmetric folds that way show some complexities where modified by reversed or thrust faults.

The regional fold trend is N-S, but in the southern part of the area, an anomalous, previously unrecognized, E-W trending folds with steeply plunging fold axes have been mapped out. Strike ridges swing into 'z'-arrays and form en-echelon arrangement in this part of the area. Field studies show that these folds were formed by drags along generally N-S striking steeply dipping faults. The 'z'-arrays of associated minor steeply plunging folds suggest that these faults are dextral strike-slip faults. Interference patterns suggest overprinting of the 2 fold trends implying the strata have undergone multiple deformation.

A model is proposed in which the en-echelon and 'z'-array nature of the strike-ridges in the area are interpreted as the result of right-lateral movement along strike-slip faults that was superimposed on the previously formed N-S trending folds.

As both the N-S trending folds and the strike-slip related structures shows the effect of drags due to intrusion of the Bukit Perak granite and movement along the Baubak fault, both structures may have formed subsequently, within the same time span, pre-dating the granite intrusion.

The occurrence of both compressional and strike-slip related structures in the area suggest that deformation, as a whole can be described as transpressive and this may imply that the closure of the Semanggol Basin at least for the N. Kedah part must be oblique.

Early Permian radiolaria from Ulu Kelantan, Malaysia

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An isolated bedded chert is exposed at an outcrop along a dirt road near Pos Belau, Ulu Kelantan. The terms "bedded chert" commonly denote rock sequence that include both chert and siliceous mudstone. The radiolarian chert exhibits a bedding style characterised by rhythmically alternating thin beds of chert ranging from 2 cm to 15 cm and siliceous mudstone. The total thickness of the bedded chert is approximately 50 m. The chert is very important clue to solve the tectonic of the Malay Peninsula. This chert is located very close to the Bentong Suture. The chert was also considered as the eastern border of the Bentong Suture by Tjia & Syed Sheikh Almashoor (1993). They recognized sequence of schist, phyllite, olistostrome and bedded chert.

Patchy distribution of cherts was also recorded in Ulu Kelantan, especially in the Kuala Betis area. These cherts were probably of the same age. The bedded chert was not yet dated. Some *Argaticeras* sp. were observed in the mudstone layers that interbed with the chert. The general strike of the chert is NW-SE and moderately dipping towards NE.

Several samples of chert were collected from the outcrops. The chert were treated with hydrofluoric acid to release the radiolaria. Some radiolaria are quite well preserved and many are poorly preserved. Three samples yielded well preserved radiolaria.

Several species of radiolaria were identified, they are *Latentifistula Crux* Nazarov and Ormiston, *Latentifistula patagilatera* Nazarov and Ormiston, *Latentibifistula triancanthopora* Nazarov and Ormiston *Pseudoalbaellella sakmariensis* Kozur, *Pseudoalbaellella longicornis* Ishiga and Imoto, *Latentifistula* sp., *Entactinia pycnoclada* Nazarov and Ormiston. *Copicyntra* sp. *Ruzhencevispongus uralicus* Kozur. Many more species could not be identified.

Latentifistula crux was used by Nazarov & Ormiston (1985) as a zonal marker for the Lowermost zone of Asselian. *Ruzhencevisponegus uralicus* Kozur was reported from the Late Antinskian. The radiolaria indicate that the age of the chert ranges from Asselian to Artinskian, Early Permian.

The age of the Gua Musang Formation was dated as Late Permian to Triassic based on the occurrence of fusulinacea in the Limestone and the Triassic bivalve. It is not sure whether the chert belongs to the Gua Musang Formation or the Bentong Group.

This chert is a biogenic silica consists of mainly radiolarian skeleton which was deposited in an environment far away from the sources of terrigenous detritus. The absence of calcareous material indicates that the chert was deposited near or below the calcite compensation depth.

The interbedded and mudstone chert represents continental margin chert association (Murchey *et al.*, 1983). No ultrabasic or basic igneous rocks were observed in the surrounding area. The chert was probably deposited in an environment very close to the continental shelf.

Granite Jalur Timur di sektor selatan: Tinjauan petrokimia dan pemineralan
(The southern sector of Eastern Belt Granite: An overview of petrochemistry and mineralization)

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Batolitos dan pluton-pluton terasing yang terdapat di timur Johor dan selatan Pahang secara amnya menganjur hampir utara-baratlaut (NNW) merangkumi keluasannya kira-kira 5,580 km^2. Granitoid berkenaan tergolong ke dalam Granit Jalur Timur berusia Trias Atas merejah ke dalam batuan metasedimen Permo-Trias. Pendekatan petrografi dan petrokimia menunjukkan bahawa mereka boleh dibahagikan kepada 5 jenis granitoid yang utama, iaitu:-

1. Granite Muadzam — Granite biotit-hornblend berporfit dengan fenokris K-feldspar berwarna merah jambu.
2. Granit Keluang — Granit biotit dan granit biotit-hornblend samabutiran berwarna kelabu.
3. Granit Kahang — Granit biotit berporfir dengan fenokris K-feldspar berwarna kelabu.
4. Granit Kota Tinggi — Granit dua fasa bertekstur heterogen.
5. Diorit Pemanggil — Diorit dan monzodiorit bertekstur homogen dan bersifat melanokrat.

Dari pendekatan petrokimia, ke semua jenis granit berciri peralumina, kecuali diorit dan monzodiorit (Diorit Pemanggil) berciri metalumina sebagaimana ditunjukkan oleh mol $Al_2O_3/(CaO + Na_2O + K_2O) > 1$ dan $Al-(K + Na + 2Ca) > 0$. Perkaitan silika dan alkali menunjukkan granitoid menjurus kepada kandungan siliko-potasik yang tergolong ke dalam sekutuan meso-leukokrat dan sodi-potasik. Variasi kimia mempamerkan jujukan pembezaan magma yang jelas. Bagi kajian ini, SiO_2 dan TiO_2 didapati amat sesuai dianggapkan sebagai indeks pembezaan magma bagi mengesan evolusinya di mana P_2O_5, Fe_2O_3, MgO dan Zr telah mempamerkan korelasi yang baik. Di samping itu, pembezaan mangma juga boleh dikesan melalui plot segitaga Rb-Ba-Sr di mana ianya mengarah kepada pengkayaan Rb. Berpandukan plot-plot ciri alumina dan nisbah kandungan Na_2O-K_2O di dapati granitoid adalah paduan di antara jenis-I dan -S, kecuali Diorit Pemanggil berjenis-I. Tambahan pula, nisbah awalan $^{87}Sr/^{86}Sr$ secara purata adalah 0.7078 ± 0.0012, agak rendah dan terletak di perantaraan. Walau bagaimanapun, Cobbing *et al.* (1992) percaya granitoid Jalur Timur secara rantaunya tergolong ke dalam jenis-I serta berasosiasi dengan pemineralan polimetalik (logam-logam asas) dan timah. Bagi memastikan kedudukan tektonik perejahan granit, unsur-unsur Rb, Y dan Nb yang tidak lincah digunakan pada gambarajah Pearce *et al.* (1984). Granitoid merejah di dalam domain VAG (volkano-arka) dan syn-COLG (sin-pelanggaran) serta bersesuaian dengan Mitchell (1977) dan Beckinsale (1979) yang mengatakan ianya wujud hasil daripada kedudukan arka volkano. Secara tidak langsung kedudukannya hampir selari dengan sutur Bentong-Raub. Sebagaimana yang lazimnya, Granit Jalur Timur terkenal dengan pemineralan timah berasosiasi dengan magnetit. Hutchison dan Taylor (1987) menyatakan bahawa skarn kasiterit-magnetit merupakan longgokan penggantian yang berkaitan dengan granit walaupun sebahagian lod-lod stratabound mungkin dikelaskan sebagai volkanogenik.

Formasi Gua Musang: Satu pemikiran semula

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Formasi Gua Musang telah lama diperkenalkan oleh Yin pada tahun 1968, untuk batuan yang terdapat di sekitat Gua Musang, Kelantan selatan. Di sekitar bandar Gua Musang, batuan yang boleh ditemui ialah unit argilit yang kebanyakkannya telah termetamorf gred rendah kepada sabak atau filit, batu kapur yang kebanyakkannya telah terhablur semula menjadi marmar, batu pasir, dan sedikit konglomerat. Kebanyakkan unit argilit dan juga batu pasir adalah bertuf, dan mempunyai asalan

volkanik. Kajian paleontologi oleh ramai pengkaji menemukan banyak fosil yang berusia daripada Perm Awal hingga ke usia Trias Tengah. Sempadan bawah kepada Formasi Gua Musang tidak tersingkap dan dipercayai terletak di atas batuan dasar lembangan jalur tengah Semenanjung Malaysia. Sempadan atasnya pula selaras dengan Formasi Semantan yang menindihnya. Dari maklumat sedimentologi Formasi Gua Musang, dan daripada maklumat fosil yang pernah direkodkan oleh ramai pengkaji, dapat ditafsirkan bahawa batuan yang membentuk Formasi Gua Musang ini sebenarnya terbentuk di sekitaran laut cetek, dan sering terganggu oleh aktiviti volkanisme.

Walaupun Formasi Gua Musang ini diperkenalkan untuk batuan yang terdapat di sekitar Gua Musang, penamaannya telah digunakan dengan meluas untuk unit batuan yang sama di jalur tengah Semenanjung Malaysia. Penggunaan nama formasi ini telah tersebar ke kawasan Kuala Betis, Dabong, Merapoh, Kuala Lipis, Chiku dan beberapa kawasan lain, terutamanya di bahagian utara jalur tengah. Selain itu, terdapat juga kawasan yang mempunyai batuan yang hampir sama dengan yang terdapat di sekitar Gua Musang, tetapi nama lain yang di gunakan, contohnya Formasi Aring dan Marmar Nilam di kawasan Aring, Kelantan. Di kawasan Kuala Lipis, terdapat beberapa nama formasi seperti Formasi Sungai Kenong, Formasi Sungai Sergis, Formasi Padang Tengku yang diletakkan dalam Kumpulan Raub oleh Procter (1972). Walau bagaimanapun, semasa Jaafar Ahmad (1976) memperkenalkan Formasi Semantan, beliau telah pemansuhkan Kumpulan Raub.

Apabila dikaji unit-unit batuan yang terdapat dalam Formasi Gua Musang yang dicadangkan oleh Yin (1968) ini, kita akan temui beberapa unit batuan yang jelas tersebar dengan meluas dan boleh dipetakan. Batu kapur yang ada dalam Formasi Gua Musang boleh ditemui di beberapa tempat, dan singkapannya juga besar. Kesemua batu kapur ini telah diketahui maklumat litologi dan petrografinya, dan banyak di antaranya yang mempunyai maklumat usia yang jelas. Selain daripada batu kapur, unit konglomerit yang ditemui di permatang Gunung Ayam juga tersingkap dengan baik, dan juga boleh dipetakan. Walaupun usia konglomerat di sini tidak diketahui dengan jelas, kedudukan stratigrafinya boleh ditentukan dalam Formasi Gua Musang. Unit argilit dan juga unit volkanik dalam Formasi Gua Musang juga boleh dipetakan dengan baik.

Kertas kerja yang dibentangkan ini bertujuan membincangkan kemungkinan menaikkan taraf Formasi Gua Musang kepada Kumpulan Gua Musang. Perbincangan ini diharapkan dapat meningkatkan lagi kajian dan penyelidikan terhadap Formasi Gua Musang yang sedia ada. Beberapa nama formasi baru yang terletak di bawah Kumpulan Gua Musang perlu dikemukakan, dan ini juga memerlukan kajian lanjut. Ada beberapa sebab mengapa taraf formasi perlu dinaikkan kepada kumpulan, dan semuanya ini akan memudahkan kita memahami geologi batuan Permo-Trias di jalur tengah Semenanjung Malaysia. Selain daripada banyak unit batuan yang boleh dipetakan dalam Formasi Gua Musang sekarang ini, terdapat beberapa unit batuan tersebut yang tidak sesuai dimasukkan ke dalam Formasi Gua Musang. Sebagai contoh, konglomerat yang membentuk banjaran Gunung Ayam di kawasan Belau-Kuala Betis kurang sesuai diletakkan dalam Formasi Gua Musang. Konglomerat dan batu pasir yang ada di sini sangat berbeza dengan litologi yang membina Formasi Gua Musang di kawasan lokaliti tipnya. Jujukan di Gunung Ayam ini juga mempunyai sekitaran pengendapan yang berbeza dengan Formasi Gua Musang. Walaupun sekitaran pengendapannya berbeza, tetapi secara rantau kedua-duanya dijangka terbentuk pada satu masa yang sama.

Batu kapur yang tertabur dengan meluas dalam Formasi Gua Musang boleh dinaikkan taraf formasi dalam Kumpulan Gua Musang. Marmar Nilah yang diperkenalkan oleh Aw (19??) boleh dijadikan sebagai satu formasi batu kapur yang terdapat dalam Kumpulan Gua Musang. Walau bagaimanapun, kajian terperinci perlu dilakukan untuk mengetahui samada kesemua batu kapur boleh dimasukkan ke dalam satu formasi atau beberapa formasi batu kapur. Jika semua batu kapur mempunyai usia dan fasies yang sama atau hampir sama dan mempunyai kedudukan stratigrafi yang sama dalam Formasi Gua Musang yang ada sekarang, sewajarlah batu kapur ini dikenali dengan satu formasi sahaja. Tetapi, jika kajian menunjukkan batu kapur mempunyai usia yang berbeza, dan kedudukan stratigrafinya juga tidak sama, maka beberapa nama perlu diberi untuk formasi batu kapur ini. Batu kapur yang tersingkap di kawasan Gua Mesah dan sekitarnya adalah dari jenis oolitik, dan serupa dengan yang terdapat di Gua Belong (selatan Belau), dan kesemua batu kapur ini mungkin boleh dijadikan satu formasi, jika usianya sama.

Jika penggunaan Kumpulan gua Musang diterima, maka semua jujukan batuan di jalur tengah Semenanjung Malaysia yang mempunyai hubungan rapat antara satu sama lain semas proses pembentukkannya dan berusia Perm-Trias, boleh dikelaskan kepada kumpulan ini. Walau bagaimanapun, jujukan Formasi Semantan yang berusia Trias Tengah-Akhir tidak termasuk dalam Kumpulan Gua Musang ini. Ini kerana Formasi Semantan merupakan endapan sekitaran laut dalam, dan formasi ini

telah lama dikenali dan penggunaannya agak mantap, berbanding dengan Formasi Gua Musang. Penamaan formasi-formasi baru hendaklah mengikut Kod Penamaan Stratigrafi yang dikeluarkan oleh American Commission on Stratigraphic Nomenclature (1961), dan yang paling penting, setiap formasi mestilah mempunyai lokaliti tip yang jelas. Selanjutnya, perbandingan perlu dilakukan antara setiap formasi dalam Kumpulan Gua Musang dengan batuan Permo-Trias dari lembangan lain, contohnya dengan lembangan baratlaut Semenanjung Malaysia, Selatan Thai dan sebagainya.

The nature of Permian-Triassic junction in the rock sequence in central Pahang

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Established Permian rocks in the areas of central Jengka Triangle from Gunung Senyum to Kampung Awah, and in the areas to the south from Teriang to Bt. Bertangga in Central Pahang are the widespread intermediate volcanic rocks of andesitic composition and the localised limestone at Gunung Senyum and Kampung Awah. And established Triassic rocks within the same areas are the shales, turbiditic sandstones and conglomerates, with localised limestone lenses of the Semantan Formation.

The andesitic rocks, being intermediate in composition and rich in mafic minerals, have mostly been weathered to reddish brown clay soil. Limited exposure of fresh andesite can however be observed at the JKR quarry at Kampung Awah. Large andesite boulders excavated out from reddish brown soil can be seen at a development site near Kota Gelanggi to the northeast of the Jengka Triangle. And small andesite blocks can be seen in dark reddish brown soil along the main Felda Jengka road from Kg. S. Jerik to Bandar Pusat Jengka.

Rocks of the Semantan Formation exposed at road cuts have mostly undergone weathering into soil. Weathered shales are yellowish brown, yellowish red to reddish brown in colour and can be seen at road cuts along Mentakab-Temerloh by-pass road and at several localities along Temerloh-Maran road. It may occasionally be difficult to be sure of whether a soil is weathered andesite or weathered shales.

The nature of contact between the Permian andesite and the Triassic Semantan Formation rocks, i.e. whether there is a break or not (an unconformity or not) has not been firmly ascertained.

During a field round to supervise undergraduate students in central Pahang, probable contact of the Permian andesite rock with the Triassic Semantan Formation rocks were observed, one along the road from Teriang to Bt. Bertangga in the south, and another along the road from Kg. S. Jerik to Bandar Pusat Jengka in the north.

At the first locality, the rock strata of the Semantan Formation consist of weathered, interbedded, thinly bedded shales and sandstones, turbiditic in character, and are folded into several gentle synclines and anticlines. The cores of the anticlines are made up of reddish-brown 'soil' that looks very much like the soil from andesitic rock. There is no obvious break between the reddish brown 'soil' and the interbedded weathered shales and sandstones.

Andesite boulders and 'outcrops' were seen by the south bank of S. Pahang near Kg. Pesagi to the north of the former locality.

At the second locality along Kg. S. Jerik-Bandar Pusat Jengka, a road cut exposes weathered rock consisting of about 2 m thick massive reddish brown 'soil', followed by about 2.5 m thick, thinly interbedded weathered tuffaceous shale and sandstone. There is no apparent break between the two. The former looks very much like soil derived from the weathering of andesitic rock whilst the latter is best interpreted to belong to the rocks of the Semantan Formation.

If the interpretation, for the observation at both localities, that the massive reddish brown 'soil' is the weathered product of andesite (of Permian age) and the weathered, interbedded tuffaceous shale and sandstone is part of the rock of the Semantan Formation is correct, the two observations suggest that there is no apparent break between the Permian andesite and the Triassic Semantan Formation. Work on this is still going on.

It is noteworthy to mention that at around the border of Pahang and Kelantan, the limestone of the Gua Musang Formation is being interpreted to span from late Permian into early Triassic.

Potensi ekonomi batuan Permo-Trias di kawasan Labis, Johor

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Kawasan Labis Johro dalam syit topo 116 mengandungi 4 kumpulan batuan yang berusia Permo-Trias. Batuan tersebut adalah batuan formasi Lop (Perm Akhir), batuan volkano Sedeli (Perm Akhir), batuan formasi Gemas (Trias Tengah-Trias Akhir) dan batuan Granit Gunung Bekok (Trias Akhir).

Formasi Lop yang terletak di bahagian barat daya Chaah terdiri daripada batuan yang mengalami metamorfisme rantau darjah rendah iaitu sabah, filit, metabatulodak, metabatupasir, dan sedikit metakonglomerat. Disamping itu ia juga mengandungi batuan volkano yang berkomposisi andesit hingga riolit, terutamanya batuan tuf dan aglomerat yang tersingkap di bekas lombong besi Bt. Lop. Usia batuan formasi Lop telah ditentukan berdasarkan kepada fosil yang ditemui dalam metabatulodak dari jenis bivalvia iaitu *Siphogrammysis* cf. *kasanesis* (Geinitz) yang berusia Perm Akhir (Kazanian) dan fosil *?Solenormorpa* sp. yang dianggarkan berusia Paleozoik Akhir. Ia dipercayai dienapkan di sekitaran pelantar laut yang cetek. Bt. Lop yang terdiri dari batuan volkano mengandungi longgokan bijih besi. Mengikut rekod carigali masa lampau S.K.C. 1/59 menunjukkan jumlah yang memberansangkan iaitu anggaran jumlah bijih besi ialah 841,000 tan dengan gred besi 57%-68%. Bijih besi terutamanya jenis hematit dan magnetit. Jumlah keluaran dari tahun 1961-1965 ialah 189,438 tan (Bean, 1969). Barit juga telah ditemui di bekas lombong Bt. Lop yang tersingkap apabila kolam dikeringkan untuk diusahakan semula pada tahun 1986. Korok barit pada jurus hampir NW dengan kecondongan hampir tegak dan saiz yang tersingkap ialah 3 meter tebal dan 6 meter tinggi. Barit mempunyai S.G. 4.26 dan kandungan kimianya adalah seperti berikut: $BaSO_4$ (90.1%), Fe_2O_3 (0.80%), SiO_2 (7.43%) dan bakinya 1.67% adalah oksida unsur minor. Ada ditemui barit merangkumi besi dan tuf, yang menunjukkan ia wujud lebih lewat. Permineralannya ada kaitan dengan kesan struktur dalam kawasan ini.

Batuan volkano Sedeli yang dianggarkan berusia Perm Akhir terdapat di bahagian timur laut Syit 116. Ia terdiri daripada batuan piroklas yang dipercayai mengalami metamorfisme rantau yang lemah. Batuan volkano Sedeli yang berhampiran dengan granit Gunung Bekok telah mengalami metamorfisme sentuhan. terdiri daripada metatuf hablur, honfels, metatuf litik hablur dan metatuf halus. Batuan piroklas yang berada jauh dari badan granit tidak mengalami metamorfisme sentuhan terdiri daripada tuf hablur, tuf hablur litik terkimpal, tuf litik hablur dan aglomerat. Pada am batuannya berkomposisi asid dan sedikit pertengahan. Batuan volkano Sedeli yang terdapat di sekitar G. Besar-Bt. 3244', dan sebahagian kecil kawasan Sg. Ulu Pukin serta kawasan pertemuan ulu-ulu Sg. Juaseh-Merek-Bekok adalah sebagai sisa bumbung. Dari eksplorasi geokimia tinjauan mendapati kawasan yang diliputi oleh sisa bumbung tersebut bagi sampel kelodak menunjukkan anomali relatif luas dan bertindih bagi unsur-unsur tertentu seperti Cu, Pb, Zn, Au, U, serta As dan Ag. Tanda-tanda permineralan juga ditemui seperti pirit dalam metatuf; galena, arsenopirit dan kalkopirit pada telerang kuarza dalam kawasan ini.

Formasi Gemas yang dipercayai berusia Trias Tengah hingga Trias Akhir terdiri daripada tuf, batuserpih, batuserpih bertuf serta sedikit batuan metamorf dan batupasir. Batuan formasi Gemas terdapat di bahagian hampir tengah merupakan jalur yang mengunjur hampir utara selatan dan membentuk topografi yang rendah serta beralun. Batuan tuf dari formasi Gemas yang telah mengalami proses luluhawa ada di antaranya sesuai sebagai sumber bahan dalam industri berasaskan lempung.

Perejahan batolit Gunung Bekok dianggarkan berlaku semasa orogeni Trias Atas. Ia membentuk kawasan perbukitan Gunung Pukin-Gunung Besar yang tinggi dan agak rapat; merupakan banjaran yang hampir utara baratlaut ke selatan tenggara syit 116. Ia merupakan kumpulan batuan granit yang terbesar di utara Johor. Batuan granit Gunung Bekok terutamanya terdiri dari granit biotit berbutiran kasar dan sederhana. Di samping itu terdapat juga granodiorit, granit biotit sangat kasar porfiritik serta sedikit monzonit kuarza dan mikrogranit. Warna kebanyakannya kelabu cerah, ada juga yang merah jambu dan sedikit kelabu gelap. Usia granit Gunung Bekok adalah berdasarkan kaedah radiometrik K-Ar terhadap batuan granit dekat Bekok; iaitu bernilai 28 ± 6 juta tahun (Bignell & Snelling, 1977). Batuan granit Gunung Bekok ada di antaranya mungkin sesuai untuk industri batuan dimensi berdasarkan variasi warna dan teksturnya yang menarik. Misalnya granit dekat Sg. Kepoh, warnanya yang hampir merah jambu, kehomogenan dan sifat fizikal yang memenuhi ciri bagi kesesuaian batuan dimensi (Abdullah Sani dalam manuskrip). Keutamaan kawasan yang dicadangkan untuk dimajukan adalah kawasan pinggiran batolit granit Gunung Bekok.

Berdasarkan kepada perkembangan semasa mengenai keprihatinan manusia terhadap alam sekitar, maka Kerajaan Negeri Johor telah mewartakan kawasan Hutan Simpan Labis yang bersempadan dengan Pahang sebagai Taman Negara Johor. Kawasan yang didasari oleh batuan Permo-Trias (batuan volkano Sedeli dan granit Gunung Bekok) adalah merupakan kawasan tadahan hujan dan kawasan pertemuan hulu berbagai sungai-sungai utama seperti Sg. Endau, Sg. Segamat, Sg. Labis, Sg. Bekok, Sg. Chaah, Sg. Selai dan sebagainya yang menjadi sumber air permukaan yang besar. Air sangat penting bagi keperluan kehidupan manusia, haiwan serta tumbuh-tumbuhan dan air akan menjadi semakin berharga pada masa akan datang dengan meningkatnya pertambahan penduduk dan berkurangnya sumber bekalan air kerana kepupusan kawasan hutan tadahan hujan. Di samping itu kawasan ini sangat menarik sebagai kawasan pelancongan yang bersambung dengan Taman Endau-Rompin. Banyak tempat-tempat yang memaparkan keindahan semulajadi dengan air terjun, jeram-jeram, lubuk-lubuk (yang terhasil dari penyesaran, pengekaran terhadap batuan yang berusia lebih 200 juta tahun dalam kawasan tersebut). Contohnya air terjun yang menarik adalah air terjun yang dipanggil 'Great Waterfall' setinggi lebih kurang 100 meter yang terdapat di Sg. Selai.

Barite and associated massive sulphide and Fe-Mn mineralization in the Central Belt of Peninsular Malaysia

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The major barite occurrences of Peninsular Malaysia lies within the Central Belt in volcano-sedimentary Permo-Triassic rocks of Kelantan, Terengganu and Pahang.

The areas which have yielded (and in some cases still producing) economic outputs of primary barite include:

— Sungai Trengan area, Terengganu
— Tasik Cini area, Pahang
— Sungai Pedah area, Kelantan
— Bukit Pencuri, Kelantan
— Jenderak, Pahang

The primary barite mineralizations in Peninsular Malaysia can be classified by their mode of occurrence into two main types, namely, stratiform and vein type.

The **Sungai Trengan** barite mineralization is synsedimentary stratiform, probably of volcanic-exhalative origin. The sedimentary barite beds lie within a succession of siltstones and shales overlain by quartzitic or arenaceous formations. The argillaceous sedimentary sequence with barite have been assigned the Lebir Formation (Rajah, 1975) of Permian age. Plutonic igneous rocks (adamellite, granite and granidiorite) outcrop to the east and west of the area.

The sediments hosting the barite are folded, striking in a NW-NNW direction with dips varying from 50-90° mainly to the east and are intimately associated or interbedded and conformable with cherty and graphitic shales.

The individual barite horizons vary in thickness up to 3 m and occur as shaley, pisolitic, nodular or massive beds with bedding and sedimentary structures. Acid intrusives cross-cut the barite in various places.

With the completion of the Kenyir Dam, the majority of the outcrops have been submerged leaving those above the 400 ft contour forming individual islands.

The **Tasik Cini** barite mineralization is hosted by stratiform meta volcano-sedimentary sequences of phyllite, slate, phyllitic metatuff and metasandstone of the Mersing Group of Permian age (Fauzi, 1989).

The mineralizations at **Bukit Botol** and **Bukit Ketaya** show classic vertical and lateral facies change so typical of massive sulphide deposits. Iron and manganese oxides form the outer facies followed by barite and massive sulphides at the basin bottom which sits on and is intruded by acid intrusives. The massive sulphides have high gold and silver values (Teh, *et al.*, 1992).

The barite deposit at **Puchong Emas**, adjacent to Bukit Ketaya, is also of stratiform volcano-sedimentary type with bedded barite occupying a small, narrow basin.

The barite outcrop at the **Sungai Mentiga** locality in the Cini area is of vein type and hosted by bedded quartzites. The outcrops of barite are associated with the plexus of hydrothermal quartz veins.

The **Sungai Pedah** occurrence is also a vein type barite deposit. The deposit is in the form of a vein (or dyke) of up to 5 m thick cutting the pink porphyritic biotite granite of Triassic age. There is extensive hydrothermal wallrock alteration of the adjacent host rock by the barite mineralization.

The **Bukit Pencuri** barite deposit is also of the vein type and hosted in clastic sediments of the arenaceous series of strata of Carboniferous to Triassic age (MacDonald, 1976). The barite veins are thin, average not exceeding 1 m, discontinuous and occur in iron-oxide stained sandstone, siltstone and breccia. The sandstone is cut by porphyry dykes.

The barite deposit at **Jenderak** is of the stratiform volcano-sedimentary type in rocks of the Kerdau Formation of Triassic age (Burton, 1973). The bedded barite mineralization is found interbedded with carbonaceous mudstones, sandstone and tuff. The barite horizon has a maximum thickness of about 5 m and is offset by at least 3 prominent strike-slip faults (Michael Lau, pers. comm.).

Biostratigraphy of the Kinta Valley, Perak

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The Kinta Valley is mainly made up of limestone or dolomite with subordinate shale. The limestone is widespread and varies in thickness. It is massive or bedded with dips varying from 15° to 70°, forming a few steep sided hills from 100 m to 500 m in height.

In the Chemor area, Middle Ordovician to Early Siluran graptolites with abundant *Orthograptus* cf. *truncatus* have been reported in shale and a Late Ordovician coral was also found in limestone. Late Early to early Late Devonian, Serpukhovian and Late Wolfcampian conodonts have also been found in the limestone.

Near Batu Gajah, Givetian (Middle Devonian) conodonts have been described. In an old mine pit (Wen Yoon Yuen mine, about 400 m northwest of Batu Gajah Golf Course), five solitary corals were found and identified by H.D. Thomas as *Siphonophyllia* cf. *gigantea* Michelin and *Zaphrentites sp.*, indicating a Tournaisian–Visean age. From the same pit, a fusuline *(Eoschubertella* cf. *obscura* Lee and Chen) had also been found, indicating a Middle Carboniferous age. The presence of Permian with Sakmarian brachiopods has been noted east of Batu Gajah between Batu Gajah and Gopeng.

In the Kampar area, limestone, dolomitic limestone and dolomite which underlie Givetian limestone have yielded corals *(Thamnopora)* and gastropods (*Murchisonia, Straparollus*). The Carboniferous has been poorly documented by a coral *(Siphonophyllia)*, a pelecypod (*Schizodus?*) and a cephalopod (*Cyrtoceras?*). On the contrary, the Permian has yielded a large amount of fossils in a good state of preservation, consisting of algae, fusulines, corals, large and thick shells of pelecypods, cephalopods and gastropods. These fossils have been collected mainly from the "old H.S. Lee mine No. 8".

In the Kampung Sungai Keroh area north of Air Kuning, the Geological Survey files indicate the presence of some fossils at the Foong Ngean mine (small gastropods and some stromatoporoids), Hoong Cheong mine (large gastropods, streptelasmid and amplexoid corals, *Actinostroma* and *Clathrodictyum*) and Kwong Pook Loong mine No. 3 (*Murchisonia*-type gastropods). The presence of stromatoporoids indicates that the rocks of these mines cannot be younger than the Devonian. Gastropods and bivalves were noted at the Toong Poh mines north of Kampung Banir and at the Zain and Nun mine northwest of Kampung Banir.

At the H.S. Lee Mine No. 8, two species of fusulines have been reported, i.e. *Misellina claudiae* (Deprat) which is restricted to the upper horizon and *Pseudofusulina kraffti* (Schellwien) in the lower horizon. In fact, these two species have been found together in Japan and their stratigraphical ranges are overlaping. Therefore, one cannot put emphasis on their distribution in two separate horizons at H.S. Lee Mine No. 8.

The following ammonoids have been reported from the H.S. Lee Mine No. 8:

(i) *Prostacheoceras skinneri* (Miller) indicating a Late Artinskian age (Bolorian)
(ii) *Adrianites* cf. *insignis*; Gemmellaro (*Adrianites insignis* indicates a Wordian age)
(iii) *Neocrinite* cf. *guangxiensis* Chao & Liang.

A Wordian age is suggested by the specimens of Adrianites.

Some thin sections cut from the limestone samples collected from the H.S. Lee Mine No. 8 stored at the Geological Survey have been re-examined by the authors. They contain *Pseudofusulina kraffti* (Schellwein), a fusuline which occurs rather commonly in the Upper Yahtashian (the upper part of Lower Permian) and this species may extend into the Bolorian. The thin sections also contain *Cancellina (Maklaya)* ex gr *pamirica* Leven 1968 associated with *Parafusulina* cf. *undulata* Chen 1934, and P. aff. *japonica* (Gumbel). Some *Misellina* specimens described in the past such as *Misellina subelliptica* (Deprat, 1915) sensu Han 1985, are very close to, if not synonymous with, *Cancellina pamirica.*

This limestone corresponds to a subtidal deposition with bioaccumulation and hydrodynamic buildup. Hydrodynamic action is marked by frequent reworking. Fauna is diverse and include large pelecypods and abundant gastropods.

Study on the 39 thin sections from 4 samples of the limestone of "Old Nam Loong Kongsi Mine No. 1" indicates that one of the sample is similar to those from the "old H.S. Lee mine No. 8" and it contains *Cancellina (Maklaya) pamirica. The* other samples represent two different facies:

i) facies rich in *Pseudovermiporella nipponica* Endo
ii) facies rich in crinoids and containing Bryozoa (Fenestellidae and others), rare small foraminifera *(Tetrataxis),* a few gastropods and two tiny corals belonging to *Lophophyllidium* and maybe *Pavastehphyllum.*

A Recent visit to new "H.S. Lee Mine No. 8" (= No. 356, recent mine number given by the Mining Directorate) shows that it consists (from top to base) of:

i) Massive limestone (wackestone to packstone), about 60 m thick, rich in fusulines at a horizon which is about 25 m above its base. The following fossils were noted:

Crinoids (the most common fossil)
Algae: *Tubiphytes obscurus* Maslov
Small foraminifera: *Climacammina*
Fusulines: *Parafusulina* sp.
Sponges: *Hikorocodium*

ii) Bedded limestone, dark grey, 10m thick, rich in crinoids and bryozoa (Fenestellidae and dendroid bryozoa). It also contains very rare *Tubiphytes obscurus* Maslov, some fragments of brachiopods (shells and spines) and rare pelecypoods, very rare sea urchin spines and some ostracods. This limestone is commonly a packstone with rare to abundant dolomite crystals. Stylolites are common. This limestone differs from the above massive limestone because of the absence of fusulines and in the abundance of bryozoa.

iii) Massive limestone, poorly exposed, locally rich in crinoids.

In conclusion, even though the biostratigarphy of the Kinta Valley area ranges from the upper Ordovisian to Permian age, the Permian is more well-dated. The presence of *Maklaya* (fusuline) at H. S. Lee Mine is interesting because this genus as well as other taxa found at this locality are unknown in the northwest Peninsular Malaysia and Peninsular Thailand. *Maklaya* indicates the highest horizon of Bolorian or for some authors the base of Kubergandian. Moreover, the Bolorian limestone at the H. S. Lee Mine is possibly extents into the Yahtahsian and it may corresponds to a period without limestone deposition in northwest Peninsular Malaysia and Peninsular Thailand.

Preliminary microfacies analysis of the Bukit Biwah Limestone, Tasik Kenyir, Terengganu

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A brief field visit to the limestones at Bukit Biwah and Bukit Taat was made in August 1993 by 14 GSM members. These hills are now islands in the lake and are separated about 500 meters of water at the widest part. 18 samples from five localities (2 in Bukit Biwah and 3 in Bukit Taat) in these hills were collected and studied by the author. Bedding planes were only observed at one part of the Bukit Biwah and these dip gently to the east. These limestones are informally referred to as the Bukit Biwah Limestone after the larger hill.

The Bukit Biwah samples are predominantly biosparites and biosparudites containing variable amount of micrite. Large corals, algae colonies and bivalves are seen in several parts of the limestone in the eastern part of the hill. The sand-sized components are predominantly algal fragments, crinoid stems, shell fragments and peloids. Fusulinids, cortoids, grapestones and other intraclasts, and rare pisoids are found in two samples. Most of the bioiclasts have micritic rims and had undergone various degree of rounding and sorting. Some had undergone a biomoldic stage are now filled with coarse sparry calcite.

Possible existence of burrows are indicated by irregular bodies filled with minute dolomites. Coarse dolomites are rare and are present as late phase pore fillers. Calcite veins are present which may represent two or more generations. However, these limestones do not show much signs of deformation.

The limestones at Bukit Taat are predominantly biomicrites and pelmicrites with lesser amount of algal biolithites. Algal and shell fragments, and echinoid stems constitute the main bioclasts. Extensive dolomitisation found in many samples show dolomites with a variety of texture ranging from small anhedral crystals to large euhedral crystals exhibiting several opague zones. A pervasive feature of these limestones is that they are strongly deformed, veined and brecciated. Most of the bioclasts are sheared and the peloids strained. Large echinoid stems, initially of single calcite crystals, show denucleation effects and result in several smaller crystals. Patches of micrite are also recrystallised to form microspar.

Several pertinent questions arise from these initial study which require further work:

1). Can the bedding be deciphered in other parts of the hills?

2). Are the two hills separated by faults as evidenced from the intensive deformation and brecciation especially in the Bukit Taat samples?

3). Are the differences in microfacies present in these two hills a reflection of lateral variation or do represent different stratigraphic horizons?
This work also document the finding of another fusulinid locality in these limestones. Detailed work should be made on to determine the extend of their distribution in these rocks and their exact ages. This should supplement the earlier determination of the Permian age of the limestone by Fontaine (1990).

4. Pisoids are generally considered to be indicators of subaerial, fresh water environment of deposition. Could their occurrence as clasts suggest that a part of these limestones were emergent during their depositional history?

Permo-Triassic tin and gold mineralization patterns of Peninsular Malaysia

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Introduction

Peninsular Malaysia can claim to show the unique status of having two important types of mineralization, that is tin and gold which are of diversed origins occurring as belts side by side or juxtaposed with one another. This was seldom recognised as when tin mining was important, gold mining had only played a minor role. Now that tin mining has become a "sunset" industry, gold mining has once again reappeared to play its shining role which once earned Peninsular Malaysia the name of Gold Chersonee way back in the ancient time. Perhaps the next generation of geologists may be forgiven for regarding Malaysia as a gold producer and tin as only of minor importance.

Tin mineralization and granites

This ubiquitous association of tin mineralization and granite was recognised in the very early writings on the study of tin mineralization and even now this view had not change (see Hosking 1988; Guo, 1988). Tischendorf (1977) and other authors in the IGC sponsored study group on "Mineralization Associated with Acid Magmatism" (MAWAM 1975, 76 and 77) had related deposits of tin (and other lithophile elements) to the what had been named as Precursor and Specialized Granites. Taylor (1986) had used the tectonic settings of tin granites as his basis for the classification of the tin deposits of the world.

The Permo-Triassic granites and primary tin mineralization of Peninsular Malaysia

Tin mineralization in the Peninsular Malaysia is observed to be related to granites and granitoids which are located in what is traditionally named as the Western and Eastern Tin Belts. The age of these granites had been dated to be mainly Upper Triassic (by Bignell and Snelling, 1977). The Rb-Sr isochron age of the Sungei Lembing Granite which is one of the tin mineralized granites of the Eastern Tin Belt, however, falls within the Late Permian.

The Western Tin Belt Granites of the Main Range had been identified to be the S-type, peraluminous and highly differentiated and those which are tin mineralized show mineralogical, textural (Ng, 1987) and chemical (Yeap, 1987) attributes which are similar to the Specialized Granite of Tischendorf (1977). Though the Eastern Tin Belt Granites are determined to be I- and S-types (Rajah *et al.*, 1977), apparently it is only the biotite-bearing S-type plutons which are tin mineralized. These tin mineralized plutons belong to the ilmenite-series of Ishihara (1977).

Tectonic setting of the gold mineralization

Unlike tin, gold mineralization appears to show a very wide variety of tectonic settings and are found throughout the geologic ages from Archean to the Present (Boyle, 1955). Many authors, especially those with experience in tin, tend to view gold mineralization as having the same tectonic setting as for tin and it is presumed that Au is genetically related to granites. Even though the source of Au in Cu-Au porphyry, Au-bearing skarns and some Au epithermal systems had been regarded as of magmatic origin, the tectonic settings which gave rise to these gold deposits were distinctly different from that for tin deposits. Ishihara (1981) had regarded intrusives related to Cu- or Cu-Au deposits as belonging to the magnetite-series as opposed to the ilmenite-series granitoids which are hosts to tin and other lithophile elements. Nevertheless granite can still act as the host for Au deposits but they are not necessarily genetically related. The origin of many epithermal Au deposits had been attributed to large-scaled convective hydrothermal systems driven by magmatic heat source in the upper parts of the earth's crust. Henley (1991) had regarded the source of the gold in epithermal systems as co-genetic with the high level intrusives while. Keith (1983) had provided evidence to show that I-type intrusives or their volcanic derivatives which petro-chemically come under the calcic, calc-alkali and alkali types have been known to be linked to major Au deposits. Many gold deposits had originated as hydrothermal submarine precipitates together with the oxide or more commonly with the sulphide phases on the sea floors. However, the origin and the source of Au in such deposits are still not clearly known (Hannington *et al.*, 1991)

The worlds most important supply of gold comes from the Late Archean to Early Proterozoic Witwatersrand quartz-pebble fossilized placer deposits. The source of the native gold found in these deposits is believed to have come from the Archean gold-quartz veins occurring in the surrounding areas (Minter, 1991). Gold tends to be derived from the deeper source rocks (probably from the mantle as many primitive komatiite magmas are known to contain significantly more Au) and generally basic and ultrabasic igneous rocks show a higher content of gold then their acid or intermediate counterparts (Rose, Hawkes and Webbs, 1979; Crocket, 1991). The hydrothermal solution which gave rise to many important gold deposits in the Archean and Phanerozoic greenstone belts are believed to have been derived from the metamorphic fluids when green schists were being metamorphosed to amphibolites (Boyle, 1955, 1959, 1961; Kerrick and Fryer, 1979; Hutchinson, Fyfe and Kerrich, 1980) and lately, the metamorphic fluids derived from the formation of granulites under regional metamorphism had been interpreted to show very good potential for Au mineralization. Clastic-dominated continental basins can mechanically and chemically concentrate gold while carbonaceous shales are known to show gold content which is 3 times that of normal shales (Crocket, 1991).

Gold mineralization in Peninsular Malaysia

Gold occurrences in Peninsular Malaysia, though of lessor importance are even more widespread then tin and though they are found mainly in the central part of the Peninsula, they also occur in economic amounts in the eastern and to a lesser extent in the western Peninsular Malaysia as well. They occur in various types of host rocks which range mainly from Carboniferous (Rusila) to Permian (Raub-Bukit Koman) to Triassic (Tersang) as veins and lodes cutting these rocks. Several syngenetic volcanogenic exhalative types of Au-polymetallic massive sulphide ore bodies are found in Permian or Triassic deep to shallow water clastics.

Tin and gold mineralization patterns

Both the tin and gold mineralization patterns show one common feature that is they are found in elongated juxtaposed and overlapping belts which run parallel to the main N-S (or rather 340° to 350°) structural trend of the Peninsula. The Western Tin Belt is believed to be confined to the part of a cratonized continental fragment stretching from south-western China to Burma, Western Peninsular Malaysia and Sumatra (or popularly known as SIBUMASU block). The Eastern Tin Belt is identified to be confined to two tiny continental fragments which are interpreted as accreted foreign terranes of the Eastern Block which is part of the larger MANABOR block. The types of tin mineralization in the Western Tin Belt range from pegmatite to aplitic, skarns, greisen systems and hydrothermal veins, breccias and replacement ore bodies in schists, granites and marble (see Yeap, 1980 and Ingham and Bradford, 1963). The Eastern Tin Belt mineralization has a narrower range and is dominated by cassiterite-magnetite skarns, thin greisen sheeted veins and stockworks in schists and granites and Cornish-type hydrothermal lodes.

Four belts of gold mineralization are identified based on the occurrence and the style and the genetic origin of the gold mineralization. Gold Belt 1 (or Western Gold Belt) is confined to the Western Block. This is a diffused belt represented mainly by alluvial gold occurrences and the primary ore bodies are seldom found. Belt 2 (Berching-Raub-Bersawah Belt) is located in the Eastern Block immediately east of the Raub-Bentong Line of Hutchison (1975). This is a very narrow belt but, however, it contains the most well-known gold deposits of Peninsular Malaysia (such as Berching, Raub-Bukit Koman, Selinsing, Buffalo Reef, Batu Bersawah etc.). These deposits consist of significantly large gold-quartz lodes/reefs and parallel vein swarms confined within a brittle-ductile shear zone. The veins and lodes/reefs strike 340° to 350° and in many of these deposits two parallel vein zones can be identified. Minor sulphides such as stibnite, pyrite, arsenopyrite and chalcopyrite accompanied the gold mineralization. The Gold Belt 3 (Gold-Base Metal Belt) which is located east of Gold Belt 2, is a much broader and shows a wider variety of gold mineralization ranging from gold-quartz vein (striking 350°, 080° and 290°-310°), bonanza-type veins in syenites, volcanogenic exhalative Au-Ag massive sulphides and Au-Ag sulphide bearing skarn. Gold Belt 4 (Lubok Mandi-Mersing Belt) is located on eastern part of Peninsular Malaysia and it is juxtaposed with the Eastern Tin Belt. The Lubok Mandi gold deposit is a 8 km gold-quartz lode hosted in weakly metamorphosed and folded slate, phyllites and meta-arenites. It strikes along 345° and has a thickness ranging from 30 cm to 100 cm. The primary gold mineralization in the Mersing area is observed as several discontinuous approximately 350° striking gold-quartz veins cutting strongly folded meta-argillites and arenites. The tin and gold mineralization patterns as observed in Peninsular Malaysia are best explained by a tectonic model involving a westward subduction of the Eastern Block oceanic lithospheric

plate beneath the Western Block at the region slightly east of the Raub-Bentong Line. This is believed to have started sometime in Permian. It is postulated that the westward dipping subduction zone had migrated eastwards with time in several leaps. By around Upper Triassic, two small continental fragments constituting the two foreign terranes of the Eastern Block were brought to collide onto the accretional complex which had been accumulating on the eastern margin of the Western Block. This collision and the subsequent relaxation phase which occurred when the subduction zone shifted further eastwards, had allowed the generation of S-type or Ilmenite-series granitoids in the lower parts of the thicker cratonized sialic crust of the Western Block and the two small foreign terranes of the Eastern Block. When the anatexis of certain parts of the sialic crust which were tin-rich took place, Precursor and Specialized granites were generated. This then gave rise to the tin deposits found in the Western and Eastern Tin Belts.

The subduction of the oceanic lithospheric plate of the Eastern Block and the accumulating sediments at the plate margin, resulted in a progressive metamorphism of these materials with time. The metamorphic fluids derived from the process of converting green schists to amphibolites and then to granulites had mobilized the available Au and then on migrating upwards along regional fractures which cut the over-riding plate had caused mineralization of the gold-quartz vein and lodes (for example Gold Belt 2). When subduction continued progressively, the subducted lithospheric materials were probably melted. Wherever Au is available, it was incorporated into the "calc-alkali" (or "alkali" during phases of relaxation) magmas which rose to a higher level or to the surface of the crust of the over-riding plate to form island arcs. This has then given rise to Au deposits which were found associated with volcanics as exhalites (alkali intrusives) and in skarns (for example Gold Belt 3).

Permo-Triassic geology and paleontology along the Dada Kering-Merapoh Highway, Pahang

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Jabatan Geologi, Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor D.E.

The Dada Kering-Gua Musang Highway cut across various rock types including igneous, metamorphic and sedimentary rocks. Richardson (1950) has divided the sedimentary rocks which dominate the geology of Merapoh area into three main facies, i.e. the calcareous, argillaceous and volcanic (pyroclastic) facies. All this facies were group together in his Calcareous Series which seems to be rather similar to the Gua Musang Formation.

The calcareous facies occurred as several isolated hills or mogotes as well as some low lying karst features in Merapoh village, extend to the south, up to Sungai Yu halt. Another karst features can also be found around Gua Mesah at Sungai Temau. The calcareous facies is mainly made of thinly bedded to massive light grey to dark grey limestones which can be classified into oosparite and biosparite. Tuffaceous and argillaceous limestones are also common. In places, the limestones are crystallised.

Macrofossils in limestones are very difficult to be identified, but microfossils have given some idea about the age of these limestones. The actual age range of the limestones is not very certain. However, from Gua Panjang Upper Permian (Dorashamian) *Colaniella media* was reported while from south of Sungai Jeleteh some Lower Triassic (Spathian) conodonts including *Neosphathodus triangularis* were recorded by Metcalfe (1990). In places, the limestones are also found interbedded with or occurred as lenses in Upper Permian brachiopod rich shales.

The Argillaceous facies comprises thickly bedded to massive tuffaceous or sometimes calcareous mudstones and shales, and thinly bedded tuffaceous shales. When fresh, some of the massive mudstones seem to be slightly metamorphosed to slates. These massive mudstones and shales usually are richly fossiliferous with dominant brachiopod fauna. Other fossils include bivalves, gastropods, nautiloid cephalopods, solitary corals, bryozoans, crinoids, algae and some plants. Where exposed the basal part of these fossiliferous shales and mudstones are commonly overlying weathered rudaceous beds of probably lapili in origin.

The brachiopod fauna is usually associated with *Leptodus*. The presence of *Oldhamina dicipens* at Sungai Toh and from another road exposure in between Gua Panjang and Sungai Yu halt indicate that

these *Leptodus* bearing shales and mudstones are Upper Permian (Middle Dorashamian or slightly older) in age. *Haydehella minuta* which marked the uppermost Paleozoic brachiopod horizon in this region are found at Sungai Jeleteh. The thinly bedded shales are scarcely fossiliferous, but the occurrence of Paratirolites at Sungai Temau suggested that they belong to uppermost Permian.

The volcanic (tuffaceous) facies comprises some massive fine-grained tuff northeast of Sungai Jeleteh and some thickly bedded coarse-grained south of Sungai Jeleteh and in between Sungai Yu halt and Sungai Yu bridge. In other places, it is very difficult to differentiate this facies from other facies.

One small body of olisthostrome and coarse-grained arenaceous and rudaceous sediments exposed in between Sungai Temau and Sungai Jeleteh.

The metamorphic rocks are found blanketing the Bukit Tujuh granite intrusion. They are made of slates, phyllites and metatuff.

Igneous rocks exposed at Bukit Sembilan comprise of porphyritic quartz granites, porphyritic biotite granite and some microgranites with some xenoliths which characterise the marginal zones of the intrusive body.

Hematite-bearing quartz vein, probably related with the Batu Yon iron mineralization are found cutting the coarse-grained tuffaceous sediments south of Sungai Jeleteh.

Fieldtrip on Permo-Triassic of Malaysia and Related Mineralization, 15-17 April 1994 — Report

Following the Seminar on Permo-Triassic of Malaysia and Related Mineralization, the Society's Sedimentology & Stratigraphy Study Group and Economic Geology Working Group successfully organised a 3-day fieldtrip from 15th to 17th April 1994. This field excursion was led by Dr. Yeap Ee Beng and Dr Azhar Haji Hussin; and due to unforeseen circumstances, Dr. Mohd. Shafeea Leman, the other leader was unable to make it.

The 28 participants left UKM Bangi and UM Kuala Lumpur early in the morning in separate vehicles and met at Genting Sempah at 8.30 am. After breakfast, the group left for Bukit Koman in a convoy of five 4WDs and a bus. The convoy arrived at Kim Chaun gold mine after a 2-hour journey. This soft-rock opencut gold mine works on part of the former Raub Australian gold mine, the best known gold mine in Malaysia. The gold mineralization in the form of gold-quartz-sulphide veins and disseminations is hosted in strongly deformed Late Permian meta-argillite and marble. The main gold-bearing veins strike 350° and have suffered ductile deformation.

The participants spent about 1 hour at the Kim Chaun gold mine. After lunch, the participants grouped at Felda Sg. Koyan to continue their journey to the next stop, the Selinsing gold mine which was 15 minutes away. At the Selinsing gold mine, the participants were shown the various processes of gold extraction and dressing by the mine manager. The participants also studied the exposures and had the chance to see the numerous old shafts and adits which are now exposed by opencut mining. The gold mineralization in this mine is also represented by 350° trending quartz veins hosted by meta-argillite. A thick cataclastic zone is also mineralized.

Before starting a long journey to the Kuala Relau Base Camp, a brief stop was made in the Buffalo Reef Prospect. The convoy arrived at the base camp at 7 pm. Only the 4WDs were used in the journey to the Kuala Juram camp, Taman Negara, which was 12 km away. Dinner, prepared at Merapoh, was served at 9 pm. Everyone enjoyed their dinner surrounded by an orchestra of cicadas and other insects. After dinner, there was a brief discussion on future projects/fieldtrips. For 2 nights the participants slept in 3 dormitories. Though the Kuala Juram camp is a bit basic, it provided great comfort amidst the wilderness of Taman Negara.

Everyone woke up early the next morning in preparation for the strenuous hike up the Gunung Tahan trail. The trail started with a narrow bridge made up of a 10 m long log placed over Sg Juram, about 5 m above the water level. This wobbly log bridge was a test to the participant's balancing skill and almost everyone (one preferred to wade across the knee-deep river) passed this test. These trail crossed Sg Tanum in a few places and several Triassic (?) metasediments outcrops were studied and sampled. The first outcrop of Jurassic (?) red mudstone and coarse sandstone was observed near Kuala Sg. Luis. From there onwards, the trail got steeper. After taking a short break at a rapid, east of Kuala Sg Luis, the participants continued their journey and reached the waterfall at about 1.30 pm, after a 4-hour hike.

The participants took a 1-hour lunch break (lunch was packed in Kuala Juram) to regain their energy before making their descent. The return journey took slightly more than 2 hours. By this time, tiredness forced most of the participants to decide to wade across Sg Juram instead of straining their wobbly legs walking across the log bridge.

Dinner was again prepared at Merapoh and collected by Dr. Ahmad Tajuddin and Dr. Yeap. Due to tiredness and the drizzly night, most participants went to bed early. Next day the participants left Kuala Juram camp at 8 am and made a short stop at Kuala Relau Base Camp,

Permo-Triassic of Malaysia and Associated Mineralization Fieldtrip


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Permo-Triassic of Malaysia and Associated Mineralization Fieldtrip


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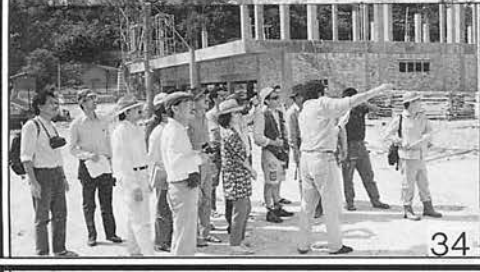
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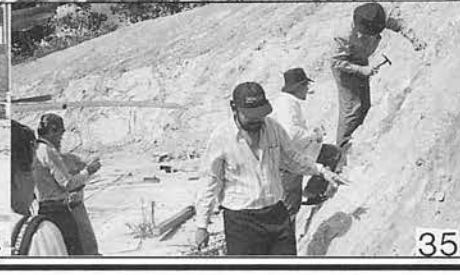
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where trip leader, Dr. Yeap presented a souvenir to Encik Zulkifli, the camp warden on behalf of the Society.

After breakfast at Merapoh, the convoy headed south to the abandoned Modal Quarry at Gua Panjang limestone hill. The carbonates comprise two sequences. The lower sequence is composed of poorly fossiliferous mudstones and wackestones. Deposition of this sequence was terminated by a disconformity. This sequence was subsequently overlain by boundstones with intraformational breccia, followed by oolitic grainstone.

The second stop on the last day was the Upper Permian Leptodus shale outcrop. Slate interfingering with minor limestone is exposed at this road cut, along the Kuala Lipis-Gua Musang road. The slate is rich in brachiopod faunas. The next stop was the Lower Triassic limestones, also along the same road. Here blocks of limestone appear to be enclosed by thinly bedded shales and siltstone.

The convoy reached Kuala Lipis at noon. After lunch, a stop was made outside the Kuala Lipis town to study the Triassic Myophoria sandstone which comprises thickly bedded sandstone with several coquina beds. After examining the exposure for 20 minutes, a coquina bed was found, and everyone had a field day collecting bivalve fossils.

A brief stop for refreshments was made at Jeram Busu near Benta. At 3.30 pm the convoy arrived near Raub to examine a new slopecut at Pasdec Garden. This interesting exposure of shale and sandstone with a bed of conglomerate resembles rocks of the Semantan Formation. The sequence is invaded by a 2 m thick felsite sill. Several bivalve fossils and plant remains were found by Dr. Ahmad Tajuddin Ibrahim, and shortly after, a 30 cm thick coquina bed was also found. A Triassic age was assigned to this sequence based on the fossils present. At 5.00 pm, after saying farewell and exchanging addresses, the participants departed for Kuala Lumpur and Bangi.

T.F. Ng

Permo-Triassic of Malaysia & Associated Mineralization — Fieldtrip

Captions to Photos

1. Arrival at Kim Chuan Gold Mine.
2. Dr. E.B. Yeap briefing the participants.
3. A closer look at the small-scale ductile deformation structures.
4. Dr. Yeap explaining the folding pattern of the metasediments.
5. Participants admiring a saddle reef.
6. Participants looking at the ball mill.
7. A worker showing goldflakes in a dulang.
8. Observing the gold on a shaking table.
9. Everyone within the fenced-up gold processing lab.
10. Dr. Yeap briefing on the lay-out of the Selinsing Mine.
11. An old adit exposed by opencast mining.
12. Mr. Yee (right), the mine manager, showing an old adit.
13. George Poon briefing on the gold mineralization at Buffalo Reef.
14. A refreshment break before the journey to Taman Negara.

15-17. Dinner at Juram Camp.

18. A group photo before the hike.
19. Steady! Steady! Just a few steps more!
20. Dr. Yeap showing the location on the Gunung Tahan Trial.
21. A short break at a metasediment outcrop.
22. Crossing Sungai Luis.
23. Another short break at Sg. Luis.
24. Lunch break.
25. Everyone fresh again & smiling after a good night's rest.
26. Dr. Yeap presenting a token of appreciation to En. Zulkifli.
27. Dr. Azhar briefing participants at Modal Quarry.
28. A closer look at the outcrop.
29. "That's where I found the fossil!"
30. Searching for brachiopods at the *Leptodus* shale outcrop.
31. Searching frantically for bivalve, fossils at *Myophoria*-bearing sandstone.
32. "Isn't this a fossil?"
33. Time for refreshments at Jeram Busor.
34. Dr. Azhar briefing on the outcrop at Pasdec Garden.
35. A closer study of the metasediments.
36. Dr. Basir showing the fossils in a coquina bed sample.

AGM & Annual Dinner 1994 — Report (Laporan)

The Annual General Meeting 1994 was held on Saturday 30 April, 1994 at the Kontiki Room (Mezzanine Floor), Federal Hotel, Kuala Lumpur. It started at 6.20 pm, slightly late due to poor directions. The AGM was chaired by the President, Fateh Chand, and attracted a crowd of 21, which included Prof. Naha, who sat in as an interested observer.

Although the room had a breathtaking view of the swimming pool, it did not distract the proceedings of the AGM. The various items on the agenda were discussed with the usual comment, queries and the expected explanations. In responding to the President's Report, Prof. Ibrahim Komoo suggested that the activities of the Society should become more outward to attract a wider audience participation. M.C. Choo in supporting the move suggest a form of "shadow cabinet" and the setting up of expert groups to deal with specific disciplines (in view of the condominium collapse at Ulu Klang). Assoc. Prof. Mohamad Ali Hasan brought up some anomalies in the President's and Secretary's Reports and suggested bar charts to reflect better the Society's membership and publication sales. Prof. Hutchison then proposed a more aggressive membership drive and suggested more local news in the *Warta Geologi*. The large number of unsold Bulletins again attracted great attention and M.C. Choo suggested cutting down the number per issue. In a lighter vein, M.C. Choo proposed the next Annual Geological Conference should be in East Malaysia. Let us see where the new Council will decide.

In view of the Minister of Primary Industries being the Guest of Honour at the Annual Dinner at 7.45 pm, the President was able to steer the AGM to a successful conclusion at 7.30 pm.

The Annual Dinner 1994 was held at the Skyroom of Federal Hotel. It was indeed a night to remember as it is the first Annual Dinner of the Society to be attended by a Minister. In his speech, GSM President, Fateh Chand, highlighted the Society's activities for the past year. The Minister of Primary Industries, Dato' Dr. Lim Keng Yaik, gave a most steering speech, the best so far by a Minister at the Society's functions. In his speech Dato' Seri Dr. Lim is of the opinion that geologists have a proactive role to play in the national development process in geoscientific input under the umbrella of a registered professional institution for the construction of dams, highways, high-rise buildings and other infrastructure projects and more optimum exploitation of the country's limited natural resources like groundwater, composites and industrial minerals.

The 8-table 8-course dinner proved to be just as delicious for the participants which included geologists (and their spouses and children) from the universities, the Geological Survey, and the industry.

G.H. Teh

Annual General Meeting '94

Captions to Photos

1. GSM President, Fateh Chand, Chairing the AGM.
2-3. The participants at the AGM.
4. A group photo of all present.

Annual General Meeting '94

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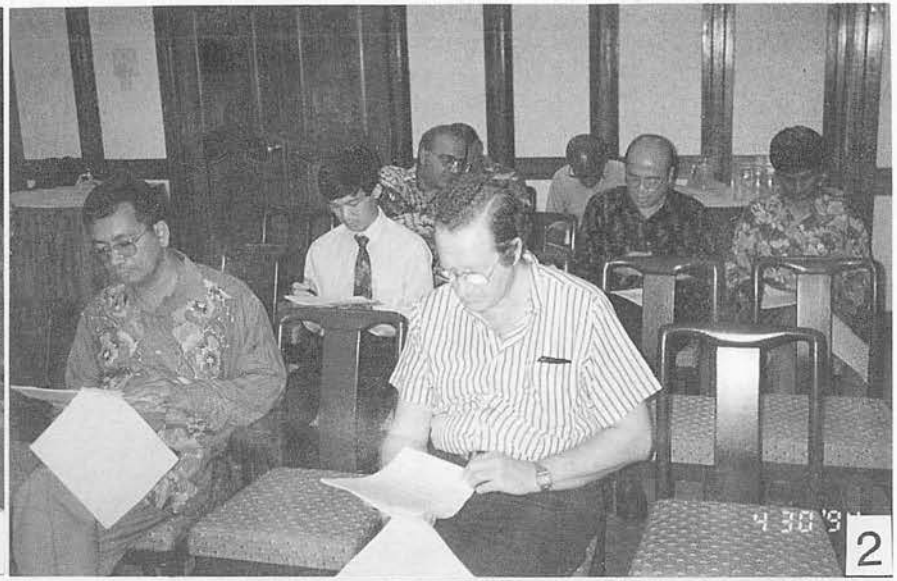

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Ucapan Presiden Persatuan Geologi Malaysia, En. Fateh Chand di Majlis Jamuan Tahunan Persatuan Geologi Malaysia pada 30 April, 1994

Yang Berhormat Dato' Seri Dr. Lim Keng Yaik
Menteri Perusahaan Utama;

Datuk-Datuk/Datin-Datin;

Honorary Members of the Society;

Ladies and Gentlemen.

Firstly, let me take this opportunity to welcome and thank Y.B. Dato' Seri for being able to be with us here tonight. I also wish to welcome all the invited guests and Society members.

Tonight's dinner is the culmination of another fruitful year for the Geological Society of Malaysia. Those of you who were here earlier this evening at our AGM participated in discussions to further realise the objectives of the Society and several proposals were accepted to be implemented by the new Council which you elected. To the outgoing Council members, I wish to say "Thank You" for all the co-operation and hard work put in. To the in-coming Council members, I wish you a warm welcome and look forward to your contribution for the session 1994/1995.

Y.B. Dato' Seri,

In the President's Report which covered last year's activities, I touched on the highlights of the Society's activities. They were:

(i) The 8th Annual Geological Conference held in Langkawi declared open by Y.B. Tuan Haji Zakaria bin Haji Said who represented the Y.B. Menteri Besar of Kedah;

(ii) The 17th Petroleum Geology Seminar held in Kuala Lumpur and declared open by Tuan Haji Mohamed Zohari Shaharun, Vice President, Exploration & Production Sector, PETRONAS;

(iii) Roving Workshops on Environmental Impact Assessment held in Kota Kinabalu, Kuching and Kuala Lumpur which were conducted jointly with the University of Plymouth, U.K.; and

(iv) 15 technical talks, 3 forums and 5 field trips held during the past year.

For the new Council Session of 1994/95 the Society will organise or co-sponsor the following:

(i) The 9th Annual Geological Conference to be held on 11-12 June 1994 at the Primula Resort, Kuala Terengganu with geological field trips to Pulau Perhentian and the surrounding areas. This meeting will be opened by Y.B. Menteri Besar of Terengganu.

(iii) A Forum on "Geology and Hillside Development" to be held in July 1994 at the University of Malaya. This forum is organised together with the Geological Survey Department and the Institute of Geology Malaysia. The Society is taking the initiative to hold this forum as we feel that geological inputs are not being made use of effectively

or are even not considered at times in some engineering projects. The construction industry tends to consult the geologists when they run into trouble which by then becomes a "reactive" role rather than a "preventive" role. Many problems resulting in cost-overruns and high maintenance costs can be avoided if proper geological inputs are considered. Today one has to use a multi-disciplinary approach with inputs from remote sensing specialists, engineering geologists, hydrogeologists, etc. besides those of architects, civil and geotechnical engineers right from the planning to the implementation stage. At this forum, we will be inviting civil engineers, housing developers, planners, architects and others involved in the construction industry. The Society, which has an Engineering Geology Working Group, will come up with some guidelines which will be tabled to the Ministry of Housing and Local Government at the end of the Forum.

(ii) During August 21-24, 1994, the Society will co-host the American Association of Petroleum Geologists (AAPG) International Conference and Exhibition to be held at the PWTC, Kuala Lumpur. An expected 1,500 delegates from around the world together with their spouses are expected to attend. The Conference theme "Southeast Asian Basin: Oil and Gas for the 21st Century" will generate exciting discussions and some 200 technical papers will be presented orally or in poster sessions. Four field trips will be held in conjunction with this Conference and they will be to Sarawak, Phuket and Southern Thailand, Northern Sumatra and around Kuala Lumpur.

Y.B. Dato' Seri dan Para Hadirin,

1994/95 promises to be even more challenging for the new Council. For a start, the new Council together with the Institute of Geology will actively pursue the Professional Geologist's Act to regulate the activities of the geologists. We feel geologists should be regulated by the government so that only qualified and competent professionals provide the necessary geological inputs since their inputs are required in engineering projects, groundwater exploration and development, environment impact assessment, search for petroleum, coal and minerals etc. Furthermore once registered the practising geologists will have to abide by its code of ethics. Y.B. Dato' Seri the Institute of Geology has requested for a suitable date for a meeting to brief you on the need of such an Act. We are well aware that you are actively involved in overseas missions to promote our primary commodities and at the same time to defend the country on issues involving tropical forests, eco-labelling and many other issues. We certainly hope you will be able to take up this issue of the Registration of Geologists.

The Society which contributed towards the formulation of the Mineral Development Policy and Planning Project is looking forward to the tabling of the New Mineral Policy and the associated legislation. Foreign investors are eagerly waiting for its release.

Ucapan YB Dato' Seri Dr. Lim Keng Yaik, Menteri Perusahaan Utama di Majlis Jamuan Tahunan Persatuan Geologi Malaysia pada 30 April, 1994

Yang Berusaha Tuan Pengerusi Majlis;

Y. Bhg. Tan Sri Dato' Dr. Othman Yeop Abdullah,
Ketua Setiausaha, Kementerian Perusahaan Utama;

Y. Berusaha Encik Fateh Chand,
Ketua Pengarah Penyiasatan Kajibumi;

Y. Berusaha Dr. Ahmad Tajuddin Ibrahim,
Setiausaha, Persatuan Geologi Malaysia;

Tan Sri-Tan Sri, Dato'-Dato', Tuan-Tuan dan Puan-Puan Yang Dihormati Sekalian.

Terlebih dahulu saya ingin mengucapkan terima kasih di atas penghormatan yang diberi kepada saya untuk hadir dan berucap di Majlis Jamuan Tahunan Persatuan Geologi Malaysia pada malam ini.

It is indeed an honour to be given the opportunity to address the members of Persatuan Geologi Malaysia at this dinner in conjunction with your Annual General Meeting.

Ladies and Gentlemen,

On occasions such as this, I cannot help but feel very proud and happy to be a Malaysian and live in a united, stable and prosperous Malaysia, which is the envy of many, including those from the developed world. We really have come a long way from being a producer of low value added primary goods, into a nation that has not only dynamically diversified into multifarious economic activities such as manufacturing tourism, and services but also into one that produces higher value added primary commodities. Although small, we have become an important player in the globalised market.

The progress and achievements that we have enjoyed up to now have not come about naturally or by chance. But are the result of a very well planned strategy, perseverance and hard work of Malaysians from all strata of society and from the various disciplines. While we can be proud of our successes thus far, we should neither feel complacent nor forget that we have a bigger target ahead, that is to establish a "prosperous society, with an economy that is fully competitive, dynamic, robust and resilient" in line with vision 2020.

As the Malaysian economy has become more globalised, we have to accept the fact that the world environment in which we operate is a dynamic one, and that it is changing all the time. As you may have observed and realised, these changes may even be hostile and of late, have definitely been posing some very real and awesome challenges that we have to address in order for us to sustain and enhance our economic growth. Without this growth, meeting our targets and fulfilling our aspirations is going to

become very difficult and hence realising our vision would remain a mere dream and not a reality. There is therefore an urgent need on the part of everyone of us to put in greater efforts, to not only sustain our present rate of growth, but also to ensure that we continue to retain our competitive edge and other related advantages, without this competitive edge, our growth rate may in fact become stunted and we would be overtaken by other economies which are also growing dynamically.

In this respect, I would presume that geologists, like other professionals, have an equally important role to play in national development and contribute their fair share towards the achieving of certain targets and goals which may be unique to the profession, but which are nevertheless important components of the overall national development programmes.

In our march towards vision 2020 we must ensure that nothing untoward happens along the way to thwart our cherished dream of creating a caring, united, and fully industrialised nation. The collapse of the Highland Towers condominium, various flooding and landslide incidents which have claimed many lives, are grim reminders that we must always be vigilant to ensure a safe, beneficial and sustainable development. There is no denying the fact that prevention is better than cure. If only preventive measures had been taken at an earlier stage, such tragedies may not have occurred and many people would not have died so tragically. And even before we have fully recovered from the Highland Towers collapse, and developers were frantically pouring concrete and placing plastic sheets in the hope of strengthening the bases of their high-rise buildings, we read with consternation that sections of a resort building in Fraser's Hill had also collapsed, fortunately no lives were lost this time.

We are also viewing with some concern reports from some quarters that indicate that our ground water resources may also be subject to pollution if preventive measures are not taken to check industrial waste, run-offs and other contaminants that may seep into the ground. In the years to come, ground water is going to become a very precious commodity, especially for people living in those parts of the country where their main supply of water comes from under the ground.

Looking at all this in toto, I feel that geologist too have a role to play in the national development process, such as in the formulation of stricter procedures and regulations pertaining to geoscientific inputs in the building of dams, roads, high-rise building and other infrastructure projects. Such geoscientific inputs are essential to ensure the safety of engineering structures and for minimising the negative impact of the environment.

I presume that in conjunction with your annual meeting, you would have taken a hard look at your role and examined whether you can venture into new areas to keep up with the changing times. I know for a fact that the geologists are a unique group of people who go around digging holes here and there, whether it be high up in the hills or down below, in the valleys and river beds or even in the deep and inaccessible jungle terrain. I am also aware of the fact that carrying out prospecting and exploration work in virgin territories is not an easy task especially considering the fact that the geologist has to carry most of his props and other equipments through rough terrain and in uncomfortable conditions for periods of up to three to four weeks in order to get the job done. The geologist should not lose heart for all the jobs that are undertaken will definitely end up as statistical, geographical and geological data that will be used by mining companies and other investors in the exploitation and extraction of the valuable

minerals which in turn are badly required to the industrial development programmes of the nation.

It is my view that geologists should not confine themselves to what is beneath the ground, but should also look at what is above and around it, including hillslopes, rivers and the environment in general. In other words, geologists have a proactive role to play to ensure a balanced development that would enhance quality of life for the people. In exercising these roles, it is hoped that geologists would come out with views related to their profession in a responsible manner and which could be implemented to achieve the various objectives.

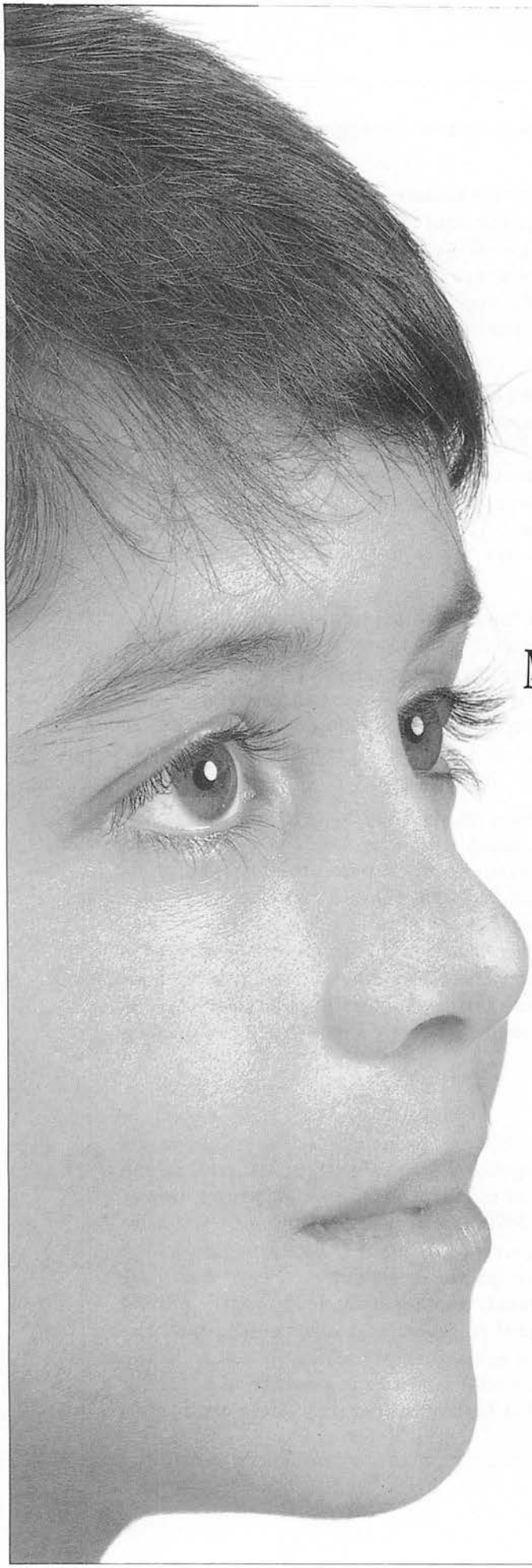
To prevent possible disasters from occurring in the construction industry, including multi million Ringgit mega infrastructure projects, the presence of geo-hazards and other underground instability elements have to be identified in advance. Thus geological inputs should be made mandatory for the selection of project sites, especially during the project conception stage, and subsequently during the implementation stage. This is to prevent tragedies like the collapse of the Highland Towers condominium from recurring and to ensure that our roads, bridges and runways do not start sinking within months of completion of the projects.

In order to ascertain that the geological inputs are acceptable and responsible, perhaps there is a need for the geological profession to be brought under the umbrella of a professional institute or a board which would register, monitor and oversee the profession and the conduct of its members. This would also ensure that school leavers with no indepth understanding or proper training in the geological sciences, but who are nevertheless employed as "geologists" by certain quarters do not get the opportunity to sign off as professional geologists on key project documents.

As the geological profession is rather unique, and is carrying out their duties, the geologists generally do not come into direct contact with the members of the public, there is little awareness among the people on the important contribution of the geologists towards national development. As such something may have to be done to create greater understanding among the populace on the important role of the geological profession to the nation, especially their contribution to the development of the mineral sector and in providing geoscientific information for the construction industry and other major infrastructure projects. For a start, more meaningful inputs on the geological sciences could be included in the school curriculum. This would definitely create greater awareness among the public from a very early stage.

Ladies and Gentlemen,

Whilst the geologists should expand their horizon to include activities above the ground, they must at the same time also not forget or disregard their traditional role in looking for things beneath the ground. In view of the fact that the country is on its way to becoming a fully industrialised nation by 2020, there is a greater need for more optimum exploitation of our limited natural resources. To ensure a sustained growth in the downstream sector, it would be necessary for the geologists to carry out more intensive exploration work that would subsequently and hopefully lead to more mining activities and extraction of our diversified mineral reserves. It is also necessary for the geologists to work hand in hand with the mining engineers and the investors in the furtherance of research and development that would lead to the production of higher value added materials such as composites and industrial minerals. There composites



1993 merupakan tahun penuh bermakna bagi Syarikat-syarikat Esso di Malaysia, kerana pada tahun tersebut usia kami di negara ini genap 100 tahun. Dalam abad yang lalu, kami telah melabur dalam berbagai bidang ke arah membantu memajukan kekayaan sumber asli Malaysia, iaitu minyak dan gas.

Namun, kami juga telah membuat pelaburan dalam satu lagi sumber asli terpenting Malaysia: generasi akan datang.

Melabur dalam sumber asli terpenting Malaysia.

Komitmen kami ke arah membina masa depan yang cerah jelas terbukti – hari ini terdapat 13 buah perpustakaan bergerak – sembilan buah di Terengganu dan empat buah di Negri Sembilan – untuk membantu menggalakkan tabiat membaca di kalangan rakyat Malaysia. Dan sebuah lagi akan dilancarkan di Negri Sembilan tidak lama lagi. Sumbangan juga telah diberikan untuk membantu sekolah-sekolah membeli buku untuk perpustakaan mereka; Esso juga menaja Anugerah Sukan Sekolah Peringkat Negeri; dan program Usahawan Muda Esso membantu membentuk usahawan-usahawan yang berjaya di masa depan.

Matlamat kami adalah untuk membantu menjadikan Malaysia sebuah negara maju menjelang tahun 2020.

Esso

BERGANDING TANGAN BERSAMA MALAYSIA

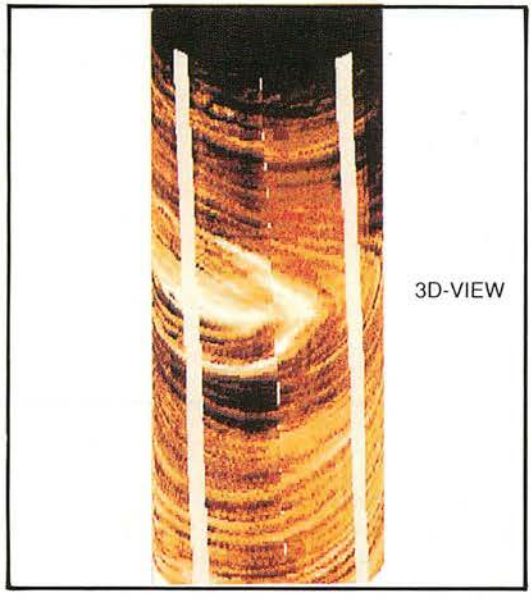
Fullbore Micro Imager*

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

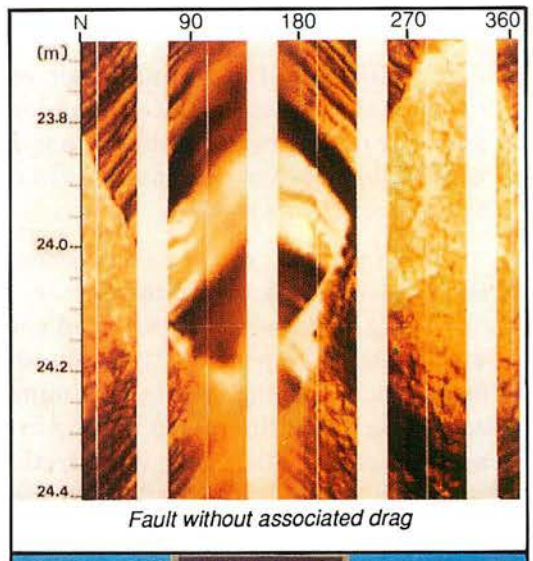
The FMI log, in conductive muds, provides electrical images almost insensitive to borehole conditions and offers quantitative information, in particular for analysis of fractures.

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

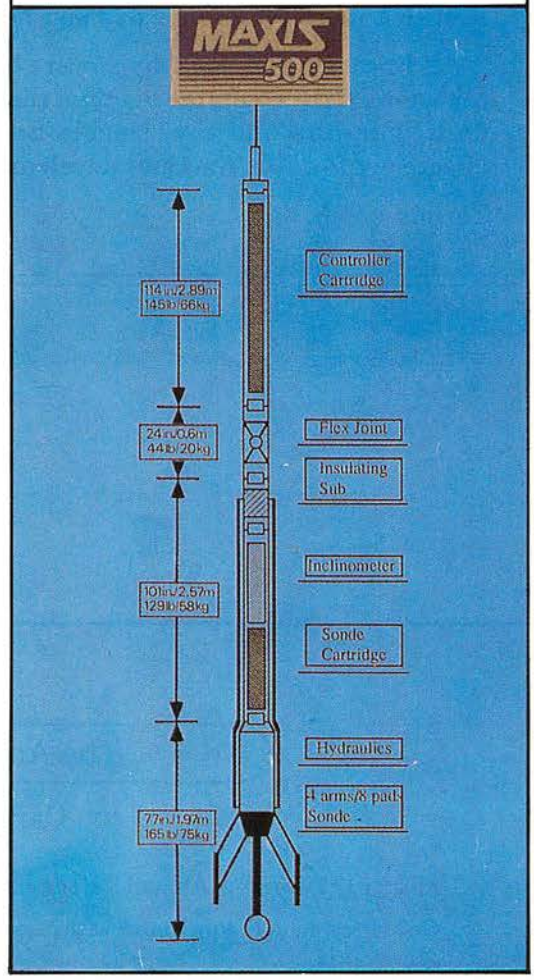
The tool's multiple logging modes allow wellsite customization of results to satisfy client needs without compromising efficiency.



"Bullseye" structure



Fault without associated drag



Schlumberger

and industrial minerals would provide the inputs for the country's industrialisation needs. Once we are firmly established in this field of composites and industrial minerals, we may even venture into the global market.

With regard to ground water, our valuable reserves have to be managed in a more responsible and coordinated manner so that they are not wasted, overdrawn thereby affecting underground stability, nor contaminated by pollutions and other toxic effluents which may prove to be hazardous to the health and well being of the society at large and to the country as a whole.

In order to promote a badly needed and more active private sector participation in the exploration and mining sector, geologists too have an important role to play in providing updated geological and geoscientific information to the private sector. This would not only provide the groundwork, but also prove an attraction for potential investors to participate in the mineral industry sector. As there is now a shift in emphasis from alluvial tin mining to a more diversified development of a broader based mineral sector, including industrial minerals, the geologists should equip themselves with new skills and expertise to meet these changing needs, especially in hard rock mining and in the furtherance of research and development in specific areas that would lead to a more comprehensive and beneficial development of the mineral sector.

In conclusion, it is my sincere hope that your Persatuan Geologi Malaysia would take note of the changing needs of the nation and take the necessary steps to realise the desired results and thus enable the members of the profession to contribute more effectively towards national development.

Terima kasih.

The Annual Dinner 1994

Captions to Photos

1. MC for the evening, Ahmad Tajuddin.
2. GSM President, Fateh Chand, with his speech.
3. YB Dato' Seri Dr. Lim with his address.
4. The main table being served.

5-10. The other tables; busy waiting, busy eating and busy posing.

11-14. Chit-chat after the dinner.

Annual Dinner '94

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Minutes of the 27th Annual General Meeting

Minutes of the 27th Annual General Meeting held at the Malaysian Petroleum Club, Podium Block, Dayabumi Complex, Kuala Lumpur at 6.15 pm on 30th April, 1993 (Friday).

Present:

Ahmad Said (Chairman)
Jimmy Khoo (Secretary)
Lee Chai Peng
Ahmad Tajuddin Hj. Ibrahim
Teh Guan Hoe
Fateh Chand
Nik Ramli Nik Hassan
Tan Boon Kong
Affendy Cheng Abdullah
Choo Mun Keong
Teoh Lay Hock
Seet Chin Peng
David Wong
Mohamad Ali Hasan
Liew Kit Kong
Paul Lim Eng Hwa
Charles S. Hutchison
Abdul Aziz Hussin
Lee Ah Kow
S. Parameswaran
Nicholas Jacob
Ibrahim Komoo

1. Confirmation of the minutes of the previous AGM (1990/94)

The minutes of the 26th AGM were passed on the proposal of Mr. Teoh Lay Hock and seconded by Mr. Mohamad Ali Hasan with the following amendments:

Page 5, no. 9: read as "**Dr.** Ahmad Tajuddin Ibrahim (UM) and **Mr.** Chin Lik Suan (Quarry Contractor)"

2. Matter Arising

2.1. The President informed the meeting that the submitted entries for the photographic competition had been exhibited at the Annual Geological Conference '92, Kuantan (May 1992) and at the Symposium on Tectonic Framework and Energy Resources in Kuala Lumpur (Nov-Dec, 1992). Mr. Mohamad Ali Hasan enquired whether the Society could present duplicates of the winning entries to various organizations/universities for permanent display purposes. The President replied that the incoming Council will decide on this.

2.2. The President informed that a 2-day field guide book on the Langkawi area is currently under preparation by Dr. Lee Chai Peng. This field guide will be published in time for the Annual Geological Conference '93 to be held in June 1993 at Langkawi.

2.3. Mr. Teoh Lay Hock enquired whether the target of 150 members had been reached for the Institute of Geology Malaysia. Mr. Fateh Chand replied that the figure had been reached and that the Institute is finalising its working paper for presentation to the Minister with regards to the Geologist's Act.

2.4. The President also informed the meeting that the incoming Council will look into the amendment of the Society's Constitution with regards to the deletion of the Professional Members class and the refund of the RM50

processing fee. He also informed that the Council had deliberated and approved automatic Life Membership for members of the Society who had been members for 20 years or more continuously. The incoming Council will discuss its implementation.

3. President's Report

Mr. Ahmad Said presented his report for the 1992/93 session. He highlighted the year's major events and thanked those who helped in their organisation. The Society continued to improve financially and all publications especially the *Warta Geologi*, had been up to date.

The President's Report was passed on the proposal of Mr. Fateh Chand and seconded by Mr. David Wong with the following amendment: Para 5, read as "11 July 1992" not as printed.

4. Secretary's Report

Mr. Jimmy Khoo presented his report for the 1992/93 session. He reported that the Council met 12 times during the year, the current office bearers and the status of the Society's membership, sales of publications and exchange of publications were highlighted.

The President elaborated on the issue of the Professional Members class. He stated that a list of names for refund of the processing fee have been prepared but the Constitution needs to be amended. There was not enough time to table the amendment at this present AGM. The incoming Council will do the necessary.

Mr. Jimmy Khoo informed the meeting that a list of names and addresses of current members of the Society is available. Since the list is 18 pages long, members may request for this list from the Society.

The President informed the meeting that Prof. Tjia is presently looking into the possibility of organising a fieldtrip to Sumatra. Members should be getting more information about this soon. He also informed that certificates for all Life Members of GSM have been drafted. Life Members will receive their certificates soon.

Mr. Mohamad Ali Hasan enquired whether the GSM is actually receiving exchange of publications with the Dewan Bahawa and Pustaka. If not, GSM should request for the exchange as the DBP had published several geological publications. The President replied that the incoming Assistant Secretary will look into the matter.

Mr. Choo Mun Keong suggested that the Society should stimulate and encourage young geoscientists to submit their papers for consideration to the Young Geoscientist Award.

The Secretary's Report was passed on the proposal of Mr. Mohamad Ali Hasan and seconded by Mr. Teoh Lay Hock.

5. Editor's Report

In his report, the Editor Dr. Teh Guan Hoe stated that the *Warta Geologi* had been brought up to date and that 4 bulletins have been published since the last AGM. He mentioned that the Society's publications are now finalised through the Society's own DTP equipment.

Dr. Hutchison proposed a vote of appreciation to the Editor for bringing the publications up to date.

The meeting deliberated at length on the storage problems of the Society's publications and what to do with the old stock of publications. Mr. Teoh Lay Hock requested that one set of the Society's publications be sent to the Geological Survey's Headquarters in Kuala Lumpur. The President agreed that this be added to the exchange list of publications in future.

Mr. Mohamad Ali Hasan wanted to know the actual income derived from advertisement carried in the Society's publications. The Editor replied that advertisement income is not much.

The Editor's Report was passed on the proposal of Mr. Fateh Chand and seconded by Dr. Ahmad Tajuddin Ibrahim.

6. Treasurer's and Honorary Auditor's Reports

The Treasurer, Dr. Lee Chai Peng, reported that the financial position of the Society continued to grow in strength with nett assets of RM483,592.70 with an excess of income over expenditure of RM37,526.90.

Mr. Choo Mun Keong and others seek clarification on the expenditure for 1992 for the telefax which was presented as blank.

Mr. Mohamad Ali Hasan wanted to know the income from the sale of batik shirts. The Treasurer replied that this will be shown in the next AGM statement of accounts.

The Treasurer's Report was passed on the proposal of Mr. Seet Chin Peng and seconded by Mr. David Wong with the following amendment:

> under balance Sheet, Current Assets read as "Institute of Geology Malaysia", not as printed.

The Honorary Auditor's Report was passed on the proposal of Mr. Mohamad Ali Hasan and seconded by Mr. Fateh Chand.

7. Election of Honorary Auditor 1993/94

The meeting recorded the Society's thanks to Mr. Peter Chew, Honorary Auditor and re-elected him to continue as Honorary Auditor for the 1993/94 session.

8. Other Business

8.1. Dr. Hutchison requested that the Society's telephone data be listed both in English as well as in Bahasa Malaysia. The Secretary replied that this have been done and hopefully the next telephone directory will carry the dual entries.

8.2. Mr. Teoh Lay Hock called for expansion of the Society's activities to include sports, socials, etc. Dr. Nik Ramli Nik Hassan called for more joint regional activities and trips. Mr. Choo Mun Keong suggested that perhaps the Alumni Geologi, Universiti Malaya can help in organising such activities to which Mr. Mohamad Ali Hasan as Chairman of the Alumni Geology, Universiti Malaya, readily agreed. Mr. S. Parameswaran suggested that the Society play an active role in the organising of exhibits in the national and state museums and galleries which are open to the public. Dr. Nik Ramli suggested that perhaps the Society should contact the National Museum to set up a corner for the GSM. The President replied that the incoming Council will look into and consider all these suggestions.

8.3. Mr. Teoh Lay Hock suggested that the new Council should also consider the setting up of an award for "old geoscientists" similar to the Young Geoscientist Award.

8.4. Mr. Choo Mun Keong suggested that the Society organise annually a "highlight event" including an annual dinner to which a VIP speaker or guest be invited. The President replied that the new Council should consider this proposal.

8.5. Mr. A. Aziz Hussin proposed that the Society put up for sale small souvenirs like paper weights, pens, tee-shirts, bags, etc. The President said that all these suggestions will be considered by the new Council.

9. Announcement of New Council 1993/94

The President Mr. Ahmad Said, announced the new Council for 1993/94 as follows:

President	:	Mr. Fateh Chand (GSD)
Vice-President	:	Mr. S.P. Sivam (UM)
Secretary	:	Dr. Ahmad Tajuddin Ibrahim (UM)
Assistant Secretary	:	Dr. S. Paramananthan (Consultant)
Treasurer	:	Dr. Lee Chai Peng (UM)
Editor	:	Dr. Teh Guan Hoe (UM)
Councillors (2-years)	:	Mr. Jimmy Khoo Kay Khean (GSD)
		Dr. Idris Mohamad (SSB)
		Mr. Choo Mun Keong (Consultant)
		Mr. Ali Mohd. Shariff (Petronas)
Councillors (1-year)	:	Mr. Chin Lik Suan (Consultant)
		Mr. Tan Boon Kong (UKM)
		Dr. Nik Ramli Nik Hassan (Forad)
		Mr. Effendy Cheng Abdullah (Petronas)
Immediate Past President	:	Mr. Ahmad Said (Carigali)

The President thanked the Council for their services during the year 1992/93 and hoped that similar services be extended to the new President, Mr. Fateh Chand. The 27th AGM of the Geological Society of Malaysia ended at 7.30 pm.

Jimmy Khoo
Councillor 1993/94

3 May 1993

PRESIDENT'S REPORT
May 1993 – April 1994

During the year 1993/1994, the Society continued its efforts in the advancement of geological sciences through its publications, the holding of conferences, technical workshops, field trips and work group meetings. The Society maintained its strength in terms of membership and finance.

The Society's two main events i.e. the Annual Geological Conference '93 and the 17th Petroleum Geology Seminar were again successfully held with good attendances and high quality papers.

The Annual Conference, the 8th in the series, was held in Langkawi on 12th and 13th June 1993 at the Delima Resort. It was declared open by Y.B. Tuan Haji Zakaria bin Haji Said who represented the Y.B. Menteri Besar of Kedah. The conference attracted over 150 participants and a record number of 51 papers were presented by geoscientists from the 5 local universities, Geological Survey of Malaysia, Petronas Research and Scientific Services, Petronas-Carigali, Projek Lebuhraya Utara-Selatan (PLUS) and Institut Kejuruteraan Malaysia. I wish to thank our supporters and donors for contributing to the success of the Annual Conference, in particular Malaysia Mining Corp. Bhd., Mamut Copper Mining Sdn. Bhd., Syarikat Sebangun Sdn. Bhd., Bt. Yong Gold Mine and Setia Barite Sdn. Bhd. I also wish to thank the Organising Chairman, Dr. Lee Chai Peng, and his committee for a job well done.

The 17th Petroleum Geology Seminar was held from 7-8 December 1993 at the Concorde Hotel, Kuala Lumpur. The Seminar which was declared open by Tuan Haji Mohamed Zohari Shaharun, Vice President, Exploration & Production Sector, PETRONAS, attracted 340 geoscientists and 27 excellent quality papers were presented. Five poster presentations were also made. Our thanks are due to EPMI, Sarawak Shell Berhad, Occidental (M), Nippon Oil (M), Schlumberger (M), Mobil (US), Excelform, Hall-Houston Malaysia Ltd., Terra Control, Technosif (M) Sdn. Bhd., Western Atlas International, Cogniseis and Digicon for their support and donations in making the seminar a very successful event. I also wish to thank the Organising Chairman, Mr. Effendy Cheng, and his committee for a well organised and successful seminar.

Apart from organising these two main events the Council continued to prepare for another major event, the AAPG International Conference to be held during 21st-24th August 1994 at the PWTC, Kuala Lumpur. Good progress has been made under the leadership of the General Chairman of the Organising Committee, Dr. Khalid Ngah.

The Society also co-hosted with the Department of Environmental Science, University of Plymouth a roving course and workshop on Environmental Impact Assessment from 8-9, 13-14 and 16-17 September, 1993 at Kota Kinabalu, Kuching

and Kuala Lumpur respectively. The workshop was a tremendous success and well received by the participants. The roving course/workshop also benefited our loyal outstation members in Sarawak and Sabah who have been missing out on such events normally held in Kuala Lumpur.

A seminar sponsored by the Society, Department of Geology (UKM), MACRES and IEM was held from 14-15 December, 1993 in Bangi. In addition, a total of 14 technical talks, 3 forums and 4 field trips were held during the past year.

The Society, after a slight setback, has brought its *Warta Geologi* up to date with the Jan/Feb 1994 issue.

The Society's financial position is sound and the Council is optimising the usage of these funds especially in the sponsoring of students to conferences/workshops/seminars/field trips.

On behalf of the Society I would like to thank everyone present here today for their attendance. I would also like to thank the Heads of the Departments of Geology of University of Malaya and Universiti Kebangsaan Malaysia and the Geological Survey of Malaysia for their kind support they have given the Society and also many individuals and organisations who continue to support the Society's activities.

Finally, I wish to thank all the Councillors and members of the Society who have given me their kind cooperation and support during the year as President of the Society.

Fateh Chand
President

SECRETARY'S REPORT

1. The Council

Members of the Council of the Geological Society of Malaysia for the period 1st May, 1993 to 30th April, 1994 are as follows:

President	:	Fateh Chand (Geological Survey Malayia)
Vice-President	:	S.P. Sivam (University of Malaya)
Secretary	:	Ahmad Tajuddin Ibrahim (University of Malaya)
Assistant Secretary	:	S. Paramananthan (Consultant)
Treasurer	:	Lee Chai Peng (University of Malaya)
Editor	:	Teh Guan Hoe (University of Malaya)
Councillors (2-years)	:	Jimmy Khoo Kay Khean (Geol. Survey Malaysia)
		Idris Mohamad (Sarawak Shall Bhd.)
		Choo Mun Keong (Consultant)
		Ali Mohd. Shariff (PETRONAS)
Councillors (1-year)	:	Chin Lik Suan (Consultant) (resigned 19.8.93)
		Tan Boon Kong (Universiti Kebangsaan Malaysia)
		Nik Ramli Nik Hassan (FORAD)
		Effendy Cheng Abdullah (PETRONAS)
		Ng Tham Fatt (University of Malaya (Coopted 20.8.93)
Immediate Past President	:	Ahmad Said (PETRONAS Carigali)

2. Council Meetings

Council Meetings were held every month through the 1993/94 session. A total of 12 Council Meetings have been held.

3. Membership

The total membership of the Society as at 31st December, 1993 is 528. There are 133 foreign members as compared to 395 local members. Details of the various classes of memberships and their geographical distribution are shown in Appendix 1.

4. Society Activities

The annual Geological Conference 1993 was held at the Delima Resort, Langkawi on the 12th and 13th June 1993. A one-day field trip was held on the 11th June, 1993 studying various outcrops on the Langkawi main island. The Conference was well attended by over 200 registered participants.

The Petroleum Geology Seminar 1993 was held at the Concorde Hotel, Kuala Lumpur on the 7th and 8th December 1993. It was attended by 340 participants.

The various Working Groups were very active and they organised a number of forum/seminar and fieldtrips (Appendix 2).

The Society jointly with the Geology Department, University of Malaya and the Department of Environmental Sciences, University of Plymouth organised a short course and workshop on 'Environmental Impact Assessment' from 8-9th September in Kota Kinabalu, 13-14th September in Kuching and 16-18th September in Kuala Lumpur. It was attended by a total of 101 participants.

A seminar on the 'Application of Remote Sensing Data in Geological Sciences in Tropical Area' was also jointly organised by the Society together with the Geology Department of Universiti Kebangsaan Malaysia, Malaysian Centre for Remote Sensing and Institution of Engineers Malaysia on the 14-15th December 1993 at the Geology Department, Universiti Kebangsaan Malaysia.

Fourteen technical talks were held during the 1993/94 session not only in Kuala Lumpur but also in Ipoh, Kota Kinabalu and Kuching. Details of the Society's activities are shown in Appendix 2.

5. Publication Sales

Publication sales remained steady as in previous years. The remaining stock and sales made during 1993 is as shown in Appendix 3. The Society continued to maintain a publication exchange with various professional bodies and libraries as shown in Appendix 4.

6. Young Geoscientist Award

A nomination was received by the Society however at the recommendation of the Young Geoscientist Award Committee, the Society decided that no award be given for the year.

7. Acknowledgments

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

Ahmad Tajuddin Ibrahim
Secretary

MEMBERSHIP OF THE SOCIETY

as at 31•12•1993

Country	Full	Associate	Student	Institutional	Honorary	Life	Total
Australia	24			6		4	34
Brunei				1		1	2
Canada	5						5
China	1						1
Columbia	1						1
Europe	15	1	1	4		6	27
Hong Kong	1						1
Indonesia	6			2	1	1	10
Japan	5				1		6
Mali			1				1
New Zealand	2						2
Philippines	2					1	3
Singapore	8	1		4		1	14
Thailand						1	1
United States of America	21		1	1		1	24
Malaysia	245	9	67	22	4	48	395
TOTAL	336	11	70	34	6	64	528

Society Activities 1993/94

	Date		Event/Venue
1.	11 June 1993	:	**Pre-Conference Fieldtrip:** Stratigraphy of Langkawi main island.
2.	12-13 June 1993	:	**Annual Geological Conference 1993** at the Delima Resorts, Langkawi, Kedah.
3.	1 July 1993	:	**Forum** on urban geology and geotechnical engineering organised by the Working Group on Engineering Geology/ Hydrogeology with Institution of Engineers Malaysia at the IEM Building.
4.	2 July 1993	:	**Site visits** in conjunction with the Urban Geology and Geotechnical Engineering Forum: a) Kuala Lumpur City Centre b) Bandar Sunway.
5.	16 July 1993	:	**Technical Talk:** The use of microwave remote sensing in geology by Dr. Bas Koopmans at the Geology Department, University of Malaya.
6.	23-27 July 1993	:	**Fieldtrip** to Cameron Highlands-Post Blau (Pahang-Kelantan) organised by the Working Group on Tectonic and Structural Geology.
7.	28 July 1993	:	**Technical Talk:** Exploration strategy based on a proven sedimentological model for the glauconitic sandstone (Lower Cretaceous) of Southern Alberta, Canada by Dr. M.Z. Farshori at the Geology Department, University of Malaya.
8.	9 August 1993	:	**Technical Talk:** Marine carbonate sequences from Foreland areas by Dr. Steven L. Dorobek at the Petronas Research and Scientific Services, Ulu Kelang.
9.	13-15 August 1993	:	**Fieldtrip** to Jenderak, Pahang and Kenyir reservoir, Trengganu organised by the Working Group on Economic Geology and Working Group on Stratigraphy/ Sedimentology.
10.	8-9, 13-14 and 16-18 September 1993	:	**Short Course and Workshop** on Environmental Impact Assessment at Geological Survey Department Kota Kinabalu and Kuching and at the Geology Department, University of Malaya.
11.	3 November 1993	:	**Technical Talk:** Sedimentology of Malaysian estuaries by Prof. Bruce Nelson at the Geology Department, University of Malaya.
12.	24 November 1993	:	**Technical Talk:** The marine geology off the North Lantau coast, Hong Kong and its application to infrastructure development by Dr. J.W. Ceri James at the Geology Department, University of Malaya.

	Date		Event/Venue
13.	25 November 1993	:	Event no. 11 repeated at Geological Survey Department, Ipoh.
14.	7-8 December 1993	:	**Petroleum Geology Seminar 1993** at the Concorde Hotel, Kuala Lumpur.
15.	17 December 1993	:	**Technical Talk:** Exploration geochemistry for gold by Prof. W.K. Fletcher at Geological Survey Department, Ipoh.
16.	11 January 1994	:	**Forum** on Groundwater organised by the Working Group on Engineering Geology/Hydrogeology at the Geology Department, University of Malaya.
17.	31 January 1994	:	**Technical Talk:** The euramerian carboniferous floras — Main characteristics and their interest from a geological viewpoint by Prof. J.P. Laveine at the Geology Department, University of Malaya.
18.	3 February 1994	:	**Technical Talk:** Behaviour of gold and other heavy minerals in streams — implications for exploration geochemistry by Prof. W.K. Fletcher at the Geological Survey Department, Sabah.
19.	19 February 1994	:	**Technical Talk:** The trend of seismo-tectonic studies for engineering purposes particularly for dams by Mr. Wasif Ahmad Siddiqui at the Geology Department, University of Malaya.
20.	25 February 1994	:	**Technical Talk:** Weardale granite and its mineralisation by Prof. M.H.P. Bott at the Geology Department, University of Malaya.
21.	2 March 1994	:	**Technical Talk:** Recent advances in tectono-sedimentary evolution of Gondwana Basins of Peninsular India by Dr. R.C. Tewari at the Geology Department, University of Malaya.
22.	13 March, 1994	:	**Fieldwork** with Prof. M.H.P. Bott around Penang Island.
23.	13 April, 1994	:	**Technical Talk:** Sequence stratigraphy — Historical perspective of concepts, problems and challenges in exploration by Prof. Dr. Robert J. Weimer at the Geology Department, University of Malaya.
24.	14 April 1994	:	**Seminar** on Permo Triassic of Malaysia and associated mineralisation organised by the Working Group on Stratigraphy/Sedimentology and Working Group on economic geology at the Geology Department, Universiti Kebangsaan Malaysia, Bangi.
25.	15-17 April 1994	:	**Fieldtrip** to Raub-Kuala Lipis-Merapoh-Gunong Tahan organised by the Working Group on Stratigraphy/ Sedimentology and Working Group on Economic Geology.
26.	26 April 1994	:	**Technical Talk:** Structural history as a clue to crustal evolution by Prof. K. Naha at the Geology Department, University of Malaya.

STOCK OF PUBLICATIONS

Bulletin No.	Sales 1993	Stock Remaining
2	7	315
3	6	326
4	6	185
5	6	88
6	7	619
7	16	365
8	7	41
10	10	14
11	4	117
12	7	32
13	4	148
14	4	28
15	6	68
16	11	90
17	7	155
18	11	146
19	9	675
20	9	522
21	10	268
22	11	328
23	6	326
24	17	494
25	9	277
26	678*	322
27	124	208
28	12	205
30	675*	325
32	29	277
Field Guide 1	6	13
Abstracts (Bulletin 6)	0	6
Stratigraphic Correlation	108	356

* inclusive of free copies distributed to Members

List of Institutions on Exchange of Publications

1 Akademie der Wissenschaften der DDR,
Zentralinstitut fur Physik der Erde,
WIB B 689, Telegrafenburg, Postsdam,
DDR-1561, Germany.

2 Director of All Union Geological Library,
Sredny pr. 74,
199026 Leningrad V-26, USSR.

3 American Museum of Natural History,
Serials Unit, Library,
Central Park West at 79th Street,
New York, N.Y. 10024-5192, USA.

4 AGID,
Attn: The Editor,
Dept. of Geology, University of Nottingham,
Nottingham NG7 2RD, England.

5 Bureau de Recherche Geologique et Minieres,
Dept. Documentation, Section echanges,
Boite Postale 6009,
45060 Orleans Cedex, France.

6 CICESE Library, Gifts & Exchange Unit,
P.O. Box 434803,
San Ysidra, Ca. 92143-4803, USA.

7 Commonwealth Science Council,
Marlborough House, Pall Mall,
London SW1Y 5HX, England.

8 Dewan Bahasa & Pustaka,
Ketua Perpustakaan,
Peti Surat 10803, Kuala Lumpur.

9 Elf Aquitaine (P),
F-31360 Boussens, France.

10 Suomalainen Tiedeakatemia–
Academia Scientiarum Fennica,
Rauhankatu 15B,
00170 Helsinki 17, Finland.

11 Central Geological Survey,
Ministry of Economic Affairs,
P.O. Box 968. Taipei, Taiwan, ROC.

12 Freie Universitat Berlin,
Geologisch-Palaontologisches Institut,
Altensteinstrasse 34a,
1000 Berlin 33, Germany.

13 The Library,
Geological Research & Development Centre,
Jalan Diponegoro 57,
Bandung, Indonesia.

14 The Secretary, Geological Society of Thailand,
c/o Dept. of Mineral Resources,
Rama VI Road,
Bangkok 10400, Thailand.

15 Geological Survey of Malaysia,
P.O. Box 1015,
30820 Ipoh, Perak.

16 Geological Survey of Malaysia,
P.O. Box 560,
93712 Kuching, Sarawak.

17 Geological Survey of Malaysia,
Locked Bag no. 2042,
88999 Kota Kinabalu, Sabah.

18 Chief of Information Dept.,
Institute of Geology of Foreign Countries,
2nd Novotikhvinskaya 12/22,
Moscow, USSR.

19 Librarian,
Institution of Mining and Metallurgy,
44 Portland Place,
London W1N 4BR, England.

20 The Editor,
Malaysian Journal of Tropical Geography,
c/o Dept. of Geography, Universiti Malaya,
59100 Kuala Lumpur.

21 Mineralogical Society of Poland,
30-059 Krakow,
al. Michiewicza 30, Poland.

22 Nanking Institute of Geology
and Palaeontology,
Academia Sinica,
Chi-Ming-Ssu, Nanking,
People's Republic of China.

23 The National Geological Library,
Kan Kia Ko,
Fu Wai, Peking,
People's Republic of China.

24 National Geophysical Research Institute,
Uppal Road,
Hyderabad 500 007, India.

25 The National Library,
Attn: Gifts & Exchange Section (Serials).
Stamford Road, Singapore 0617.

26 Library,
National Science Museum,
Ueno Park, Tokyo, Japan.

27 The Librarian,
New South Wales Dept. of Mineral Resources,
GPO Box 536,
St. Leonard, NSW 2065, Australia.

28 Acquisitions, Library,
Oklahoma Geological Survey.
The University of Oklahoma,
830 Van Vleet Oval, Room 163,
Norman, Oklahoma 73069, USA.

29 Peking Graduate School,
Peking College of Geology,
Xueyuan Road,
Peking, China.

30 The Librarian, Petronas,
P.O. Box 12444,
50778 Kuala Lumpur.

31 Library,
Scripta Geologica,
P.O. Box 9517,
2300 RA Leiden,
The Netherlands.

31 The Director,
SEATRAD Centre,
Jalan Sultan Azlan Shah,
31400 Ipoh, Perak.

32 The Librarian,
UN Offshore Mineral Prospecting,
c/o Mineral Resources Dept.
Private Mail Bag,
Suva, Fiji.

33 U.S.G.S. Library,
Mail Stop 955,
345 Middlefield Road,
Menlo Park, Ca. 94025, USA.

34 U.S.G.S. Library (Exchange & Gift),
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Reston, VA. 22092, USA.

35 Cawangan Hadiah & Pertukaran,
Perpustakaan Tun Seri Lanang,
Universiti Kebangsaan Malaysia,
43600 Bangi.

36 Ketua,
Jabatan Geologi,
Universiti Kebangsaan Malaysia,
43600 Bangi.

37 University of Kansas Libraries,
Serials/Exchange,
Lawrence, Ka. 66045, USA.

38 The Librarian,
University of Malaya,
59100 Kuala Lumpur.

39 Perpustakaan,
Universiti Sains Malaysia,
31750 Tronoh, Perak.

40 The Librarian,
Institute of Geoscience,
University of Tsukuba,
Tsukuba-City, Ibaraki-Pref 305,
Japan.

41 Bahagian Bahan-bahan Bersiri dan Dokumen,
Pepustakaan, Universiti Sains Malaysia,
11800 P. Pinang.

42 Editor, Episodes,
P.O. Box 919,
Herndon, Va. 22070, USA.

43 Peter Chew & Co.,
Room 2, No. 127-1,
Jalan Kampong Pandan,
55100 Kuala Lumpur.

44 Ketua,
Maktab Rendah Sains, MARA,
Jasin, Melaka.

45 Librarian, AAPG,
P.O. Box 979,
Tulsa, Okla. 74101, USA.

46 Petromin Pub. Co.
24 Peck Seah Street,
03-00 Nelsons Bldg.
Singapore 0207.

47 Gift Section, The Library of Congress,
Representative, American Embassy,
P.O. Box 10035, Kuala Lumpur.

48 Geological Survey of Japan,
Library, 1-3 Higashi 1-chome,
Tsukuba-shi, Ibaraki-ken,
305 Japan.

49 Department of Earth and Planetary Science
Faculty of Science,
Hiroshima University,
Higashi Hiroshima 724, Japan

50 The Librarian,
Geological Library
Chamber of Geological Engineers of Turkey,
P.T. 464 – Kizilay
06424 Ankara, Turkey

51 AAPG House of Delegates Representative
Petcons & Assoc.,
4310 Compton Circle,
Bellaire, Tx. 77401-4205,
USA.

52 Ministry of Development
Librarian
Negara Brunei Darusallam 1190

53 Head, Information Science Department,
Nuclear Energy Unit
Kompleks Puspati, Bangi
43000 Kajang

54 Geological Society of Korea,
The President,
Dept. of Geological Sciences,
Seoul National University,
Seoul 151, Korea.

55 Editorial Board,
Natural History Museum & Institute,
Chiba, 955-2 Soba-cho,
Chiba 280, Japan.

56 Kementerian Hal Ehwal Dalam Negeri Malaysia
(Bahagian Penerbitan),
P.O. Box 10382, Kuala Lumpur.

57 Perpustakaan Negara Malaysia,
Bhg. Penyerahan Akta & Hadiah &
Pertukaran,
232 Jalan Tun Razak,
50572 Kuala Lumpur.

58. Faculty of Agriculture & Natural Resources
Attn: The Dean,
Africa University,
P.O. Box 1320,
Mutare, Zimbabwe

59. Scientific Research Council
Attn: Dr. Gladstone v. Taylor
P.O. Box 350
Kingston 6,
Jamaica, W.I.

EDITOR'S REPORT 1993/94

After a brief delay in the earlier half of 1993, the Society's newsletter, the *WARTA GEOLOGI*, is now brought up to date with the publication of Vol. 20 No. 1 (Jan-Feb 1994).

Bulletin 33, the Symposium on Tectonic Framework and Energy Resources of the Western Margin of the Pacific Basin Proceedings is now in the final proof stage while Bulletins 34 and 35 are in the page proof stage.

I would like to record my thanks to Ng Tham Fatt for helping in the various editorial processes and A.K. Fan for her help in the voluminous amount of input.

The help of members of the Editorial Subcommittee in proof-reading, the reviewers and the advice of members of the Editorial Advisory Board are all greatly appreciated.

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

G.H. Teh
Editor

TREASURER'S REPORT 1993

The Society's financial position continues to be strong with nett assets worth RM417,114 in 1993 as compared to RM473,325 in 1992 with an apparent deficit of RM56,211. This is because about RM118,527.11 belonging to the Society is held in the CPCEMR Symposium account which is in the process of being transferred back to the Society account.

Following the suggestions of various members at the last AGM, the Society increased its funding of geological activities especially field-trips and workshops organised by the various study groups. The major expenditures are still our publications and Annual Conference.

The Society would like to express its sincere thanks to its faithful supporters who have continued to uphold our endeavours with their kind donations.

We would also like to express our thanks to our former auditor, Mr. Peter Chew for his many years of service to the Society. We welcome and thank our new auditor, Mr. Law Jack Foo of J.F. Law & Co. who has taken over from Mr. Peter Chew.

Lee Chai Peng
24 March, 1994

PERSATUAN GEOLOGI MALAYSIA
GEOLOGICAL SOCIETY OF MALAYSIA

BALANCE SHEET AS AT 31 DECEMBER 1993

	1993 RM	1992 RM
FIXED ASSETS		
	23,725	23,661
CURRENT ASSETS		
Fixed Deposits	354,775	414,777
Cash at bank	77,148	22,326
Petty cash	867	616
Expenses prepaid	11,253	22,213
	444,043	459,932
Less:		
CURRENT LIABILITIES		
Accruals	360	—
NET CURRENT ASSETS	443,683	459,932
	467,408	483,593
Represented by:		
MEMBERS'S FUND		
Balance brought forward	473,325	435,798
(Less)/Add:		
Deficit/Surplus of income	(56,211)	37,527
	417,114	473,325
Student Loan Fund	6,955	6955
AAPG (AHH)	26	—
Young Geoscientist Award	3,313	3,313
AAPG-GSM Conference	40,000	—
	467,408	483,593

PERSATUAN GEOLOGI MALAYSIA
GEOLOGICAL SOCIETY OF MALAYSIA
INCOME AND EXPENDITURE ACCOUNT
FOR THE YEAR ENDED 31 DECEMBER 1993

	1993 RM	1992 RM
INCOME		
Entrance fee	840	980
Fixed deposits interest received	9,255	22,773
PGS '91 - Donations received	—	53,754
Subscriptions	22,252	24,656
Sales of publications	9,703	14,616
Telefax	1,152	500
Xerox	693	1,360
	43,895	118,639
LESS EXPENDITURE		
Annual dinner	1,736	1,705
Annual conference	8,819	9,984
Best student award	3,000	3,000
Bank charges	375	490
Depreciation on fixed assets	2,636	2,629
Honorarium	7,185	5,414
Postages	7,639	5,065
Printing & stationery — Miscellaneous	3,920	2,073
Newsletter	16,763	1,330
Bulletins	36,050	38,717
Refreshment	859	628
Professional fee	300	—
Subscription to professional bodies	329	65
Sundry expenses	920	965
Speakers' account	1,913	4,880
Sponsorship	1,300	3,649
Study group	5,722	9
Telephone expenses	640	509
	100,106	81,112
(DEFICIT)/SURPLUS OF INCOME	(56,211)	37,527

Report of the Auditors to the Members of the Geological Society of Malaysia

Accountant's Declaration

I certify that I have examined the accompanying Balance Sheet as at 31st December, 1993, the Income and Expenditure Account and the Receipts and Payments Account for the year ended on date, together with the books and vouchers of Persatuan Geologi Malaysia (Geological Society of Malaysia) and confirm that these financial statements are in accordance therewith

Signed

LAW JACK FOO
NO. 488/3/95 (J)
PUBLIC ACCOUNTANT

Signed

J.F. LAW & CO.
NO. AF 0344
PUBLIC ACCOUNTANTS

Kuala Lumpur
DATED: 25 MAR 1994

BERITA-BERITA PERSATUAN
News of the Society

KEAHLIAN (Membership)

The following applications for membership were approved:

Full Members

1. Raja Abadul Halim Raja Muda
No. 4, Jalan PJS10/16, Taman Subang Indah, Subang Jaya, 47500 Petaling Jaya.

2. Shariff Abd. Kadir S. Omang
Jabatan Sains Bumi, UKM Kampus Sabah, LB 62, 88996 Kota Kinabalu.

3. Peter Christian Dadswell
1st Floor, Administration Building, Block A, Kemaman Supply Base, 24000 Kemaman.

Associate Member

1. Aminah bt. Ismail
22-B, Jalan Sri Semantan 1, Damansara Heights, Kuala Lumpur.

2. Bhajan Singh
14, Jalan SS7/30, 47301 Petaling Jaya.

PETUKARAN ALAMAT (Change of Address)

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

1. Ibrahim Samsudin
6 Jalan AU 1A/3B, Taman Keramat Permai, 54200 Kuala Lumpur.

2. Foo Wah Yang
Petronas Carigali Overseas Sdn. Bhd., P.O. Box 12407, 50776 Kuala Lumpur.

3. Wong Vui Chung
P.O. Box 12588, 88828 Kota Kinabalu, Sabah.

4. Hamka Istamar
Ranhill Bersekutu Sdn. Bhd., Box 74 & 75, 29 Fl., Menara Maybank, 100 Jalan Tun Perak, 50050 Kuala Lujmpur.

5. K.Y. Foo
14 Dataran Perajurit 5, 31400 Ipoh, Perak.

6. John Ringis
c/o Fugro Survey, 18 Prowse St., West Perth, Western Australia 6005.

7. Barry Huffer
Halliburton Drilling Systems, 2091, Lorong 10, Jalan Krokop, C.D.T. No.12, 98009 Miri.

8. Chong Foo Shin
18 Jalan Datoh Mahmud, Pasir Puteh, Ipoh.

9. Ausaf-Ur Rahman
Geography Department, National University of Singapore, Kent Ridge, Singapore 0511.

PERTAMBAHAN BAHARU PERPUSTAKAAN (New Library Additions)

The Society has received the following publications:

1. Statistics on mining industry, 1992.
2. The Gunnedah Basin, New South Wales, 1993.
3. Chronique de la Recherche Miniere, no. 513, 1993.
4. IMM Bulletin no. 1015 & 1016, 1993.
5. Geological Survey of Japan, Bulletin vol. 44, nos. 9-12, 1993.
6. Humans and Nature, no. 2, 1993.
7. Institute of Geoscience, The University of Tsukuba, Annual Report no. 19, 1993.
8. Commonwealth Science Council, newsletter, Sept-Oct '93.
9. Abstracts of the Geological Congress of Turkey 1994.
10. Seatrad Bulletin, vol. XIV, no. 2, 1993.
11. AAPG Explorer, March & April 1994
12. Explanatory text of the Geologic map of Taiwan, scale 1:50,000; sheet 67: Fangliao, 1993.
13. SOPAC: Proceedings of the 22nd session, 2-9 Oct 1993.
14. AGID News, no. 74/75, 1993.
15. The Science Reports of the Tohoku University, vol. 63, no. 1, 1994.
16. AAPG Bulletin vol. 78/1-78/3, 1994.
17. Geological Bulletin of Turkey, vol. 36, no. 1, 1993.
18. Berliner Geowissenschaftliche Abhandlungen, Reihe A, Band 140, 142, 143 (1992), 145, 146, 147 (1993)
19. American Museum Noritates, no. 3083 (1993), no. 3086 & 3092 (1994).

PERSATUAN GEOLOGI MALAYSIA
GEOLOGICAL SOCIETY OF MALAYSIA

SPONSORSHIPS FOR MEMBERS' PARTICIPATION AT THE AAPG CONVENTION 1994

Shell Companies of Malaysia and ESSO Production Malaysia Incorporated have donated a sum of money to the Society to sponsor Members especially Student members to the AAPG International Conference and Exhibition to be held on August 21-24, 1994 at the Putra World Trade Centre, Kuala Lumpur

Interested Members are invited to apply for these sponsorships. All applicationts must be made using official forms obtainable from The Secretary, Geological Society of Malaysia. All applications must reach The Secretary by the 1st of July, 1994.

The conditions of eligibility and categories of sponsorships are outlined below:

Conditions of Eligibility

1. Must be a full member/student member of the Society.
2. For full members — must have been a member since 1993.
3. For students — must be a fulltime student.

Categories of Sponsorships

1. Students

i) Top 20% of the class for Year III and IV and Top 10% of the Year II students 1994 (based on their total marks in geological/geophysical subjects in the 1993/94 academic session) will be given 100% sponsorship including travelling and lodging expenses.

ii) All other geology/geophysics student including fulltime postgraduates can be given up to RM50.00 sponsorships.

2. Members

i) Members delivering papers can be given up to RM700.00 sponsorships in the case that they are unable to secure financial assistance from their own organisations.

ii) Other members can be given up to RM500.00 sponsorships.

Final selection of successful candidates will be made by the GSM Council.

For application forms or further information please contact:

Dr. Ahmad Tajuddin Ibrahim,
Secretary,
Geological Society of Malaysia,
c/o Department of Geology,
University of Malaya,
59100 Kuala Lumpur.
Tel: (603) 757 7036 Fax: (603) 756 3900

BERITA-BERITA LAIN
Other News

Senarai Tesis SmSn Semester II Sesi 1991/92 Jabatan Geologi, Universiti Kebangsaan Malaysia, Bangi

1. Abd. Rasid Bin Jaapar
   Geologi am kawasan Tawar-Kuala Pegang, Baling, Kedah D. Aman. 82 halaman.
2. Asminah Bt. Hj. Rajuli
   Geologi am kawasan Ayer Putih-Padang Peliang Sungai Tiang, Kedah. 85 halaman.
3. Azimah Binti Hussin
   Geologi am kawasan Johol-Bukit Rokan, Negeri Sembilan. 108 halaman.
4. Kamarudin Bin Samuding
   Geologi am kawasan Sungai Relai, Ulu Kelantan, Kelantan D. Naim. 85 halaman.
5. Kamarudin Bin Zakaria
   Geologi am kawasan Sungai Lebir, Gua Musang, Ulu Kelantan, Kelantan. 100 halaman.
6. Lim Chun Hui
   Geologi kawasan Sungai Bok, Marudi, Bahagian Miri, Sarawak. 93 halaman.
7. Mohd. Faizul B. Hamdan
   Geologi am kawasan Simpang Pulai-Gopeng, Perak. 78 halaman.
8. Mohd. Fauzi Bin Abdul Kadir
   Geologi am kawasan Bakong, Miri, Sarawak. 97 halaman.
9. Mohd. Lazim Bin Mohamed
   Geologi am kawasan Chenderiang, Perak. 71 halaman.
10. Nor Azian Bin Hamzah
    Geologi am kawasan Baling-Pengkalan Hulu. 60 halaman.
11. Norsham Bt. Samsudin
    Geologi am kawasan Kuala Pilah-Kuala Jempol, Negeri Sembilan. 83 halaman.
12. Raja Abd. Halim Bin Raja Muda
    Geologi am kawasan Sungai Sekaloh, Niah, Miri, Sarawak. 89 halaman.
13. Rozita Bt. Hj. Said
    Geologi am kawasan barat Sungai Tiang, Kedah. 66 halaman.
14. Ruben Raj a/l I. Susai
    Geologi am kawasan sekitar Sungai Aring, Ulu Kelantan, Kelantan D.N. 131 halaman.
15. Shaifol Bahary Sulaiman
    Geologi am kawasan Mersing Endau, Johor Darul Takzim. 101 halaman.
16. Simun Rugag J. Rukag
    Geologi kawasan Mersing-Jemaluang, Johor Darul Takzim. 104 halaman.
17. Tuan Rusli Bin Tuan Mohamed
    Geologi am kawasan Bakas-Seruas Bakong, Miri, Sarawak. 74 halaman.
18. Yap Kam Fai Dominic
    Geologi am kawasan Timurlaut Perlis, Perlis Indera Kayangan. 170 halaman.
19. Zuraidah Ideris
    Geologi am kawasan Dangi, Kuala Pilah, Negeri Sembilan. 78 halaman.

Senarai Tesis Sesi 1991/92
Jabatan Geologi, Universiti Malaya, Kuala Lumpur

1. Ahmad Nizam Hasan
   Geologi Struktur Kawasan Puchong-Pantai Dalam (Selangor-Kuala Lumpur). 77 pp.
2. Azman Abdul Ghani
   Petrologi dan geokimia Pulau Perhentian dan pulau-pulau sekitarannya Besut, Terengganu. 225 pp.
3. Brendawati Ismail
   Geology of the Krokong area, Bau, West Sarawak. 81 pp.
4. Juliah Shamsul Shaari
   Study of the amphibole schists of the Raub area. 40 pp.
5. Mohd Fauzi Abd. Aziz
   Kajian mengenai batuan skis dinding kawasan Hulu Kelang, Selangor Darul Ehsan. 65 pp.
6. Shafari Muda
   Petrologi dan petrografi batuan hibrid dan batukapur kawasan Ulu Dong, Raub, Pahang. 141 pp.
7. Shahridan Faiez Mohideen Abdul Kader
   Geology of the Santubong area, W. Sarawak. 67 pp.
8. Stephen Moligan
   The geology of Bt. Kubong, Labuan. 25 pp.
9. Zarita Hj. Zahur Hussain
   Structural geology along Jalan Baru Machincang, Langkawi, Kedah. 70 pp.
10. Zul Mustafa
    Petrologi igneus dan geokimia, kawasan Sungai Ruan, Raub, Pahang Darul Makmur. 90 pp.
11. Sikh Husin Sikh Abdul Rahman
    Geologi am kawasan Masjid Tanah, Melaka. 60 pp.
12. Azizan Ali
    Geologi am kawasan Sg. Patani, Kedah D.A. dengan penekanan kepada kajian kestabilan cerun Lebuhraya Utara Selatan Gunung Sg. Patani km 916-km108.2. 153 pp.
13. Domenice A/K John Duncan
    The geology of G. Segu-S. Sedu Semenggok area, W. Sarawak. 118 pp.
14. Dorsihan Mohamad Jais
    Perbandingan struktur geologi antara Formasi Pilah Schists dan Formasi Kepis serta hubungannya dengan evolusi tektonik semenanjung Malaysia. 92 pp.
15. Edward Kuol
    The geology of Gunung Sedong Kampung Taie area, W. Sarawak, Malaysia. 123 pp.
16. Fredolin Javino
    The neogene Sandakan Formation and underlying mélange. 115 pp.
17. George A/L Peter Menon
    The geology of the Batu Kitang-Siniawan area, W. Sarawak, Malaysia. 88 pp.
18. Kamarulbahrin Hashim
    Geologi kawasan Kuala Kangsar-Changkat Jering. 70 pp.
19. Hamid Ariffin
    Geologi struktur kawasan timur Pulau Tuba dan pulau-pulau sekitarnya. 170 pp.
20. Law Seng Keong
    Structural geology of Pulau Angsa, Selangor, Darul Ehsan. 27 pp.
21. Mohamed Faizal Zakaria
    Geologi kawasan barat Yong Peng. 90 pp.
22. Mohd Nasir Sheik Mohammad
    Geologi am kawasan Lebuhraya Simpang Ampat-Air Keroh, km 107-km 126.7 dan sedikit berkenaan dengan kestabilan cerun. 100 pp.

23. Norakmah Setapa
Geologi kawasan Pasir Raja-Ulu Paka, Dungun, Terengganu. 87 pp.

24. Norliza Fatahur Raji
Kajian terhadap cerun-cerun potongan jalanraya di sepanjang Jalanraya Segamat-Labis. 40 pp.

25. Noor Ilmi Abu Bakar
Petrography of the eastern part of Gunung Keriang. 41 pp.

26. Sen Siong Choo @ Atoi
Geology of the Tangkulap-Kuamut area, Sabah. 105 pp.

27. Shari Ismail
Geologi am dan survey geomagnetik kawasan Kuala Terengganu. 77 pp.

28. Siti Shamsiah Sh. Bakar
Petrologi dan geokimia batuan volkan Segamat, Johor Darul Takzim. 69 pp.

29. Wong Chun Ken
Geological map of eastern Bidu-Bidu Hills area, Sabah. 77 pp.

30. Zamri Ramli
Geologi kawasan Pagoh, Johor Darul Takzim. 83 pp.

INTENSIVE TRAINING COURSE

Quantified Risk Analysis

(9-11 May 1994)

&

Environmental Impact Assessment

(24-26 October 1994)

Venue: Petaling Jaya Hilton

Jointly organised by:

Institute of Advanced Studies, Universiti Malaya
Faculty of Engineering, National University of Singapore

With the support of:

Department of Environment, Malaysia
Factories and Machinery Department, Malaysia
Society of Loss Prevention in the Oil, Chemical and Process Industries, Singapore
Institution of Engineers, Malaysia

COURSE OBJECTIVES

This is the third consecutive year that these two courses of current significance are being offered. Course I focuses on quantified risk analysis (QRA) and Course II deals with environmental impact assessment (EIA). These courses will be held for three days each and are designed to introduce the concepts and practices of QRA and EIA to practicing engineers, technologists, scientists, managers as well as administrators in the relevant regulatory government agencies. Participants can choose to register for either one or both courses.

The QRA course will deal with quantified risk analysis with specific reference to the oil, chemical and process industries. The topics covered will include risk identification techniques, source term estimation, atmospheric dispersion modelling, consequence assessment of releases and hazard evaluation techniques.

The EIA course will review the current status of EIA requirements and processes in Malaysia. This will be followed by in-depth discussions on the approaches and methodologies for the impact analysis on landuse and erosion, socio-economics, geology, biological systems, air quality, noise, water quality and waste generation. Relevant aspects of environmental monitoring and a formal approach to environmental audit will also be included.

The course will be supported by case studies, discussions, proprietary video and hands-on risk analysis using computer models.

COURSE TUTORS

Prof. Mohd. Ali Hashim who is the course coordinator is a Professor of Chemical Engineering and the Dean of the Institute of Advanced Studies, Universiti Malaya. He has worked for several years in the areas of environmental engineering and separation processes and he has been a consultant to various organisations.

Dr. Ching Chi Bun is a senior lecturer at the Department of Chemical Engineering, National University of Singapore. In the past decade, he has offered courses on Loss Prevention and Quantified Risk Analysis to undergraduates and worked as a consultant to industrialists and practicing engineers on these subjects. Currently, Dr. Ching is the president of the Society of Loss Prevention in the Oil, Chemical and Process Industries, Singapore.

Prof. Low Kwai Sim is a professor at the Department of Geography, Universiti Malaya. Her field of specialisation is tropical hydrology, specialising in erosion risk and impact assessment.

Prof. Low Kum Sang is a professor at the Department of Physics, Universiti Malaya. He specialises in laser technology and has been actively involved in consultancy projects on air quality impact analysis.

Prof. Jahara Yahaya is a professor at the Faculty of Economics and Administration, Universiti Malaya. She specialises in socio-economics and has been actively involved in consultancy projects on socio-economic impact analysis.

Prof. Cheruvu Anandeswara Sastry is a visiting professor at the Institute of Advanced Studies, Universiti Malaya. He specialises in biochemical engineering and environmental engineering. He has been involved in consultancy projects for WHO, ESCAP, UNESCO, COSTED and UNEP.

Assoc. Prof. Tong Soo Loong who is the assistant course coordinator is an associate professor at the Department of Chemistry, Universiti Malaya. He specialises in analytical environmental chemistry and has been actively involved in research and consultancy projects on water quality studies.

Assoc. Prof. John Kuna Raj is an associate professor at the Department of Geology, Universiti Malaya. He has been actively involved in geological consultancy projects.

Dr. Yap Siaw Yang who is also the assistant course coordinator is a lecturer at the Institute of Advanced Studies, Universiti Malaya. Her field of specialisation is ecology and she has been actively involved in consultancy projects on ecological impact assessment.

Dr. Than Cheok Fah is a lecturer at the Department of Mechanical Engineering, Universiti Malaya. He specialises in safety and hazards assessment.

COURSE CONTENTS

COURSE I: Quantified Risk Analysis (9-11 May 1994)

1. Major hazard control legislations; QRA/ ERA requirements, practices and policy in Malaysia; a review of the state of QRA/ ERA reporting in Malaysia.
2. Hazard identification techniques; check lists, index ranking, FMEA and Hazop; process safety review and management.
3. Hazard evaluation; frequency and probability; logic diagrams; failure rate data; FAR concept and criteria of acceptability, risk assessment and societal risk.
4. Source term estimation, fire and explosion. Vapour, liquid and two phase release rate models.
5. Hazard analysis case study, hazard control and mitigation.
6. Atmospheric dispersion modelling; puff and plume models; effects of wind.
7. Consequence assessment of releases; flammable and toxic releases; vapour cloud explosion; BLEVE; heat flux, blast and missile.

COURSE II: Environmental Impact Assessment (24-26 October 1994)

1. EIA requirements and practices in Malaysia; EIA processes; a review of current trends and recent developments.
2. Landuse and erosion impact analysis
   Land utilization type; landuse requirements; land qualities and characteristics; land suitability classifications.
   Soil erosion susceptibility; parameters used in estimations of soil erosion potentials; comparisons of actual versus potential erosion to be developed; erosion susceptibility classifications and implications.
3. Noise impact analysis
   Environmental and occupational impacts; noise exposure guidelines and regulations (environmental and occupational); noise sources and potential noise levels; methodology of impact assessment; assessment of impacts to workers and surrounding population; mitigation, control and monitoring.
4. Air quality impact analysis
   Air quality guidelines and regulations; methodology of assessment; ambient air quality levels; meteorological factors of air pollutants dispersion; air quality modelling; impact assessment; mitigation, control and monitoring.
5. Vegetation and wildlife impact analysis
   Habitat and ecosystem concepts; biodiversity; food chain and food web; baseline data and reporting of flora and fauna; methodology of ecological impact assessment; ecological impact mitigation,

control and monitoring; conservation and protected area; Wildlife Protection Act and Endangered Species Act; sustainable use of biological resources.

6. Water quality impact analysis
Scoping; water quality related legislations and guidelines; identification of environmental components and indicators; causes and effects; baseline data - sources of information, field survey, sampling and laboratory testing; predicting water use, effluent discharges and water quality modelling; mitigating measures, control and monitoring programmes.

7. Socio-economic impact analysis
Socio-economic considerations in EIA; types of socio-economic impacts; identification of dimensions which are socio-economic related; examples and types of socio-economic impacts; basic processes in socio-economic impact assessment.

8. Geological impact analysis
Physical environment; external and internal geological processes; earthquakes; groundwater regime; surface and subsurface earth materials; mitigating measures, control and monitoring.

9. Environmental audit
Waste audit; health and safety audit; pre-assessment phase, data collection phase and synthesis phase; unit operations, flow diagram and material balance; waste reduction options and waste reduction action plan.

VENUE

PETALING JAYA HILTON
No. 2 Jalan Barat
46200 Petaling Jaya
Selangor Darul Ehsan

DATES

Course I (QRA): 9-11 May 1994
Course II (EIA): 24-26 October 1994

TIME

The lectures, case studies and hands-on exercises will run daily from 9.00 am to 5.00 pm.

COURSE FEES

Course I QRA (3 days) RM1,300
Course II EIA (3 days) RM950

(Inclusive of course book and materials, daily lunch and refreshments)

REGISTRATION

Please complete the Registration Form and send it to the course coordinator with your cheque or bankdraft payable to **The Bursar, Universiti Malaya**. For enquiries, please call Mrs. L.L. Loong on Tel: 03-7577000 ext. 200 or Fax: 03-7568940.

CLOSING DATES FOR REGISTRATION

QRA Course: 25 April 1994
EIA Course: 10 October 1994

CANCELLATIONS

A full and prompt refund will be given to cancellations made 14 days prior to course commencement. There will be no refund after this date. The organiser reserves the right to cancel the course should unforeseen circumstances occur in which case a full refund will be made.

CERTIFICATE OF ATTENDANCE

Certificates of attendance will be issued to all participants.

FURTHER INFORMATION

QRA/EIA Course Coordinator
Institute of Advanced Studies
Universiti Malaya
59100 Kuala Lumpur
MALAYSIA
(Attn: Prof. Mohd. Ali Hasim)
Fax No: 03-7568940

First Announcement and Call for Papers

The 16th New Zealand Geothermal Workshop

Improving Models of Geothermal Reservoirs

9, 10, 11 November 1994

Organised by the Geothermal Institute and the New Zealand Geothermal Association in conjunction with the Centre for Continuing Education, The University of Auckland

CALL FOR PAPERS

The Geothermal Institute and the New Zealand Geothermal Association will host the 16th NZ Geothermal Workshop at the University of Auckland on 9, 10, 11 November 1994. The meeting will be a forum to exchange information on all aspects of the exploration, development and use of geothermal resources worldwide. Intending authors should submit a title to the Convenors by 27 May 1994. All accepted papers will be published in the Proceedings of the Workshop which are widely distributed.

This year the workshop theme is improving Models of Geothermal Reservoirs, and papers on this subject are particularly welcome.

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.

DEADLINES

1. Submission of title: 27 May
2. Notification of acceptance: 24 June
3. Final paper: 19 August
4. Workshop: 9-11 November (inclusive)

DESIGNPOWER HUGH TOKELEY MEMORIAL AWARD

Design Power New Zealand Ltd. will sponsor an award for the best paper presented at the Workshop. This covers topics on steam field and power plant design and engineering, environmental aspects, scientific solutions to engineering problems and non-electrical uses of geothermal energy.

THE CONVENORS

c/o Geothermal Institute
The University of Auckland
Private Bag 92019, Auckland
New Zealand
Fax: 64-9-373 7436

ADMINISTRATIVE INQUIRIES

Professional Courses
Centre for Continuing Education
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

2nd CIRCULAR

Invitation, Call for Papers and General Information

GEOSEA '95

Eight Regional conference on Geology, Mineral and Energy Resources of Southeast Asia

"Geology, Minerals and Energy Resources for Sustainable Development to the 21st Century"

With SPECIAL SESSION on:

Oil and Gas Asia '95

Space-Time Evolution of Active Tectonics of the Eurasian Margin

and the Oil and Gas Asia '95 International Exhibition:

"Energy, Mining, Geology and Environment"

Shangri-La's EDSA PLAZA
Mandaluyong, Metro Manila, Philippines
14-18 February 1995

THE ORGANIZING COMMITTEE

GENERAL CHAIRMAN:	*Raymundo S. Punongbayan*
VICE-CHAIRMEN:	*Rolando de Guzman*
	Nazario Vasquez
SECRETARIAT:	
Secretary General:	*Guillermo R. Balce*
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	Conrad Miranda
	Ernesto Corpuz
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Publications	*Mario A. Aurelio / Rolando E. Pena*
Treasury	*Romeo M. Almeda*
Scientific Program	*Graciano P. Yumul, Jr.*
Promotions/Socials	*Milagros V. Reyes*
Air Transportation/Accommodations	*Rene Daniel S. Rieza*
Tours/Local Transport	*Edwin G. Domingo*
Physical Arrangements	*Leonardo M. Ote*
Exhibits	*Carol Odvina (HQ Link)*

Aims and Objectives

The GEOSEA Conference is held in Southeast Asia every three years. Previous venues were Kuala Lumpur (1972, 1984), Jakarta (1975, 1987), Bangkok (1978, 1991) and Manila (1981). The conference is primarily aimed to provide a forum on the geology, minerals, and energy resources of Southeast Asia and to provide opportunities for exchange of ideas and information among geoscientists from within and outside the region. In view of the rapid advancement in the geoscientific knowledge and understanding of the Southeast Asia region, GEOSEA '95 promises to be another successful forum in the geosciences.

Program

Geoscientific papers dealing with topics on the Southeast Asian Region encompassing the GEOSEA member countries — Cambodia, Indonesia, Malaysia, Philippines, Thailand, Vietnam — and neighboring countries such as Papua New Guinea, India, Sri Lanka, Bangladesh, Bhutan, China, Korea and Japan are encouraged for presentation in lecture form and poster presentation. The scientific program will consist of 3 main sessions and 3 Special Sessions.

Opening Ceremonies

14 February – Tuesday	:	Oil and Gas Asia '95
15 February – Wednesday	:	GEOSEA '95
17 February – Friday	:	Active Tectonics of the Eurasian Margin

Scientific Sessions

Session 1 (15 February – Wednesday): Geoscience as a Framework for Sustainable Development:

General Geology, Stratigraphy, Sedimentology, Paleontology, Structural Geology and Tectonics, Petrology and Geochemistry, Marine Geology and Geophysics

Session 2 (16 February – Wednesday): Sustainable Development of Minerals and Energy Resources:

Metallic and Non-metallic Mineral Resources, Energy Resources, Hydrogeology and Water Resources, Geotechniques in the Establishment and Maintenance of Energy Systems

Session 3 (17 February – Thursday): Management of Natural Hazards for Sustainable Development:

Volcanism, Earthquakes and other Geologic Constraints to Sustainable Development, Environmental Geoscience, Engineering Geology, Geological Education, Information and Resource Management

Special Session 1 (14-15 February – Tuesday-Wednesday): Oil and Gas Asia '95

Oil and Gas Asia '95 follows the successful convening of Oil and Gas Asia '93 held in November 1993 in Manila. This conference will feature new discoveries, exploration activities and updates, pipeline development, geotechniques in exploration, new fiscal regimes favoring exploration, and environment-friendly approaches for sustainable development in the oil industry

Special Session 2 (17-18 February – Friday-Saturday): Space-Time Evolution of Active Tectonics of the Eurasian Margin

The Special session features the results of studies generated by the RP-France Programme on geodynamics of convergent margins in the Philippines and the Indonesia-France Programme on the tectonics of East Indonesia. To be discussed here are: Characteristics of past and present tectonism in the Eurasian Margin and associated magmatism, geodesy, seismology, sedimentary basins; tectonic evolution of the Philippines in relation to the 1,200 km long Philippine Fault, geodynamic evolution of Sulawesi Island, Banda Sea and Adjacent areas

Exhibition : *14-17 February, Tuesday-Friday*

Poster Sessions : *14-17 February, Tuesday-Friday*

Council Meeting : *18 February, Saturday*

Closing Ceremonies : *18 February, Saturday*

Call for Papers

Within the framework of the above scientific program, papers touching on any of the above topics may be submitted.

Contributors may submit up to two papers on which they appear as first authors. They must be listed in order of priority for inclusion in the program. Contributors are advised to indicate in which session they wish to have their papers present. The Scientific Program Committee however reserves the right to accept or refuse contributions and to judge whether a contribution will be presented orally or as a poster material, while taking into consideration the author's preference for oral or poster presentation. Oral and poster presentations will carry equal weights regarding quality of contributions. Scientific papers may be presented orally or as poster material.

Abstracts

Abstracts are to be written in English with a maximum of **500 words**. They are to be submitted to the Organizing Committee (see exact address below) on or before **30 June 1994**. All abstracts will be published in an abstract volume to be distributed to all participants during the conference.

Manuscripts

To be accepted for inclusion in the Conference Proceedings, papers must address one of the topics in the listed conference sessions. Manuscripts should be original and comprise previously unpublished data, interpretations or syntheses. Invited reviews will also be considered. Papers should consist of not more then **10,000 words**, although longer papers may be considered in special circumstances. **Three (3) original copies** of the text, figures, tables and captions, typed in double-spacing on good quality A4 paper, together with 5.25" or 3.5" floppy diskettes containing the manuscript (PC compatible word processors: Winword, Word Perfect, Wordstar), should be submitted to the Organizing Committee on or before **18 November 1994**.

In writing manuscripts, margin settings to be observed are as follows: Top – 1.0", Bottom – 1.0", Left – 1.25", Right – 1.25". All illustrations should be in glossy paper at the suggested size for reproduction. Please avoid larger-than-A4-sized illustrations. Full papers will be included in a compilation of papers which will be made available during the conference. Incomplete papers will not be included. The Organizing Committee also plans to publish select papers of the conference in international scientific journals. In this case, the selection and refereeing papers will be conducted by the journal's editorial board.

GEOSEA '95 Council Meeting

On Saturday, 18 February 1995, the last day of the conference, the GEOSEA '95 Council Meeting will be convened. Country reports on the status of geoscience and its role in Sustainable Development in the GEOSEA member states will be presented during the meeting. Through a resolution, the Council expects to issue a MANILA DECLARATION intended to draw the attention of policy makers on the role of geoscience in sustainable development.

Official Language and Time Allocations

English will be the official conference language. Translation into other languages will not be available during the conference. Morning sessions will be from 8.00 am to 12.00 pm while afternoon

sessions will be from 1:30 pm to 5.30 pm. Oral presentors will be given approximately twenty (20) minutes to deliver their papers and discuss with the audience.

Deadlines

Submission of Title and Abstracts:	**30 June 1994**
Submission of Manuscripts:	**18 November 1994**

Registration

Registration may be done by filing up the enclosed registration form and sending it duly accomplished together with the corresponding payment to GEOSEA '95 Organizing Committee.

Schedule of Fees

General Registration to GEOSEA '95[1]

Presentor			Participant
Early Abstract:	US$100	(August 1994)	Early Registration: US$200
Late Abstract:	US$200	(September 1994 to 14 February 1995)	Late Registration: US$300

For active members of the Geological Society of the Philippines[1]

Presentor			Participant
Early Abstract:	PP1000	(August 1994)	Early Registration: PP2000
Late Abstract:	PP2000	(September 1994 to 14 February 1995)	Late Registration: PP3000

Registration to Special Session 1: Oil and Gas Asia 95[2]

Presentor			Participant
Early Abstract:	US$200	(August 1994)	Early Registration: US$300
Late Abstract:	US$300	(September 1994 to 14 February 1995)	Late Registration: US$400

For active members of the Geological Society of the Philippines[2]

Presentor			Participant
Early Abstract:	PP2000	(August 1994)	Early Registration: PP3000
Late Abstract:	PP3000	(September 1994 to 14 February 1995)	Late Registration: PP4000

Accompanying Person[3]

Early Registrant:	US$40	(August 1994)
Late Registrant:	US$60	(September 1994 to 14 February 1995)

[1]Aside from the right to attend the scientific session, registration to the GEOSEA '95 Conference entitles registrants to attend Special Sessions 2 and 3 provided they confirm intention to attend (please see Registration Form). Due to the limited member of slots in the Special Sessions, participants shall be selected on a first-confirmed- first-served basis. Presentors are automatically accommodated.

[2]Registration to Special Session 1: Oil and Gas Asia '95 entitles registrants to attend any of the GEOSEA '95 sessions as well as the other Special Sessions provided they confirm attendance (please see Registration Form). Due to the limited number of slots in the Special Sessions, participants shall be selected on a first-confirmed-first-served basis. Presentors are automatically accommodated.

[3] Registered accompanying persons are entitled to Accompanying Persons' Program.

Field Trips

GEOSEA '95 will feature field trips before and after the Conference proper. In general, each trip will be limited to not more than 30 participants. Priority will be by first-come-first-served basis.

Field Trip No. 1: Pinatubo Volcano - Dizon Porphyry Copper - Zambales Ophiolite and Chromite deposits (2 days)

The June 1991 eruption of the Pinatubo Volcano, located about a hundred km NW of Metro Manila, is one of the most destructive in this century. In this field trip, participants will have the rare chance to see this volcano. In the vicinity, lies the copper deposits of the Dizon Mines and the Ophiolite Sequences of the Zambales Range.

Convenors: Dr. Graciano P. Yumul, Jr. (UPNIGS), Tomas D. Malihan (Benguet Corp.), Claro Jose C. Manipon (MGB), Rene Solidum (PHIVOLCS), Joel Aquino/Christ Remotigue (UPNIGS)
Duration: 19-20 February 1995
Cost: US$150.00

Field Trip No. 2: Baguio Gold and Copper - Mines Pinatubo Lahars (4 days)

Pinatubo's eruptions have been felt worldwide when thick ash columns engulfed the earths atmosphere for several days. In the country, these eruptions combined with torrential rains during the rainy season, have created tremendous amounts of Lahars in the lowlands. This trip allows participants to physically assess the wrath as well as the processes involved during lahar events. East of the volcano across the Central Luzon Valley stands the Cordillera Range, where the century-old Baguio Gold and Copper Mines are located. The Lepanto Mines in the region is the site of one of the only three Enargite-Luzonite deposits in the world. It is also a place where epithermal gold and porphyry copper can be found in a single mine. Baguio City is located at 1,500 m above sea level and brags as the summer capital of the Philippines.

Convenors: Edwin G. Domingo (MGB), Lepanto Mines, Philex
Duration: 19-22 February 1995
Cost: US$300.00

Field Trip No. 3: Taal Volcano - Makban Geothermal field - Caliraya Hydroelectric Plant - Calaca Coal-fired Power Plant (2 days)

Around 80 km to the SE of Metro Manila sits the world's smallest volcano, Taal. At present, the volcano is within a lake which represents a collapsed caldera of an older but much larger volcano. The Mak-ban Geothermal Field makes use of heat from another volcano (Mount Makiling-Banahaw) in the same Southern Luzon region. Further to the east, the Caliraya Hydroelectric Plant features the Philippines' largest man-made lake. The Calaca Coal-fired Power Plant in the western shores of Calumpan Peninsula in Batangas Province exemplies one of the country's conventional means of coping up with the high energy demand.

Convenors: Rene Solidum (PHIVOLCS), (Albert Buban) PGI, Mr. Juan Pilac
Duration: 19-20 February 1995
Cost: US$150.00

Field Trip No. 4: Cebu

Cebu Island in Central Philippines is noted for having the largest porphyry copper mine in Southeast Asia. The mine occupies the central portion of the island and this is flanked by a thick sequence of sedimentary rocks including limestone and marble. These rocks in turn, are the main source material of a number of marble and cement plants. The island also has a thriving stonecraft industry utilizing the by-products of rock quarries in the island and neighboring provinces.

Convenors: Wilfredo Diegor (MGDS-DENR)
Duration: 19-21 February 1995
Cost: US$250.00

Field Trip No. 5: RP-France Project — Active tectonics and The Philippine Fault

Leg 1: Leyte

One of the more spectacular on-shore manifestations of the Philippine Fault s located in the island of Leyte in the central Visayan Region. Here, the fault principally moves in a strike-slip manner as it cuts through the recent Philippine Volcanic Arc which hosts several of the country's more important geothermal fields. GPS measurements in the PNOC Tongonan Geothermal Network reveal creep along the fault at a rate of 2.5 cm/yr on the average. Active deformation is also manifested in the outlying sedimentary formations within the island.

Convenors: M.A. Aurelio (MGB), E. Barrier (UPMC), H. Ferrer (PNOC)
Duration: 19-20 February 1995
Cost: US$200.00

Leg 2: Mindanao

Further south in Mindanao, the Philippine Fault develops into a transpressive regime where the strike-slip motion is coupled with collision-related deformation. Deformation along this part of the fault provides insights to the behavior of transition zones from strike-slip to collisional settings. The collision zone is best manifested in the Moluccas Sea.

Convenors: R.D. Quebral (MGB), M. Pubellier (UPMC)
Duration: 21-23 February 1995
Costs: US$250.00 (PP5,000.00)

Leg 1 and 2

Cost: US$400.00 (PP7,500.00)

Field Trip No. 6: French-Indonesian Project — Tectonics of East Indonesia and implications in mineral resources

Leg 1: Palu

Sulawesi Island, just south of Mindanao, is part of a region characterized by the interaction of three major crustal plates — Indian Ocean Plate, Pacific Plate and Eurasian Plate. At the extremity of the northern arm of Sulawesi Island are the recent volcanic rocks around Menado, which is part of the Sangihe arc that figures in a collision with the Halmahera arc at the Moluccas Sea. Further down at Palu, around the juncture of the northern arm and south Sulawesi are the basement rocks in Tuwa and granitoids in Kulawi and Kamarori. Also near Palu are splays of the 750-km long left-lateral Palu Fault which abuts against the North Sulawesi Trench to the north.

Convenors: M. Polvé
Duration: 19-21 February 1995
Cost*: US$440

Leg 2: Ujung Pandang

Still further south, towards Ujung Pandang (near the extremity of South Sulawesi) are the pre-Tertiary basement rocks consisting of ophiolites and a variety of metamorphic rocks including galucophane schist, gneisses and eclogites at Barru; there are also volcanic and sedimentary formations in the vicinities of Parepare, Makale, Rantepao and Palopo. These rocks manifest the long history of magmatism associated with the complicated tectonic history of the island and the surrounding areas.

Convenors: M. Polvé
Duration: 22-25 February 1995
Cost*: US$510.00

*Cost for this field trip does not include air fare from Manila and back. Cost of Legs 1 and 2 is around US$1,650.00 including air fare from Manila and back.

Special GEOSEA '95 Golf Fest

In the vicinity of the conference venue are several golf courses. GEOSEA '95 is Organizing a Golf Fest open to everybody, golfers and non-golfers alike! (driving lessons may be given to first-timers). The event will be held on 13 February 1995. Assistance will be offered to persons intending to play on other days.

Host:	Roger Laraya	
Duration:	13 February 1995	
	14-19 February 1995 (as per individual request)	
Cost:	fairway	— US$60.00/18 or 9 holes (includes green fee and caddy fee)
	driving range	— US$2.00/bucket

Accommodations and Hotel Reservations

Special rates have been negotiated for delegates at several hotels (see below). These rates are available only upon advance booking through the Accommodations Committee of the GEOSEA '95 Organizing Committee. Special conference rates can not be guaranteed for late registrants.

To confirm your accommodations booking, a deposit of at least one nights's fee must be received by Organizing Committee no later than December 15, 1994. Any reservations made after this date will be considered depending on room availability.

Notice of cancellations must be received by the Organizing Committee no later than January 15, 1995.

ACCOMMODATION RATES #

NAME/ADDRESS	ROOM RATES	
	Single Occupancy	Double Occupancy
Shangri-La's EDSA PLAZA Hotel ***** Ortigas Complex, Mandaluyong, Metro Manila Tel. 632 68 88 Fax. (632) 631 10 76	Superior City View US$116 Superior Garden View US$126 De Luxe US$133	Superior City View US$130 Superior Garden View US$140 De Luxe US$147
Hotel Nikko Manila Garden ***** EDSA, Makati, Metro Manila Tel. 810 41 01 Fax. (632) 817 18 62	Regular US$80 Executive Club US$168	Regular US$90 Executive Club US$182
Hotel Intercontinental ***** EDSA, Makati, Metro Manila Tel. 815 97 11 Fax. (632) 812 43 89	Superior US$110 De Luxe US$120	Superior US$110 De Luxe US$120
Legend Hotel *** Pioneer Street, Mandaluyong, Metro Manila Tel. 633 15 01 to 20 Fax. (632) 632 08 45	Standard US$40 De Luxe US$50	Standard US$40 De Luxe US$50 Suite US$75
Charter House *** Legaspi St., Legaspi Village, Makati, Metro Manila Tel. 817 60 01 to 16 Fax. (632) 817 70 71	Standard US$56	Standard US$62 Suite US$68
Gilarmi Mansion ** Ayala Avenue, Makati, Metro Manila Tel. Fax>	Standard US$38	

***** Five-Star Hotel *** Three-Star Hotel **Two-Star Hotel

Rates quoted herein are subject to prevailing government taxes and service charges. Currently, they are at 13.7% and 10% respectively and are subject to change as mandated by the government. Dollar rates are subject to change when the published rate is increased or decreased.

Advance Payments/Deposits

Quoted prices are in US dollars. Payments may be made either in US dollars or in Philippine Pesos (based on prevailing exchange rates). Payments in manager's cheques and credit cards are also accepted. Registration forms may be sent by facsimile only if payment is made by credit card. Registrations will not be processed without corresponding payments.

Personal Mail While in the GEOSEA '95 Conference

The Organizers hold no responsibility over personal mail of participants *during* the conference. Please have your mail sent either to your accommodation address or to the Conference Venue address:

c/o The GEOSEA "95
Shangri-La's EDSA PLAZA Hotel
Mandaluyong, Metro Manila
PHILIPPINES
Tel: 633 88 88
Fax: (632) 631 10 67

All correspondences and inquiries on the GEOSEA '95 should be addressed to:

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

KALENDAR (CALENDAR)

1994

→→→ May 1994←←←

May 10-14

MINING LATIN AMERICA (Meeting), Santiago de Chile. (IMM, 44 Portland Place, London W1N 4BR, UK. Phone: 44 71 580 3802; telefax: 44 71 436 5388)

May 15-18

GEOLOGICAL ASSOCIATION OF CANADA / MINERALOGICAL ASSOCIATION OF CANADA (Joint Annual Meeting). Waterloo, Ontario, Canada. (Alan V. Margin, Department of Earth Sciences, University of Waterloo, Waterloo, Ontario N2L 3GL, Canada. Phone: (519) 885-1211, ext. 3231; telefax: (519) 746-7484)

May 16-18

GEOLOGICAL ASSOCIATION OF CANADA / MINERALOGICAL ASSOCIATION OF CANADA, ann. mtg., Waterloo, Ontario. (Alan V. Morgan, Dept. of Earth Sciences, University of Waterloo, Waterloo, Ontario, N2L 3G1. Phone: 519/885-1211, ext. 3231. Fax: 519/746-7484)

May 29-June 1

GLACIAL CYCLES AT HIGH LATITUDES – THEIR EFFECTS ON THE PHYSICAL ENVIRONMENT (International Symposium). Fjaerland, Norway. (Dr. Anders Elvetei. Project Administrator, Department of Geology, P.O. Box 1047 Blindern, 0316 Oslo, Norway. Phone: 47-22-85 66 56; telefax: 47-22-85 42 15)

May 23-28

INTERNATIONAL ASSOCIATION OF COMPUTER METHODS AND ADVANCES IN GEOMECHANICS, mtg., Morgantown, W. Va. (Society of Petroleum Engineers, Box 833836, Richardson, Texas 75083-3836. Phone: 214/952-9435)

May 28-June 1

SILICICLASTIC-CARBONATE FACIES, mtg., Veracruz, Mexico, by Society for Sedimentary Geology. (Julie Ball, SEPM, Box 4756, Tulsa, Okla, 74159-0756. Phone: 918/743-9765. Fax: 918/743-2498)

→→→ June 1994←←←

June 5-11

GEOCHRONOLOGY, COSMOCHRONOLOGY AND ISOTOPE GEOLOGY (ICOG-8) (Meeting), Berkeley, California, USA. (Garniss H. Curtis, Institute of Human Origins – Geochronology Center, 2453 Ridge Road, Berkeley, CA 94709, USA. Phone: (415) 845-4003; telefax: (415) 845-9453)

June 6-7

WEDDELL SEA TECTONICS AND GONDWANA BREAKUP (Meeting), Cambridge, UK. (Dr. Edward King, Weddell Sea Meeting, British Antarctic Survey. High Cross, Madingley Road, Cambridge, CB3 OET, UK. Phone: (0223) 62616; telex: 817725 BASCAMG)

June 6-10 (Correction)

EUROPEAN ASSOCIATION OF EXPLORATION GEOPHYSICISTS (56th Annual Meeting and Technical Exhibition), Vienna, Austria. (Evert van der Gaag, Business Manager EAEG, P.O. Box 298, 3700 AG Zeist, The Netherlands. Phone: +31 (0)3404 56997; telefax: +31 (0)3404 62640)

June 12-15

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS and SEPM (Society for Sedimentary Geology) (Annual Meeting), Denver, Colorado, USA. (SEPM, P.O. Box 4756, Tulsa, OK 74159-0756, USA)

June 14–18

SECOND EUROPEAN METALS CONFERENCE FROM AGRICOLA TO THE PRESENT (EMC '94), Dresden and Freiberg. (The Institution of Mining and Metallurgy, Conference Office, 44 Portland Place, London W1N 4BR, England. Phone: 44 71 580 3802. Telex: 26 14 10 Fax: 44 71 436 5388.)

June 15-20

FRACTURED UNLITHIFIED AQUITARDS: ORIGINS AND TRANSPORT PROCESSES (GSA Penhose Conference). Racine, Wisconsin, USA. (Dr. John A. Cherry, Waterloo Centre for Groundwater Research, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada. Dr. David M. Mickelson, Department of Geology and

Geophysics, University of Wisconsin, Madison, Wisconsin 53706, USA. Telefax: Cherry (519) 746-5644; Mickelson (608) 262-0693)

June 16-19

DINOSAURS OF WYOMING, field mtg., Casper. (Walter R. Merschat, Box 356. Casper, 82602. Phone: 307/266-4409. Fax: 307/266-1113)

June 20-24

GEOSCIENCE INFORMATION (International Meeting), Prague, Czech Republic. (Jiri G. Hruska, Geofond of Czech Republic, Kosteini 26, 170 21 Praha 7-Letna. Phone: (0042) 2 379346; telefax: (0042) 2 370647)

→→→ July 1994←←←

July

INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS (21st General Assembly), Boulder, Colorado, USA.

July 1-5

HYDROMETALLURGY, int'l mtg., Cambridge, England, by Society of Chemical Industry, and Institution of Mining and Metallurgy. (SCI, 14/15 Belgrave Square, London SW1X 8PS. Phone: 071 235 3681. Fax: 071 823 1698) [December '92]

July 4-8

HISTORY OF GEOLOGY IN THE PACIFIC REGION, int'l mtg., Sydney, Australia by International Commission on the History of the Geological Sciences. (INHIGEO, c/o Earth Resources Foundation, Dept. of Geology and Geophysics, University of Sydney, New South Wales, Australia 2006. Phone: (02) 552 6136. Fax: (02) 552 6058)

July 5-9

FORAMINIFERA (International Meeting), Berkeley, California, USA. (FORAMS '94, Museum of Paleontology, University of California, Berkeley, CA 94720, USA. Phone: (510) 642-1821; telefax: (510) 642-1822)

July 10-14

EARTHQUAKE ENGINEERING (5th National Conference), Chicago, Illinois, USA. (EERI, 499 14th Street, Suite 320, Oakland, CA 94612-1902, USA. Phone: (510) 451-0905; telefax: (510) 451-5411)

July 10-14

CLASTIC DEPOSITS OF THE TRANSGRESSIVE SYSTEM TRACT, mtg., Long Beach, Wash., by Society for Sedimentary Geology. (SEPM, c/o Ed Clifton, Conoco, Box 2197, Houston, 77252. Phone: 713/293-2839)

July 10-15

ENVIRONMENTAL GEOTECHNICS (International Meeting), Edmonton, Alberta, Canada. (D.C. Sego, First International Congress on Environmental Geotechnics, Dept. of Civil Engineering, University of Alberta, Edmonton, Alberta T6G 2G7, Canada. Phone: (403) 492-7228; telefax: (403) 492-8198)

July 25-29

BASEMENT TECTONICS (11th International Meeting), Potsdam, Germany. (Prof. Dr. Onno Oncken, GeoForschung-Zentrum. Telegrafenberg, D-0-1561 Potsdam, Germany. Phone: 331-310306; telefax: 331-310601)

→→→ August 1994←←←

Aug 12-18

9TH IAGOD SYMPOSIUM OF THE INTERNATIONAL ASSOCIATION ON THE GENESIS OF ORE DEPOSITS (IAGOD 1994), Beijing, China. (Dr. Wang Zejiu, 9th IAGOD Symposium, Chinese Academy of Geological Sciences, 26 Baiwanzhuang Road, Beijing 100037, China)

August 14-19

PHYSICS AND CHEMISTRY OF THE UPPER MANTLE (International Symposium), São Paulo, Brazil. (Professor Wilson Teixeira, Instituto de Geociencias. Universidade de São Paulo, P.O. Box 20899, 01498-970 São Paulo, Brazil. Phone: 55-11-8138777 ext. 3987; telefax: 55-11-2104958; E-mail: BRENHA @-IAG.USP.BR)

August 20-26

SEDIMENTOLOGICAL CONGRESS (14th International), Recife, Brazil. (Margareth M. Alheiros, 14th ISC, Caixa Postal 7801, Cidade Universitaria, 50739-970 Recife (PE), Brazil)

August 21-24

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (International Conference and Exhibition), Kuala Lumpur, Malaysia. (AAPG Convention Department, P.O. Box 979, Tulsa, OK 74101, USA. Phone: (918) 584-2555)

August 28-31

PERMIAN STRATIGRAPHY, ENVIRONMENTS AND RESOURCES (1st International Symposium), Guiyang, Guizhou, China. (Dr. Wang Xiang-dong, Secretariat of Organizing Committee for ISP-1994, Laboratory of Palaeobiology & Stratigraphy, Nanjing Institute of Geology & Palaeontology, Chi-Ming-Ssu, Nanjing, 21008 China. Phone: 86-25-714443; telefax: 86-25-712207)

August 29-September 1

PROTEROZOIC CRUSTAL & METALLOGENIC EVOLUTION (International Conference), Windhoek, Namibia. (Dr. G.I.C. Schneider, Geological Society of Namibia, P.O. Box 699, Windhoek, Namibia. Phone: 264-61-37240; telefax: 264-61-228324)

→→→ September 1994←←←

September 4-9 (Correction)

INTERNATIONAL MINERALOGICAL ASSOCIATION (16th General Meeting), Pisa, Italy. (Professor Stefano Merlino, Dipartimento di Scienze della Terra, Via S. Maria 53, 56100 Pisa, Italy. Telefax: 395040976: E-MAIL: IMA94@VM.CNUCE-CNR.IT

September 5-9

INTERNATIONAL ASSOCIATION OF ENGINEERING GEOLOGY (7th Congress), Lisbon, Portugal. (Organizing Committee, 7th IAEG Congress, c/o LNEC, Av. do Brasil, 101, 1799 Lisboa Codex, Portugal. Phone: 351-1-8473822; telefax: 351-1-8497660; telex: 16760 LNEC P)

September 5-9

ARCTIC MARGINS (International Meeting) Magadan, Russia. (Kirill V. Simakov, North East Scientific Centre, 16 Portovaga St., Magadan, Russia, 685000. Phone: (907) 474-7219, in the USA; (7-41) 3 233-0953 in Russia)

September 12-16

INTERNATIONAL VOLCANOLOGICAL CONGRESS (International Congress). Ankara, Turkey. Sponsored by the International Association of Volcanology and Chemistry of the Earth's Interior. (Dr. Ayla Tankut, Organizing Secretary, Int. Volcanological Congress, Dept. Geological Engineering, Middle East Technical University, 06531 Ankara, Turkey. Phone: 90-4-210-1000, ext. 2682 or 2679; telefax: 90-4-210-1263.

September 19-24

EUROPEAN PALAEOBOTANICAL-PALYNOLOGICAL CONGRESS (4th), Heerlen, The Netherlands. (Dr. G.F.W. Herngreen, General-Secretary, c/o Geological Survey, P.O. Box 157, 2000 AD, Haarlem)

September 26-29

LITTORAL 94 (2nd International Symposium), Lisbon Portugal. (Associacao EUROCOAST-PORTUGAL, a/c do Instituto de Hidráulica e Recursos Hidricos, Faculdade de Engenharia, Universidade do Porto, Rua dos Bragas, 4099 Porto Codex Portugal. Telefax: 351-2-310870, 351-2-318787, 351-2-319280)

→→→ October 1994←←←

October 4-7

BASIN FORMATION AND INVERSION IN EUROPE-ENDOGENOUS AND EXOGENOUS ASPECTS (Annual Meeting of German Geological Society), Heidelberg, Germany. (Professor Th. Bechstädt and Professor R.O. Greiling, Geologisch-Palaeontologisches Institut, Ruprecht-Karls-Universität, Im Neuenheimer Feld 234, D-6900 Hidelberg, Germany. Phone: (06221) 562831; telefax: (06221) 565503; telex: 461515 unihd)

October 15-26

JURASSIC STRATIGRAPHY (4th International Congress), Mendoza-Neuquen, Argentina. (Dr. A.C. Riccardi, C.C. 886, 1900 La Plata, Argentina. Phone: 54-21-39125; telefax: 54-21-530189)

October 23-27

SOCIETY OF EXPLORATION GEOPHYSICISTS (64th Annual Meeting). Los Angeles, California, USA. (Convention Assistant, Society of Exploration Geophysicists, P.O. Box 3098, Tulsa, OK 74101, USA)

October 24-27

GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Seattle, Washington, USA. (Jean Kinney, GSA Headquarters, P.O. Box 9140, 3300 Penrose Place, Boulder, CO 80301, USA. Phone: (303) 447-2020)

1995

February 20-25

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

March 5-8

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

March 6-9

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

April 10-13

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

May 15-19

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

May 29–June 2

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

June 11-16

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

June 12-16

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

June 18-22

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

July 2-14

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

August 28-September 2

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

October 10-14

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

November 6-9

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

1996

October 28-31

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Unless with the consent of the Editor, papers which have been published before should not be submitted for consideration.

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Format **Warta Geologi & Buletin** (20x28 cm)

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 papers not exceeding 21 x 30 cm. 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.

Original maps and illustrations or as glossy prints should ideally be submitted with sufficiently bold and large lettering to permit reduction to 15 x 22 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 cm and preferably larger. Use of metric system of measurements (ISU) is strongly urged wherever possible.

Reference cited in the text should be listed at the end of the paper and arranged in alphabetical order and typed double-spaced. The references should be quoted in the following manner:

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Goh Yok Leng, 1975. *Bedrock geology and mineralization of the Seng Mines, Sungei Way, Selangor.* Unpublished University of Malaya B.Sc. (Hons.) thesis, 62 p.

Hutchison, C.S., 1989. *Geological Evolution of South-east Asia*. Oxford Monographs on Geology and Geophysics, 13, Oxford University Press, England, 368p.

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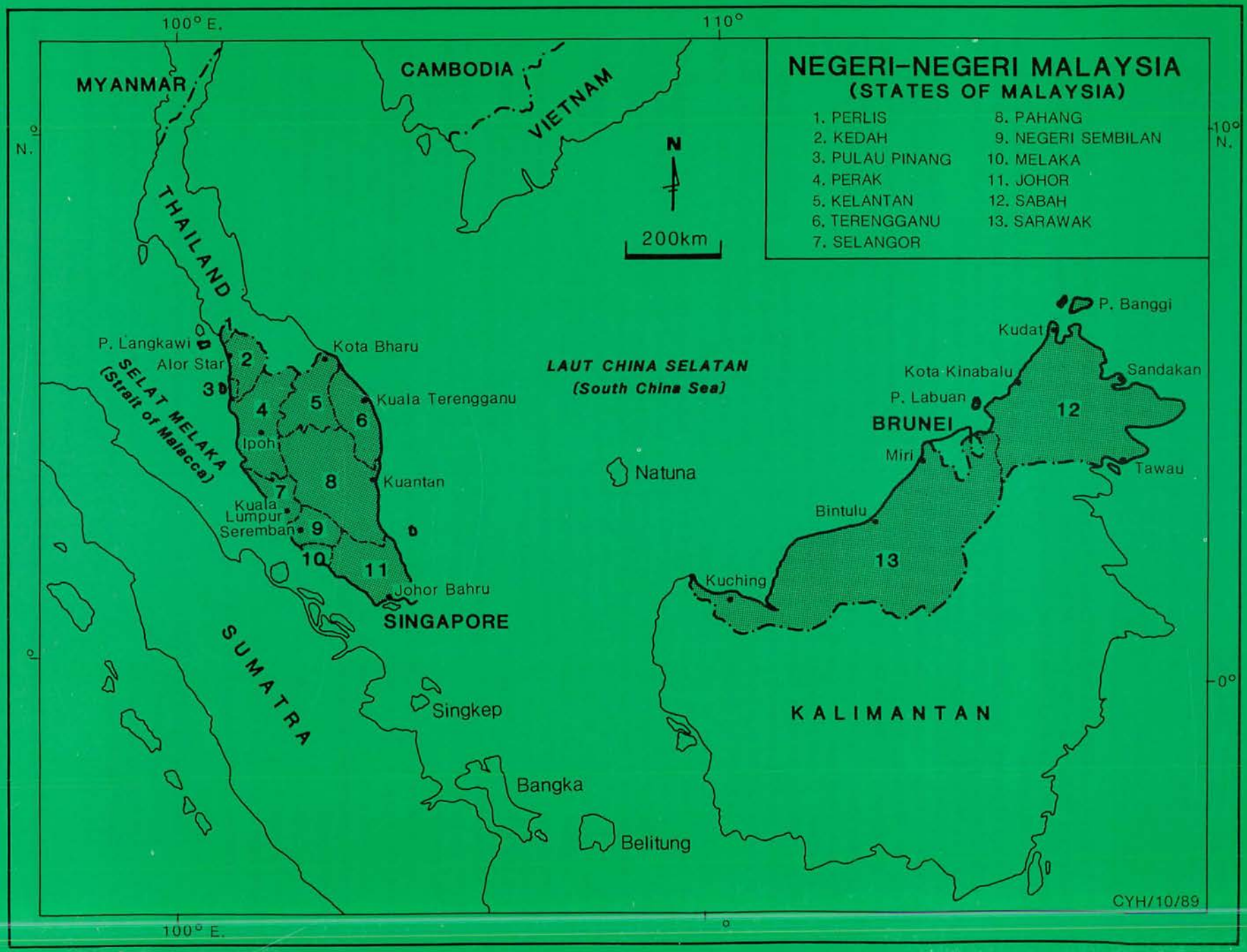
NEGERI-NEGERI MALAYSIA
(STATES OF MALAYSIA)
1. PERLIS
2. KEDAH
3. PULAU PINANG
4. PERAK
5. KELANTAN
6. TERENGGANU
7. SELANGOR
8. PAHANG
9. NEGERI SEMBILAN
10. MELAKA
11. JOHOR
12. SABAH
13. SARAWAK
100° E.
110°
10° N.
0°
MYANMAR
CAMBODIA
VIETNAM
THAILAND
N
200km
P. Langkawi
Alor Star
Kota Bharu
Kuala Terengganu
Ipoh
Kuala Lumpur
Seremban
Kuantan
Johor Bahru
SINGAPORE
SELAT MELAKA
(Strait of Malacca)
LAUT CHINA SELATAN
(South China Sea)
Natuna
P. Banggi
Kudat
Kota Kinabalu
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