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KANDUNGAN (Contents)

DIKELUARKAN DWIBULANAN
ISSUED BIMONTHLY

PERSATUAN GEOLOGI MALAYSIA
(GEOLOGICAL SOCIETY OF MALAYSIA)

Majlis (Council) 1988/89

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CATATAN GEOLOGI
(GEOLOGICAL NOTES)

THE TELOGENETIC FORMATION OF A RED BED

Sriyanee De Silva,
Department of Earth Sciences, University of Oxford, Parks Road, Oxford OX1 3PR.

Abstract

A red bed found within the abssyal plain clastic deposit, the Metah Member of the Belaga Formation (Cretaceous - Eocene), Sarawak, Malaysia was studied stratigraphically and petrographically. The bed lies in close proximity to the unconformity where the younger "Begrih-Liang" Formation (Pliocene) onlaps the Metah Member. Petrographic evidence indicates the red bed underwent additional porosity enhancement prior to porosity occlusion by haematite. The existing models for red bed genesis do not apply in this study and a hypothesis involving telogenetic processes is suggested to explain the genesis of the red bed.

Introduction

The purpose of this short paper is to investigate the presence of an anomalous red bed occurrence within an abssyal clastic deposit and to evaluate its formation in the light of existing hypotheses on red bed genesis. The importance of the overlying sediments during telogenesis (the regime at or near the surface after effective burial) is emphasized.

Stratigraphical and sedimentological setting

The Belaga Formation, Late Cretaceous to Eocene (Liechti *et al.*, 1960), forms a cresentic belt trending southwestwardly. It has been described as an accretionary prism formed by the subduction of the South China Sea beneath the basement of West Sarawak (Hamilton, 1979; James, 1984). The greatly deformed wedge of melanges and broken formations of abssyal plain clastic sediment is overlain by a Mid-Tertiary outer-arc basin (Hamilton, 1979) which includes the Balingian and Begrih-Liang Formations (Fig. 2). The Belaga Formation is divided into five members based on the microfauna present, and has a minimum thickness of 10,000 m to 15,000 m (Chung, 1982). The Metah Member, which outcrops in the area south of Mukah (Fig. 1), is a sequence of thinly bedded fine-grained turbidites and thickly bedded coarse-grained arenitic turbidites. The coarse-grained arenites are interpreted as channel-fill sediments of a deep sea fan. The presence of planktonic Upper Eocene foraminifera *Globorotalia centralis* and *Globorotalia cero-azuliensis* (Liechti, *et al.*, 1960) supports the sedimentological evidence for a deep marine, abssyal plain environment of deposition.

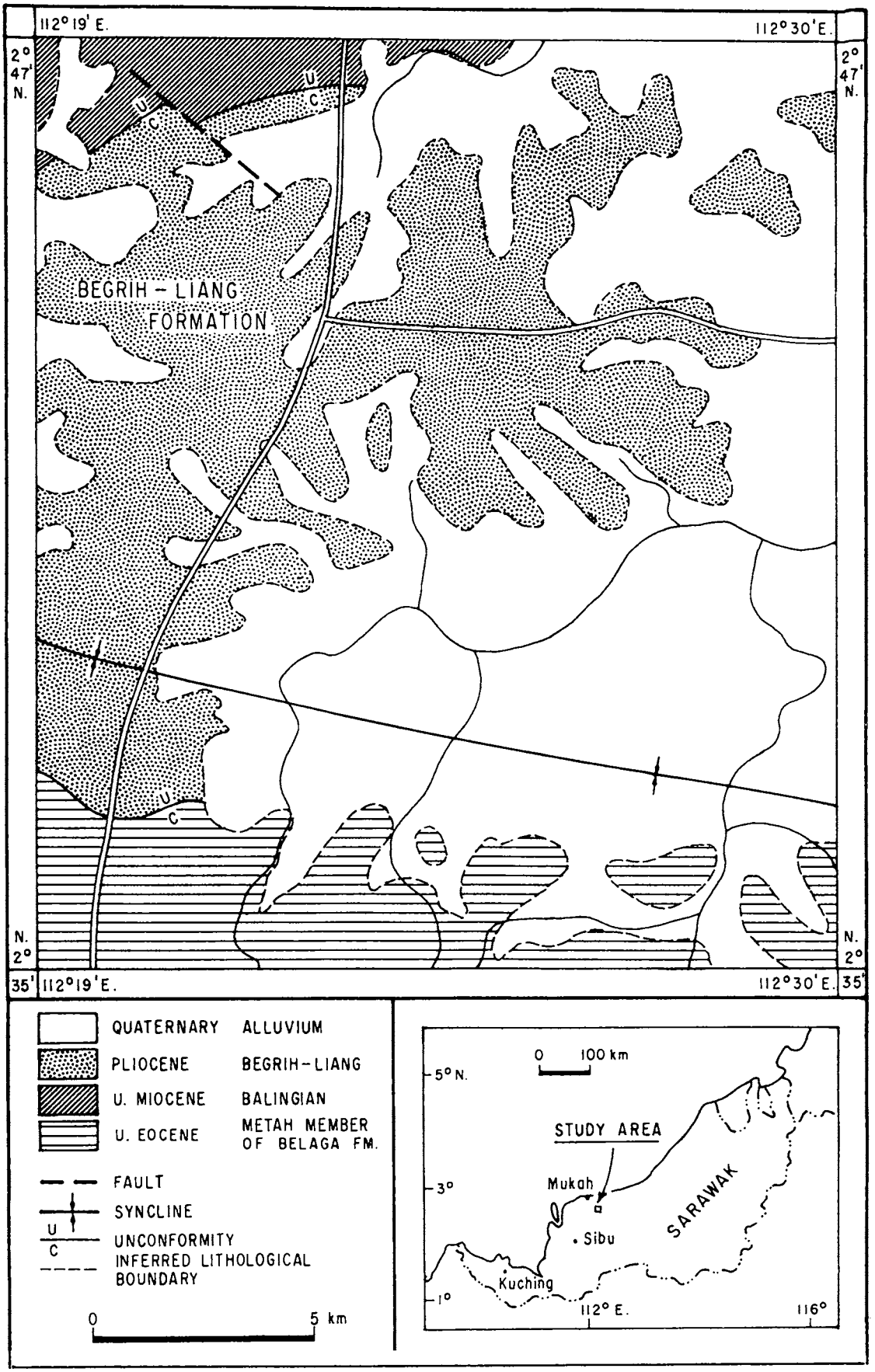

Fig. 1. Location map of area studied.

FORMATION	LITHOFACIES	SUB-FACIES
BALINGIAN	ARGILLACEOUS	Fossilerous mudstone Rootlet mudstone(seat-earth)
	ARENACEOUS	sandstone Pebbly sandstone
	ORGANIC	Coal peat
BEGRIH-LIANG	ARGILLACEOUS	Rootlet mudstone(seat-earth) Nodular bed
	HETEROLITHIC	Lenticular bed Flaser bed
		Wavy-bedded Layered sandstone-mudstone
	ARENACEOUS	Laminated sandstone Fine sandstone
	RUDACEOUS	Orthoconglomerate Sandy conglomerate
	ORGANIC	Coal peat

Fig. 2. Stratigraphy and sedimentology of the South Mukah-Balingian area.

In the southern part of the study area (Fig. 1), the Balingian Formation (Upper Miocene) and the Begrih-Liang Formation (Pliocene) (de Silva, 1986a) onlap the Metah Member. The sedimentological evidence (de Silva, 1986b) suggest deltaic and paralic paludal environments for both formations. The Begrih-Liang Formation, in particular, contains coal seams and associated lithofacies such as mudstones with iron nodules and concretions.

The red bed within the Metah Member lies adjacent to the onlap of the Begrih-Liang Formation on to the Metah Member. It is a twenty-five centimetre thick structureless, tabular quartzose sandstone characterized by a bright, almost vermillion red colour. The bed is contained within a sequence of thinly-bedded (10-20 cm) fine-grained turbidites, in which grey, sandy siltstones fine into black muds. The red bed is unique only in its colour. It is, otherwise, petrologically comparable to the thick-bedded (50-100 cm), structureless coarse-grained arenites found elsewhere within the formation. They are interpreted as channel deposits which incise the abssyal plains.

Petrographical evidence

A. Red bed (Plate 1)

In thin section, the rock is seen to be texturally submature, but mineralogically mature. The opaque matrix (which comprises of 35% of the rock) obscures most of the fabric of the sandstone although the grains do show the presence of tight packing in places. The sorting is moderate, with approximately 40% of the rock lying within the range of 0.5 mm to 1.0 mm. The grains are angular to subangular, with angularity being both primary and secondary. The secondary angularity, which dominates, is mainly due to dissolution along grain boundaries, causing the grain surfaces to be i-regular and diffuse in thin section. Inherent primary angularity is recognized in some monocrystalline grains with well-defined grain boundaries. The matrix fills oversized voids, as well as interstices between grains. The matrix has locally permeated through intragranular fractures.

The grains are primarily monocrystalline quartz (50% of the rock) showing both undulose and unit extinction. The remainder of the rock consists of polycrystalline quartz (10%) and cryptocrystalline (5%). The matrix consists of amorphous aggregates, identified under reflected light as faintly limonitized haematite with clays found locally. The aggregates are less than 30 microns in diameter and, therefore, the rock could be classified as a quartz wacke (Pettijohn, Potter and Siever, 1972).

The moderate sorting coupled with the coarse grain size suggest a moderately high hydrodynamic environment, such as a channel where transportation would be by grain flow or fluidized flow. The mineralogical maturity could be interpreted as multi-cycle sediments originating from a sedimentary source or a stable tectonic setting, or perhaps reworking within the basin prior to deposition. This does not preclude the maturity arising as a consequence of selective diagenetic dissolution of more labile grains.

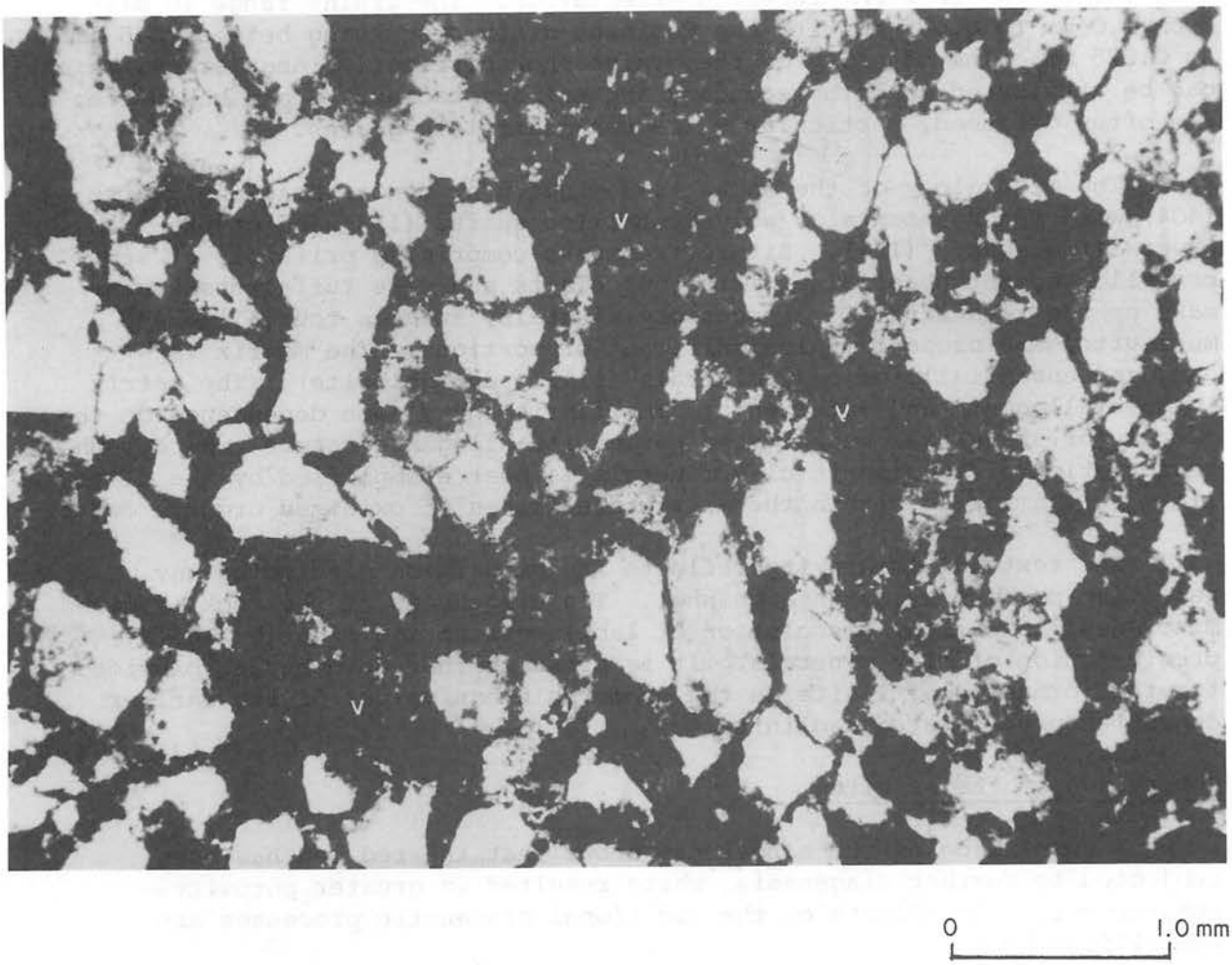

Plate 1. A photomicrograph of a thin section of the quartz wacke. The black matrix is composed chiefly of iron oxide. Note the over-sized voids (v) which are contained by the matrix. (Plane polarized light, magnification 60X).

The diagenetic history is obscured by the overprinting effect of the haematite precipitation. However, the presence of oversized voids, floating grains, diffuse grain boundaries and fractured grains imply porosity enhancement prior to the occlusion by the later opaque matrix.

B. Thick bedded arenites (Plate 2)

Petrographic analyses shows that they are texturally wackes (more than 20% matrix) with quartz as the dominant mineral. There is little grain contact with the matrix filling the interstices. As with the red bed, the grains show no preferred orientation. The grains range in size from 1.0 mm to 0.075 mm with the dominant grain size being between 0.5 mm to 0.625 mm. The majority of the grains show distinctive angularity, which can be attributed to both secondary and primary causes. Grain boundaries are often diffused, particularly the non-quartzitic grains.

The mineralogy of the wacke is dominated by monocrystalline quartz (40%) with minor amounts of polycrystalline quartz (15%) and cryptocrystalline quartz (15%). Lithic fragments comprising primarily of semi-consolidated intrabasinal argillaceous clasts and rare tuffaceous grains make up the remaining 10%. Accessory minerals, such as tourmaline and muscovite, are present in insignificant proportions. The matrix is composed essentially of clay minerals (illite and chlorite). The matrix is both allogenic and authigenic. The fabric shows some dependence on the matrix for structural support indicating its allogenic nature, whereas the neoformation of authigenic clay minerals is best exemplified by the clay rims. Disseminated within the matrix are flakes of oxidized organic debris.

The textural immaturity reflects its deposition precluding any selective processes, as in a channel. The diagenesis of the rock involved minor desilification, dissolution of labile grains and finally the precipitation of clay minerals. It is probable that deep burial provided for the formation of illite as the neomorphic equivalent of the earlier deposited/precipitated kaolinite.

Comparison of the arenites

A comparison of the sandstones shows that the red bed has been subjected to further diagenesis, which resulted in greater porosity enhancement. The effects of the additional diagenetic processes are exemplified by -

i) additional dissolution of labile grains such as cryptocrystalline quartz, lithic fragments, and acce-sory minerals (muscovite and tourmaline) leading to their total/partial eradication.

ii) further desilification at grain boundaries enhancing the angularity of the remaining quartz grains.

iii) the occlusion of the secondary porosity by the precipitation of the haematite, which is apparently replacing and displacing the inherent clay matrix. It is probable that the haematite aggregates nucleated on the clay, which then either obliterates the grains or obcures its presence.

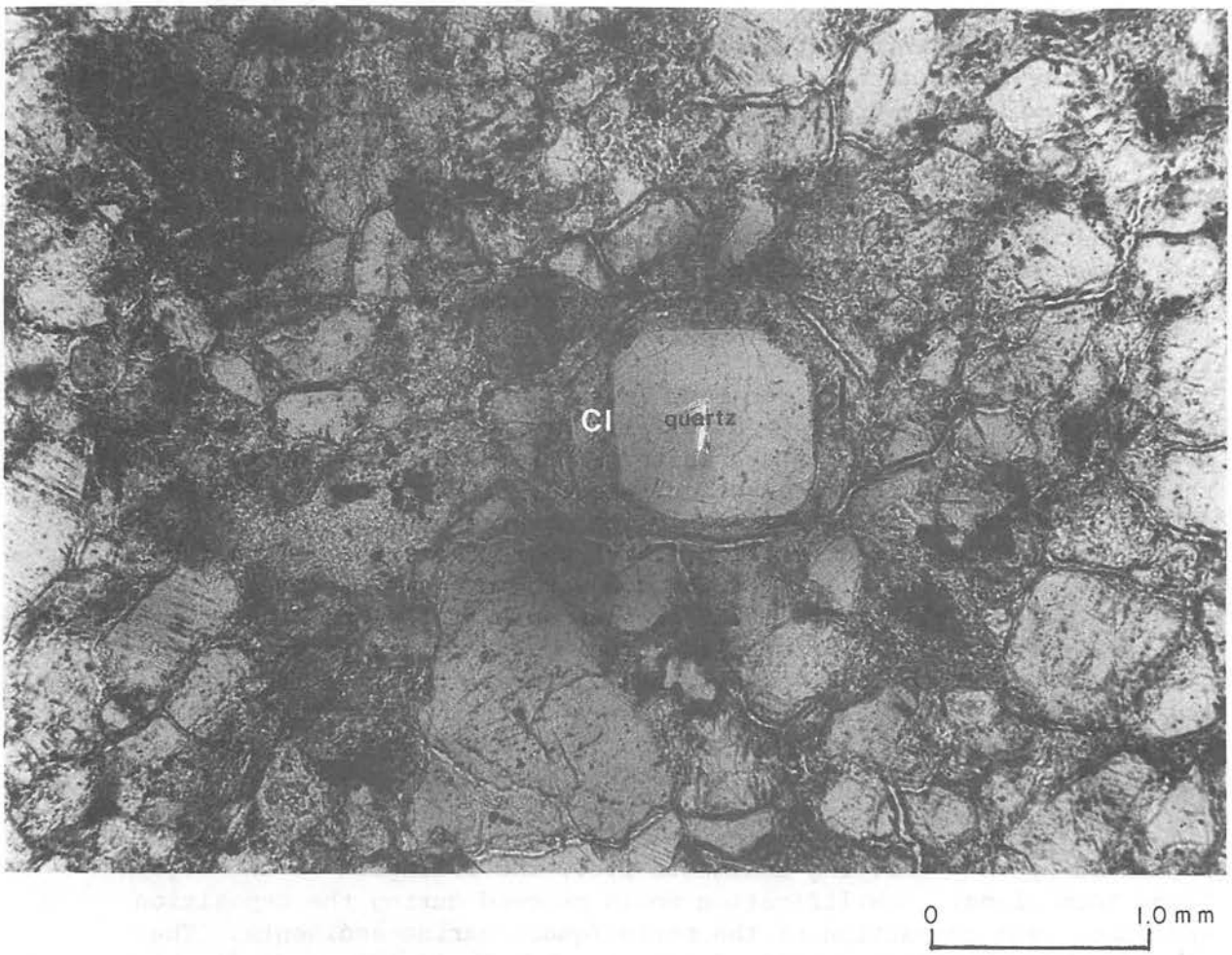

Plate 2. A photomicrograph of the thick bedded sandstone showing a high clay and organic debris matrix with mainly quartz clasts, poor sorting and is texturally immature. Cl: Chlorite rim. (Plane polarized light magnification 60X)

The haematite in the matrix indicates that the initial precipitate was likely to have been an amorphous ferric hydroxide or goethite (Langmuir, 1971) which subsequently ages into haematite (Berner, 1969). This precipitation usually originates from interstitial fluids during diagenesis and is the most important process responsible for the colouration of red beds (Turner, 1980).

Discussion

The models for red bed genesis currently available are summarized in Table 1. From field evidence and petrographic analyses it is apparent that the hypotheses are inappropriate for the genesis of the anomalous red bed. In the first instance, the haematite precipitation does not occur in the epidiagenetic stage. The occlusion of secondary porosity by haematite excludes intrastratal alteration during early diagenesis, and suggests that the precipitation occurred after burial to considerable depth (cf. haematite filling intragranular fractures). This post-porosity enhancement occlusion makes models (i) to (iv) inapplicable. The absence of weathering features, palaeo or otherwise, in the encompassing rocks, does suggests that the oxidizing effect was extremely localized and confined to the channel deposit, and, therefore, making models (v) to (vii) unsatisfactory as solutions.

The absence of other red beds lower in the stratigraphic sequence and the general adage that deep burial decreases permeability and porosity precludes the mesogenetic stage (after Schmidt and McDonald, 1979) for the creation of the red colouration. Hence, it is hypothesized that the porosity enhancement and later occlusion occurred during the telogenetic stage (after Schmidt and McDonald, 1979) where the uplift of the abyssal plain sediments would allow for the downward movement of meteoric water. Sporadic periods of uplift would serve as an effective pumping mechanism for the flushing of the permeable channel by the meteoric waters. These periods of uplift would be expressed stratigraphically in the overlying sediments as regressions. The presence of more than ten coal seams in Begrih-Liang Formation alone (de Silva, 1986b) and the rhythmicity of the lithofacies (Fig. 2) exemplify periodic diastrophism.

The geochemistry of the percolating meteoric fluids would be regulated by the overlying sediments i.e., the Balingian or the Begrih-Liang Formations. Desilification would proceed during the deposition and subsequent compaction of the marine/quasi-marine sediments. The alkaline connate fluids would admix with the alkaline marine meteoric waters and be flushed into the underlying sediments, presumably along the unconformity. The additional porosity created would be occluded when the connate waters become acidic and carry iron ions in sufficient quantities during the compaction and dehumification of organic matter in the paludal deposits of the overlying sediments. The presence of sideritic and pyritic nodules and concretions in both overlying formations (de Silva, 1986b) attest to the fact that there was no deficiency of iron. The precipitation of the iron hydroxide/oxyhydroxide, and subsequent conversion to haematite requires a considerable length of time, in the order of a million years or more (Walker, 1967). The extreme localization of this telogenetic effect may reflect the depth of penetration of the meteoric fluids (the red bed is adjacent to the unconformity) and the absence of any other permeable strata in the immediate vicinity.

Conclusions

The reddening of a channel deposit within the Metah Member is ascribed to telogenetic porosity enhancement and subsequent occlusion by percolating meteoric waters which were contaminated by connate fluids from the overlying compacting sediments. The ageing of the iron hydroxide precipite to haematite requires a time span of not less than a million years, hence, making the Balingian and "Begrih-Liang" Formations prime sources of the necessary ions and modifying telogenetic fluids.

Acknowledgements

This paper is based on the work done for the author's B.Sc thesis. The author is grateful to all the help given by Dr. Azhar and other members of the Department of Geology, University of Malaya. The fieldwork was supported by a sponsorship by Carigali. Thanks are also due to Dr. Hugh Jenkyns and Marc Helman for kindly reviewing the manuscript, and to Steve Baker for the photographs.

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Manuscript received 9 December 1987.

Table 1. Models for red bed genesis.

MODELS FOR RED BED GENESIS	
i.	Intrastratal alteration during early diagenesis in arid/semi-arid climates (Walker, 1967, 1976; and Walker, *et al.*, 1978).
ii.	Intrastratal alteration during early diagenesis in moist climates (Walker, 1974).
iii.	Syndepositional biotic oxidation of clays in pelagic environments where rates of oxidation of biota are equivalent to rates of organic matter input.
iv.	Secondary red beds presumed to be produced by the erosion and redeposition of pre-existing red beds (Krynine, 1949 in Turner, 1980).
v.	Palaeoweathering due to deep penetration of oxidizing condition causing secondary reddening in the substratum (Trotter, in Turner, 1980).
vi.	Laterization (chemical weathering leading to the relative accumulation of residual oxides of aluminium, iron, manganese and titanium).
vii.	Palaeosol formation.

PERTEMUAN PERSATUAN)
(MEETINGS OF THE SOCIETY)

ANNUAL CONFERENCE '88 - BUKIT FRASER

This year's Annual Conference, the third in the series, marks a significant change in format and participation. For the first time since the inception of the Annual Conference in 1986, we have a record participation of 143 geologists, the majority from the Geological Survey of Malaysia, who are at Fraser's Hill for their own Annual Conference.

28 papers were presented by a cross-section of geologists from the Survey, and the local Universities (UM, UKM and USM). There was active discussions and exchange of ideas and know-how during discussion time, tea breaks, meals and also whenever the participants met during their stay.

The Society is indeed grateful to the Director-General of Geological Survey of Malaysia for supporting this Annual Conference with the participation of his geologists, his active participation during the Conference and for his address and declaring the Conference open.

From the positive remarks about the usefulness of having the Society's Annual Conference at the same time as the Surveys, it is hoped that this cooperation should be further enhanced and improved upon.

Another highlight of the Conference was the sumptuous Chinese (halal) course dinner hosted by Malaysian Mining Corporation (MMC). The Society is most grateful to MMC for the generous contribution.

G.H. Teh

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PERSIDANGAN TAHUNAN GEOLOGI '88
Annual Geological Conference '88

Merlin Inn Resort
Fraser's Hill
4th – 5th January 1988

ANNUAL GEOLOGICAL CONFERENCE '88

PROGRAMME

Monday, 4th January, 1988

8.00 a.m. : Late Registration

8.45 a.m. : Welcoming address by Dr. Hamzah Mohamad, President, Geological Society of Malaysia.

9.00 a.m. : Address by Mr. Yin Ee Heng, Director-General, Geological Survey of Malaysia.

9.15 a.m. : Coffee Break

SESSION I

9.45 a.m. : KEYNOTE PAPER I
K.R. CHAKRABORTY - Constrains on the Pre-Cenozoic tectonic evolution of the Malay Peninsula.

10.20 a.m. : IBRAHIM ABDULLAH - Geologi struktur Ahli Gersik Atas, Formasi Setul, Pulau Langgun, Langkawi.

10.40 a.m. : AZHAR HJ. HUSSIN - Diagenetic patterns in the Mid-Tertiary Batu Gading Limestones, Sarawak.

11.00 a.m. : H.D. TJIA & SYED S. ALMASHOOR - Geological environment of the chaotic deposits, Pertang area, Negeri Sembilan.

11.20 a.m. : NURAITENG TEE ABDULLAH - Some diagenetic aspects of the Subis Limestone, Sarawak.

11.40 a.m. : KAMALUDIN BIN HASSAN - Significance of palynology in Late Quaternary sediments in Peninsular Malaysia.

12.00 noon : Lunch Break

SESSION II

1.20 p.m. : KEYNOTE PAPER II
J.K. RAJ - Stability of slope cuts in Peninsular Malaysia.

1.50 p.m. : ABDUL GHANI RAFEK - Contoh penggunaan Kaedah Kerintangan Geoelektrik untuk penjelajahan bawah tanah.

2.10 p.m. : YUNUS ABDUL RAZAK - Soil logging practice - What is the standard?

2.30 p.m. : KADDERI MD. DESA - Penafsiran Landsat kawasan Sabah Barat dan Utara.

2.50 p.m. : TAN BOON KONG - Geology and soils along parts of the North-South Highway, Peninsular Malaysia.

3.10 p.m. : Coffee Break

3.40 p.m. : YUSUF BIN BUJANG - Penyiasatan terperinci hidrogeologi di kawasan Jebungan, Mukah, Sarawak.

4.00 p.m. : HENRY LITONG AMONG - Construction of horizontal wells in Kampung Paloh, Sarikei Division, Sarawak.

4.20 p.m. : IBRAHIM KOMOO - Kegagalan cerun di sepanjang lebuhraya utama di Semenanjung Malaysia.

4.40 p.m. : MOHD. SAYYADUL ARAFIN & C.Y. LEE - Some results of resistivity survey for hydrogeological investigation of Perlis.

7.30 p.m. : DINNER - Hosted by the Malaysia Mining Corp.

Tuesday, 5th January, 1988

SESSION III

9.00 a.m. : KEYNOTE PAPER III
K.K. CHEANG - Major types of primary gold deposits in Malaysia.

9.30 a.m. : U.N. MISRA, K.K. CHEANG & N.N. RAO - Gold: mineralogy and metal extraction.

9.50 a.m. : DORANI BIN JOHARI - Coal reserve estimation, Tebulan Block, Merit-Pila Coalfield, Sarawak.

10.10 a.m. : Coffee Break

10.40 a.m. : G.H. TEH & R.W. HUTCHINSON - Geochemistry of woodtin: genetic implications.

11.00 a.m. : TAN TEONG HENG - Alteration in Mamut adamellite.

11.20 a.m. : TUAN BESAR TUAN SARIF - A dest-top planning for geological exploration of platinum.

11.40 a.m. : K.K. CHEANG & ZULKIFLI CHE KASIM - Gold-bearing quartz veins from the Ajmal Mine, Kuala Lipis area, Pahang, Malaysia.

12.00 noon : Lunch Break

SESSION IV

1.20 p.m. : KEYNOTE PAPER IV
I. METCALFE - Recent conodont data from Peninsular Malaysia: palaeotectonic implications

1.50 p.m. : KEYNOTE PAPER V
WONG TING WOON - The Triassic system of Peninsular Malaysia

2.20 p.m. : AZHAR HJ. HUSSIN - Structural style in the Upper Palaeozoic and Lower Mesozoic, Kedah-Perlis.

2.40 p.m. : ANN YASMIN BT. NORDIN - An algal-mud mound in the Triassic limestone hill of Bt. Kodiang, Kedah.

3.00 p.m. : Coffee Break

3.30 p.m. : FAN CHOON MENG & P.C. AW - Processing of illite powder in Bidor, Perak: A study of the process and the potential uses of illite clay.

3.50 p.m. : KWAN TAI SEONG - K/Ar mica dates for granites from the Bujang Melaka area.

4.10 p.m. : Closing Remarks

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PERSIDANGAN TAHUNAN GEOLOGI 1988
(Annual Geological Conference 1988)

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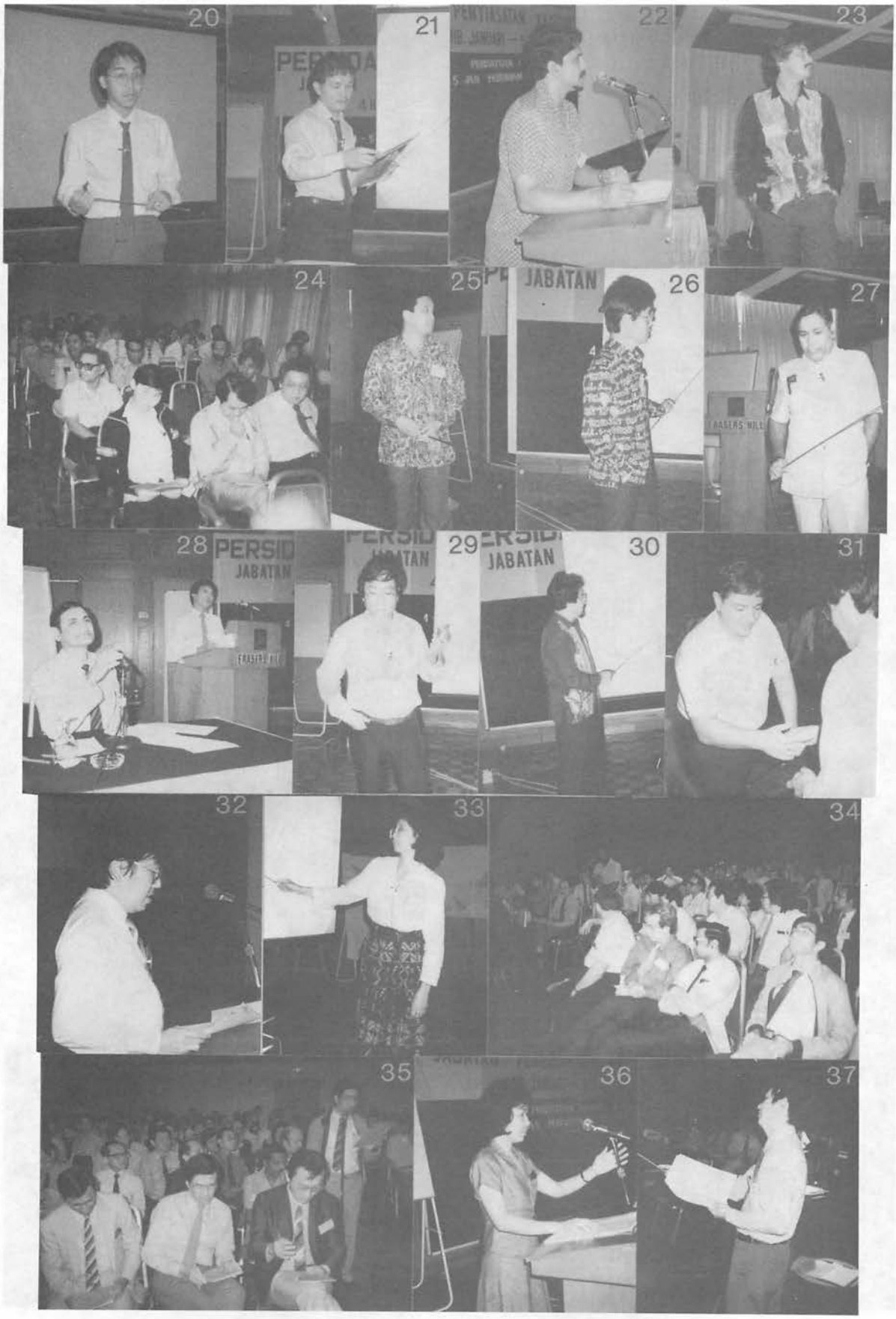

PERSIDANGAN TAHUNAN GEOLOGI 1988
(Annual Geological Conference 1988)

ANNUAL GEOLOGICAL CONFERENCE 1988 - FRASER'S HILL
(CAPTION TO PHOTOGRAPHS)

1. At the registration desk.
2. The Organising Chairman starting off the proceedings.
3. Mr. E.H. Yin, Director-General Geological Survey Malaysia, with his speech.
4. Society President, Hamzah Mohamad, with his welcoming address.
5. The Society President presenting Mr. Yin with a token of appreciation.
6-9. The large turnout at the Conference.
10. K.R. Chakraborty receiving a souvenir from Session Chairman Senathi Rajah for his keynote paper.
11. Ibrahim Abdullah with his paper on the Setul Formation.
12. Azhar Hj. Hussin indicating the location of the Batu Guding limestones.
13. Syed S. Almashoor with his joint paper.
14. Nuraiteng Tee Abdullah on the Subis Limestone.
15. J.K. Raj with his Keynote Paper.
16. Abdul Ghani Rafek with his paper.
17. Yunus Abdul Razak on Soil Logging.
18. Kadderi Md. Desa with his contribution.
19. Tan Boon Kong presenting his paper.
20. Yusuf bin Bujang on hidrogeological investigations at Jebungan.
21. Henry Litong Among with his overheads.
22. Mohd. Sayyadul with his joint paper.
23. Ibrahim Komoo on slope failures.
24. A section of the audience.
25. K.K. Cheang on primary gold deposits.
26. G.H. Teh with a paper on woodtin.
27. U.N. Misra presenting a joint paper.
28. Session Chairman, Fateh Chand, opening Doraini's paper for discussion.
29. Tan Teong Heng on alteration in Mamut adamellite.
30. Tuan Besar Tuan Sarif with his paper.
31. I. Metcalfe receiving a souvenir from Session Chairman K.Y. Foo.
32. Wong Ting Woon on Triassic of Peninsular Malaysia.
33. Ann Yasmin presenting her paper.
34. Suntharalingam with a question.
35. L.H. Teoh commenting.
36. Fan Choon Meng with a joint paper.
37. Kwan Tai Seong on Bujang Melaka granites.
38-49. At the sumptuous course dinner hosted by MMC.
50. Dr. Hamzah Mohamad with a Short Speech.
51. The Society President presenting a token of appreciation to MMC representative, Albert Loh.
52. Albert Loh, representing MMC, with his speech.

CONSTRAINTS ON THE PRE-CENOZOIC TECTONIC EVOLUTION OF THE MALAY PENINSULA

K.R. CHAKRABORTY
Dept. of Geology, University of Malaya

Pre-Cenozoic tectonic evolution of the Malay Peninsula remains poorly understood. Petrological and other geological observations cannot be properly accommodated within the framework of published subduction-collision related models.

Space-time-composition relationships of the Permian to Triassic granitoid batholiths of the eastern block (i.e. central and eastern belts of the three-fold division), as evident from the currently available data, are not consistent with eastward (present day) subduction. The difficulties that are encountered can be partly resolved by assuming a westward migration of the trench, but it would create additional problems with respect to both magmatic pattern and spatial disposition of the stratigraphic units.

The calc-alkaline to alkali-calcic nature of the batholiths, the presence of bimodal association, the occurrence of high potassic basic plutonic suite, and many other petrochemical discriminants strongly suggest that the eastern block batholiths have evolved in an intraplate continental extensional setting. The progressive closure of an ocean basin during Permian-Triassic thus seems unlikely. The question of whether the extensional setting was related to failed continental rift, to rhomb graben within a transcurrent zone, or to continental back-arc basin, remains open. The latter, however, would require a westward subduction with a trench on the east of the eastern block, which is not incompatible with the space-time-composition relationship of the eastern block batholiths.

GEOLOGI STRUKTUR AHLI GERSIK ATAS FORMASI SETUL PULAU LANGGUN, LANGKAWI

IBRAHIM ABDULLAH
Jabatan Geologi, UKM, Bangi, Selangor

Batuan Ahli Gersik Atas Formasi Stul telah mengalami perlipatan dan penyesaran. Paksi lipatan ialah antara utara-timur laut dan timur laut-timur. Sesar mendatar yang terdapat ditafsirkan terhasil oleh tindakan mampatan maksimum dari arah hampir utara-selatan. Sistem tegasan itu juga ditafsirkan telah menyebabkan pembentukan sesar tertib kedua.

Sistem tegasan di atas menerbitkan sesar-sesar mendatar dekstral yang berjurus lebih-kurang 330 (150). Arah ini bersesuaian dengan arah satah ketakselarasan yang telah dicadangkan untuk memisahkan batuan Formasi Setul dan Formasi Singa di atasnya. Berhampiran dengan lokasi cadangan satah ketakselarasan, didapati batuan Atas Formasi Singa telah terlentur. Perlenturan begini boleh disebabkan oleh seretan yang terjadi apabila berlaku anjakan di atas satah sesar. Berdasarkan cerapan struktur, ditafsirkan sempadan antara batuan Ahli Gersik Formasi Setul dan batuan Dasar Formasi Singa di Pulau Langgun merupakan sempadan sesar, bukan satu ketakselarasan.

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DIAGENETIC PATTERNS IN THE MID-TERTIARY BATU GADING LIMESTONES, SARAWAK

AZHAR HJ. HUSSIN
Dept. of Geology, University of Malaya

The 40 m thick limestones exposed in the vicinity of Batu Gading, Middle Baram area in Sarawak are composed of an Upper Eocene limestone, overlain disconformably by a Miocene limestone. The limestones rest with an angular unconformity on the folded sandstone-shale sequence of the Kelalan Formation.

The Eocene limestones exhibit a spectrum of microfacies variation with packstones and grainstones as end members. A cross-bedded, poorly washed, quartz grains bearing crinoidal-nummulitic packstone dominate the lower portion of these limestones. Minor occurrences of clean-washed nummulitid-discocyclinid-alveolinid grainstone occur in pockets and lenses. Smaller patch reefs composed of algal-bounded foraminifera constitute the other microfacies observed. Micritic rims on skeletal components are only slightly developed. Lesser amount of micritic pore-lining cement and fibrous calcite spars are present in the grainstones. Fractured tests, presence of associated stylolites and solution enlarged fractures are more apparent in the lower portion of the sequence. Extensive bioturbation are often observed close to the disconformity surface. Dissolution features such as channel voids, moldic porosity decrease in intensity downsequence from this surface. Larger calcite spars show a tendency to be more ferroan in the lower section while the calcite spar close to the disconformity surface are non-ferroan. These features indicate that the disconformity surface was an emergent surface.

The Miocene limestone consists of transported blocks of the Eocene limestone, large corals and algal colonies in the lower portion, overlain by a sequence of foraminiferal mudstone before being gradually replaced upsequence by sandstone and shale. Extensive micritization, dissolution and development of cavities floored by crystal silts are formed in the Miocene limestone. The calcite spars are non-ferroan and the limestone generally lack evidence of pressure solution.

The diagenetic pattern in the Batu Gading limestone suggest that diagenesis of the lower portion of the Upper Eocene limestone took place in depth under an overburden load. The pore waters are interpreted to be reducing and water movements were probably sluggish. However, the upper portion of the same limestone indicate extensive meteoric diagenesis occurring beneath an emergent surface. This was followed by marine inundation with the resultant deposition of the Miocene limestone. The extensive dissolution in the latter indicates that these limestones migrated from an initial marine environment to within the fresh-water phreatic zone during the early part of its burial history.

SOME DIAGENETIC ASPECTS OF THE SUBIS LIMESTONE

NURAITENG TEE ABDULLAH
Geology Department, University of Malaya

The Subis Hill, in the vicinity of Batu Niah, forms a shallow water reefal buildup. Preliminary field study indicate the existence of core-reefal facies, flank facies and open marine facies. These facies are predominantly composed of bioclastic packstone and wackestone. Petrographic studies of samples from these 3 major facies indicate that the bioclastic components were extensively micritised, resulting in the formation of micritic envelopes and where micritization was more intense, the eventual loss of skeletal microstructures. Degree of micritization appears to be governed by the original skeletal component. Within the core facies, the original aragonitic composition of the coral framework was totally leached away, creating moldic porosity and leaving behind only the micritised outlines of the corals. Other bioclastic components and limemud in the core facies were either not affected by this initial dissolution phase or were only slightly affected. This initial dissolution is absent from the other facies. Subsequent to the initial dissolution phase, the newly created voids were filled by calcite cement (C1). These form interlocking mosaic; where voids are relatively large, the sizes of the calcite mosaic increase towards the center of the voids. The C1 cement infilling the coral framework are turbid with opaque inclusions, while the C1 cement infilling smaller vugs in the limemud are clearer.

The core facies also record a second phase of dissolution. This phase results in extensive leaching which is non-selective, i.e. it attacked both bioclastic components and limemud and even earlier formed C1 cement, thus resulting in the formation of extensive vuggy porosity. Vugs were later filled by large, poikilotopic calcite (C2) showing cross-cutting fabric. Abundant micritic detritus, generally in the form of clots or peloids were trapped within the growing spar. Within the flank facies, vugs created by the second dissolution phase were observed. Vugs were filled by C2 cement which is in the form of calcite mosaic. This cement also contain abundant micritic detritus in the forms of peloids or clots.

In the open marine facies, bioclastic wackestones do not show evidence of dissolution. Chambers of fossils were filled with ferroan calcite mosaic. Petrographic studies of the Subis Limestone indicate that the reefal buildup had passed through several diagenetic environments. The formation of the Subis Limestone took place in warm, shallow marine waters. This is in line with the faunal content (presence of abundant corals, coralline algae, *Lepidocyclina*, etc) and the presence of extensive micritization of the faunal elements. Evidence for the presence of marine cement have not been observed. They may have been present but could have been subsequently dissolved away. From this marine environment, the Subis Limestone migrated into the fresh-water phreatic environment where solution by undersaturated meteoric waters took place. The core facies and the flank facies remained essentially submerged in this zone of solution while the open marine facies remained outside of it. Fluctuations within the freshwater phreatic zone is interpreted to have been responsible for the formation of ± C1 and C2 cements. Both these cements were interpreted to have been formed within the active zone of fresh water circulation. The ferron calcite cement of the open marine facies is interpreted to have been formed in marine pore waters. The Fe^{++} could have been derived from the clay minerals that were deposited in this facies.

GEOLOGICAL ENVIRONMENT OF THE CHAOTIC DEPOSITS PERTANG AREA, NEGERI SEMBILAN

H.D. TJIA & SYED S. ALMASHOOR
Department of Geology,
Universiti Kebangsaan Malaysia

Two long, NE-trending roadcuts in the south slope of Bukit Penagoh expose regularly bedded sediments with wide intervals of chaotically disposed, small to large blocks of clastic sediments. The rocks are volcaniclastics, quartzite, conglomerate, pebbly mudstone and breccia. Among them are red tuffs, foliated tuffs and silicified tuffs. Some of the large blocks consist of folded sediments. General bedding and foliation are NW to NNW with dips moderately to very steep eastward. Large slabs of conglomerate are parallel to this general attitude. Three dominant fault sets transect the outcrop. One set strikes NW with moderate to gentle dips is usually of listric character indicating tectonic transport SW-ward. A second set also strikes NW but dips steeply to almost vertical; to this set belong wide zones of mylonite. Transcurrent movements probably occurred along faults of the second set. The third and youngest set consists of ESE-striking normal faults hading south.

The new regional geological map by the Geological Survey of Malaysia (1985) indicates that this particular outcrop is in the Devonian Karak Formation. The association of normal-bedded sediments with intervals of disrupted to chaotically arranged sedimentary fragments and the presence of older blocks (metasediments, folded sediments) together with younger sedimentary clasts are consistent for *olistostrome*. In addition, the presence of volcaniclastics suggest an island-arc setting where the olistostrome developed in an accretionary wedge above a subducting oceanic lithosphere. The reverse faults appear to indicate the sense of subduction, i.e. towards northeast.

SIGNIFICANCE OF PALYNOLOGICAL STUDY IN LATE QUATERNARY SEDIMENTS IN PENINSULAR MALAYSIA

KAMALUDIN BIN HASSAN
Geological Survey of Malaysia, Ipoh

Penggunaan palinologi di dalam kajian geologi Kuaterner adalah merupakan suatu lapangan yang baru di rantau Asia Tenggara. Kertas kerja ini cuba membincangkan kegunaan palinologi di dalam interprestasi persekitaran longgokan unit-unit Holosen di Semenanjung Malaysia berdasarkan kepada keputusan di kawasan Selatan Perak dan kajian di Seberang Prai. Pengunaan palinologi di dalam mengariskan stratigrafi Kuaterner adalah ditekankan. Di sini diperkenalkan satu unit baru untuk Holosen iaitu Ahli Parit Buntar.

The application of palynology to Quaternary geological studies is relatively a new field in this region. This paper discusses the palynological interpretation on the environments of deposition applied to some of the Holocene sediments in Peninsular Malaysia based on the results of the Lower Perak area and studies conducted in Seberang Prai. The significance of palynology in delineating the Quaternary stratigraphy is stressed. A new unit for the Holocene, the Parit Buntar Member of the Gula Formation, is introduced.

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STABILITY OF SLOPE CUTS IN PENINSULAR MALAYSIA

J.K. RAJ
Jabatan Geologi,
Universiti Malaya

In Peninsular Malaysia, thick weathering profiles are found over bedrock masses and have developed as a result of prolonged and pervasive chemical weathering. These weathering profiles are characterized by a morphological zonation, with each zone consisting of soil and/or rock material showing differences in the extent of preservation of minerals, textures and structures of the original bedrock material and mass. Slope cuts in the Peninsula have usually been excavated in such variable earth materials and it is this feature that is the single most important factor influencing their stability.

Granitic bedrock underlies the more hilly to mountainous areas of the Peninsula and shows weathering profiles that can be subdivided into three broad morphological zones, an upper Zone I of pedochemically and geochemically weathered bedrock, an intermediate Zone II of in-situ geochemically weathered bedrock and a lower Zone III of partly weathered to unweathered bedrock. Zone I is up to about 12 m thick and consists of soil material of a sandy clay to clayey sand texture, while Zone II is up to about 30 m thick and consists of material of a sandy silt to silty sand texture that indistinctly to distinctly preserves the textures and structures of the original bedrock mass. Unweathered corestones and core-boulders are also often found in the lower part of Zone II, while Zone III consists of unweathered bedrock that shows weathering effects along structural discontinuity planes only. Shallow cuts in granitic bedrock areas only expose Zone I material and are usually stable, though they are sometimes affected by shallow slips that occur long after the end of construction during periods of rainfall and are preceeded by the development of desiccation cracks within the Zone I material. Slope cuts of moderate heights expose material of Zones I and II, and have been affected by several small discontinuity plane controlled failures, as wedge failures, slab and block slides, for these discontinuity planes are often distinctly preserved in the Zone II material. Small shallow slips have also affected the Zone I material of these cuts. Larger failures of a slump-flow nature have also affected these cuts and result from the infiltration induced saturation of the slope material. Apparent cohesion is an important property of the Zone II material, for the cuts of moderate heights often appear stable even at steep angles, particularly when it is considered that the Zone II material shows a drained strength characterized by only a friction angle (Ø) value of about 38 to 42°. Very deep cuts expose material of morphological Zones I, II and III and are affected by the same types of failures that affect the shallower cuts, except for the Zone III material which is only affected by structural plane controlled failures as wedge failures, block and slab slides. Groundwater is not considered to be an important factor influencing the stability of the deep and shallower cuts, except in some cases, for groundwater tables are usually located below the slope failure surfaces.

Metamorphic bedrock is found in the undulating to hilly areas of the Peninsula and shows weathering profiles that can usually only be subdivided into two broad morphological zones, an upper thin to thick Zone I of pedochemically and geochemically weathered bedrock and a lower thick to very thick Zone II of in-situ geochemically weathered bedrock. Only in very deep slope cuts is the morphological Zone III of partly weathered to unweathered bedrock exposed. Zone I is from 2 to 10 m thick and consists of soil material of a silty to clayey texture, while Zone II is up to 30 m and more thick and consists of soil material of a silty texture that distinctly preserves the textures and structures of the original bedrock mass. Shallow cuts in metamorphic bedrock areas usually only expose Zone I material and are affected by shallow slips that occur during periods of rainfall long after the end of construction and are preceeded by the development of dessication cracks within the slope material. In many cases, these cuts are affected by slumps that occur under undrained conditions for the cuts usually intersect groundwater tables. Deeper cuts expose material of Zones I and II ana are usually affected by structural planes controlled failures as wedge failures, block and slab slides as relict foliation and joint planes are distinctly preserved in the Zone II material. Larger scale failures involving compound slides and slumps also affect these cuts and occur under both drained and undrained conditions.

Sedimentary bedrock outcrops over the undulating to hilly areas of the Peninsula and shows weathering profiles that can be subdivided into two broad morphological zones, an upper Zone I of pedochemically and geochemically weathered bedrock and a lower Zone II of geochemically weathered bedrock. Zone I is from 3 to 10 m thick and consists of soil material of a silty to clayey texture, while Zone II is up to 20 m and more thick and consists of sandy to clayey soil material that distinctly retains the textures and structures of the original bedrock. Shallow cuts in the sedimentary bedrock areas expose Zone I material and are affected by shallow slips, while deeper cuts expose Zones I and II and are affected by larger structural plane controlled failures. These failures include slab and block slides as well as wedge failures and usually occur during or following periods of rainfall after the end of construction. In low-lying areas, slumps involving Zone I material sometimes occur under undrained conditions, when shallow groundwater tables are present.

SOIL LOGGING PRACTICE – WHAT IS THE STANDARD?

YUNUS ABDUL RAZAK
Geological Survey of Malaysia, Kuala Lumpur.

Accurate and complete description of soil profiles always play an important role in any soil investigation. The description forms the basis for preliminary screening of soil samples for testing, and provides important information to the design engineers. The proposed MCCSSOW description system represents a compact and easily memorized approach where description of each soil profile is based on seven descriptors as follows:- 1) Moisture conditions; 2) Soil colour; 3) Soil consistency; 4) Soil structure; 5) Soil type; 6) Origin; and 7) Ground water condition.

Each descriptor has its own engineering significance. The system is equally applicable for use in trial pits, cuts, shafts, adits, as well as for exploration boreholes and laboratory description. The system if practiced by the Geological Survey will result in a systematic and standardized geotechnical data bank.

CONTOH PENGGUNAAN KAEDAH KERINTANGAN GEOELEKTRIK UNTUK PENJELAJAHAN BAWAH TANAH

ABDUL GHANI RAFEK
Jabatan Geologi,
Universiti Kebangsaan Malaysia

Kaedah kerintangan geoelektrik berupa sesuatu kaedah geofizis yang membolehkan penentuan keadaan bawah tanah dengan pengukuran di permukaan bumi. Untuk kaedah ini terdapat dua aturcara pengukuran, iaitu pengukuran kerintangan geoelektrik duga dalam (vertical geoelectrical resistivity soundings measurements) dan pengukuran atau pemetaan kerintangan geoelektrik mendatar (horizontal geoelectrical profiling or mapping). Kaedah yang kedua dibincangkan di sini.

Kaedah pemetaan kerintangan geoelektrik lazimnya digunakan untuk mengesan sempadan-sempadan perbezaan kerintangan spesifik yang tegak atau hampir tegak. Bentuk lengkung kerintangan ketara yang diukur di permukaan bumi bukan sahaja dipengaruhi oleh perbezaan kerintangan spesifik lapisan-lapisan yang ada di sempadan tetapi juga oleh peraturan elektrod yang digunakan. Lengkung teori untuk satu sempadan menegak bagi peraturan Wenner, dwikutub ganda dua linear (double dipole (linear) array) Wenner-setengah dan Schlumberger-setengah memperlihatkan ketajaman yang berbeza di sempadan tersebut. Pengukuran dilakukan di suatu kawasan batuan kapur yang telah mengalami kars untuk memilah peraturan yang amat sesuai untuk pemetaan kawasan tersebut sambil menentukan keberkesanan kaedah ini.

PENAFSIRAN LANDSAT KAWASAN SABAH BARAT DAN UTARA

KADDERI MD. DESA
Jabatan Geologi,
Universiti Kebangsaan Malaysia

Penafsiran geologi kawasan Sabah Barat dan Utara telah dilakukan berdasarkan gambar landsat dan beberapa korelasi lapangan. Penafsiran landsat dapat mencam terain sedimen berserta pola strukturnya, terain igneus, beberapa sesar utama, morfologi gelongsoran batuan bersekil besar, dan morfologi graben.

Terain dan pola umum struktur batuan sedimen ditafsirkan berdasarkan tekstur dan taburan pematang yang sebahagian besar mempunyai korelasi dengan arah jurus. Teren igneus berdasarkan sifat rona dan tekstur pematang. Penafsiran sesar pula berdasarkan anjakan dan pola pematang serta perbezaan fitur geomorfologi. Satu zon yang dinamakan zon lineamen *en enchelon* ditafsirkan terdiri daripada satu deretan lembah-lembah berbentuk graben yang selari dengan zon gelongsoran batuan. Kedua-dua zon ini ditafsirkan terbentuk hasil dari pemumkuman tektonik.

Penafsiran lanjut pola umum struktur batuan sedimen menunjukan perbezaan jelas antara geologi bahagian utara, bahagian pantai barat dan bahagian tengah Sabah. Di samping itu, penafsiran ini juga menunjukkan ada kesan putaran telah berlaku pada geologi kawasan ini.

GEOLOGY AND SOILS ALONG PARTS OF THE NORTH-SOUTH HIGHWAY, PENINSULAR MALAYSIA

TAN, BOON KONG
Jabatan Geologi, UKM, Bangi.

This paper briefly outlines the geology traversed by the North-South Highway from Gurun to Johor Bahru. The highway is divided into seven segments as follows:–

i. Gurun – Butterworth
ii. Butterworth – Changkat Jering
iii. Ipoh – Tanjung Malim
iv. Tanjung Malim – Kuala Lumpur
v. New Klang Valley Expressway
vi. Seremban – Air Hitam, and
vii. Air Hitam – Johor Bahru

The route geology of each segment is presented, based on the geological map of Peninsular Malaysia (Geological Survey of Malaysia, 1973) and borehole data. Based on the geology, attempts have also been made to indicate possible locations for quarry sites (for rock aggregates) and borrow pits (for earth fills), general excavation requirements (blasting versus ripping, etc.) and problematical soils and rocks.

In addition, a discussion of the various types of soil deposits along the highway is also included. The discussion on the soil deposits is based on the extraction, compilation and interpretation of borehole data from the numerous soil investigation reports carried out along the highway. Altogether, about 650 horehole logs were examined to extract and compile the data presented. Some limited results of XRD analyses for clay minerals are also given.

PENYIASATAN TERPERINCI HIDROGEOLOGI DI KAWASAN JEBUNGAN, MUKAH, SARAWAK

YUSUF BIN BUJANG
Jabatan Penyiasatan Kajibumi, Sarawak

Di kawasan Jebungan, Sarawak, dua tapak telah dikenalpasti dari penyiasatan awal hidrogeologi untuk dilakukan penyiasatan terperinci air tanah. Tujuan utama dari penyiasatan ini adalah menentukan kesesuaian akuifer dari tapak tersebut untuk pengabstrakan air tanah yang tawar untuk Skim Cadangan Bekalan Air bagi kampung-kampung yang terletak di kawasan Hilir Sungai Mukah. Penyiasatan terperinci melibatkan penentuan litologi dan kualiti air untuk menaksirkan taburan, ketebalan dan semulajadi akuifer. Kajian imbangan air juga dilakukan dalam menentukan keupayaan akuifer untuk memenuhi keperluan air. Penggunaan air masa kini adalah 541 m^3/hari dan dijangkakan sebanyak 879 m^3/hari pada tahun 2000. Air tanah dari kawasan Jebungan juga diperlukan untuk pekan Mukah semasa musim kemarau selama tempuh maksima dua minggu setiap tahun apabila sumber air yang tersedia ada mengalami intrusi air laut. Penggunaan air untuk pekan Mukah adalah dijangkakan sebanyak 1000 m^3/hari. Berdasarkan kajian imbangan air, keperluan harian air dari akuifer untuk kampung-kampung dan pekan Mukah semasa musim kemarau adalah mencukupi. Sistem perigi mendaftar adalah dicadangkan untuk mengambil air dari akuifer bagi bekalan air.

Based on the results of a preliminary survey, two sites have been identified in the Jebungan area, Sarawak for detailed groundwater investigation. The aim of these investigations is to determine the suitability of the aquifer at the two sites for the abstraction of fresh groundwater for the proposed Water-Supply Scheme of the villages located in the Lower Sungai Mukah area. The detailed investigations involved lithological and water-quality studies to assess the distribution, thickness and nature of the aquifers. A water balance study was also conducted to determine the ability of the aquifers to meet the year-round requirement of water. The present domestic water requirement is 541 m^3/day, and is projected to be 879m^3/day in the year 2000. Groundwater from Jebungan area is also needed during the dry spell for supply to Mukah town for a maximum duration of two weeks per year when the existing source of water for Mukah is intruded by saline water. This requirement of Mukah town is expected to be about 1000 m^3/day. Based on the water balance study, the daily requirements of the villages and Mukah town during the dry spell can be sufficiently obtained from the aquifers. A system of horizontal wells is recommended for the removal of water from the aquifers for the proposed Water-Supply.

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KEGAGALAN CERUN DI SEPANJANG LEBUHRAYA UTAMA DI SEMENANJUNG MALAYSIA

(Slope failure along major highways in Peninsular Malaysia)

IBRAHIM KOMOO
Jabatan Geologi, UKM, Bangi

Kegagalan cerun merupakan satu masalah kejuruteraan terbesar di sepanjang lebuhraya utama di Semenanjung Malaysia. Kedua-dua, lebuhraya Kuala Lumpur–Karak dan lebuhraya timur–barat yang masing-masing dibuka kepada awam pada tahun 1978 dan 1982, kini sedang dibaikpulih, setiap satunya menelan puluhan juta ringgit. Masalah kegagalan cerun ini juga mulai dirasai oleh lebuhraya yang lebih baru dibina.

Satu survei kegagalan cerun telah dilakukan sepanjang lebuhraya Kuala Lumpur – Karak pada tahun 1985–86, dan survei yang sama dijalankan sepanjang lebuhraya timur–barat pada tahun 1986–87. Pada lebuhraya yang lain, cerapan lapangan telah dilakukan di kawasan kegagalan cerun dari masa ke semasa sejak tahun 1982 hingga kini.

Dalam survei ini, tumpuan diberikan kepada pengelasan kegagalan cerun, pengcaman faktor penyebab utama, keadaan litologi dan struktur batuan, dan geometri cerun. Pendekatan survei ialah untuk melihat kaitan antara jenis kegagalan dan sifat geologi kejuruteraan cerun. Pengalaman daripada hasil survei ini diharapkan dapat dijadikan panduan untuk pembinaan cerun baru dan proses baikpulih cerun yang sedia ada.

Kertas ini akan menghuraikan secara ringkas hasil survei, terutama perbandingan kegagalan cerun antara lebuhraya Kuala Lumpur – Karak dan lebuhraya timur – barat, dan menghuraikan beberapa contoh kegagalan cerun yang tipikal di sepanjang lebuhraya utama di Semenanjung Malaysia.

CONSTRUCTION OF HORIZONTAL WELLS IN KAMPUNG PALOH, SARIKEI DIVISION, SARAWAK

HENRY LITONG AMONG
Geological Survey of Malaysia, Sarawak

A horizontal production well system was constructed at Terabah, Kampung Paloh in Sarawak. The well system is designed to supply 240 m^3 (52,800 gallons) of water per day for the projected kampung population of 1585 people by the year 1990.

The horizontal well system was constructed in an unconfined aquifer which consists of unconsolidated fine sand with some medium sand. The system consists of three subsidiary collector wells and a main collector well. Each well consists of 4 lengths of cylindrical concrete culvert with an internal diameter of 1.22 m and height of 6.08 m. Each subsidiary collector well is installed with one pair of slotted 101 mm diameter PVC pipes. The total length of the screens for every collector well is 100 m. It is installed horizontally at an average depth of 3.0 m below the groundwater-table. The PVC pipe, which has an open area of 0.00167 m^2 per metre, is slotted on the upper half along its length. The slot is 0.2 mm wide and has an effective length of 4 cm. Coarse sand of 0.7 mm to 1.00 mm in size is used as filter sand. Groundwater from the subsidiary collector wells is channelled to the main collector well by 202 mm diameter PVC pipes.

The installation of the screens and the collector wells requires the lowering of the groundwater-table which is achieved using a dewatering wellpoint system. This ensures a stable trenchy-slope and a dry, firm working condition.

Construction of the horizontal well system was successfully completed in three months and proven by a month-long pumping test to work satisfactorily.

SOME RESULTS OF RESISTIVITY SURVEY FOR HYDROGEOLOGICAL INVESTIGATION OF PERLIS

MOHAMMED SAYYADUL ARAFIN
School of Material and Mineral Resources Engineering,
Universiti Sains Malaysia, Perak Branch Campus, 30000 Ipoh.

C.Y. LEE
School of Physics, Universiti Sains Malaysia, 11800 Minden, Pulau Pinang.

An extensive resistivity survey was carried out for hydrogeological investigation of Perlis. Electrical measurements were made at a network of 200 sounding points spread over the region north of Kangar. This paper emphasizes on (i) interpretation of some of the sounding curves of the Chuping Sugarcane Plantation area and (ii) a discussion of some of the results of the resistivity survey of Perlis.

The interpretation of the vertical electrical sounding curves (VES) from the Chuping Plantation area shows some interesting results. Our quantitative interpretation strongly suggests that the groundwater in the vicinity of the Sugarcane Factory has low (less than 10 ohm-m) resistivity. This means that the groundwater could be either brackish to saline or contaminated. The first possibility is very unlikely as the sea is quite far from the area. The danger of groundwater contamination from indiscriminate use of fertilizers and other chemicals (especially insecticides) is highly probable although the level of contamination is perhaps not serious.

A fence diagram, longitudinal conductance and water-table maps are prepared by utilizing the results of the interpretation of resistivity sounding data and the borehole data. The fence diagram gives an overall three dimensional view of the geology of Perlis. It shows approximate locations of the contacts between different formations and the number of layers. The longitudinal conductance map is an important tool to a hydrogeologist. It shows areas of pervious and impervious materials. A high longitudinal conductance map is an important tool to a hydrogeologist. It shows areas of pervious and impervious materials. A high longitudinal conductance could be either due to large thickness or low resistivity or both of an aquifer, and vice-versa.

The watertable map prepared from the resistivity results is important in determining the flow of groundwater. The cost of preparing such a map from the geophysical results is low compared to that obtained from the well-data.

MAJOR TYPES OF PRIMARY GOLD DEPOSITS IN MALAYSIA

K.K. CHEANG
Mineral Resources Engineering Program
Universiti Sains Malaysia (Perak Branch Campus)
Jalan Bandaraya, 30000 Ipoh.

An attempt is made to classify and to characterise some major primary gold deposits in Malaysia. Such an effort is justifiable in providing exploration geologists with basic models which can be used to recognise diagnostic features of various types of gold deposits in the field and hence, their possible size, grade and ore-bearing structures or stratigraphic horizons.

In Malaysia, the major primary gold occurrences include those associated with:

a) Gold-Copper Porphyry systems

b) Stratabound Volcanogenic Massive Sulphides
(Kuroko Type) with Zn–Cu–Pb–Au–Ag mineralization

c) Gold-bearing Fault-related Epithermal Quartz
Veins transecting Metasediments or Granites.

d) Modifications or Combinations of the Above

Definitive exploration characteristics of the different types of gold deposits are discussed with comments on their amenability to separation and extraction.

GOLD: MINERALOGY AND METAL EXTRACTION

U.N. MISRA, K.K. CHEANG AND N.N. RAO
School of Material and Mineral Resources Engineering
Universiti Sains Malaysia
Kampus Cawangan Perak,
Jalan Bandaraya,
30000 Ipoh, Perak.

Mineralogical studies, if appropriately and compatibly carried out with metallurgical test work, may provide a conclusive means of understanding gold losses and recovery. They furnish exegesis for test work failures through the identification of the gold minerals and the ascertainment of the gold distribution in the ore or metallurgical product. The information supplied by the mineralogical studies is such that it can be regarded as the first step towards the development of right extraction techniques for those ores where the test work alone failed to bring out definite results. Factors influencing the extraction of gold are:

(i) the mineral in which the gold is concentrated,

(ii) its grain size and, when dealing with very fine size (10 μm and less),

(iii) the host minerals and the association it forms with gold-bearing minerals.

Knowledge of such pertinent variable yield elucidation for good and bad recoveries.

This paper describes the mineralogical techniques for the study of gold ores and metallurgical products and presents the gold mineralogy in relation to its metallurgy. An effective method of studying difficult gold ores (refractory types), combining gold extraction test work, assaying and mineralogical examination and capable of providing affirmative results over comparatively small period of time is insinuated. Current practices and potential new technologies for the treatment of refractory ores are discussed.

ANGGARAN TIMBUNAN ARANGBATU, BLOCK TEBULAN, LAPANGAN ARANGBATU MERIT-PILA, SARAWAK

Coal reserve estimation, Tebulan Block, Merit-Pila coalfield, Sarawak

DORANI BIN JOHARI
Jabatan Penyiasatan Kajibumi, Sarawak

Block Tebulan terletak di kawasan baratlaut lapangan arangbatu Merit-Pila, Sarawak yang meliputi kawasan seluas 16 km persegi.

Kajian terperinci kawasan tersebut menunjukkan keujudan 18 jaluran arangbatu iaitu jaluran A_1, A_2, B_1, B_2, Bx, C, D, Dx, E, Ex, F, Fx, G, Gx, H, I_1, I_2 dan J. Daripada jaluran-jaluran tersebut hanya jaluran B_2, C, D, E, F, G, H dan I_1, mempunyai kepentingan ekonomi.

Jaluran-jaluran tersebut berjurus timur-barat dan memiring ke arah selatan ketebalan jaluran berbeza di antara kurang daripada satu meter hingga kira-kira 3.5 meter. Arangbatu Blok Tebulan terkandung dalam gred sub-bituminous B.

Anggaran awal simpanan arangbatu di Block Tebulan ialah 80 juta tan.

The Tebulan Block is situated on the northwestern part of the Merit-Pila coalfield, Sarawak covering an area of about 16 km^2.

Detailed work carried out in the area indicated the presence of 18 coal seams which have been named seam A_1, A_2, B_1, B_2, Bx, C, D, Dx, E, Ex, F, Fx, G, Gx, H, I_1, I_2 and J. Out of these only seams B_2, C, D, E, F, G, H and I_1 are of economic significance.

The seams strike approximately in the east-west direction and dip toward the south. Seam thicknesses range from less than a meter to about 3.5 meters. The coal of the Tebulan Block falls in the rank of the sub-bituminous B coal.

The preliminary estimate of the total coal reserve of the Tebulan Block is about 80 million tonnes.

GOLD-BEARING, QUARTZ VEINS FROM THE AJMAL MINE KUALA LIPIS AREA, PAHANG, MALAYSIA

K.K. CHEANG
Mineral Resources Engineering Program
Universiti Sains Malaysia (Perak Branch Campus)
Jalan Bandaraya, 30000 Ipoh

ZULKIFLI CHE KASIM
Geological Survey Malaysia
Tiger Lane, 31400 Ipoh

At present, the Kuala Lipis area is one of the most significant gold-producing regions in Malaysia with most of the gold being recovered from the alluvium. The gold-bearing horizons are confined to gravelly or sandy layers situated just on top of the local Carboniferous limestone bedrock.

However, substantial amounts of primary gold occur within the quartz veins which transect the Carboniferous bedrock. Most of these veins are steeply dipping and fault-related. One set of veins strike approximately north-south while the second set is predominantly northwest-southeast.

Gold occurs as free, desseminated grains within the milky vein quartz. Preliminary studies of polished ore sections indicated that free gold is also intimately associated with sulphide aggregates consisting of predominantly galena, sphalerite, pyrite and an unknown olive-grey mineral. Optical, chemical and X-ray diffraction studies confirmed the olive-grey mineral to be tetrahedrite, the antimony-rich end-member of the solid-solution series $Cu_{12}Sb_4S_{13} - Cu_{12}As_4S_{13}$. This mineral has only been reported from two other areas in Malaysia. The mineralogy and textural complexities of the ores will be discussed.

Preliminary fluid inclusion studies of vein quartz containing gold and mixed sulphides will also be presented together with a new technique for the preparation of doubly-polished thin sections.

GEOCHEMISTRY OF WOODTIN: GENETIC IMPLICATIONS

G.H. TEH
Geology Department, University of Malaya

R. W. HUTCHINSON
Geology Department, Colorado School of Mines, U.S.A.

Scans of woodtin samples from Nigeria, New Mexico, Cornwall and Malaysia by SIMS Spectrometry revealed the abundance of certain trace and minor elements hitherto not found in cassiterites from the more common environments.

Quantitatives data was then obtained for 28 selected elements using the electron microprobe.

The geochemical data thus made available coupled with REE data from SIMS Spectrometry are of great significance in ascertaining the environment of woodtin genesis.

ALTERATION IN MAMUT ADAMELLITE

TAN TEONG HING
Jabatan Geologi, UKM, Bangi.

The Mamut adamellite stock consists of four successive concentric zones, each characterized by distinct mineralogy. The zonation, from the core towards the periphery of the stock begins with a hornblende zone which grades into the tremolite, the biotite, and finally the chlorite zone. The zonation trend is probably due to Fe metasomatism which caused the replacement of earlier-formed minerals by later-formed Fe-rich minerals. This trend is also indicated by a depletion of Fe-bearing daughter minerals in the primary fluid inclusions from the core towards the periphyry of the stock.

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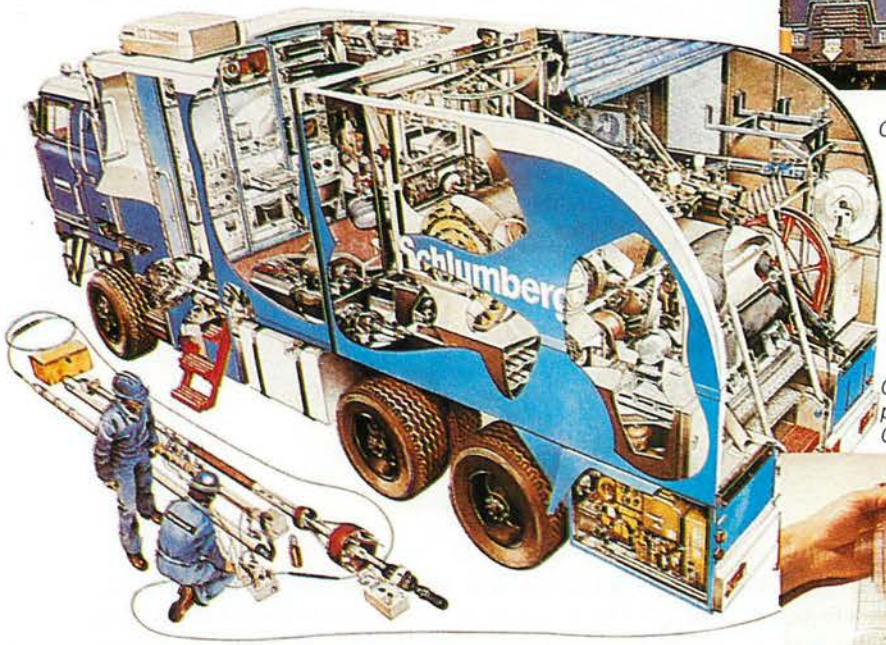
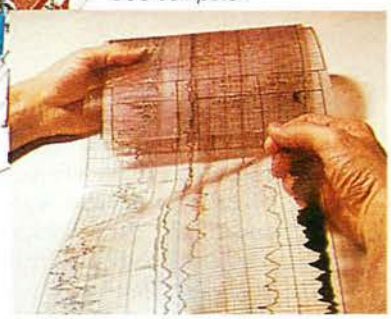


Schlumberger crew checking a logging tool.

Cyberlook, an interpreted log prepared at the wellsite by the CSU computer.



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RECENT CONODONT DATA FROM PENINSULAR MALAYSIA: PALAEOTECTONIC IMPLICATIONS

I. METCALFE
6, Jalan 12/2, 46200 Petaling Jaya.

Recent biostratigraphical and palaeobiogeographical conodont data from Peninsular Malaysia have palaeotectonic implications for the geological evolution of the Malay Peninsula.

Conodont biostratigraphical studies on the Kanthan Limestone in Perak show a significant stratigraphical break at the Devonian – Carboniferous boundary which may be related to rifting on the margin of Gondwanaland.

Combined structural and conodont biostratigraphical studies indicate a major compressional event in Peninsular Malaysia during late Carboniferous – early Permian times.

Olistostromes occurring along the Bentong – Raub 'Line' near Raub have been dated by conodonts as late Early Triassic and indicate that there was active, probably extensional, tectonics during the early Triassic.

New conodont finds indicate that the Chuping Limestone in Perlis extends up to the late Triassic and thus with the Kodiang Limestone of Kedah formed an extensive carbonate platform during the Permian and Triassic. This carbonate platform extends into Sumatra but is separated from age equivalent shallow marine carbonates in the Central Belt of the Peninsula and southeast Sumatra by a deep marine basin in which the Semanggol Formation of the Peninsula and the Kuala Formation in north Sumatra accumulated.

Palaeobiogeographical studies of early Triassic conodont faunas from Kedah and Pahang indicate that it is unlikely that the Sibumasu and East Malaya tectonic blocks were marginal to Gondwanaland in the early Triassic.

THE TRIASSIC SYSTEM OF PENINSULAR MALAYSIA

WONG TING WOON
Geological Survey of Malaysia, Ipoh.

Triassic represents an important phase in the geologic evolution of Peninsular Malaysia. It is more or less the end phase of the long period of marine sedimentation commencing as early as the Cambrian time. The pre-Triassic sedimentary rocks are essentially marine and post-Triassic rocks characteristically non-marine.

The well represented Triassic sequences are exposed in two major areas in Peninsular Malaysia, one at the northwestern corner and the other from north to south along the axial region.

At the northwestern Peninsula, the lithostratigraphic units are the Kodiang Limestone and the Semanggol Formation. Kodiang Limestone is essentially a shelf carbonate. Further east, the shelf carbonate facies is replaced by flysch-type deposit of the Semanggol Formation. There is little evidence of a transition between the Kodiang Limestone and the contemporary Semanggol Formation. Along the Central Belt area, different lithostratigraphic names were given to different parts of the same continuous unit as a result of isolated works by geologists in different areas. At the northern portion, Gua Musang Formation, Kerdau Formation, Gunung Rabong Formation, Jelai Formation, Telong Formation and Aring Formation can be well represented by Gua Musang Aring Formation and Gunung Rabong Formation. At the central portion Kerdau Formation, Lipis Group, Semantan Formation, Raub Group, Kaling Formation, Jelai Formation can be reduced essentially to Semantan Formation and Kaling Formation. In the south, most new workers prefer to use Gemas Formation in place of the Tenang beds, Gemas beds, Jurong Formation and Jelai Formation for the different parts of the same unit.

Lower Triassic, more or less represents a period of non-deposition or possibly an orogenic phase throughout the country except in the northern Peninsula where deposition of Gua Musang Formation and Kodiang Limestone went on continuously from the Middle Permian, suggesting tectonic stability in this part of the country during Lower Triassic time. Elsewhere, cleaved Palaeozoic rocks are overlain by relatively uncleaved rocks of Middle to Late Triassic age. Eruptive submarine volcanism is common throughout the Triassic time. Several granites intruding Triassic sediments have yield radiometric dates that indicate Late Triassic and Cretaceous ages of intrusions. Coarser clastic sediments especially the occurrence of intraformational conglomerate in the upper portions of the Triassic sequences indicates instability culminating in a major orogenic event which terminates the marine sedimentation at the end of Triassic.

A DESK-TOP PLANNING FOR GEOLOGICAL EXPLORATION OF PLATINUM

TUAN BESAR TUAN SARIF
School of Materials and Mineral Resources
Universiti Sains Malaysia
Kampus Cawangan Perak
Jalan Bandaraya,
30000 Ipoh,Perak.

The recent political unrest and instability in South Africa has now focussed the world's attention to look for other possible sources of platinum. Conceptual framework for exploration based on lithologic association, age of host rocks and association of platinum with other minerals are proposed and will be discussed in detail. Based on recent literatures on platinum, the three criteria proposed here seems to be promising. Geochemical techniques, drilling and manual prospecting are suggested as possible techniques to be used in searching for platinum.

AN ALGAL-MUD MOUND IN THE TRIASSIC LIMESTONE HILL OF BUKIT KODIANG, KEDAH

ANN YASMIN BT. NORDIN
Jabatan Geologi, Universiti Malaya

In the quarry of Bt. Kodiang, 5 conformable lithostratigraphic units were observed. They are, in their vertical sequence:

Youngest Unit	1.	12 m of thinly bedded black calcareous mudstone.
	2.	30 m of grey massive limestone
	3.	2 m of maroon intraformational breccia
	4.	20 m of black calcareous mudstone
Oldest Unit	5.	5 m of dolomitic limestone with chert nodules

The boundaries between the units are sharp.

The chert nodules within the dolomitic limestone of Unit 5 vary in size from 1 cm lenses to 30–40 cm long and appear to 'float' within the dolomite. Occasionally, the chert nodules are fractured perpendicular to their long axis and the gaps are filled with the dolomitic limestone.

The black calcareous mudstone Unit 4 consists mainly of micritic, thin shelled bioclasts and grazing trace fossils. This unit grades into maroon coloured intraformational breccia unit of Unit 3 with 0.1 mm to 30 cm size clasts of dolomite, chert and mudstone. There is also an increase in clast-size upsequence.

The grey massive limestone of Unit 2 is composed mainly of a skeletal packstone in the lower part, grading upwards into a coral-algal boundstone. Within the packstone, the constituents were mainly heavily micritized bioclastic clasts of indeminate origin.

The thinly bedded black calcareous mudstone of Unit 1 consists of 2–4 cm beds and are deformed into kink folds.

The dolomitic limestone with chert nodules were deposited in an environment that was favourable for dolomitization, probably in quiet shallow marine waters that were at times exposed to the atmosphere. The deposition of silica probably occurred near the sediment-water interface in which fractures in the chert nodules may be related to dessication processes during or near subaerial exposure.

The black calcareous mudstone signify a very quiet environment with absence of waves or continuous currents. This may either be in very shallow shell waters where lime mud formed in abundance or in deeper offshore waters where lime mud may be brought in from shallower areas. However, the presence of extensive micrite matrix and open-marine benthonic organisms like the thin shelled bivalves and grazing trace fossils suggest a deeper water deposit.

The maroon intraformational breccia is interpreted as having been subjected to gradual subaerial exposure sometime in the Triassic. The maroon colour suggests that deposition took place in an area where there is an excess supply of oxygen or where sedimentation rate is very low, or both. This could suggest a slow emergence of the deep-water black mudstone facies resulting in a subaerial setting.

The grey massive limestone is considered here to represent a shallow water algal-mud mound facies. The criteria used to determine the depositional environments of these carbonate sediments are based on the general mound shape of the sediment body, the microfacies variations from packstone to boundstone within the body and the association of alga, coral and bryozoans within the sediments.

The algal-mud mound was developed due to the slight build-up caused by the emergence of the calcareous mudstone. Thus, the mound was formed essentially by organic trapping of algae and bryozoans. Bioclastic debris brought down from the relatively higher shelf areas were also trapped on this mound. As the mound 'grew' higher upward in the photic zone, the biotic community were slowly replaced by more encrusting forms of organisms such as corals and large bryozoans. However, eventually, the mound ceased to grow, as seen from the sharp contact with the thin bedded black calcareous mudstone. This was probably due to the sudden sinking of the mound and the subsequent influx of mud from the shelf areas.

Thus, the Kodiang basin was subjected to different bathymetric levels within the Triassic; from shallow marine to deep to shallow and back to deep marine again. This conclusion differs from the interpretation by Gobbett (1973) and de Coo (1974) regarding the Kodiang basin.

Geological Society of Malaysia – Annual Geological Conference 1988

STRUCTURAL STYLE IN THE UPPER PALAEOZOIC AND LOWER MESOZOIC, KEDAH – PERLIS

AZHAR HJ. HUSSIN
Geology Dept., University of Malaya

PROCESSING OF ILLITE POWDER IN BIDOR, PERAK: A STUDY OF THE PROCESS AND THE POTENTIAL USES OF ILLITE CLAY

FAN CHOON MENG and AW PECK CHIN
Geological Survey of Malaysia, Ipoh.

The wet process used by one of the two local plants in processing illite is described here. The crude clay after being mixed in the agitation tank is passed through the sedimentation tanks, trommel, sluice box and the vibration screen to remove the coarse materials. The refined slurry is pumped into the filter press. The wet cake from the filter press is then air dried, pulverized, bagged and ready for sale.

The product contains mainly illite with very small amount of kaolin, quartz and montmorillonite. It contains more than 8 percent of K_2O and 2 percent of MgO and shows good fluxing properties as indicated by the firing test. However the product has comparatively low brightness.

The product under study is mostly exported to Japan. It is mainly used for the coating of welding rods because of its fluxing properties. It may also be used in the manufacture of white-filled mixes, sponge rubber and latex foam. Previous investigation has shown that the use of illite in these rubber products have certain advantages over other fillers. There is also the possibility of using it in the ceramic industry as a partial substitute for feldspar. Illite can also be used as a base for certain cosmetic products. Unfortunately the illite under discussion was found to be less favourable because of its high iron content.

K/Ar MICA DATES FOR GRANITES FROM THE BUJANG MELAKA AREA

KWAN TAI SEONG
Geological Survey of Malaysia, Alor Setar

K/Ar analysis of micas from 12 localities in the Bujang Melaka pluton yielded dates ranging from 131 ± 5 Ma to 235 ± 8 Ma. The anomalously old dates are ascribed to samples that have been probably contaminated with sources of radiogenic argon. On the other hand, thermal influence in the vicinity of fractures is deemed responsible for the partial resetting of the K/Ar systems in samples which are too young. In general, the rest of the K/Ar dates are in agreement with those of Bignell and Snelling (1977), and are concordant with their established Rb/Sr whole-rock isochron age of 218 ± Ma for the Bujang Melaka pluton. No significant time lapse is evident from the K/Ar data for the different varieties of granites in the area, thus suggesting that these probably represent different consanguineous phases of the same pluton. S single K/Ar date of 211 ± 6 Ma (Bignell and Snelling, 1977) support the hypothesis that the pegmatites and associated mineralisation of tin in the area are related to the residual aspect of this same intrusive event.

CERAMAH TEKNIK (TECHNICAL TALKS)

S.P. Chen, D. Kelter & K.K. Liaw: Coal Exploration in Sarawak

Three workers, Encik S.P. Chen, Dr. b. Kelter and Encik K.K. Liaw gave a technical talk to the Society in the Department of Geology, University of Malaya on coal exploration in Sarawak on 14th January, 1988. The talk was structured in 2 parts. Part 1 concerned the methodology and status of coal exploration and in part 2, a special coal exploration technique of retilting was introduced, and its application in environment of deposition and structural studies of coal basin was elaborated.

The Geological Survey of Malaysia is carrying out coal exploration work in the Merit Pila Coal Field and exploration is centered in the Merit, Tebulan and Musa Blocks covering about 50 km^2. To-date evaluation of the Merit Block was completed and the report published. Field work for Tebulan Block was also finished. The coal exploration methodology from literature research stage in the office to field geological and topographic mapping, coal outcrop studies, shallow vacuum and deep drilling, and borehole logging techniques was discussed. Presentation of data in a series of maps and plans to show cross sections, seam variation, seam thickness distribution seam structure, overburden thickness and ratio and resource computation were shown.

The Malaysia Coal Reserve Classification which can accommodate reserve figures with various geological cut-off including thickness, depth, ash, etc. and a schematic representation of coal and rock based on grain size were introduced. The simplified schematic representation of lithologic type gives a good visual impact and simplifies correlation.

The speakers also demonstrated how a basin, through increasing angles of tilt can cause distortion of the concentric structural lines typical that of a basin, to hyperbolic to parallel lines at 5^{o}. Applying this in the reverse, with the aid of computer programme, the palaeo-land form can be re-constructed by simulating the correct retilt of the seam. This concept was illustrated by using data from the Tebulan Block. By comparing the retilted structure with other data such as seam thickness, ash distribution, etc. discontinuities caused by tectonics, such as a graben, can be delineated. When the effect of the structure is compensated, the palaeo-relief could be established.

S.P. Chen

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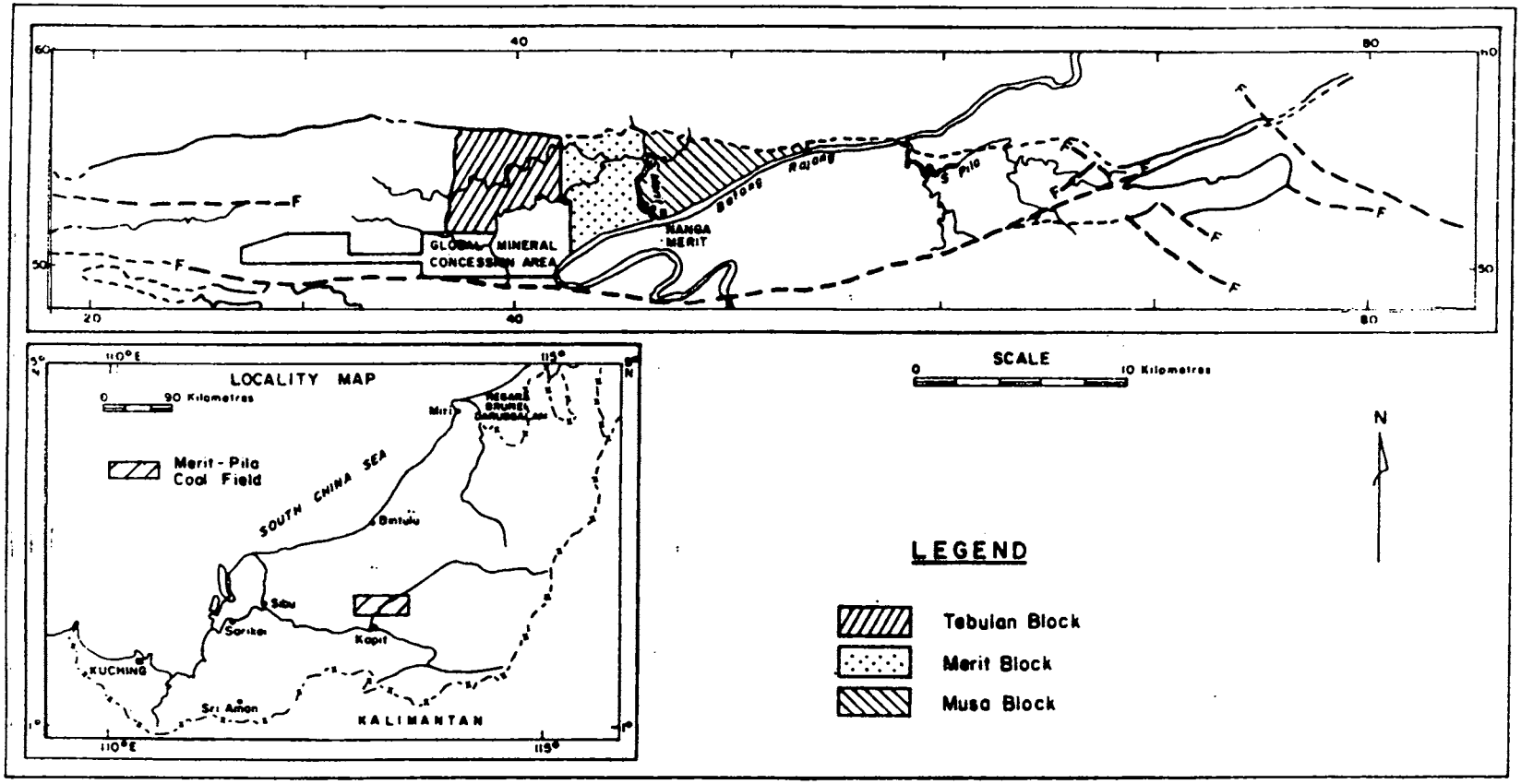


Fig. 1. The Merit Pila Coal Field, Sarawak.

S.P. CHEN

D. KELTER

K.K. LIAW

THE INTERESTED AUDIENCE

CERAMAH TEKNIK (TECHNICAL TALKS)

D.F. Strong: Metallogeny of Circum-Atlantic orogenic terrain with emphasis on granite related deposits.

Laporan (Report)

Prof. D.F. Strong from Memorial University of Newfoundland, St. John's Newfoundland, presented the above-mentioned talk to about 35 members at the Department of Geology, Universiti Kebangsaan Malaysia on 18 January 1988.

Prof. Strong began his talk by elaborating on the four main suites of Palaeozoic granitoid plutons in the Newfoundland sector of the Appalachian-Caledonian orogen which are characteristic of three major tectonic zones. These are 1) composite mafic-silicic hornblende-bearing suites; 2) microcline-megacrystic biotite granites; 3) biotite-muscovite ("two-mica") leucogranites; and 4) alkaline-peralkaline granites.

Available geochemical and isotopic data suggest a crustal origin for the granitoid rocks of these suites, which have characteristic chemical features for each tectonic zone, like distinct evolutionary patterns of initial $^{87}Sr/^{86}Sr$ ratios increasing in time.

Next Prof. Strong showed the granitic suites comparable to those of Newfoundland have been well-documented in other regions as containing characteristic types of mineralization. Suite 1 is typically host to porphyry Cu and Mo deposits, e.g. in the American Cordillera; Suite 2 is generally barren; Suite 3 contains U, Sn, W, Be and associated deposits of Western Europe; and Suite 4 is associated with Sn deposits in Nigeria, fluorspar in Newfoundland and U in Namibia.

The talk was punctuated with relevant slides of the various rock types and their related deposits.

G.H. Teh

D.F. STRONG AT PELAPAH KANAN
(Photo by Wan Fuad)

PAGI SISWAZAH

Laporan (Report)

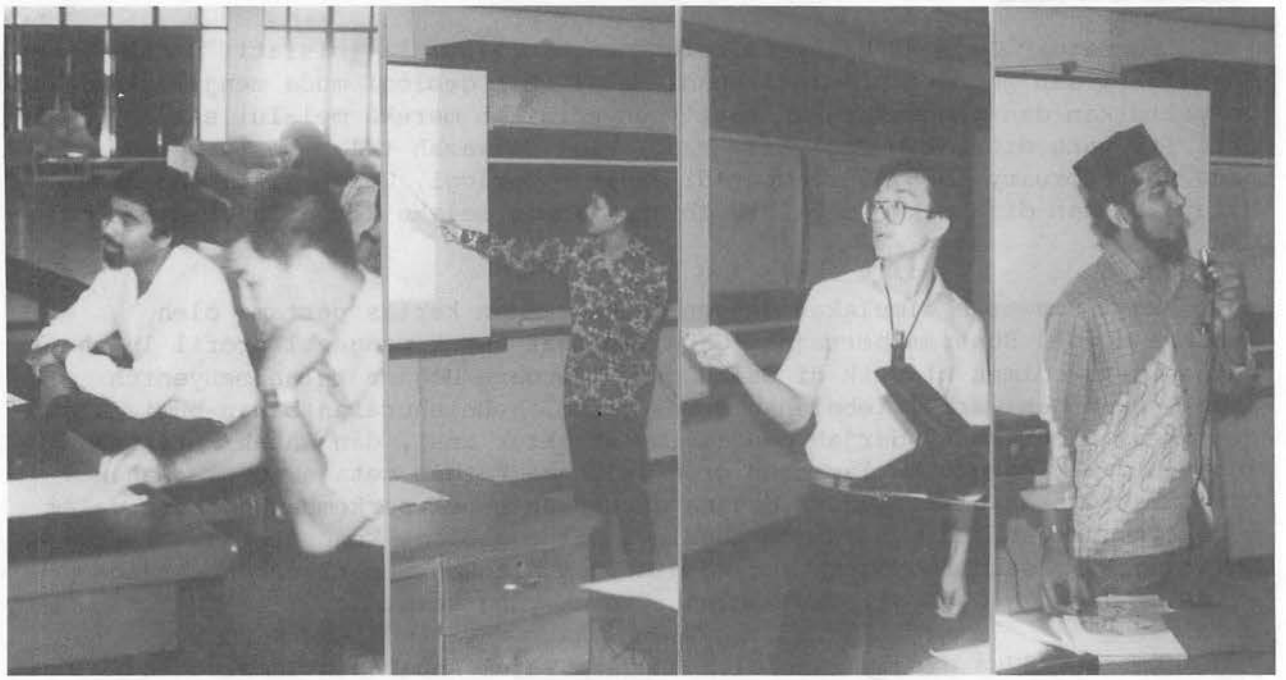
Persatuan Geologi Malaysia telah mengambil semula inisiatif untuk mencungkil dan memberi peluang kepada bakal ahli geologi muda menjalankan penyelidikan dan membentangkan hasil penyelidikan mereka melalui satu aktiviti yang dinamakan Pagi Siswazah. Pagi Siswazah telah berlangsung pada 6hb February 1988, bertempat di Jabatan Geologi, Universiti Kebangsaan Malaysia, dan dirasmikan oleh Dr. Ibrahim Komoo selaku Ketua Jabatan Geologi, UKM.

Pagi Siswazah dimulakan dengan pembentangan kertas pertama oleh saudara Mogana Sundram bertajuk 'Cara lapangan untuk mengenal profil luluhawa batuan metasedimen klastik di Selangor'. Saudara Mogana telah menyentuh aspek perubahan warna, kebolehan gores jarum, kebolehuraian bahan bumi dalam air, kegagalan ramas, darjah pengawitan struktur asal, dan satah ketakselarasan dalam pencirian lapangan gred luluhawa batuan metasedimen. Bahan yang disampaikan oleh saudara Mogana merupakan aspek perkembangan baru dalam pencirian batuan sedimen dan metasedimen dalam geologi kejuruteraan. Sekarang ini, saudara Mogana sedang giat menjalankan penyelidikan sarjana sains di Jabatan Geologi, UKM mengenai tajuk yang sama.

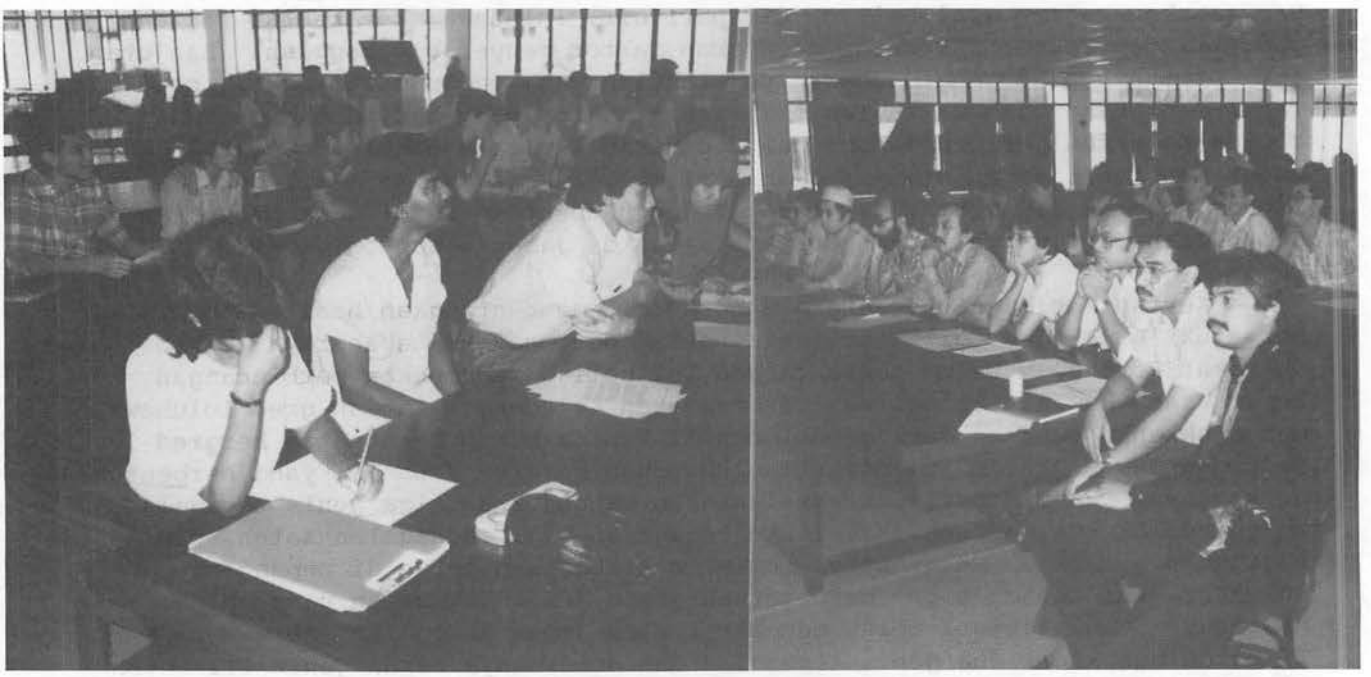
Kertas kedua disampaikan oleh saudara Tajul Anuar bin Jamaluddin yang membentangkan 'Aspek geologi dan kegagalan cerun di Lebuh-raya Timur-Barat'. Hadirin pagi siswazah telah mendengar perincian kegagalan cerun dan kaitannya dengan litologi, topografi, regim hidrologi dan hidrogeologi serta kecerunan muka bumi berdasarkan kajian awal terhadap 128 kes kegagalan. Ini termasuk 85 kegagalan cerun potongan, 22 cerun tambakan dan 21 cerun potongan-tambakan. Statistik berhubung dengan saiz (mendatar dan menegak), isipadu, ketumpatan kegagalan linear (jumlah kegagalan cerun/km), gred luluhawa kritikal dan hubungan dengan faktor di atas dibentangkan. Berdasarkan kajian awal beliau, didapati air, luluhawa, ketakselarasan dan geometri dan rekabentuk cerun merupakan faktor penyebab kegagalan. Lanjutan dari pertanyaan mengenai langkah penstabilan yang perlu dicadangkan, saudara Tajul menyatakan bahawa kajian terperinci faktor penyebab, dan proses kegagalan cerun perlu difahami dan dicirikan terlebih dahulu. Cadangan untuk menstabil cerun atau langkah awal mengelak kegagalan mesti berdasarkan kepada fahaman dan cirian di atas. Tajuk pembentangan ini juga merupakan sebahagian dari penyelidikan sarjana sains di Jabatan Geologi, UKM.

Kertas ketiga oleh saudara Ong Chu Yin membentangkan hasil penyelidikan bertajuk 'Aspek geologi kejuruteraan cerun potongan di Lebuh-raya Ipoh-Changkat Jering'. Dalam pembentangan ini beliau menumpukan perbincangan kepada satu kawasan tinggi sekitar banjaran Keledang. Kajian gred luluhawa menunjukkan perubahan dari gred I dan II kepada bahan berbongkah bergred IV, dan seterusnya urutan ini diikuti oleh bahan bergred V dan VI yang berbentuk di atasnya. Hasil survei ketakselanjaran manunjukkan tiga jenis kegagalan boleh berlaku di kawasan ini, iaitu kegagalan baji, kegagalan satah, dan kegagalan jatuhan. Selanjutnya beliau membahagikan cerun di sepanjang lebuhraya ini kepada tiga, berdasarkan jenis-jenis kegagalan yang boleh berlaku. Cerun jenis I boleh mengalami satu jenis kegagalan, cerun jenis II boleh mengalami dua jenis kegagalan dan seterusnya cerun jenis III boleh mengalami ketiga-tiga jenis kegagalan. Saudara Ong Chu Yin juga sedang menjalankan penyelidikan sarjana sains di Jabatan Geologi, UKM di kawasan yang sama.

PAGI SISWAZAH



MOGANA SUNDRAN TAJUL ANUAR ONG CHU YIN MAZMAN ABU BAKAR



THE LARGE TURNOUT

(Photos by Azhar & G.H. Teh)

Saudara Mazman Abu Bakar sebagai penyeminar terakhir membentangkan hasil penyelidikan beliau bertajuk 'Pengenapan dan tektonik neogen di Limbang Sarawak'. Semasa pembentangan beliau telah menghuraikan aspek sedimen dan struktur primer dalam Formasi Belait dan Formasi Liang. Struktur semasa pengendapan seperti syal diapir yang mengambarkan keadaan tektonik semasa pengendapan juga dibincangkan. Dalam membincangkan urutan stratigrafi beliau juga menyentuh aspek mikropaleontologi dan palinologi. Kajian saudara Mazman juga menunjukkan bahawa Formasi Liang boleh berbeza unit litologinya dari unit litologi bersyal hinggalah berkonglomerat seperti yang biasa ditemui di Sabah.. Saudara Mazman Abu Bakar sekarang ini bertugas sebagai tutor di Jabatan Geologi, Universiti Malaya.

Pagi Siswazah ini telah ditutup oleh Dr. Hamzah Mohamad, selaku Presiden Persatuan Geologi Malaysia. Dalam ucapan penutupnya, beliau ada menyentuh kemungkinan di masa akan datang Persatuan akan berusaha memberikan 'gran asas' penyelidikan kepada ahli geologi muda, terutama kepada mereka yang tidak berpeluang mendapat sumber kewangan rasmi atau kerana tugas hariannya yang berlainan dengan aspek geologi. Majlis Pagi Siswazah ini telah dihadiri oleh 55 orang ahli, terutamanya ahli pelajar.

Kadderi Md. Desa

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Cara pengenalan lapangan profil luluhawa batuan metasedimen klastik di Selangor dan Wilayah Persekutuan

Mogana Sundaram, Jabatan Geologi, Universiti Kebangsaan Malaysia.

Satu kajian terperinci telah dijalankan ke atas batuan sedimen dan metasedimen klastik di kawasan Selangor dan Wilayah Persekutuan untuk mengenalpasti ciri-ciri pengenalan darjah luluhawa di lapangan.

Ciri-ciri yang digunakan dalam pengenalan gred luluhawa bahan bumi adalah seperti perubahan warna, kebolehan gores dengan jarum, kebolehan bahan bumi terurai dalam air dan sifat kegagalan apabila diramas atau dipatah dengan tangan di lapangan.

Darjah luluhawa jasad batuan pula dikenali dengan cara melihat perubahan warna pada satah ketakselanjaran peratus komposisi batuan dan tanah, pengawetan struktur asal dan perubahan warna batuan asal.

Hasil daripada penggunaan ciri-ciri di atas, profil luluhawa dapat dibahagikan kepada gred VI, V (Vc, Vb dan Va), Iv (IVb dan IVa), III, II dan I.

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Geologi dan kegagalan cerun di Lebuhraya Timur-Barat

Tajul Anuar b. Jamaluddin, Jabatan Geologi, Universiti Kebangsaan Malaysia.

Lebuhraya Timur-Barat, sepanjang 117 km menghubungkan Jeli di Kelantan dan Gerik di Perak. Lebuhraya ini terletak di dalam terain yang dianggap

paling sukar, dengan altitud berjulat daripada 250 kaki (76 m) hingga 3,400 kaki (1036 m) dari paras laut. Keadaan topografi dan hidrogeologi sepanjang lebuhraya ini boleh dibahagikan kepada 9 seksyen taksiran.

Geologi kawasan sepanjang lebuhraya terutamanya terdiri daripada jujukan sedimen-piroklastik berusia Paleozoik Bawah yang telah direjahi oleh batuan granit pluton. Jujukan pre-granit umumnya telah dipengaruhi oleh metamorfisme rantau dan sentuhan semasa aktiviti rejahan granit pada Mesozoik Awal hingga Tengah. Jasad batolith yang berkomposisi granit telah mengambil tempat dengan beberapa differensiasi minor. Jujukan batuan berada dalam siri lipatan yang secara kasarnya berarah sekitar utara-selatan.

Sejak lebuhraya ini dibuka kepada lalulintas pada tahun 1982, kegagalan cerun telah menjadi masalah kejuruteraan yang terbesar. Cerapan lapangan yang dilakukan pada bulan November/Disember 1987 mencatatkan sebanyak 128 kes kegagalan cerun. Ini melibatkan 85 cerun potongan, 22 cerun tambakan dan 21 cerun potongan tmabakan. Jenis kegagalan yang paling utama adalah kegagalan hakisan dan jatuhan batuan, diikuti oleh kegagalan gelinciran.

Cerun batuan igneus menunjukkan kekerapan kegagalan bagi setiap kilometer yang paling tinggi, diikuti oleh cerun batuan metasedimen dan cerun batuan metamorf. Seksyen yang bertopografi rencam dan dengan masalah hidrogeologi yang relatif tinggi mencatatkan kekerapan kegagalan yang paling tinggi.

Bagi setiap jenis litologi, didapati masing-masing mempunyai gred luluhawa kritikal yang tersendiri terhadap kegagalan cerun. Isipadu kegagalan pula menunjukkan kaitannya dengan jenis cerun dan jenis litologi. Faktor penyebab kegagalan yang paling utama ialah air, luluhawa, ketak-selanjaran dan geometri dan rekabentuk cerun.

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Aspek geologi kejuruteraan cerun potongan di Lebuhraya Ipoh-Changkat Jering

Ong Chu Yin, Jabatan Geologi, Universiti Kebangsaan ialaysia.

Lebuhraya Ipoh-Changkat Jering, sepanjang 56 km, memintas Banjaran Keledang, setinggi 76 m hingga 526 m. Pintasan melalui kawasan bertopografi tinggi itu melibatkan banyak potongan cerun.

Kajian terhadap profil luluhawa menunjukkan urutan gred luluhawa yang berubah daripada batuan (Gred I dan Gred II) kepada bahan bumi berbongkah (Gred IV) dan ditutupi oleh tanah (Gred V dan Gred VI) di bahagian atas. Terdapat juga profil luluhawa yang tidak mempunyai bahan bumi berbongkah. Perubahan lapisan tanah kepada batuan secara mendadak ini memperlihatkan antara muka tanah dan batuan yang tajam.

Survei ketakselanjaran di Lebuhraya Ipoh-Changkat Jering menunjukkan kemungkinan berlakunya tiga jenis kegagalan cerun batuan iaitu kegagalan bentuk baji, kegagalan satah dan kegagalan tebalikan (jatuhan batuan). Cerun batuan di lebuhraya tersebut dibahagikan kepada tiga jenis berdasarkan kepada jenis kegagalan cerun yang mungkin berlaku. Cerun Jenis I boleh mengalami satu jenis kegagalan manakala cerun Jenis II boleh mengalami dua jenis kegagalan. Cerun Jenis III pula boleh mengalami ketiga-tiga jenis kegagalan cerun yang mungkin.

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Pengendapan neogen dan tektonik di kawasan Limbang, Sarawak.

Mazman Abu Bakar, Jabatan Geologi, Universiti Malaya.

Formasi-formasi Neogen di kawasan Limbang terdiri dari batuan sedimen dan lanar. Kawasan kajian terdiri dari tiga formasi, iaitu Formasi Setap (Awal Miosen - Miosen Pertengahan), Formasi Belait (Awal Miosen - Miosen Lewat) dan Formasi Liang yang berumur Pliosen bawah atau lebih muda. Pengendapan bagi formasi-formasi ini adalah dari jenis 'parallic' dekat pantai dan delta.

Formasi Setap adalah saling berjejarian dengan Formasi Belait dan satu tak konformitas bersudut terdapat antara Formasi Setap dan Formasi Belait dengan Formasi Liang. Formasi-formasi Neogen di kawasan ini berwujud sebagai lembangan-lembangan sinklin yang besar dan telah mengalami sedikit perlipatan, dengan paksinya menganjur ke arah utara-selatan, dan dipisahkan oleh antiklin yang sempit. Antiklin sempit ini didapati di sepanjang sempadan antara lembangan sinklin Pandaruan-Labu dan lembangan sinklin Limbang. Asalan antiklin ini ditafsirkan sebagai badan diapirik yang terhasil sebab beban Formasi Belait di atasnya. Deformasi dan perlipatan lebih hebat dalam Formasi Setap dari Formasi Belait. Kedua-dua formasi ini ditindih oleh Formasi Liang yang hanya telah terlipat sedikit. Proses-proses tektonik berhubung dengan amblesan dan pengangkatan kawasan-kawasan sekeliling telah mengawal pengendapan sedimen di kawasan ini.

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BERITA-BERITA PERSATUAN
(NEWS OF THE SOCIETY)

KEAHLIAN (MEMBERSHIP)

The following applications for membership were approved:

Full Members

1. Ng Chak Ngoon, 58-B, Jalan SS15/4, 47500 Subang Jaya, Selangor.
2. Adzmi Yaacob, FRI, 52109 Kepong.
3. Mohammad Tahir Ismail, Jabatan Geologi, Universiti Malaya, 59100 Kuala Lumpur.
4. Ak. Hj. Harun Pg. Hj. Abd. Rahman, Petroleum Unit, Department of P.M. 4 Floor, RBA Plaza, Bandar Seri Begawan 2007, Brunei.
5. Basiron Jalil, Petronas Laboratory, Lot 1026, PKNS Ind. Est., 54200 Kuala Lumpur.
6. Rashidah Hj. Abd. Karim, Petronas Lab., Lot 1026, PKNS Ind. Est., 54200 Kuala Lumpur.

Associate Member

1. Azuhan Mohamed, Pusat Penyelidikan, JPT, Bt. 4½ Jalan Ampang, 68000 Ampang.

Student Members

1. Lim Hock Kuang, Jabatan Geologi, Universiti Kebangsaan Malaysia, 43600 Bangi.
2. Dewarman, Jabatan Geologi, UKM, 43600 Bangi.
3. Tajul Anuar Jamaluddin, Jabatan Geologi, UKM, 43600 Bangi.
4. Selvarajah Chandrasegera, Jabatan Geologi, Universiti Malaya, 59100 Kuala Lumpur.
5. Eswaran s/o A.R. Padmanabaan, Jabatan Geologi, UM, 59100 Kuala Lumpur.
6. Azimah Ali, Jabatan Geologi, UM, 59100 Kuala Lumpur.
7. Abdul Hadi Abd. Rahman, Jabatan Geologi, UM, 59100 Kuala Lumpur.
8. Zulkifli Abd. Majid, Jabatan Geologi, UM, 59100 Kuala Lumpur.

Institutional Member

1. Marathon Petroleum Indonesia, Attn: Mr. Jan Van Dillewijn, P.O. Box 3293, Jakarta, Indonesia.

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Pertukaran Alamat (Change of Address)

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

1. Peter L. Cutts, c/o Phillip Petroleum Co. (U.K.) Ltd., The Adelphi, John Adam St., London WC2N 6BW, U.K.
2. Kwan Tai Seong, Geological Survey of Malaysia, Seberang Jalan Putera, 05150 Alor Setar, Kedah.
3. Jimmie Aung Khin, 23, Newton Road 02-02, Newton Meadows, Singapore 1130.
4. Paulus G. Gibin, Geological Survey of Malaysia, Jalan Penanpang, 88300 Kota Kinabalu, Sabah.
5. M.T. Jones, 25 Kedumba Cres., Turramurra, N.S.W. Australia 2074.
6. Larry S. Grubbs, 803, Walkwood Court, Houston, Texas 77079, USA.
7. Lim See Peng, B-23, Jalan Loke Yew Flats, 55200 Kuala Lumpur.
8. Yew Chee Cheong, c/o Exploration Department, Esso Australia Ltd., 127 Kent Street, Sydney, NSW 2000, Australia.
9. S. Senathi Rajah, Lot 1380, Lorong Kubur Pauh, Kampong Pauh, Panji, 15200 Kota Bharu, Kelantan.
10. Lim Keng Hoo, 4 Regat Swimming Club, Off Jalan Gopeng, 31350 Ipoh, Perak.
11. Keith Grant, Grant Petroleum Exploration Consultants, 5 Tallowwood Avenue, Cherrybrook, N.S.W. 2120, Australia.
12. Daud A.F. Batchelor, P.T. Kasongan Bumi Kencana, Setiabudi Bldg., 1st Floor D-VI, Jl. Rasuna Said, Kuningan, Jakarta Selatan, Indonesia.
13. Mohammad Yamin Ali, Grant Institute of Geology, University of Edinburgh, King's Building, West Mains Road, Edinburgh EH9 3JW, Scotland.
14. Lai Kok Hoong, 517 Lillian Penson Hall, Talbot Square, London W21TT, U.K.

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Pertambahan Baru Perpustakaan (New Library Additions)

The Society has received the following publications:

1. Contour - 2 (version 2.0). A system for filing, editing of borehole data and estimating the valves at points set on a regular grid in 2-dimensional configuration designed for microcomputers with BASIC language capabilities by Eric K.H. Goh, 1987.
2. Application of geostatistics in the optimization of sampling grids using microcomputers by Eric K.H. Goh, 1987.
3. Pulp density measurement at gravel pump mines in Southern Thailand by Vichit Boonrasri and Chart Hongtiamchant, 1986.
4. Geophysical Research Bulletin, vol. 25, no. 3, 1987.
5. Institution of Mining & Metallurgy, Bulletin nos. 970-973, 1987.
6. Seatrad Bulletin, vol. viii, no. 4, 1987.
7. Annual Report, Institute of Geoscience, The University of Tsukuba, no. 13, 1987.
8. Bulletin des Centres de Recherches Exploration - Production Elf Aquitaine, vol. 11, no. 2, 1987.
9. Commonwealth Science Council, Nov-Dec. 1987.
10. Petromin, Jan. 1988.
11. Principaux resultats scientifiques et techniques, 1986.
12. Acta Palaeontologica Sinica, vol. 26, nos. 3-5, 1987.
13. Journal of stratigraphy, vol. 11, nos. 2 & 3, 1987.
14. Acta micropalaeontologica sinica, vol. 4, no. 3, 1987.
15. Oklahoma Geological Survey, Bulletin 142, 1987.

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BERITA-BERITA LAIN
(OTHER NEWS)

SENARAI TESIS-TESIS UNIVERSITI MALAYA 1987
(LIST OF THESES, UNIVERSITY OF MALAYA 1987)

1. Sedimentologi bagi Formasi Tebak di kawasan Lebuhraya Segamat-Kuantan (km 54 - km 82), Pekan, Pahang - Ahmad Jasli Selamat

2. Geologi am kawasan Keluang, Johor - Azhar Yusof

3. The general geology of Marudi area, Sarawak - Azimah Ali

4. The geology and mineralisation of Chegar Perah area, Pahang - Cheah Eng Hoe

5. Parent rock - soil mantle relationships in Rawang, Selangor - Eswaran A.R.P.

6. The geology of Bk. Niah area, Niah, Sarawak - Flavia Kandau

7. Geologi am Kawasan Tenggara, Selangor - Hamdan Hassan

8. Geologi am kawasan Lebuhraya Pasir Raja, Ulu Paka, Terengganu - Huasaini Omar

9. The geology of the area around Sook Plain, Sabah - John Temaga

10. The geology of Sapulut-Matiku area, Sabah - Kamarullatif Abdul Karim

11. The igneous petrology and geochemistry of Kuala Krai-Manek Urai area, Kelantan - Kee Hwa Lim

12. Geology and mineralisation of the Cheroh-Tersang area, Pahang - Khoo Sui Choon

13. The geology, mineralisation and geochemical studies of the Ulu Kinta area, Perak - Liau Boon Leong

14. Geologi am lebuhraya Timur-Barat (km 10 - km 36), Kelantan - Mazlan Mustafa

15. Geologi am Felda Tenang dan kawasan sekitarnya, Ulu Besut, Terengganu - Mohd. Nasir Abd. Rahman

16. Geologi dan permineralan kawasan Tasik Chini, lebuhraya Kuantan-Segamat, Pekan, Pahang - Mohd. Sabar Ahmad

17. The geology of the road section between Kimanis and Keningau, Sabah - M. Pathmavathy

18. The geology of the Siburan area, Sarawak - Nasroffine Pauzi

19. Geology of the Ipoh-Changkat Jering area, Perak - Norlia Yub Ghazali

20. Geologi kawasan Kg. Batu Putih-Estet Ranggoon, Kertih, Terengganu - Rusli Abdullah

21. Stratigraphy, sedimentology and structure of Sipitang-Merapok area, Sabah - Salvarajah S.

22. The geology of Sapulut-Labang area, Sabah - Selvarajah C.

23. General geology of the Kuching-Bako area, Sarawak - Setebin Roslan Rajali

24. Geology kawasan Wang Kelian-Kaki Bukit, Perlis - Yusni Md. Yusuf

25. Geology, mineralisation and geochemical studies of Bk. Penchuri-Bk. Tandak-Bk. Gharu area, Kelantan - Zainuddin Md. Yusuf

26. The geology of Matang area, Sarawak - Zakaraya Marzuki

27. Geologi kawasan selatan Kangar, Perlis - Zulkifli Abdul Majid

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GOLD 89 IN EUROPE

INTERNATIONAL SYMPOSIUM IN EUROPE ON GOLD METALLOGENY, EXPLORATION AND BENEFICIATION.

TOULOUSE, 23-24-25 MAI 1989, UNIVERSITE PAUL SABATIER
Organised by:
The University of Toulouse (France) and Southampton (U.K.) and the Bureau de Recherches Géologiques et Minières (France)

Technical programme

The Symposium will be held at the University Paul-Sabatier, 118 route de Narbonne, Toulouse.

The conference will take place from 23 to 25 May inclusive, and will consist of lecture presentations and poster sessions.

Timetable

16-22 May 1989 - Pre-symposium excursions
23-24-25 May 1989 - Symposium
26 May - 1st June 1989 - Post-symposium excursions

Scientific programme

The aim of the Symposium is to bring attention to the recent researches on gold, particularly in the fields of exploration, genesis and valorization. The conference will have the following themes (based on the common gold occurrences: viz., *massive sulphides, and "sedex-type", epithermal vein-type gold, gold in shear zone and placer gold)*:

1. Gold Provinces or districts: case histories, genesis, gitology.
2. Geochemistry, application of geochemical methods in the evaluation of prospects (this section includes exploration geochemistry, geochemistry of alteration zones, etc.).
3. Transport and precipitation of gold (includes placer gold).
4. Mineralogy of gold deposits and its control on the choice of extraction methods.
5. Methods of extraction, beneficiation and gold recovery.

Languages - The official languages of the Symposium will be French and English and simultaneous translation will be provided for each presentation.

Symposium charges

Members: 1,000 FF.
Students and accompanying persons: 500 FF.
Registration costs include: reception, transport between University and hotels, abstract volume (Terra Cognita), final volume of publications and coffee/tea break).
3 lunches on the University Campus 23-24 and 25 May: 180 FF.
Cost of registration after 1st March 1989: 1,300 FF.
Students and accompanying persons: 600 FF.

Technical excursions

There will be 5 technical excursions both before and after the Symposium. They have been chosen to afford an opportunity for participants to visit the principal auriferous districts of Europe - several of which have active mining.

Excursion 1 - Gold in La Montagne Noire (S.W. of the Massif Central of France) and in the eastern Pyrenees (Spain and France).

Excursion 2 - The gold districts of the Limousin (north-east Massif Central of France).

Excursion 3 - Gold mineralization in NW Spain.

Excursion 4 - Evolution of the volcanic rocks and gold-alunite deposits of the Cabo de Gata volcanic field, Rodalquilar, Almeria, S.E. Spain.

Excursion 5 - Gold districts of the Bohemian Massif (Czechoslovakia).

Information:

Symposium secretaries
R.P. FOSTER: Department of Geology, University of Southampton-
Southampton SO9 5NH, UNITED KINGDOM.
Phone: (0703) 55.91.92 - Télex: 47.661
or
F. TOLLON: Laboratoire de Minéralogie, Université Paul Sabatier,
39 Allées Jules Guesde - 31400 TOULOUSE FRANCE.
Phone: 61.53.02.35 - Télex: 521880F

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SEMINAR ON MINING POLICY FOR MALAYSIA

1-2 June 1989 at Holiday Inn City Centre, Kuala Lumpur.
Institut Kejuruteraan Galian, Malaysia (Institute of Mineral Engineering, Malaysia)

The Institute will be holding a two-day seminar as captioned above. The Council feels that it is timely to hold the seminar in view of the changing pattern of the mining industry and the need for a fresh look on a mining policy with the objective of ensuring the best possible climate for Malaysia'a mineral resources.

This will be a one paper seminar consisting of a plenary session and three workshop sessions as follows:-

1) Investments
2) Procedures and regulations
3) Legislations

The Chairman of each workshop will present the views and recommendations of his workshop at the final plenary session.

The paper for the seminar entitled "Towards A More Meaningful Mining Policy For Malaysia" will be presented by Encik Redzwan Sumun, one of the past Presidents. He is currently Executive Secretary of the Association of Tin Producing Countries and has thirty years experience in the mining industry, having served the Mines Department for twenty enght years holding the position of Director General of Mines prior to assumming his current post.

It is the Council's intention that the proceedings and findings of the seminar be circulated as widely as possible. Please keep these dates open for this important event which could very well determine what the mining industry would look like in the 21st century.

Further details:

The Organizing Chairman,
Institute of Mineral Engineering, Malaysia,
Peti Surat 2523,
Kuala Lumpur.

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KURSUS-KURSUS LATIHAN & BENGKEL-BENGKEL (TRAINING COURSES & WORKSHOPS)

1989

March 1989 - April 1989
MINERAL EXPLORATION (Paris, France). A 4-week annual course organized by the Ecole Nationale Supérieure des Mines and sponsored by Unesco. Language: French. For Information: Prof. K.D. Phan, Ecole des Mines, 35 rue St. Honoré, 77305 Fontainebleau Cedex, France.

March 1989 - November 1989
PHOTOINTERPRETATION APPLIED TO GEOLOGY AND GEOTECHNICS (Bogota, Colombia). Annual post-graduate diploma courses organized by the Government of Colombia, Centro Interamericano de Foto-interpretacion, International Institute for Aerial Survey and Earth Sciences and Unesco. Language: Spanish. For Information: Academic Secretariat of the CIAF, Apartado Aereo 53754, Bogotạ 2, Colombia.

April 1989 - July 1989
RURAL GROUNDWATER DEVELOPMENT (Loughborough, U.K.). A 10-week diploma course organized annually by WEDC. For Information: WEDC, University of Technology, Loughborough, Leics, LE11 3TU, U.K.

April 1989 - July 1989
ENVIRONMENTAL EVALUATION MANAGEMENT AND CONTROL (Liverpool, U.K.). Annual 12-week training course for administrators, consultants and professionals. For Information: Dr. H.W. Pearson, Environmental Management Course, Department of Botany, University of Liverpool, P.O. Box 147, Liverpool L69 3BX, U.K.

May 1989
HYDROLOGY OF FRACTURED ROCKS (Montpellier, France). Annual three-week post-graduate course sponsored by Unesco. For Information: Professeur C. Drogue, Laboratoire d'Hydrogeologie, Universite des Sciences et Techniques du Languedoc, Place Eugene Bataillon, 34060 Montpellier, France.

May 1989 - June 1989
GEOPHYSICS APPLIED TO GEOTHERMAL PROSPECTION (Manizales, Colombia). Annual course organized for Latin Americans by the Latin American Organization for Energy with financial assistance from Unesco. Language: Spanish. For Information: Organizacion Latino-americana de Energia (OLADE), P.O. Box 119, Quito, Ecuador.

May 1989 - November 1989
GENERAL HYDROLOGY with emphasis on groundwater (Buenos Aires, Argentina). A six-month post-graduate diploma course organized every other year and sponsored by Unesco. Language: Spanish. For Information: Comité Nacional para el Programa Hidrologico Internacional de la Republica Argentina, Av 9 de Julio 1925 - 15° piso, 1332 Buenos Aires, Argentina.

June 1989
SEDIMENT TECHNOLOGY (Ankara, Turkey). An annual four-week Unesco-sponsored post-graduate course. For Information: Dr. Ergun Demiroz, DSI Teknik Arastirma ve Kalite Kontrol, Dairesi Baskanligi, 06100 Ankara, Turkey.

June 1989 - August 1989
TECHNIQUES OF HYDROLOGIC INVESTIGATIONS (Washington, D.C. and Denver, Colorado, U.S.A.). Annual training course for international participants. For Information: Office of International Hydrology, Water Resources Division, U.S. Geological Survey, 470 National Center, Reston, VA 22092, U.S.A.

July 1989 - August 1989
SUMMER COURSE ON EARTH SCIENCES: CRYSTALLOGRAPHY, MINERALOGY, METALLOGENY (Madrid, Spain). Annual course organized by the Department of Geology and Geochemistry of the Universidad Autonoma de Madrid and sponsored by Unesco. Language: Spanish. For Information: Departamento de Geologia y Geoquimica, Facultad de Ciencias, Universidad Autonoma de Madrid, Canto Blanco, Madrid 34, Spain.

July 1989 - September 1989
VOLCANOLOGY (Quito, Ecuador). Annual 10-week course organized for Latin Americans by the Latin American Organization for Energy with financial assistance from Unesco. Language: Spanish. For Information: Organizacion Latino-americana de Energia (OLADE), P.O. Box 119, Quito, Ecuador.

August 1989 - June 1991
SOIL SCIENCE AND WATER MANAGEMENT (Wageningen, The Netherlands). A 2-year MSc course organized by Agricultural University Wageningen. Course starts every other year. Language: English. For Information: The Director of Studies of the MSc Course in Soil Science and Water Management, P.O. Box 37, 6700 AA Wageningen, The Netherlands.

August 1989 - October 1989
GEOCHEMICAL PROSPECTING METHODS (Prague, Czechoslovakia). Certificate course organized every second year by the Geological Survey of Czechoslovakia and sponsored by Unesco, IAGC and Czechoslovakia. Language: English. For Information: GEOCHIM Unesco CSSR, Geological Survey of Prague, Malostranské nam. 19, 11821 Prague 1, Czechoslovakia.

September 1989 - October 1989
GROUNDWATER TRACING TECHNIQUES (Graz, Austria). Five-week course organized every other year by the Institute of Technical Geology, Petrography and Mineralogy and sponsored by Unesco. Language: English. For Information: Institute of Technical Geology, Petrography and Mineralogy of the University of Technology, Rechbauerstrasse 12, A-8010 Graz, Austria.

September 1989 - October 1989
REMOTE SENSING AND DIGITAL IMAGE ANALYSIS (Sioux Falls, South Dakota, U.S.A.). U.S. Geological Survey training course for non-U.S. natural scientists on manual interpretation and digital analysis of remotely sensed data. For Information: Training Section, Office of International Geology, U.S. Geological Survey, 917 National Center, Reston, VA 20092, U.S.A.

September 1989 - November 1989
DRILLING OF GEOTHERMAL WELLS (Mexicali, Mexico). Annual 12-week seminar organized for Latin Americans by the Latin American Organization for Energy with financial assistance from Unesco. Language: Spanish. For Information: Organizacion Latino-americana de Energia (OLADE), P.O. Box 119, Quito, Ecuador.

September 1989 - November 1989
GEOTHERMAL RESERVOIR ENGINEERING (Mexicali, Mexico). Annual 9-week course organized for Latin Americans by the Latin American Organization for Energy with financial assistance from Unesco. Language: Spanish. For Information: Organizacion Latino-americana de Energia (OLADE), P.O. Box 119, Quito, Ecuador.

September 1989 - November 1989
GEOTHERMAL ENERGY (Kyushu, Japan). Annual short course organized by the Government of Japan and sponsored by Unesco. Language: English. For Information: Japan International Cooperation Agency (2nd Training Division, Training Affairs Department), P.O. Box 216, Shinjuku Mitsui Building, 2 - 1, Nishi-shinjuku, Shinkuku-ku, Tokyo 160, Japan.

September 1989 - July 1990
PETROLEUM EXPLORATION GEOLOGY (Headington, Oxford, U.K.). An annual diploma course designed by Oxford Polytechnic to prepare post-graduate geologists for the duties of geologists in oil exploration teams. For Information: M. Hoggins, Department of Geology and Physical Sciences, Oxford Polytechnic, Headington, Oxford OX3 OBP, U.K.

September 1989 - August/November 1990
AEROSPACE SURVEYS FOR: 1) GEOCHEMICAL SURVEY; 2) WATER RESOURCES SURVEY; 3) APPLIED GEOMORPHOLOGY AND ENGINEERING GEOLOGY (Enschede, The Netherlands). Annual post-graduate courses, organized by the International Institute for Aerospace Survey and Earth Sciences (ITC), with Unesco. Language: English. For Information: ITC Student Registration Office, P.O. Box 6, 7500 AA Enschede, The Netherlands.

September 1989 - August 1990
MINERAL EXPLORATION AND EXPLORATION GEOPHYSICS (Delft, The Netherlands). Annual diploma courses organized by the International Institute for Aerospace Survey and Earth Sciences with Unesco. Language: English. For Information: ITC Student Registration Office (ME), P.O. Box 6, 7500 AA Enschede, The Netherlands.

October 1989 - August 1989
HYDROLOGY AND HYDROGEOLOGY (Belgium). Language: French. For Information: Professeur Dr. ir. A. Monjoie, Directeur des Laboratoires de Géologie de l'Ingénieur, d'Hydrogéologie et de Prospection géophysique - Batiment B19, Faculté des Sciences Appliquées, Université de Liége - SART TILMAN, B-4000 Liege, Belgium.

October 1989 - November 1989
TECTONICS, SEISMOLOGY AND SEISMIC RISK ASSESSMENTS (Potsdam, D.D.R.). One-month training course organized annually by East German Academy of Sciences in collaboration with Unesco. Language: English. For Information: Prof. Dr. H. Kautzleben, Director, Central Earth's Physics Institute, Academy of Sciences of the German Democratic Republic, Telegraphenberg, DDR-500 Postdam, German Democratic Republic.

October 1989 - July 1990
ENGINEERING HYDROLOGY (Galway, Ireland). Annual diploma and post-graduate courses organized by the Dept. of Engineering Hydrology, University College, Galway, Ireland. Sponsored by Unesco-IHP and the World Meteorological Organization. For Information: Prof. J-E. Nash, Department of Engineering Hydrology, University College Galway, Galway, Ireland.

October 1989 - September 1990
WATER AND WASTE ENGINEERING FOR DEVELOPING COUNTRIES (Loughborough, England, U.K.). Twelve-month MSc. programme organized annually for engineers and scientists from developing countries by WEDC. For Information: John Pickford, WEDC, University of Technology, Loughborough, Leics, LE11 3TU, U.K.

October 1989 - September 1990
HYDRAULIC ENGINEERING AND HYDROLOGY (Delft, The Netherlands). Diploma courses organized annually by the International Institute for Hydraulic and Environmental Engineering and sponsored by Unesco for professionals from developing countries. Language: English. For Information: International Institute for Hydraulic and Environmental Engineering (IHE), Oude Delft 95, P.O. Box 3015, 2601 DA Delft, The Netherlands.

October 1989 - September 1991
FUNDAMENTAL AND APPLIED QUATERNARY GEOLOGY (Brussels, Belgium). Annually organized training course leading to a Master's degree in Quaternary Geology by the Vrije Universiteit Brussel (IFAQ) and sponsored by Unesco. Language: English. For Information: Prof. Dr. R. Paepe, Director of IFAQ, Kwartairgeologie, Vrije Universiteit Brussel, Pleinlaan 2, B-1050, Brussels, Belgium.

November 1989 - December 1989
REMOTE SENSING APPLICATIONS FOR EARTH SCIENCES (Enschede, The Netherlands). Annual short course organized by International Institute for Aerospace Survey and Earth Sciences (ITC), with Unesco. Language: English. For Information: ITC Student Registration Office, P.O. Box 6, 7500 AA Enschede, The Netherlands.

November 1989 - June 1990
GEOTHERMICS (Pisa, Italy). Certificate course organized annually by the Istituto Internazionale per le Ricerche Geotermiche and sponsored by Unesco, UNDP and Italy. Language: English. For Information: Istituto Internazionale per le Ricerche Geotermiche, I Via Buongusto, 56100 Pisa, Italy.

November 1989 - October 1990
ENGINEERING GEOLOGY (Delft, The Netherlands). Annual post-graduate course organized by the International Institute for Aerospace Survey and Earth Sciences (ITC). Language: English. For Information: ITC Student Registration Office, P.O. Box 6, 7500 AA Enschede, The Netherlands.

1990

January 1990 - July 1990
GENERAL AND APPLIED HYDROLOGY (Madrid, Spain). An annual, 6-month course sponsored by Unesco. Language: Spanish. For Information: Centro de Estudios y Experimentacion de Obras Publicas y Urbanismo, Alfonso XII, Num. 3, Madrid 7, Spain.

January 1990 - July 1990
GROUNDWATER HYDROLOGY (Barcelona, Spain). An annual 6-month, post-graduate course sponsored by Unesco. Language: Spanish. For Information: Curso Internacional de Hidrologia Subterranea, Calle Beethoven, 15, 3°, 08021 Barcelona, Spain.

February 1990
METALLOGENY (Quito, Ecuador). Annual 3-week training course for Latin Americans organized by Central University of Quito, the Autonomous University of Madrid (Spain), and Unesco. Language: Spanish. For Information: Director, Curso Internacional de Metalogenia, Escuela de Geologia, Minas y Petroleos, Division de Post-grado, Universidad Central, Apartado Postal 8779, Quito, Ecuador.

February 1990 - March 1990
GEOCHEMICAL PROSPECTING TECHNIQUES (Tervuren, Belgium). Annual course sponsored by the Royal Museum of Central Africa and UNDP. Language: French. For Information: Musée royal de l'Afrique centrale, Steenveg op Leuven, 13, B-1980 Tervuren, Belgium.

February 1990 - April 1990
INTRODUCTION TO DIGITAL IMAGE PROCESSING (Enschede, The Netherlands). Annual course organized by the International Institute for Aerial Survey and Earth Sciences, Enschede, The Netherlands, with Unesco. Language: English. For Information: Student Registration Office, ITC, P.O. Box 6, 7500 AA Enschede, The Netherlands.

February 1990 - June 1990
MINERAL EXPLORATION (Leoben, Austria). Diploma course organized annually by the University of Mining and Metallurgy in Leoben and sponsored by Unesco. Language: English. For Information: University for Mining and Metallurgy, Post-graduate course on mineral exploration, Montanuniversität, Leoben, A-8700, Austria.

February 1990 - July 1990
HYDROLOGY (Budapest, Hungary). An annual six-month, post-graduate course organized by the Research Centre for Water Resources Development (Budapest) and sponsored by Unesco. Language: English. For Information: VITUKI International Post-Graduate Course on Hydrology, H-1453 Budapest, Pf. 227 Hungary.

February 1990 - August 1990
HYDROLOGY (Padova, Italy). An annual, 6-month, postgraduate course sponsored by Unesco. Language: English. For Information: Professor A. Ghetti, Centro Internazionale di Idrologia "Dino Tonini," via sette Chiese, 35043 Monselice, Italy.

October 1990 - September 1992
GEOLOGICAL EXPLORATION METHODS (Nottingham, U.K.). Two-year MSc course starting every other year with emphasis on applied methodology, data acquisition and interpretations). For Information: Dr. M.A. Lovell, Department of Geology, University of Nottingham NG7 2RD, U.K.

December 1990 - January 1991
METHODS AND TECHNIQUES IN EXPLORATION GEOPHYSICS (Hyderabad, India). Diploma course organized every second year by the National Geophysical Research Institute of the Council of Scientific and Industrial Research, Hyderabad, India, and sponsored by Unesco. Language: English. For Information: The Director, International Training Course on Methods and Techniques in Geophysical Exploration, National Geophysical Research Institute, Hyderabad, 500 007 (A.P.) India.

KALENDAR (CALENDAR)

1989

April 1-6, 1989
GEODYNAMICS AND SEISMIC SOURCE PROCESSES - STRESS, STRENGTH AND VISCOSITY IN THE LITHOSPHERE (Meeting), Potsdam, G.D.R. Co-sponsored by ICL. (Prof. E. Hurtig, ZIPE, Potsdam, DDR 1561, German Democratic Republic).

April 3-10, 1989
ECONOMIC GEOLOGY AND GEOTECHNICS OF ACTIVE TECTONIC REGIONS (2nd Sino-British Geological Conference), London, U.K. (Dr. B.A. Thomson, Dept. of Geological Sciences, University College London, Gower Street, London WC1E 6BT, England, U.K.).

April 4-6, 1989
CONTAMINANT TRANSPORT IN GROUND-WATER (International Symposium), Stuttgart, F.R.G. (W. Kinzelbach, Institut für Wasserbay, Universität Stuttgart, Pfaffenwaldring 61, D-7000 Stuttgart 80, F.R. Germany).

April 10-11, 1989
SHALLOW GAS AND LEAKY RESERVOIRS (Meeting), Stavanger, Norway. (Norwegian Petroleum Society, P.O. Box 1897 Vika, 0124 Oslo I, Norway).

April 16-19, 1989
EXTRACTIVE INDUSTRY GEOLOGY (Conference), Birmingham, U.K. (Dave Hopkins, c/o Tarmac Quarry Products, Ltd., Millfields Road, Ettingshall, Wolverhampton WV4 6JP, England, U.K.

April 16-22, 1989
FOSSIL AND LIVING DINOFLAGELLATES (Annual Meeting), Woods Hole, Mass, U.S.A. (D.K. Goodman, ARCO Oil & Gas, 2300 W. Plano Parkway, Plano, TX 75075, U.S.A.).

April 17-18, 1989
THE HYDROGEOLOGY OF CRYSTALLINE BASEMENT AQUIFERS IN TROPICAL REGIONS (Meeting Geological Society and AGID), London, U.K. (W. Burgess, Dames & Moore, 15-17 Church Street, Twickenham TW1 3NJ, England, U.K.

April 17-20, 1989
THE CAUSES AND CONSEQUENCES OF LONG-TERM SEA LEVEL CHANGE (AGU Chapman Conference), Snowbird, Utah, U.S.A. (AGU Meetings, 2000 Florida Avenue NW, Washington, DC 20009, U.S.A.).

April 18-21, 1989
ECLOGITE (3rd International Conference), Würzburg, F.R.G. (Martin Okrusch, Mineralogisches Institut, Universität Würzburg, Am Hubland, D-8700 Würzburg, F.R.G.).

April 20-22, 1989
TECTONIC FEATURES ON MARS (Workshop), Richland, Washington, U.S.A. (Pam Jones Lunar and Planetary Institute, 3303 NASA Road 1, Houston, TX 77058-4399, U.S.A.).

April 20-23, 1989
COGEODATA (5th South American Symposium), Caracas, Venezuela. Co-sponsored by IUGS. (Prof. Dr. N.G. Munoz J., P.O. Box 50447, Caracas 1050-A, Venezuela).

April 23-26, 1989
AAPG (Annual Meeting), San Antonio, Texas. (AAPG, P.O. Box 989, Tulsa, OK 74101. U.S.A.).

April 24-26, 1989
SEDIMENTOLOGY (10th European Regional Meeting), Budapest. IAS. (Mrs. A. Lukacs, Hungarian Geological Institute, Budapest XIV, Népstadion ut 14 H-1143, Hungary).

April 26-28, 1989
PAST GLOBAL CHANGES (IUGS Workshop), Interlaken, Switzerland. (Ken Hsü, Geologisches Institut, ETH - Zentrum, CH-8092 Zurich, Switzerland).

April 26-28, 1989
ANTARCTIC GEOCHRONOLOGY (International Workshop), Munich, F.R.G. (H. Miller, Inst. für Allgemeine und Angewandte Geology, Luisenstrasse 37, D-8000 Munich 2, F.R.G.).

May 29 - June 1, 1989
NONMARINE CRETACEOUS CORRELATIONS (IGCP-245 International Meeting), Drumheller, Alberta, Canada. (D.F. Stott, Geological Survey of Canada, 3303 - 33rd Street NW, Calgary, Alberta, Canada T2L 2A7).

May - June 1989
HYDROLOGY OF MOUNTAINOUS AREAS (IAHS Workshop), Bratislava, Czechoslovakia. (Dr. L. Molnar, Institute of Hydrology and Hydraulics, Trnavska 32, 826-51 Bratislava, Czechoslovakia).

May 8-11, 1989
NUMERICAL MODELS IN GEOMECHANICS (3rd International Symposium), Niagara Falls, Canada. (Prof. S. Pietruszczak, Dept. of Civil Engineering and Engineering Mechanics, McMaster University, Hamilton, Ontario, Canada L8S 4L7).

May 8-12, 1989
AMERICAN GEOPHYSICAL UNION (Spring Meeting), Baltimore, Md., U.S.A. (AGU Meetings, 2000 Florida Avenue NW, Washington, DC 20009, U.S.A.).

May 8-12, 1989
ENGINEERING GEOLOGY PROBLEMS IN RESIDUAL SOILS (International Symposium), Abidjan-Yamassoukro, Ivory Coast. Languages: French and English (Ing. Dr. Gérare Cougny, Laboratoire du Bàtiment et des Travaux Publics, 04 Bp 3 Abidjan 04, Ivory Coast).

May 8-12, 1989
GLOBAL CHANGES IN SOUTH AMERICA DURING THE QUATERNARY: PAST-PRESENT-FUTURE (International Symposium), Sao Paulo. (K. Suguio, Inst. Geociencias, USP CP 20.899, CEP 01498, Sao Paulo, Brazil).

May 9-11, 1989
SEA-LEVEL CHANGES AT ACTIVE PLATE MARGINS (Meeting BSRG and IAS), London, U.K. (D.M.I. Mcdonald, British Antarctic Survey, High Cross, Madingley Road, Cambridge CBE OET, England, U.K.).

May 14-17, 1989
GAC/MAC (Annual Meeting), Montreal, Canada. (C. Stearn, Dept. Geological Sciences, McGill University, 3450 University Street, Montreal, Quebec, Canada H3A 2A7) Also includes IMAGE ANALYSIS IN MINERAL AND EARTH SCIENCES (CANMET/GAC/ MAC Workshop) (Dr. Paul Mainwaring, MPL, CANMET, 555 Booth Street, Ottawa, Ontario, Canada K1A OG1).

May 15-17, 1989
ENVIRONMENTAL GEOTECHNOLOGY (2nd International Symposium), Shanghai, China. (Secretary, ISEG, c/o Box 415, Bethlehem, PA 18016, U.S.A.).

May 22-27, 1989
PALAEONTOLOGY AND STRATIGRAPHY (International Meeting), Messina and Taormina, Italy. Languages: Italian, French and English. (Centenario di G. Seguenza, Istituto di Scienze della Terra, Universita degli Studi, 98100 Messina, Italy).

May 23-25, 1989
GOLD IN EUROPE (International Conference), Toulouse, France (R.P. Foster, Department of Geology, University of Southampton, Hants. SO9 5NH, U.K.).

May 28 - June 3, 1989
HYDROGEOLOGICAL MAPS - A TOOL FOR ECONOMIC AND SOCIAL DEVELOPMENT (International Symposium), Hannover, F.R.G. (Hydrogeological Maps Symposium, BGR Organising Unit, Postfach 510153, D-3000 Hannover 51, F.R.G.).

June 5 - June 9, 1989
RIVER SEDIMENTATION (4th International Symposium), Xi'an, China. (Dr. Ding Lianzhen, IRTCES, P.O. Box 366, Beijing, P.R.C.).

June 6-10, 1989
RHENOHERCYNIAN AND SUBVARISCAN FOLD BELTS (International Workshop), Boppard/Rhein, F.R.G. Language: English. (Dr. Andreas Vogel, Mathematical Geophysics Group, Free University of Berlin, Podbielskiallee 60, D-1000 Berlin 33).

June 25 - July 1, 1989
IAVCEI (General Assembly), Santa Fe, New Mexico, U.S.A. (Dr. M.A. Dungan, Department of Geological Sciences, Southern Methodist University, Dallas, TX 75275, U.S.A.) Will also include IGCP 257: Precambrian Mafic Dyke Swarms (Meeting) (John W. Geissman, Department of Geology, The University of New Mexico, Northrop Hall, Albuquerque, NM 87131, U.S.A.).

June 26-29, 1989
ENGINEERING GEOLOGY IN TROPICAL TERRAINS (International Conference), Selangor Darul Ehsan, Malaysia. Co-sponsored by IAEG. (Dept. Geology, Universiti Kebangsaan, 43600 Bangi, Selangor Darul Ehsan, Malaysia).

June 26-30, 1989
GOLD GEOLOGY AND EXPLORATION (International Symposium), Shengyang, China. Co-sponsored by IMA. (Professor Zhu Fengsan, Secretariat of ISGGE, Chinese Society of Metals, 46 Dongsixi Dajie, Beijing, P.R.C.).

July 5-8, 1989
CHAROPHYTES (International Colloquium), Montpellier, France. Languages: French and English. (Colloque Charophytes, Laboratoire de Paleobotanique, U.S.T.L., Place E. Bataillon, F-34 060 Montpellier, France).

July 9-19, 1989
INTERNATIONAL GEOLOGICAL CONGRESS (28th), Washington, D.C., U.S.A. (International Geological Congress, P.O. BOX 1001, Herndon, VA 22070, U.S.A.).

July 12-15, 1989
NEW MINERAL RAW MATERIALS (4th International Symposium), Karovy Vary, Czechoslovakia. (NEMIRAM, Geological Survey, Malostranske nam. 19, 11821 Praha 1, Czechoslovakia).

July 17-19, 1989
MINING IN THE ARCTIC (International Symposium), Fairbanks, Alaska. (Dr. Sukumar Bandopadhyay, 108 Brooks Building, Department of Mining and Geological Engineering, University of Alaska Fairbanks, Fairbanks, Alaska 99775, U.S.A.).

July 22-24, 1989
TECTONOTHERMAL EXPRESSION OF TERRANE ACCRETION WITHIN THE APPALACHIAN OROGEN (IGCP-233 International Conference), Athens, Georgia, U.S.A. (R.D. Dallmeyer, Department of Geology, University of Georgia, Athens, GA 30602, U.S.A.).

July 24 - August 4, 1989
INTERNATIONAL ASSOCIATION OF GEOMAGNETISM AND AERONOMY (6th Scientific Assembly), Exeter, U.K. (Dr. Roy Jady, IAGA 1989 Organizing Secretary, Department of Mathematics, University of Exeter, Exeter EX4 4QE, U.K.).

July 31 - August 3, 1989
EROSION AND VOLCANIC DEBRIS FLOW TECHNOLOGY (International Symposium), Yogyakarta, Indonesia. (Mr. Hartono Pramudo, Tromol Pos 23/KBT Kebayoran Baru, Jakarta Selatan, Indonesia).

August 1-3, 1989
PLATINUM (5th International Symposium), Espoo, Finland. Co-sponsored by IAGOD. (Prof. H. Papunen, Department of Geology, University of Turku, SF-20500 Turku, Finland).

August 2-4, 1989
PREPAREDNESS, MITIGATION AND MANAGEMENT OF NATURAL DISASTERS (Symposium), New Delhi, India. Language: English. (Dr. R.C. Agrawal, Symposium PMMND, c/o Dept. of Earthquake Engineering, University of Roorkee, Roorkee-247667, India).

August 3-12, 1989
WATER-ROCK INTERACTION (6th IAGC International Symposium), Malvern, England. (Dr. W.M. Edmunds, British Geological Survey, Wallingford, Oxon OX10 8BB, U.K.).

August 7-10, 1989
PACIFIC NEOGENE STRATIGRAPHIC, PALEOCEANOGRAPHIC AND ANDEAN EVENTS (IGCP-246 Meeting), Vina del Mar, Chile. (IGCP-246, Pacific Science Association, VI Inter-Congress, Box 14187, Suc. 21, Santiago, Chile).

August 13-18, 1989
SOIL MECHANICS AND FOUNDATION ENGINEERING (12th International Conference), Rio de Janeiro, Brazil. (Organizing Committee, XII ICSMFE, Caixa Postal 1559, 2000 Rio de Janeiro PJ, Brazil).

August 14-17, 1989
PRECAMBRIAN GRANITOIDS: Petrogenesis, Geochemistry, and Metallogeny (IGCP 217 and 247 Symposium), Helsinki, Finland. (Precambrian Granitoids Symposium, Department of Geology, University of Helsinki, P.O. Box 115, SF-00171 Helsinki, Finland).

August 14-29, 1989
SPELEOLOGY (10th International Congress), Budapest, Hungary. (10th International Congress of Speleology, c/o Magyar Karszt -'es Barlangkutatas Tarsulat, Anker köz 1, H-1061 Budapest, Hungary).

August 21-25, 1989
INTERNATIONAL ASSOCIATION FOR HYDRAULIC RESEARCH (23rd Congress), Ottawa, Canada. (IAHR Secretariat, National Research Council, Building M-58, Montreal Road, Ottawa, Ontario, Canada K1A OR6).

August 21 - September 1, 1989
IASPEI (25th General Assembly), Istanbul, Turkey. Co-sponsored by ICL. (Dr. Otkay Ergunay, Earthquake Research Division, Ministry of Public Works and Settlement, Yuksel Cad No. 7/F, Ankara, Turkey).

August 22-25, 1989
CLASTIC TIDAL DEPOSITS (2nd International Research Symposium), Calgary, Alberta, Canada. (Ray Rahmani, Canadian Hunter Exploration Ltd., 435 - 4th Avenue S.W., Calgary, Alberta, Canada T2P 3A8).

August 28 - September 2, 1989
AIPEA (9th International Clay Conference), Strasbourg, France. (Prof. Dr. Yves Tardy, Institut de Géologie, 1 rue Blessig, 67084 Strasbourg, France).

August 30 - September 2, 1989
ROCK AT GREAT DEPTH (Symposium), Pau, France. (Symposium, Elf Aquitaine, CSTCS, Bat. L5, 64018 Pau Cedex France).

August 31 - September 6, 1989
PALEOLIMNOLOGY (5th International Symposium), Ambleside, Cumbria, U.K. (Prof. Frank Oldfield, Department of Geography, University of Liverpool, P.O. Box 147, Liverpool L69 3BX, U.K.).

September 3-9, 1989
GEOMORPHOLOGY (2nd International Conference), Frankfurt/Main, F.R.G. (Prof. Dr. Arno Semmel, Institut für Physische Geographie, Universität Frankfurt, Senckenberganlage 36, Postfach 11 19 32, D-6000 Frankfurt/Main, F.R. Germany).

September 4-7, 1989
CHALK (International Symposium), Brighton, U.K. (Dr. R.N. Mortimore, Department of Civil Engineering, Brighton Polytechnic, Moulsecoomb, Brighton BN2 4GJ, U.K.).

September 4-8, 1989
NON-METALLIC MINERALS (2nd World Congress), Beijing, China. (Prof. Xu Changyou, Wuhan University of Technology, Wuhan, Hubei Province, P.R. China).

September 4-8, 1989
COASTAL EVOLUTION, MANAGEMENT AND EXPLORATION IN SOUTHEAST ASIA (IGCP-274 International Symposium), Ipoh, Malaysia. (Dr. H.D. Tjia, Jabatan Geologi, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia).

September 4-9, 1989
ANALYSIS OF SEISMICITY AND SEISMIC RISK (4th International Symposium), Bechyne, Czechoslovakia. (Dr. Z. Schenkova, Geophysical Institute, Bocni II, 14131 Progue 4, Czechoslovakia).

September 4-13, 1989
MICROPALEONTOLOGICAL COLLOQUIUM (26th), Budapest, Hungary. IPA. (Dr. A. Nagymarosy, Department of Geology, "Eötvös L." University, Budapest VIII, Muzeum krt. 4/A H-1088, Hungary).

September 10-14, 1989
QUATERNARY ENGINEERING GEOLOGY (Conference), Edinburgh, U.K. Cosponsored by IAEG. (Dr. J.A. Little, Dept. of Civil Engineering, Heriot-Watt University, Riccarton, Edinburgh EH14 4AS, Scotland, U.K.)

September 10-15, 1989
GEOLOGY AND RESERVOIR HETEROGENEITY (Symposium), Banff, Alberta, Canada. (Mrs.) Pat Larlham, Faculty of Extension, University of Alberta, Edmonton, Alberta, Canada T6G 2G4).

September 10-16, 1989
PALAEOCEANOGRAPHY (3rd International Conference), Cambridge, U.K. (N.J. Shackleton, Department of Earth Sciences, University of Cambridge, Dowing Street, Cambridge CB2 3EQ, U.K.).

September 11-22, 1989
ARCHEAN - PROTEROZOIC TRANSITION (Field Conference), Harare, Zimbabwe. Co-sponsored by IGCP and IUGS. (Apt 89, Geological Society of Zimbabwe, P.O. Box 8427, Causeway, Harare, Zimbabwe).

September 12-15, 1989
COAL: Formation, Occurrence and Related Properties (International Meeting), Orléans, France. (P. Bertrand, Unité de Recherche en Pétrologie, Organique, Université d'Orleans, 45067 Orléans, Cedex 2, France).

September 14-19, 1989
EDITING INTO THE 90's (Joint CBE, EASE, AESE Meeting), Ottawa, Canada. (Conference Office, National Research Council of Canada, Ottawa, Ontario, Canada K1A OR6).

September 17-24, 1989
AGGLUTINATED FORAMINIFERA (3rd International Workshop), Tübingen, F.R.G. (Dr. C.H. Leben, Geologisches Institut der Universität, Sigwartstrasse 10, D-7400 Tübingen, Federal Republic of Germany).

September 17-24, 1989
ENERGY (14th World Congress), Montreal, Quebec, Canada. (World Energy Conf., 34th St. James's Street, London SW1A 1HD, U.K.).

September 18-22, 1989
ORGANIC GEOCHEMISTRY (14th International Congress), Paris, France. (Ms. Yolande Rondot, Institut Francais du Petrole, B.P. 311, 92506 Rueil-Malmaison cedex, France).

September 24-30, 1989
CARBONIFEROUS STRATIGRAPHY (IUGS Subcommission Biennial Field and General Meeting), Utah/Nevada, U.S.A. (Walter L. Manger, Department of Geology, University of Arkansas, Fayetteville, AK 72701, U.S.A.).

September 25-28, 1989
MINING LATIN AMERICA (IMM Conference and Exhibition), Rio de Janerio, Brazil. (The Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, U.K.).

October 1-4, 1989
SINKHOLES AND THE ENGINEERING AND ENVIRONMENTAL IMPACTS OF KARST (3rd Multidisciplinary Conference), St. Petersburg, Florida, U.S.A. (Conference, Florida Sinkhole Research Institute, University of Central Florida, Orlando, FL 332816, U.S.A.).

October 1-6, 1989
GEOCHEMICAL EXPLORATION (13th International Symposium) and BRAZILIAN GEOCHEMICAL CONGRESS (2nd), Rio de Janeiro, Brazil. Co-sponsored by AEG. Languages: Symposium - English; Congress - Protuguese. (D.C. Bruni, 13th IGES, P.O. Box 2432, 20010, Rio de Janeiro, R.J., Brazil).

October 2-4, 1989
FLUVIAL SEDIMENTOLOGY (4th International Conference), Barcelona, Spain. (C. Puigdefàbregas, Servei Geologic de Catalunya, carrer Diputacio 92, 08015 Barcelona, Spain).

October 2-5, 1989
GROUNDWATER MANAGEMENT: QUANTITY AND QUALITY (International Symposium), Benidorm, Alicante, Spain. Language: English. (Secretary General, IAHS, Institute of Hydrology, Wallingford, Oxon. OX10 8BB, U.K.).

October 16-20, 1989
EARTHQUAKE PROGNOSTICS (4th International Seminar). Beijing, P.R. China. Language: English. (Prof. Wu Yilin, Grustal Deformation Department, Institute of Seismology, State Seismological Bureau of China, Xiao Hong Shan, Wuhan, P.R. China).

October 16-20, 1989
MATHEMATICAL METHODS IN GEOLOGY (IAMG Symposium), Pribram, Czechoslovakia. Sekretariat symposia, Hornicka Pribram ve Vede a Technice, post. schr. 41,261 02 Pribram, Czechoslovakia).

October 18-20, 1989
STRUCTURAL AND TECTONIC MODELLING AND ITS APPLICATION TO PETROLEUM GEOLOGY (Meeting), Stavanger, Norway. (Norwegian Petroleum Society, P.O. Box 1897 - Vika, 0124 Oslo, Norway).

October 22-25, 1989
WORLD GOLD '89 (Meeting), Reno, Nevada, U.S.A. (Society of Mining Engineers, P.O. Box 625002, Littleton, CO 80162, U.S.A.).

October 23-27, 1989
COAL SCIENCE (International Conference), Tokyo, Japan. Language: English. (Secretariat for ICCS, Coal Conversion Department, New Energy Development Organization (NEDO), Sunshine 60 Building, 1-1, Higashi-Ikeburkuro 3-chome, Toshima-ku, Tokyo 170, Japan).

October 29 - November 2, 1989
SOCIETY OF EXPLORATION GEOPHYSICISTS (Annual Meeting), Dallas, Texas, U.S.A. (Convention Assistant, SEG, P.O. Box 3098, Tulsa, OK 74101, U.S.A.).

November 6-9, 1989
GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), St. Louis, Missouri, U.S.A. (Meetings Department, GSA, P.O. Box 9140, Boulder, CO 80301, U.S.A.).

November 13-15, 1989
MINERAL EXPLORATION PROGRAMME '89 (Symposium), Madrid, Spain. (MEP '89, 4 Brandon Road, London N7 9TR, England, U.K.).

November 14-16, 1989
WORLD WATER (Conference), Wembley, London, U.K. (World Water '89, Conference, Office, Institution of Civil Engineers, 1 - 7 Great George Street, Westminster, London SW1P 3AA, U.K.).

November - December 1989
PETROLEUM GEOLOGY SEMINAR '89, Kuala Lumpur, Malaysia. (c/o Organizing Chairman, Geological Society of Malaysia, Geology Department, University of Malaya, 59100 Kuala Lumpur, Malaysia).

December 4-8, 1989
AMERICAN GEOPHYSICAL UNION (Fall Meeting), San Francisco, Calif., U.S.A. (AGU Meetings, 2000 Florida Avenue NW, Washington, DC 20009, U.S.A.).

1990

January, 1990
ANNUAL CONFERENCE '90, GEOLOGICAL SOCIETY MALAYSIA (Organising Chairman, Geological Society of Malaysia, c/o Geology Dept., University of Malaya, 59100 Kuala Lumpur, Malaysia).

January 15-27, 1990
OMAN OPHIOLITE, STRUCTURE, PETROLOGY, STRATIGRAPHY (International Symposium), Muscat, Sultanate of Oman. (Secretary, Hilal Azry, Ministry of Petroleum and Minerals, P.O. Box 551, Muscat, Oman).

February 5-9, 1990
BRACHIOPODS (2nd International Congress), Dunedin, New Zealand. (J.D. Campbell, Geology Department, University of Otago, P.O. Box 56, Dunedin, New Zealand).

April 18-20, 1990
OROGENESIS IN ACTION: Tectonics and Processes in the West Equatorial Pacific Margin (Meeting), London, U.K. (R. Hall, Department of Geological Sciences, University College London, Gower Street, London WC1E 6BT, U.K.).

May 6-12, 1990
PACIFIC RIM 90 (International Congress), Gold Coast, Queensland, Australia. (The AusIMM-Pacrim 90, P.O. Box 731, Toowong Qld 4066, Australia).

May 14-18, 1990
WORLD MINING (14th Congress), Beijing, P.R. China. (China Organizing Committee, 14th World Mining Congress, 54 Sanlihe Road, Beijing, People's Republic of China).

May 29 - June, 1990
EUROPEAN ASSOCIATION OF EXPLORATION GEOPHYSICISTS (52nd Annual Meeting), Copenhagen, Denmark. (J. Tychsen, Miljoministeriet, Amaliegade 13, DK-1265, Copenhagen K, Denmark).

June 1990
GEOCHEMISTRY OF WEATHERING (2nd International Symposium), Aix-en-Provence, France. Sponsored by IAGC. (B. Hitchon, Alberta Research Council, Box 8330, Station F. Edmonton, Alberta, Canada T6H 5X2).

June 3-6, 1990
AAPG/SEPM (Annual Meeting), San Francisco, California, U.S.A. (Convention Department, AAPG, Box 979, Tulsa, OK 74101, U.S.A.).

June 25-30, 1990
GEOSCIENCE INFORMATION (4th International Conference), Ottawa, Canada. (A. Bourgeouis, Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario, Canada K1A 0E8).

June 28 - July 3, 1990
INTERNATIONAL MINERALOGICAL ASSOCIATION (15th General Assembly), Beijing, P.R. China. (Prof. Huang Yunhui, c/o Institute of Mineral Deposits, Chinese Academy of Geological Sciences, Baiwan-zhuang Road 26, Fuchengmenwai, Beijing, P.R. China).

July, 1990
CAMBRIAN SYSTEM (3rd International Symposium), Novosibirsk, U.S.S.R. (Dr. J.W. Cowie, Department of Geology, University of Bristol, Queen's Building, University Walk, Bristol BS8 1RJ, England).

July 19-28, 1990
INTERNATIONAL UNION OF CRYSTALLOGRAPHY (15th Congress), Bordeaux, France. (Stefan S. Hafner, University of Marburg, 3550 Marburg, F.R. Germany).

July 29 - August 3, 1990
CIRCUM-PACIFIC ENERGY AND MINERALS RESOURCES (Conference), Honolulu, Hawaii. (Mary Stewart, Circum-Pacific Council on Energy and Mineral Resources, 5100 Westheimer Road, Houston, TX 77056, U.S.A.).

August, 1990
IGES (13th International Geochemical Exploration Symposium), Rio de Janeiro, Brazil. Sponsored by AEG. (Sherman Marsh, USGS, Federal Center MS 973, Denver, CO 80309-0250, U.S.A.).

August 6-10, 1990
IAEG (6th International Congress), Amsterdam, The Netherlands. Language: English and French. (Dr. L. Primel, L.C.P.C., 58 Boulevard Lefebvre, 75732 Paris Cedex 15, France).

August 12-18, 1990
INTERNATIONAL ASSOCIATION ON THE GENESIS OF ORE DEPOSITS (8th Symposium), Ottawa, Canada. (Dr. R.W. Boyle, 601 Booth Street, Ottawa, Canada K1A 0E8).

August 15-17, 1990
ARCTIC GEOLOGY AND PETROLEUM POTENTIAL (Meeting), Troms, Norway. (Norwegian Petroleum Society, Box 1897-Vika, 0124 Oslo 1, Norway).

August 26 - September 1, 1990
SEDIMENTOLOGY (13th International IAS Congress), Nottingham, U.K. (I.N. McCave, Department of Earth Sciences, University of Cambridge, Dowing Street, Cambridge CB2 3EQ, U.K.).

August 26 - September 8, 1990
LATIN AMERICAN CONODONT SYMPOSIUM, La Paz, Bolivia and San Juan, Argentina. (Mario Hunicken, Academia Nacional de Ciencias, Casilla Correo 36, 5000 Cordoba, Argentina).

August 27 - September 1, 1990
WATER RESOURCES IN MOUNTAINOUS REGIONS (International Symposium and IAH 22nd Congress), Lausanne, Switzerland. (Dr. A. Parriaux, Laboratory of Geology EPFL (GEOLEP), CH-1015 Lausanne, Switzerland).

September 1990
GEOCHEMICAL EXPLORATION (13th International Symposium), Prague, Czechoslovakia. Joint IAGC and AEG meeting. (B. Hitchon, Alberta Research Council, P.O. 8330, Station F. Edmonton, Alberta, Canada T6H 5X2).

September - October 1990
IPA GRAPTOLITE WORKING GROUP (4th International Conference), Nanjing, P.R. China. (Chen Xu, Nanjing Institute of Geology and Palaeontology, Academia Sinica, Chi-Ming-Sau, Nanjing, P.R. China).

September 3-8, 1990
VOLCANOLOGY (International Congress), Mainz, F.R.G. (G. Brey, Max Planck Institut für Chemie, Abtl. Kosmochemie, Saarstrasse 23, 6500 Mainz, Federal Republic of Germany).

September 4-7, 1990
DEEP SEISMIC REFLECTION PROFILING OF THE CONTINENTAL LITHOSPHERE (4th International Symposium), Bayreuth, F.R.G. (C. Reichert, DEKORP, NLfB, Postfach 510153, D-3000 Hannover 51, F.R. Germany).

September 17-21, 1990
ARCHAEN (Symposium), Perth, Australia. (D.I. Groves, Department of Geology, University of Western Australia, Nedlands, Western Australia 6009).

September 23-27, 1990
SOCIETY OF EXPLORATION GEOPHYSICISTS (Annual Meeting), San Francisco, U.S.A. (Convention Assistant, SEG, P.O. Box 3098, Tulsa, OK 74101, U.S.A).

September 24-29, 1990
GEOCHRONOLOGY, COSMOCHRONOLOGY AND ISOTOPE GEOLOGY (7th International Conference), Canberra, Australia. (Organizing Committee, ICOG 7, Research School of Earth Sciences, Australian National University, GPO Box 4, Canberra, ACT 2601, Australia).

September 28 - October 2, 1990
BENTHIC FORAMINIFERA (4th International Symposium), Sendai, Japan. (Dr. Yokichi Takayanagi, Institute of Geology and Paleontology, Tohoku University, Sendai, 980 Japan).

October 29 - November 1, 1990
GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Dallas, Texas, U.S.A. (GSA, P.O. 9140 Boulder, CO 80301, U.S.A.).

November 1990
MEDITERRANEAN NEOGENE (9th International Congress), Barcelona, Spain. Cosponsored by IUGS. (Prof. Jordi Martinell, Fac. de Geologia, Univ. de Barcelona, Zona Universitaria de Pedralbes, 08028 Barcelona, Spain).

1991

March, 1991
ECONOMIC EVALUATION OF MINERAL RESOURCES (International Conference), Kosice, Czechoslovakia. Languages: Russian and English. (Intergeoekonomika 1991 CSSR, GEOFOND Bratislava-branch Kosice, Eng. St. Richter, Garbanova 1, 040 11 Kosice, Czechoslovakia).

April 7-10, 1991
AAPG/SEPM (Annual Meeting), Dallas, Texas, U.S.A. (Convention Department, AAPG, Box 979, Tulsa, OK 74101, U.S.A.).

April 26 - May 1, 1991
ASSOCIATION OF EXPLORATION GEOCHEMISTS (15th International Geochemical Exploration Symposium), Reno, U.S.A. (Richard B. Jones, Nevada Bureau of Mines and Geology, University of Nevada, Reno, Nevada 89557-0088, U.S.A.

May 27-29, 1991
GAC/MAC (Joint Annual Meeting), Toronto, Canada. (J. Fawcett, Department of Geology, University of Toronto, Toronto, Ontario, Canada M5S 1A1).

August 2-9, 1991
QUATERNARY RESEARCH (13th International Congress), Beijing, P.R. China. (Secretariat, 13th INQUA Congress, Chinese Academy of Sciences, 52 Sanlihe, Beijing 100864, P.R. China).

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GEOLOGICAL SOCIETY OF MALAYSIA PUBLICATIONS

General Information

The Society publishes the *Buletin Persatuan Geologi Malaysia* (Bulletin Geological Society of Malaysia) and the *Warta Geologi* (Newsletter of the Geological Society of Malaysia) which is issued bimonthly.

Papers of general interest or on the geology of the Southeast Asian region (South China, Burma, Thailand, Indochina, Malaysia, Singapore, Indonesia, Brunei and the Philippines) and also marine areas within the region are welcome for publication in the *Bulletin*. Short notes, progress reports and general items of information are best submitted to the *Warta Geologi*.

Papers should be as concise as possible. However, there is no fixed limit as to the length and number of illustrations. Therefore, papers of monograph length are also welcome. Normally, the whole paper should not exceed 30 printed pages and it is advisable that authors of papers longer than 30 printed pages should obtain the consent of the Editor before submission of the papers.

The final decision of any paper submitted for publication rests with the Editor who is aided by an Editorial Advisory Board. The Editor may send any paper submitted for review by one or more reviewers. Scripts of papers found to be unsuitable for publication may not be returned to the authors but reasons for the rejection will be given. The authors of papers found to be unsuitable for publication may appeal only to the Editor for re-consideration if they do not agree with the reasons for rejection. The Editor will consider the appeal together with the Editorial Advisory Board.

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

Authors must agree not to publish elsewhere a paper submitted to and accepted by the Society.

Authors alone are responsible for the facts and opinions given in their papers and for the correctness of references etc.

Twenty-five reprints of each paper are free-of-charge. Contributors should notify the Editor of extra reprints (which are of non-profit costs) required.

All papers should be submitted to the Editor, Geological Society of Malaysia, c/o Department of Geology, University of Malaya, 59100 Kuala Lumpur, MALAYSIA

Script Requirements

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 × 33 cm. One side of the page must only be typed on.

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

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A concise and informative abstract in English is required for each paper written in Bahasa Malaysia or English. A paper written in Bahasa Malaysia must have an abstract in Bahasa Malaysia as well.

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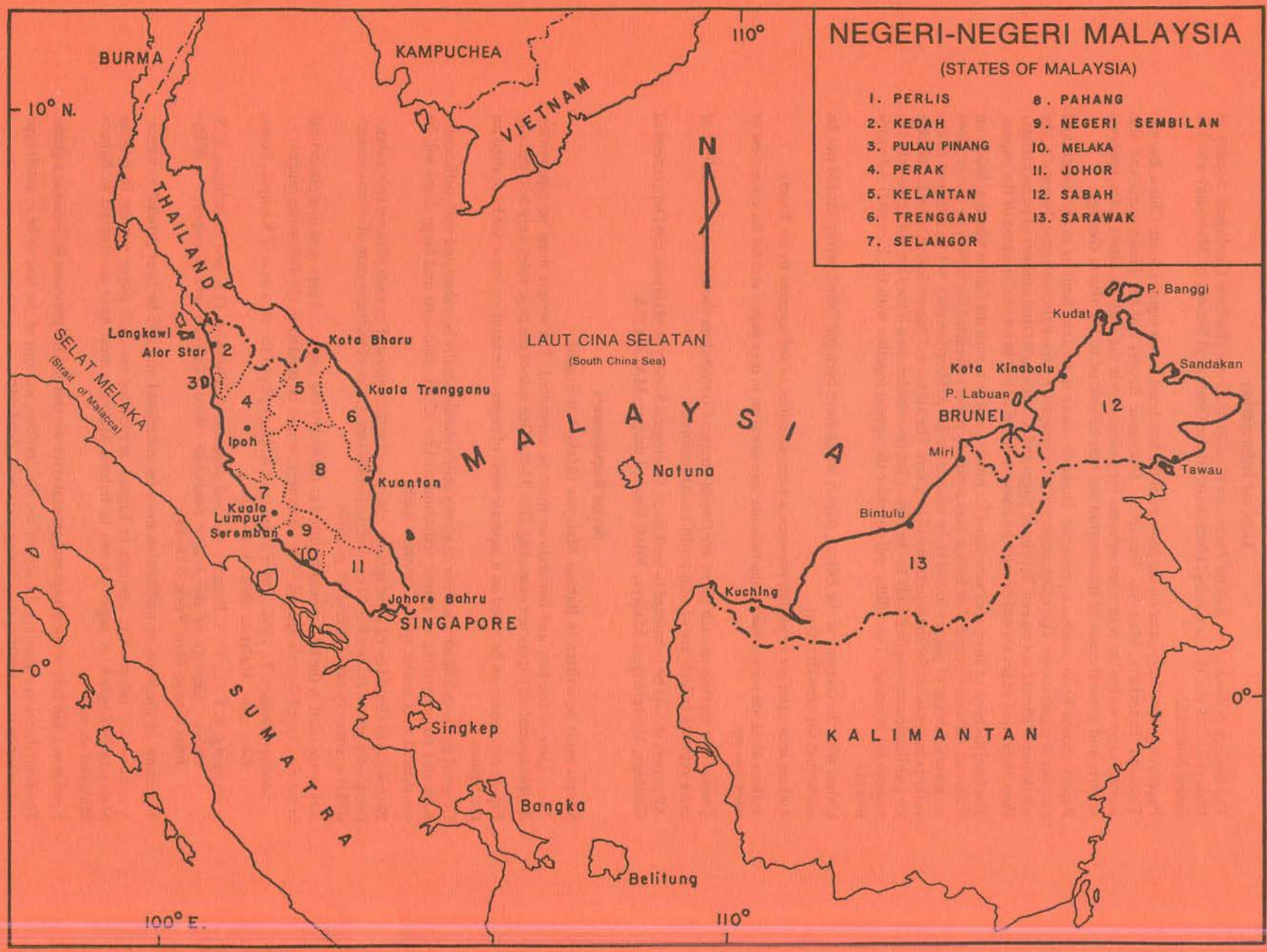
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