PP 168/12/92 ISSN 0126-5539

PERSATUAN GEOLOGI MALAYSIA

WARTA GEOLOGI

NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MALAYSIA

Jil. 19, No. 3 (Vol. 19, No. 3) May–Jun 1993

KANDUNGAN (Contents)

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Published by the Geological Society of Malaysia,
Department of Geology, University of Malaya, 59100 Kuala Lumpur.
Tel: 603-757 7036 Fax: 603-756 3900

Printed by Art Printing Works Sdn. Bhd., 29 Jalan Riong, 59100 Kuala Lumpur.

CATATAN GEOLOGI
Geological Notes

Permian conodonts from the Raub Gold Mine, Pahang, Peninsular Malaysia

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Abstract: Interbedded siltstones, mudstones and limestones of the "Raub Group" exposed at the Raub Gold Mine, Raub, Pahang have yielded the conodont *Neogondolella rosenkrantzi* (Bender & Stoppel) which indicates a Late Permian (either Guadalupian or Dzhulfian) age. The sedimentary rocks at the Raub Gold mine are tightly to isoclinally folded and comparison of the structural style with that of the Middle-Upper Triassic Semantan Formation suggests a structural discontinuity which may correspond to the age of suturing of the Sibumasu and East Malaya tectonic blocks.

INTRODUCTION

The sedimentary rocks of the Raub Gold Mine in the Bukit Koman area near Raub, Pahang were first described by Richardson (1939) who recognised a "Calcareous Formation" and an "Arenaceous Formation". These rocks were later referred to the Raub Group by Alexander (1959, 1968) and Foo (1983), who used the term to include all the Carbo-Permian strata which crop out along the central zone from Kelantan to Johore. Rocks of the Raub Group have been dated as Carboniferous - Permian from only a few places by macrofossils (Muir-Wood, 1948; Jones *et al.*, 1966; Alexander, 1968; Yancey, 1972; Metcalfe, 1983). There are no previous published records of dateable fossils from the sediments exposed at the Raub Gold Mine.

CONODONT LOCALITY, FAUNA AND AGE

Two limestone conodont samples, Nos 1031 and 1032, each of 4kg weight, were collected from isoclinally folded, interbedded siltstones, mudstones and limestones exposed at the Raub Gold Mine near Bukit Koman, Raub (Fig 1). Sample 1031, from a fine-grained, dark-grey, thin limestone bed was found to be barren. Sample 1032, from a thicker (0.5m) discontinuous limestone bed which contains some limestone intraclasts up to 1cm diameter, yielded the following conodont elements:

Neogondolella rosenkrantzi (Bender & Stoppel), Pa	1
Unidentifiable ramiform elements	17
TOTAL	18

Neogondolella rosenkrantzi (Bender & Stoppel) has been recorded from the upper Guadalupian (Capitanian) to Dzhulfian of Western North America, East Greenland, Nepal and China (Clark and Behnken, 1971; Ziegler, 1973; Clark and Wang, 1988). This indicates that the limestone containing the conodonts at the Raub Gold Mine are Late Permian (either Guadalupian or Dzhulfian) in age.

COLOUR AND TEXTURAL ALTERATION OF THE CONODONT ELEMENTS

The conodont elements exhibit a colour alteration index of 5 and are black in colour. This indicates that they have been heated to temperatures within the range 300°C to 480°C (Epstein *et al.*, 1977). The conodonts are also cracked and pitted (eg. Plate 1, Fig. 3) and exhibit textural alteration consistent with regional metamorphism (Rejebian *et al.*, 1987).

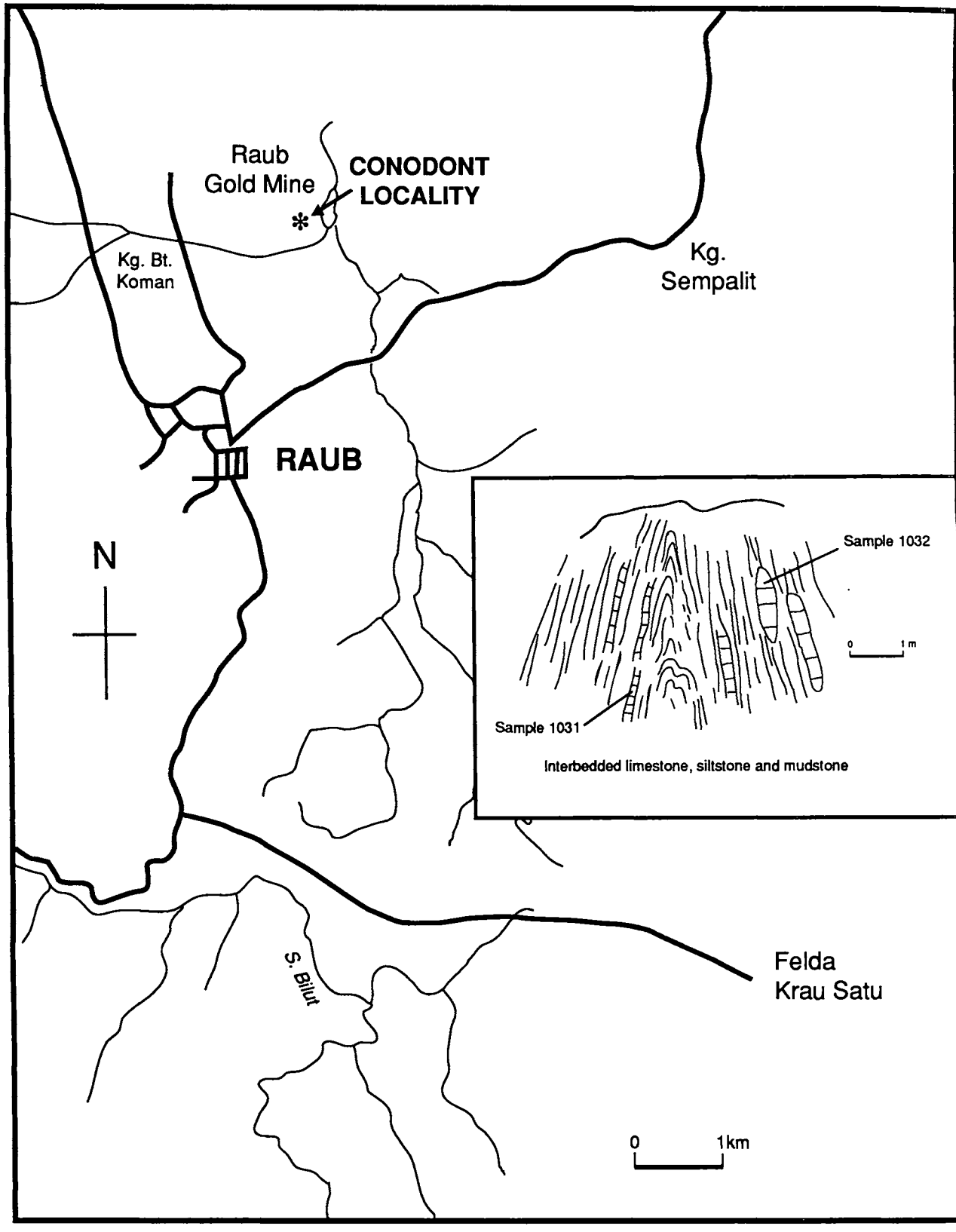

Figure 1. Map showing the location of the Raub Gold Mine and conodont locality. Inset shows sketch of strata from which samples were collected.

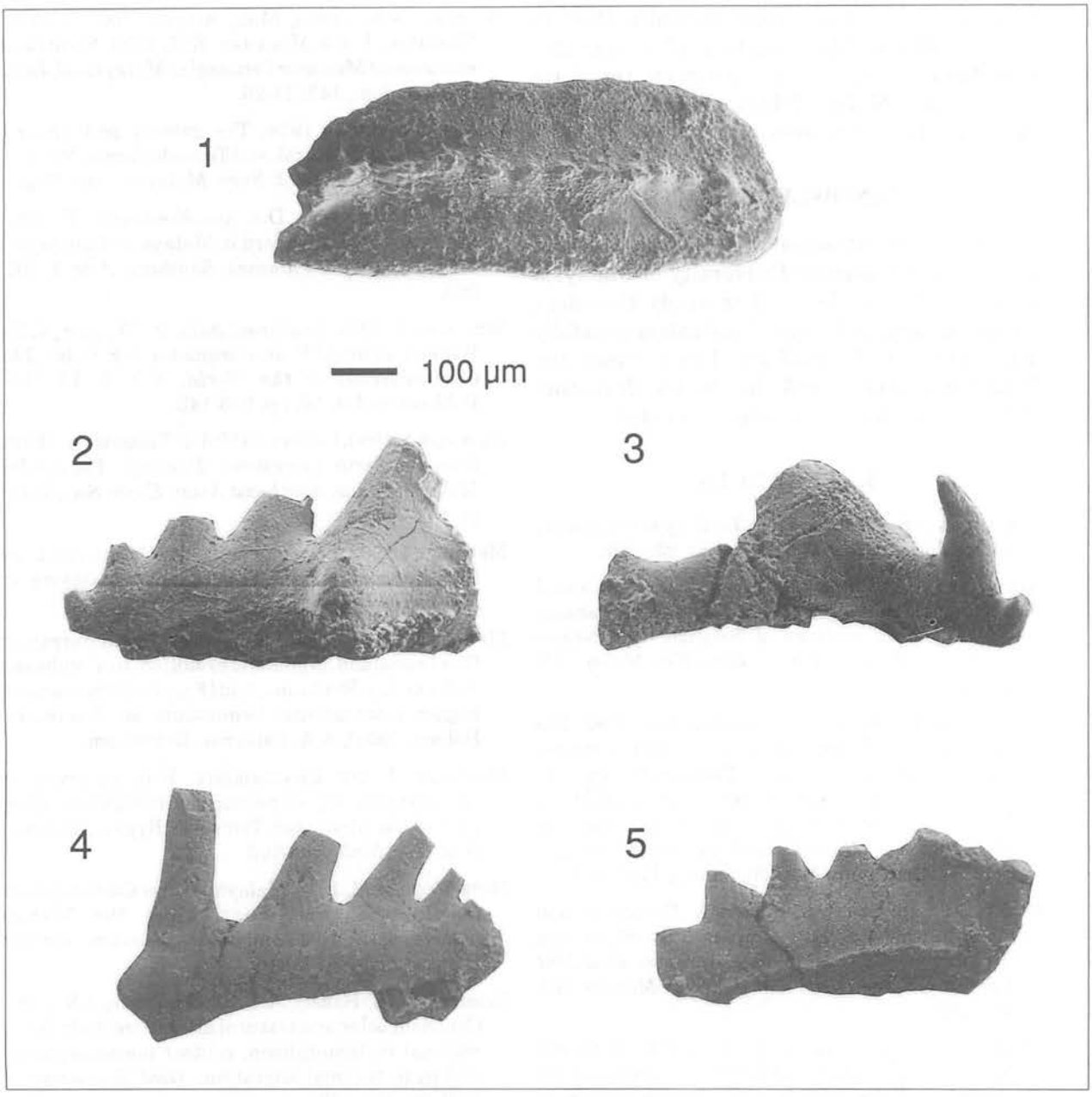

Plate 1. Conodonts from the Raub Gold Mine. 1. *Neogondolella rosenkrantzi* (Bender & Stoppel), Pa element, upper view, sample 1032. 2-5. Unidentifiable ramiform elements; note cracking and pitting of the elements.

DISCUSSION

The sedimentary rocks exposed at the Raub Gold Mine are tightly to isoclinally folded (Richardson, 1939 figs 18-24 and author's observations, see Fig. 1) which indicates a structural discontinuity between these sediments and the Middle to Upper Triassic Semantan Formation and equivalents which exhibit broad open upright folds (Jaafar, 1976, Harbury *et al.*, 1990; Metcalfe and Chakraborty, in press).

Early Triassic limestones exposed along the eastern margin of the Central Belt near Cheroh and north of Kuala Lipis (Metcalfe, 1990. 1992) yield conodonts with a similar colour alteration index but they appear to be texturally less altered implying that they have been heated but not necessarily subjected to regional metamorphism. The age of suturing of the Sibumasu and Indochina/East Malaya terranes has been suggested to be Late Permian - Early

Triassic (Cooper *et al.*, 1989; Metcalfe, 1990, in press) and the identification of a probable structural discontinuity between the Late Permian and Middle Triassic in the Raub area supports this conclusion.

ACKNOWLEDGMENTS

Conodont extraction was undertaken whilst in receipt of National University of Malaysia Research Grant No. 6/86 to study Conodont Biostratigraphy in Malaysia and this is gratefully acknowledged. I would also like to thank the Department of Geology & Geophysics, University of New England for facilities provided.

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Manuscript received April 1993

CATATAN GEOLOGI
Geological Notes

Clay minerals in the weathering profile of a quartz-muscovite schist in the Siliau area, Negeri Sembilan

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Abstract: X-ray diffractograms show that randomly interstratified illite-montmorillonite and kaolinite are the clay minerals present in the upper morphological horizons of the weathering profile, whilst kaolinite and illite are the clay minerals present in the lowest morphological horizon. In the intermediate morphological horizons, the diffractograms show that kaolinite, illite and randomly interstratified illite-montmorillonite are the clay minerals present. Increasing amounts of randomly interstratified illite-montmorillonite and kaolinite up the weathering profile, and a corresponding decrease of illite, reflect increasing effects of weathering processes; disaggregation and disintergration of muscovites and sericites within the original bedrock material initially resulting in illite, followed by development of randomly interstratified illite-montmorillonite and kaolinite through leaching of the illites.

INTRODUCTION

There is a general lack of published literature on the clay minerals of weathering profiles over quartz-mica schist bedrock in Malaysia, except for Yeow (1975) and Siti Zauyah (1986). Yeow (1975) studied two well drained weathering profiles; one over a quartz-phengite schist (exposed at a 8 m high slope cut), and the other over a graphitic muscovite-quartz schist (exposed at a 10 m high slope cut). In the profile over the quartz-phengite schist, Yeow (1975) concluded that kaolinite formed where rapid leaching of potassium and iron from the phengite occurred, but where the rate of removal of these ions was slow, a mixed layer phengite-montmorillonite was formed. In the profile over the graphitic muscovite-quartz schist, Yeow (1975) concluded that muscovite altered to kaolinite and halloysite, though the rate of decomposition was slow. Siti Zauyah (1986) investigated a well drained weathering profile (exposed at a 8 m high slope cut) over a graphitic-quartz-sericite schist and concluded that sericite altered to kaolinite.

In studying the characterisation (for engineering geological purposes) of a weathering profile over a quartz-muscovite schist bedrock, samples were collected at various depths and their clay fractions investigated by X-ray diffraction studies. Results of these diffraction studies are presented in this paper which also briefly considers the origins of the clay minerals identified to be present in the weathering profile.

SAMPLING SITE – GEOLOGICAL SETTING

The selected weathering profile is exposed at a slope cut, located on the east side of the Seremban – Port Dickson Road at Km 16.4 (Fig. 1). The road here cuts across a low hill and trends in a general north to south direction across an undulating terrain of low hills and flat-bottomed, alluviated valleys. The cut is of an approximately symmetrical shape with a length of about 100 m along its base and a maximum vertical height of 14 m. The cut, which has an overall angle of 42°, is benched, with the benches of some 3.20, and 4.02, m

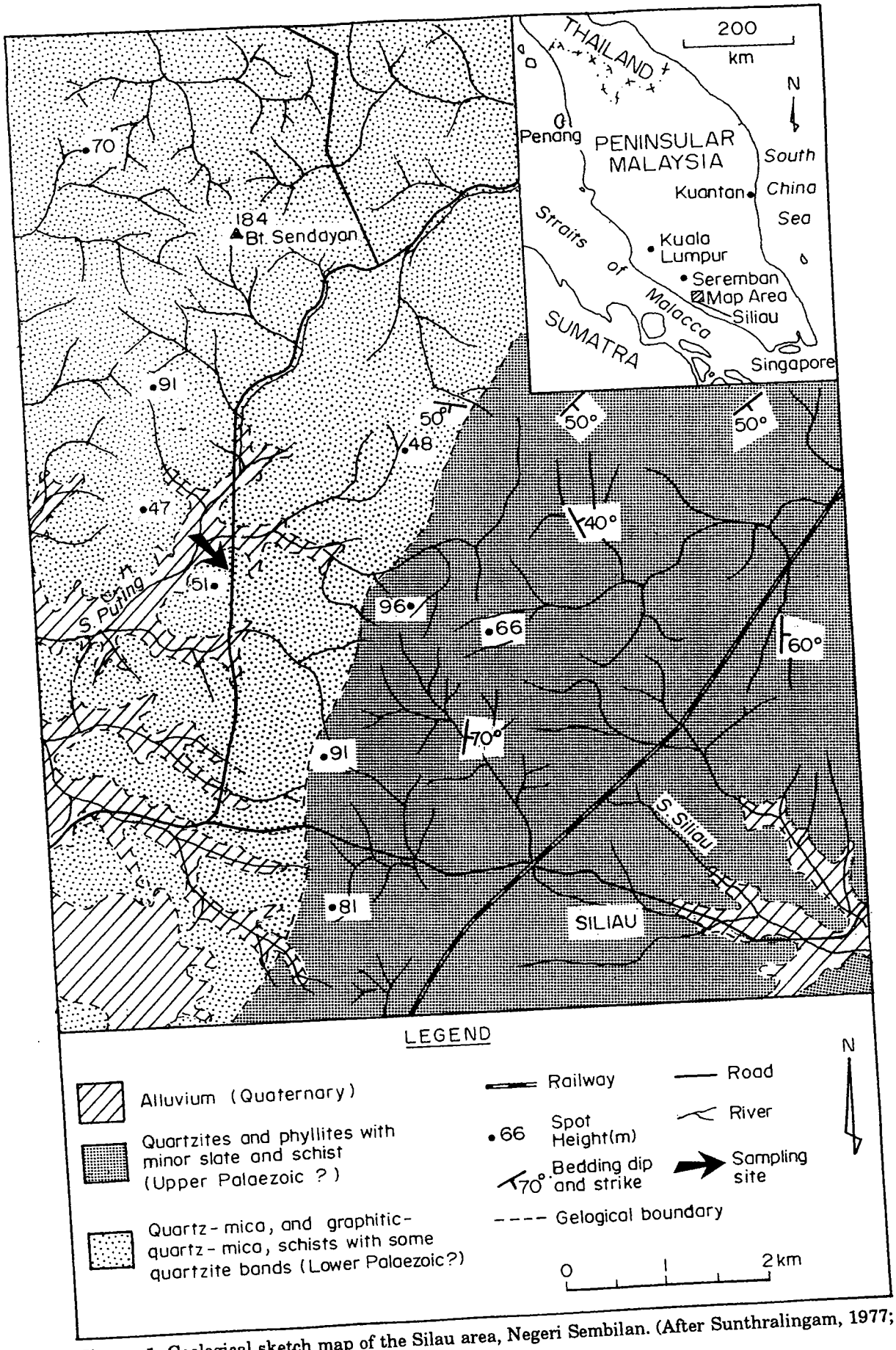


Figure 1. Geological sketch map of the Silau area, Negeri Sembilan. (After Sunthralingam, 1977; Mohd. Sidi, 1985)

vertical height, and face angles of 60°, separated by horizontal berms of variable width. The lowest bench is some 5.24 m high with a face angle of 68°.

At this cut is exposed a weathering profile developed over an original bedrock mass that consisted of light grey to buff coloured, quartz-muscovite schists with abundant quartz veins and pods. These schists form part of a sequence of quartz-schists, quartz-mica schists, graphitic schists, quartz-graphite-mica schists with some bands of quartzite that are tightly folded with generally north to northwest strikes. These schists have been correlated with the Dinding Schists of the Kuala Lumpur area (Khalid, 1972) and are of a probable Lower Palaeozoic age (Sunthralingam, 1977; Mohd. Sidi, 1985).

The exposed weathering profile can be subdivided into a number of morphological horizons, each of which is characterised by the lateral similarity of morphological features (Fig. 2). Completely unweathered bedrock material is, however, not exposed at the cut, though the weathered material indistinctly to distinctly preserves all of the textural and structural features of the original bedrock mass. The relict foliation, though variable, mainly strikes northwest-southeast with steep (60° to 80° northeastward dips. Several indistinct to distinct, relict joints, and a few faults, of variable orientations are also seen.

In thin-sections, the less weathered schist bedrock material is seen to consist of thin layers of fine grained quartz crystals in parallel alignment with thicker layers of aligned muscovites, sericites and clay minerals. In the thin-sections, thin quartz veins as well as secondary iron oxide and hydroxide grains are also often seen.

METHODS OF SAMPLING AND X-RAY DIFFRACTION

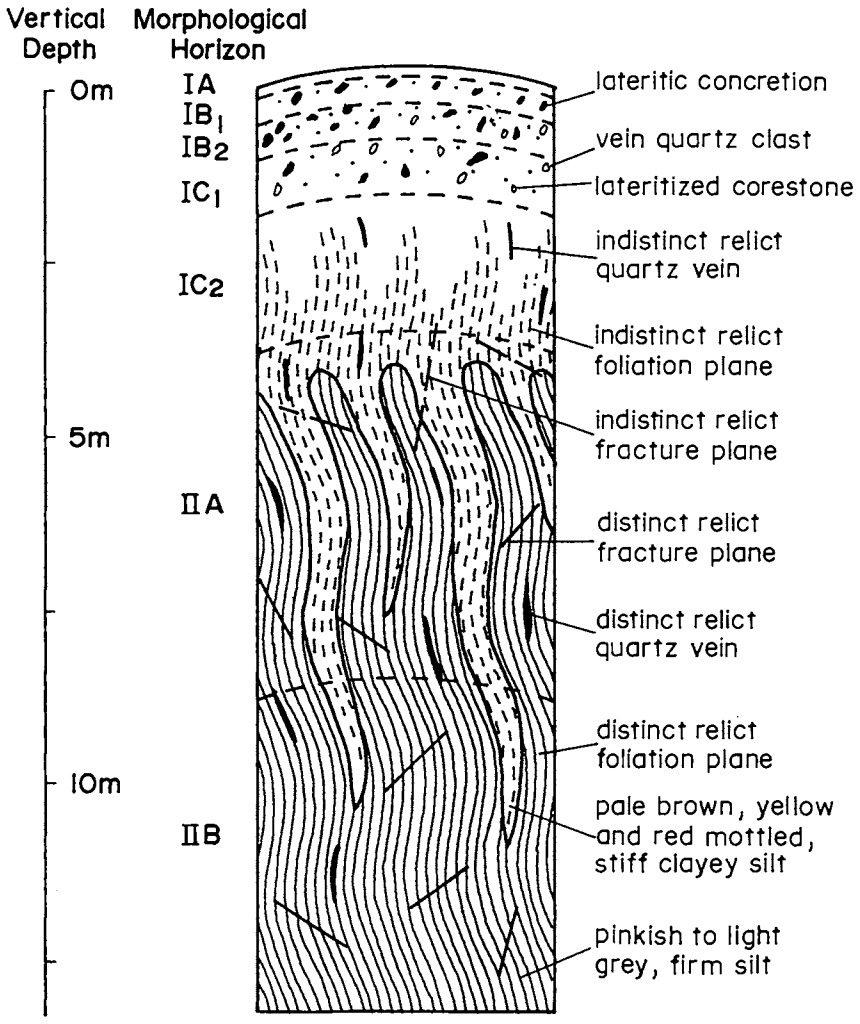
In order to characterise the weathering profile, samples of the weathered materials were collected at various depths (Fig. 3) using thin walled, cylindrical brass rings of 7.6 cm internal diameter and 4 cm height. Moisture contents of these samples were determined, following which they were air dried and separated into smaller fractions using a sample splitter. Fractions of samples for the x-ray diffraction studies were gently ground with a porcelain mortar and pestle and placed into 30 ml test tubes. The test tubes were filled with distilled water, and three drops of concentrated ammonia solution added before they were vigorously shaken for two minutes and allowed to stand overnight. The suspension in the top 1 cm of the test tubes was then collected with a glass dropper and spread onto glass slides to air dry.

Following air drying, the glass slides were scanned from 5° to 28° 2θ at a goniometer speed of 1°/min using a Copper tube in order to obtain diffractograms of the clay fractions under untreated conditions. Two drops of 6% glycerol in ethyl alcohol were then dropped onto the slides, and after air-drying, were scanned from 5° to 15° 2θ to obtain diffractograms under glycolated conditions. The slides were then heated in an oven for one hour at 500°C, and after cooling in a desiccator, scanned from 5° to 15° 2θ to obtain diffractograms under conditions of heating to 500°C.

RESULTS

The resulting x-ray diffractograms (Fig. 4) show several reflections that indicate the presence of a number of clay minerals. The reflections are also of variable intensities and show that there is a vertical variation in the types, and amounts, of the different clay minerals within the weathering profile.

In clay fractions of the lowest morphological horizon IIB (Samples 9 and 10), the narrow and slightly asymmetrical reflections on the untreated diffractograms at 8.75°, 17.75° and 26.7°, 2θ (corresponding to d-spacings of 10.1, 5.0 and 3.34 Å, respectively) indicate the presence of illite; confirmation being the absence of shift of the 8.75° 2θ reflection on glycolation and on heating to 500°C (Fig. 4). It is to be noted that the term 'illite' is here used in the sense proposed by Grim, Bray and Bradley (1937) i.e. as being a general name for mica-like clay minerals. The narrow and symmetrical reflections on the untreated diffractograms at 12.25° and 24.8° 2θ (corresponding to d-spacings of 7.20 and 3.58 Å, respectively) indicate the



Morphological Horizon	Description
IA	Strong brown, friable, loose, clayey gravel; many roots; boundary wavy, diffuse.
IB_1	Reddish yellow, friable sandy clay with many gravel sized lateritic concretions and vein quartz clasts; some roots; boundary irregular, diffuse.
IB_2	Yellowish red, friable sandy clay with abundant gravel sized lateritic concretions and vein quartz clasts; a few lateritized corestones; boundary irregular, diffuse
IC_1	Pale brown and yellow mottled, stiff sandy clay with many gravel sized vein quartz clasts, lateritic concretions and lateritized corestones; boundary irregular, diffuse.
IC_2	Pale brown, yellow and red mottled, stiff clayey silt with some lateritic concretions, lateritized corestones and vein quartz clasts: indistinct relict foliation but distinct relict quartz veins and pods; boundary, irregular, diffuse.
IIA	Thick bands of pale brown, yellow and red, mottled, stiff, clayey silt with indistinct relict foliation and thin bands of pinkish to light grey, firm silt with distinct relict foliation, quartz veins and pods; indistinct relict fracture planes with secondary iron oxide and hydroxide concretions and stains; boundary broken, diffuse.
IIB	Thick bands of pinkish to light grey firm silt with distinct relict foliation and thin bands of yellow to pale brown, stiff clayey silt with indistinct relict foliation; distinct relict quartz veins and pods; distinct relict fracture planes with secondary iron oxide and hydroxide concretions and stains.

Figure 2. Schematic sketch, and field description, of morphological horizons within the weathering profile over the quartz-mica schist.

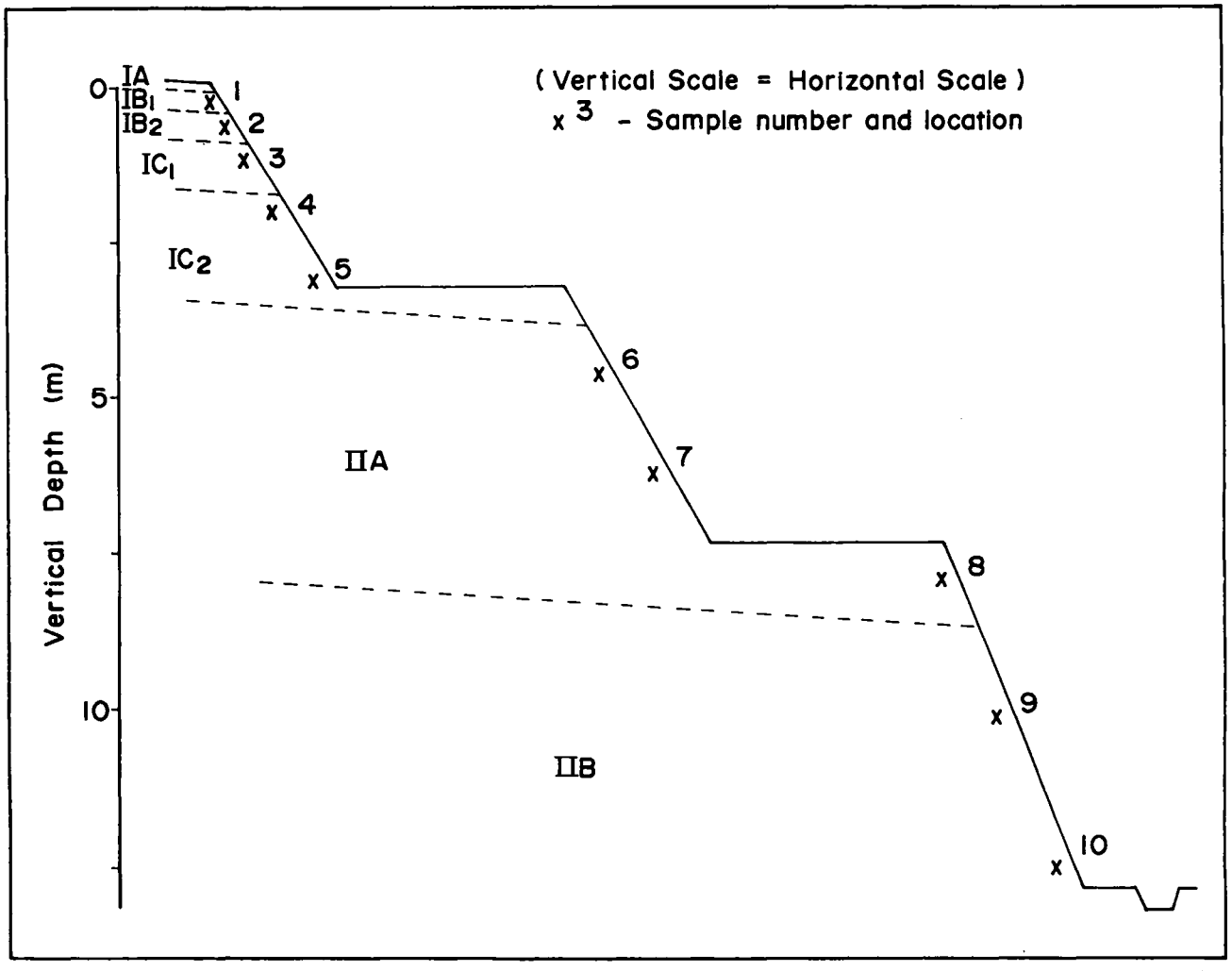


Figure 3. Sample locations, and lateral extensions of morphological horizons within the weathering profile over the quartz-mica schist.

presence of kaolinite; confirmation being the absence of shift of the 12.25° 2θ reflection on glycolation and its disappearence on heating to 500°C. Some fine grained quartz is also present in the clay fractions and can be identified from the small reflection at 20.75 2θ on the untreated diffractograms, in addition to the reflection at 26.2° 2θ which, however, also marks illite. The source of the other low reflections between 19.0 and 22.0 2θ on the untreated diffractograms is not certain, though they are likely to indicate the presence of illite-muscovite (Table 142, Thorez, 1975).

In clay fractions of the top-most morphological (actually pedological) horizons IB_1, IB_2 and IC_1 (Samples 1 to 3), the narrow and symmetrical reflections on the untreated diffractograms at 12.25° and 24.8° 2θ again indicate the presence of kaolinite; confirmation being the absence of shift of the 12.25° 2θ reflection on glycolation and its disappearence on heating to 500°C. The broad and somewhat symmetrical reflections on the un-treated diffractograms between 7° and 8.5° 2θ, and around 17.8° 2θ are, however, not characteristic of individual discrete clay minerals and indicate the presence of an interstratified (or mixed-layered) clay mineral. In view of the fact that the broad reflections between 7° and 8.5° 2θ shift towards low 2θ angles on glycolation, and drop to around 8.5° 2θ on heating to 500°C, it is considered that this clay mineral is an interstratified illite-montmorillonite (Moore and Reynolds, 1989). The absence of other reflections at lower 2θ angles on the untreated

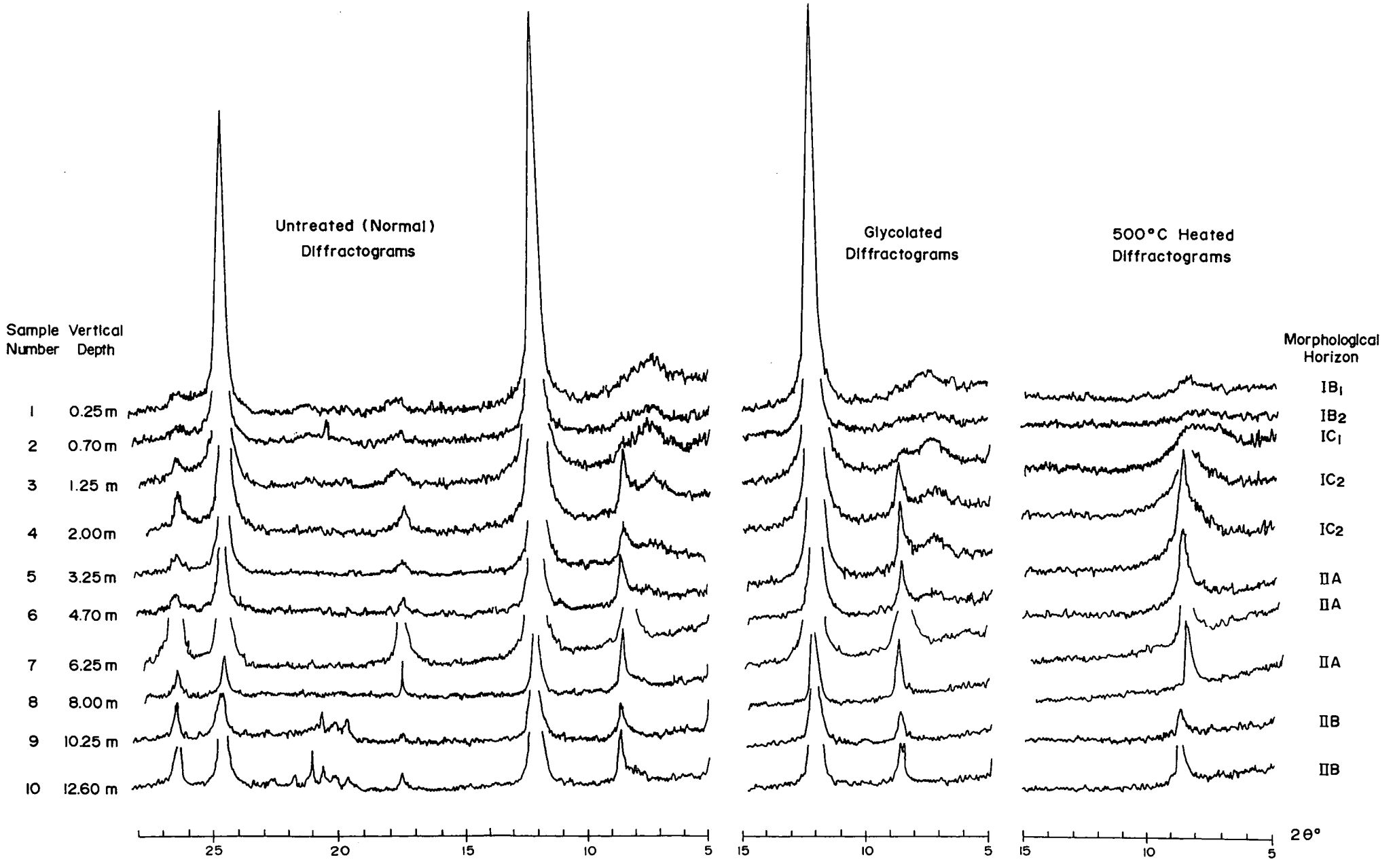


Figure 4. X-ray diffractograms of the clay fractions of samples from the weathering profile over the quartz-mica schist.

diffractograms furthermore, shows that the inter-stratification is of a random nature. Comparisons with calculated diffraction patterns in Reynolds (1980), and Moore and Reynolds (1989), indicate that the interstratified montmorillonite layers form at most some 20% of the randomly interstratified clay mineral.

In clay fractions of the upper, intermediate morphological (or pedological) horizon IC_2 (Samples 4 and 5), the narrow and symmetrical reflections on the untreated diffractograms at 12.25° and 24.8° 2θ indicate the presence of kaolinite; confirmation being the absence of shift of the 12.25° 2θ reflection on glycolation and its disappearence on heating to 500°C. The narrow and asymmetrical reflections on the untreated diffractograms at 8.75°, 17.75° and 26.7° 2θ, indicate the presence of illite; confirmation being the absence of shift of the 8.75° 2θ reflection on glycolation and on heating to 500°C. It is to be noted, however, that some montmorillonite layers are randomly interstratified within the illite in view of the asymmetrical (towards low 2θ angles) 8.75° 2θ reflections on the untreated diffractograms as well as their separation into two separate reflections on glycolation (von Reichenbach and Rich, 1975).

In clay fractions of the lower, intermediate morphological horizon IIA (Samples 6 to 8), the narrow and symmetrical reflections on the untreated diffractograms at 12.25° and 24.8° 2θ indicate the presence of kaolinite; confirmation being the absence of shift of the 12.25° 2θ reflection on glycolation and its disappearence on heating to 500°C. The narrow and asymmetrical reflections on the untreated diffractograms at 8.75°, 17.75° and 26.7° 2θ, indicate the presence of illite; confirmation being the absence of shift of the 8.75° 2θ reflection on glycolation and on heating to 500°C.

DISCUSSION

From the results, it can be seen that there is a vertical variation in clay mineralogy within the weathering profile. In the lower part of the weathering profile (in morphological horizons IIA and IIB), illite and kaolinite are the clay minerals present, while in the top-most part (in pedological horizons IB_1, IB_2 and IC_1), randomly interstratified illite-montmorilonite and kaolinite are the clay minerals present. At intermediate depths within the profile, in morphological horizon IC_2, kaolinite and illite (with some interstratified montmorillonite layers) are the clay minerals present, whilst in morphological horizon IIA, kaolinite and illite are the clay minerals present.

The occurrence of illite in the lower morphological horizons is to be expected in view of the mineral composition of the quartz-muscovite schist bedrock material, for disaggregation and disintegration of the muscovites will lead to the sericite and the clay sized material identified as illite on the diffractograms. A similar origin can also be considered for the illites found in the intermediate morphological horizons IIA.

The occurrence of the randomly interstratified illite-montmorillonite in the upper morphological horizons IB_1, IB_2 and IC_1 is also to be expected, for several authors, including Grim (1953), Droste and Tharin (1958), Millot (1970), and MacEwan and Ruiz-Amil (1975) have pointed out that the leaching of cations, particularly K^+, from illite structures and the entrance of water, gives rise to randomly interstratified illite-montmorillonite. The presence of some randomly interstratified montmorillonite layers within the illites of the intermediate morphological horizon IC_2 can also be attributed to these processes. Increasing effects of these processes within the weathering profile are furthermore, clearly shown by the diffractograms (Fig. 4) with the gradual broadening and asymmetry of the 8.75° and 17.75° 2θ reflections up the profile. Interestingly enough, the presence of randomly interstratified illite-montmorillonite only becomes clearly discernible in the diffractograms from morphological horizon IC_2; this horizon constituting the *solvum* (or parent material) for the overlying pedological soil horizons.

The occurrence of kaolinite within the weathering profile is a somewhat unexpected one in view of the mineral composition of the quartz-muscovite schist bedrock material. Increasing amounts of kaolinite up the weathering profile (as shown by increasing

reflection peaks), however, shows that it has developed as a result of weathering processes. In the intermediate morphological horizons IC_1 and IC_2 furthermore, broadening of the 8.75° and 17.75° 2θ illite reflections are seen to correspond with an increase in the peaks of the 12.25° 2θ kaolinite reflection and indicate that development of the kaolinite is associated with leaching of the illite. Such an origin for kaolinite has in fact been proposed by several other authors including Loughnan (1969), Weaver and Pollard (1973), Yeow (1975) and Siti (1986).

CONCLUSION

It is concluded that randomly interstratified illite-montmorillonite and kaolinite are the clay minerals present in the upper morphological horizons of the weathering profile over the quartz-muscovite schist, whilst kaolinite and illite are the clay minerals present in the lowest morphological horizon. In the intermediate morphological horizons, kaolinite, illite and randomly interstratified illite-montmorillonite are the clay minerals present. It is also concluded that increasing amounts of kaolinite and randomly interstratified illite-montmorillonite up the weathering profile, and a corresponding decrease of illite, reflect increasing effects of weathering processes; disaggregation and disintergration of the original bedrock material initially resulting in illite, followed by development of randomly interstratified illite-montmorillonite and kaolinite through leaching of the illites.

ACKNOWLEDGEMENTS

This study forms part of a research project on the geotechnical properties of earth materials in Malaysia funded by IRPA grant No. 04-07-04-172 from the Government of Malaysia. En. Roshdy is thanked for drafting the figures.

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Manuscript received 30 April 1993

PERTEMUAN PERSATUAN
Meetings of the Society

Annual Geological Conference '93 — Laporan (Report)

The 8th Annual Geological Conference 1993 was held on the 12th & 13th June 1993, at the DeLima Resort in Langkawi. It was declared open by Y.B. Haji Zakaria bin Haji Said who represented the Mentri Besar of Kedah Darul Aman.

The Conference attracted over 150 participants, many of whom turned up with their families for a holiday in Langkawi. A new record of 51 papers on various aspects of geology were presented by geoscientists from the five local universities, Geological Survey of Malaysia, Petronas Research and Scientific Services, Petronas-Carigali, PLUS and IKM. Despite the tight schedule, most speakers kept to their alloted time for their presentations leaving very little time for discussions.

The two Pre-Conference Field-trips ran into some problems due to the inavailability of boats on the first day and heavy rain on the second morning. Nevertheless the participants did get a chance to see the main sedimentary formations and major igneous intrusion on Langkawi. The trip up Gunung Raya was particularly memorable with breath-taking views of various parts of the islands at different stops along the way up.

We have once again to thank our stauch supporters and donors for contributing to the success of this Annual Geological Conference 1993, in particular Malaysian Mining Corp. Bhd. for again hosting the Conference Dinner and Mamut Copper Mining Sdn. Bhd. and Syarikat Sebangun Sdn. Bhd. for co-hosting the Ice-Breaker Barbecue to formally welcome the delegates to the conference. We are also thankful to Bukit Yong Gold Mine Sdn. Bhd. and Setia Barite Sdn. Bhd. for their contributions.

C.P. Lee
Organising Chairman

Speech by the Organising Chairman, Dr. Lee Chai Peng at the Opening Ceremony, Annual Geological Conference '93

Tuan Pengerusi Majlis,

Y.B. Dato Hj. Zakaria Hj. Said,
Wakil Y.A.B. Menteri Besar Kedah Darul Aman,

Encik Fateh Chand,
Presiden Persatuan Geologi Malaysia,

Para Jemputan Khas,

Tuan-tuan dan Puan-puan hadirin sekalian.

Bagi pihak Persatuan Geologi Malaysia saya terlebih dahulu ingin mengucapkan ribuan terima kasih kepada Y.B. Dato Hj. Zakaria Hj. Said, Wakil Y.A.B. Menteri Besar Kedah Darul Aman, kerana sudi menghadirkan diri untuk memyampaikan ucapan perasmian dan merasmikan Persidangan Tahunan Geologi Ke Lapan ini.

Honoured Guests,
Ladies and Gentlemen,

I am sure most of you would remember the TV series "Fantasy Island" where every episode began with the plane landing and when the guests had all arrived Mr. Roarke will toast them and say "I am Mr. Roarke your host. Welcome to Fantasy Island!" Today I have the privilege to act out one of my fantasies so ....." I am Dr. Lee, your Organizing Chairman. Welcome to Langkawi Island!"

Langkawi was just a sleepy-hollow when I first came here as a student in the mid-70's and I fell in love with her immediately. I came back again and again and even did a Masters thesis on the Machinchang Formation and yet am still very much in love with her. Langkawi has changed a lot since then yet much of her rustic charm remains. I do hope that all of you too would fall in love with this beautiful place and come back to enjoy her again and again.

On behalf of the Geological Society of Malaysia I would like to once again welcome you to Pulau Langkawi and thank you all for your kind attendance at this opening ceremony of the 8th Annual Geological Conference (1993).

As Organizing Chairman, I would like to express my sincere appreciation and grateful thanks to the many people who have helped me to do the job especially to members of the Organizing Committee, the generous donors and hosts of the lunches and dinners, the authors of papers and my many helpers especially Mrs. Anna Lee, and last but not least, to all of you for your kind interest and participation in this year's Conference.

TERIMA KASIH DAN SELAMAT DATANG KE LANGKAWI!

Welcoming Address by the President, Geological Society of Malaysia, Mr. Fateh Chand at the Annual Geological Conference '93

Y.B. Dato Hj. Zakaria Bin Hj. Said,
Wakil Y.A.B. Menteri Besar Kedah

Pengerusi,
Jawatankuasa Pengelola Persidangan Tahunan Geologi Yang Ke-Lapan,

Tan Sri-Tan Sri, Dato'-Dato',

Tuan-Tuan dan Puan-Puan hadiran sekalian,

Salam Sejahtera dan Selamat Pagi.

Bagi pihak Persatuan Geologi Malaysia terlebih dahulu saya mengucapkan setinggi-tinggi ucapan terima kasih kepada Y.B. Dato Hj. Zakaria Bin Hj. Said, wakil Y.A.B. Menteri Besar Kedah, di atas kesudian beliau menerima undangan kami untuk menyampaikan ucapan perasmian, seterusnya merasmikan Persidangan Geologi Tahunan Kali Ke-Lapan ini. Kehadiran beliau merupakan satu perhatian dan ganjaran besar kepada Persatuan ini. Tidak ketinggalan juga saya mengucapkan selamat datang kepada para jemputan khas, puan-puan dan tuan-tuan, para peserta sekalian.

Ladies and Gentlemen,

This conference, the 8th in the series of Annual Geological Conferences, has attracted a total of 50 technical papers and was preceeded by an enjoyable Pre-Conference field trip around Langkawi. The response has been excellent not only because of the exciting geology in Langkawi but also for its scenic beauty. I am sure you all would agree that the geological heritage of Langkawi, which has given rise to the lovely bays, beaches, waterfalls and the landscape in general, is a plus point for tourism.

On behalf of the Council I would like to thank all the authors of the technical papers for their technical contributions. We have papers from 5 universities, Petronas Research, Petronas Carigali, Geological Survey Malaysia, Institut Kerjaraya Malaysia and PLUS. I am sure we can look forward to an interesting technical program.

Ladies and Gentlemen,

The Geological Society is indeed very proud to have organised a number of significant conferences, seminars, workshops, field trips and technical talks during the past years. Last year's annual conference was held in Kuantan with pre- and post-conference field trips. We also organised and co-sponsored with the Circum-Pacific Council for Energy and Mineral Resources a 'Symposium on Tectonic Framework and Energy Resources of the Western Margin of the Pacific Basin' in November/December 1992 in Kuala Lumpur. For these, special thanks are due to Encik Ahmad Said, our immediate past President, and the members of his organising committee. The Society is looking forward to hosting the 1993 Petroleum Geology Seminar and to co-host the American Association of Petroleum

Geologists International Convention to be held in August 1994 in Kuala Lumpur. I am sure we can count on your support for these two events.

Ladies and Gentlemen,

I like to take this opportunity to thank various organisations and individuals who have faithfully supported the Geological Society and in particular I wish to thank the organising Chairman of this Conference Dr. Lee Chai Peng for the excellent work done by him and his team and to Malaysian Mining Corporation, Mamut Copper Mine, Sebangun, Nilai Agencies Sdn. Bhd., and Setia Barat Sdn. Bhd. for their contributions in cash or in kind.

I would also like to thank all our distinguished guests especially Y.B. Dato Hj. Zakaria Bin Hj. Said and all the participants for their support and kind attendance to make this a successful conference. Sekarang saya ingin menjemput Y.B. Dato Hj. Zakaria Bin Hj. Said untuk memberi sepatah dua kata dan merasmikan persidangan ini.

Sekian terima kasih.

Opening Address by YB. Dato' Haji Zakaria Said, Exco Member representing YAB. Menteri Besar Kedah Darul Aman at the Annual Geological Conference '93

Assalamualaikum warahmatullahi wabarakatuh. Bismillahir-rahmanir-rahim.

* Yang Mulia Pengerusi Majlis.
* Yang Berbahagia encik Fateh Chand,
  Presiden Persatuan Geologi Malaysia.
* Yang Berbahagia Dr. Lee Chai Peng,
  Pengerusi Jawatankuasa Pengelola Persidangan.
* Tuan-tuan dan puan-puan serta hadirin yang dihormati sekelian.

Terlebih dulu saya ingin menyampaikan salam hormat dari Yang Amat Berhormat Menteri Besar, Tan Sri Dato' Seri Haji Osman Aroff kepada tuan-tuan dan puan-puan sekelian.

Yang Amat Berhormat dukacita tidak dapat bersama-sama di majlis ini kerana beberapa sebab yang tidak dapat dielakkan. Walau bagaimanapun Yang Amat Berhormat berharap semoga persidangan ini berjalan lancar dan memperolehi kejayaan.

Sebagai wakil Yang Amat Berhormat Menteri Besar, saya sukacita turut mengalu-alukan para perwakilan ke Negeri Kedah Darul Aman dan terima kasih kepada pihak Persatuan kerana sudi memilih Pulau Langkawi sebagai tempat persidangan kali ini.

Saya berharap suasana alam sekitar yang indah lagi nyaman serta tenteram akan membantu para wakil melahirkan idea-idea lebih bernas yang dengannya bukan saja dapat meningkatkan mutu profession ahli-ahli geologis kita malah dapat pula memberi sumbangan kepada pembangunan negara, khasnya dalam bidang geologi.

HADIRIN SEKELIAN,

Saya merasa amat terhormat diberi kesempatan mewakili Yang Amat Berhormat Menteri Besar untuk berucap kepada para peserta persidangan yang terdiri dari tokoh-tokoh geologi dari pelbagai Universiti di Malaysia dan juga mereka yang berkhidmat dengan Kerajaan, Badan-Badan Berkanun dan dari Sektor Swasta.

Penyertaan tuan-tuan dan puan-puan jelas menunjukkan betapa penting persidangan ini bukan saja kepada Persatuan malah kepada Kerajaan. Kerajaan akur bahawa tuan-tuan dan puan-puan merupakan tenaga penting yang terlibat secara langsung di dalam explorasi sumber-sumber asli kekayaan negara seperti petrol, gas, sumber air bawah tanah, galian dan sebagainya.

Tuan-tuan dan puan-puan juga turat membantu Kerajaan di dalam kerja-kerja membina ampangan, terowong dan juga rangkaian jalan dan lebuhraya di seluruh negara.

Sebenarnya pertumbuhan pusat-pusat ekonomi di bandar-bandar dan sekitar pinggirannya juga kerana peranan ahli-ahli geologi sehingga membolehkan tempat-tempat tersebut seperti Lembah Kelang (Kuala Lumpur) dan Lembah Kinta (Ipoh) terkenal dengan pengeluaran bijih timah, Miri, Bintulu dan Kerteh dengan pengeluaran petrol dan gas, manakala Raub dan Bau terkenal dengan pengeluaran emas.

Para geologi kita juga telah bekerja keras menyusun data-data mengenai galian yang lengkap sebagai maklumat untuk menarik syarikat-syarikat tempatan dan luar negeri melabur dalam sektor ini.

Penggubalan Dasar Pembangunan Galian dan undang-undang yang berkaitan dengannya juga sudah tentu akan menggalakkan pelaburan asing dan dalam masa yang sama menjaga kepentingan negara kita.

HADIRIN SEKELIAN,

Pemilihan Pulau Langkawi sebagai tempat persidangan kali ini adalah amat tepat sekali kerana pulau ini mempunyai pelbagai sumber asli yang berpotensi besar untuk dimajukan seperti batu marmar, granite,

tanah liat dan sebagainya.

Kerajaan Negeri berhasrat untuk memajukan bahan-bahan tersebut sebagai sumber ekonomi dan dalam masa yang sama mahu mengekalkan keadaan alam semula jadi dan nyaman sebagai daya terikan pelancong.

Pulau Langkawi sekarang mula bertukar wajah menjadi pusat pelancongan yang terkenal bukan saja dirantau ini malah di seluruh dunia.

Bagi mengimbangi kemajuan kedua-dua bidang ini, Kerajaan Negeri berharap para geologis kita dapat membantu agar Pulau Langkawi terus membangun sebagai pusat pelancongan dan dalam masa yang sama sumber ekonomi dari pelbagai hasil galiannya dapat dipertingkatkan lagi.

HADIRIN SEKELIAN,

Negeri Kedah Darul Aman yang terkenal sebagai 'Jelapang Padi', juga adakalanya menghadapi masalah kekurangan air sama ada untuk keperluan pertanian mahupun perindustrian.

Walaupun masalah ini tidak serious tetapi Kerajaan Negeri berharap para geologi dapat membantu dalam kerja-kerja penyelidikan untuk mencari sumber air termasuk di bawah tanah untuk kegunaan pembangunan.

Pada masa ini Kerajaan Negeri sedang melaksanakan program pembangunan air yang agak koprehensif untuk keperluan secukupnya bagi kegunaan pelbagai sektor memandangkan negeri ini sedang pesat membangun terutama dalam bidang industri.

Tetapi untuk keperluan masa depan dengan mengambil kira pertumbuhan penduduk semakin pesat, Kerajaan sudah tentu memerlukan kerja-kerja penyelidikan yang berterusan oleh pakar-pakar geologi agar sumber air di negeri ini tidak berkurangan.

Ini adalah satu tugas yang amat berat, tetapi saya percaya tuan-tuan dan puan-puan sebagai pakar dalam bidang ini dapat membantu mencari sumber-sumber baru agar pembangunan masa depan negeri ini khasnya dalam sektor pertanian dan industri untuk meningkatkan taraf sosio-ekonomi rakyat tidak terjejas.

Buat mengakhirinya, saya sekali lagi mengucapkan ribuan terima kasih kepada pihak penganjur kerana sudi menerima saya mewakili Yang Amat Berhormat Menteri Besar untuk menyempurnakan majlis ini.

Dengan lafaz bismillahir-rahmanir-rahim, saya sukacita merasmikan Persidangan Tahunan Persatuan Geologi Malaysia 1993. Sekian, Selamat Bersidang.

Annual Geological Conference '93


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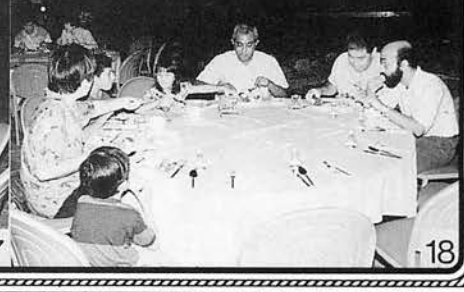
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Annual Geological Conference '93

Pre-Conference Fieldtrip 10th June 1993 (By Boat)

1. "There has been some miscommunication. The boat trip is off."
2. "Anyway smile for a group photo."

Pre-Conference Fieldtrip 11th June 1993 (By Land)

3. Discussing the excellent cross-bedded sandstones of the Machinchang Formation – in the rain!
4. Stopping for lunch at the Crocodile Farm.
5. Examining the Setul limestone at the JKR Quarry.
6. Time for photographs against background of the Setul limestone islands off Tanjong Rhu.
7. Discussions on the nature of the Raya Granite.
8. A closer look for fine textures in the metamorphosed Singa Formation roof pendant.
9. A group photo near the summit of Gunung Raya.

Ice-Breaker Barbecue 11th June 1993

10-13. There is plenty of food for everybody.
14-18. There is enough tables to enjoy your food too.

Annual Geological Conference 12 & 13 June 1993

19. C.P. Lee, the Organising Chairman with his Welcoming Address.
20. GSM President, Fateh Chand, with his address.
21. YB Dato Haji Zakaria Said representing the Menteri Besar.
22-25. The large audience at the Opening Ceremony.
26. Nuraiteng Tee Abdullah starting off Technical Session I.
27. Mohd. Shafeea Leman on Permian fauna.
28. Basir Jasin on bedded chert at Bukit Kodiang.
29. Azhar Hj. Hussin on the G. Semanggol area.
30. Kamal Roslan Mohamed on the Semantan Formation.
31. Mark Alex-Sanders on microfloral provincialism.
32. Uyop Said with his presentation.
33. R.J. Morley on biostratigraphic characterisation.
34. Ahmad Munif Koraini on Batu Arang palynomorphs.
35. Shamsudin Jirin on palynology of Sabah Trough.
36. Ahmad Jantan with his joint paper.
37. K.R. Chakraborty posing a question.
38. Lee Chai Peng on trace fossils in Labuan.
39. Presentation of Ismail Che Mat Zin's paper.
40. Ghazala Roohi with her presentation.
41. Leong Lap Sau on Poisson's ratio.
42. Izman Hamid with his paper.
43. Mohd. Firdaus on geothermics of sedimentary basins.
44. Abdul Ghani Rafek with a joint paper.
45. Lunch time!
46. Juhari Mat Akhir with his presentation.
47. G.H. Teh on ICP-AAS analysis.
48. Tan Boon Kong on adsorption capability of clay soil.
49. Muhinder Singh on construction of roadways.
50. J.K. Raj on Batu Arang.
51. Khairul Anuar with his joint paper.
52. H.D. Tjia on the pseudofossil at Santubong.
53. Mohamad Ali Hasan on waste disposal system.
54. Mohd. For on excavated material classification.
55. Anizan Ishak on geomorphology of SE Johor.
56. M.Z. Farshori on the Pahang River Delta.
57. A question from Muhamad Barzani Gasim.
58. K.R. Chakraborty on the Main Range batholiths.
59. Rohayu Che Omar on the use of Niggli numbers.
60. Mohammad Yamin on the Central Luconia carbonates.
61. Liew Kit Kong with his paper.
62. Askury Abd. Kadir on the Palong Pluton/
63. Ibrahim Abdullah on deformations of the Semantan Formation.
64. Siti Zauyah with her presentation.
65. Muhamad Barzani Gasim on the G. Danum area.
66. Zaiton Harun on the Bukit Berapat fault zone.
67. Syed Sheikh on the Baubak Fault.
68. Norul Ashikin on the Jongkok Batu area.
69. Wan Fuad on Sn-Au mineralization.
70. E.B. Yeap on primary gold mineralization.
71. Mazlan Abdullah on geomagnetic modelling.
72. C.P. Lee with the Closing Remarks.

Conference Dinner 12th June 1993.

73-77. Some of the tables at the dinner.
78. The Organising Chairman making sure everyone has a place.
79. Anna making her rounds.
80. The main table at the dinner.
81-87. The other tables at the dinner.
88. GSM President, Fateh Chand, thanking MMC for the dinner.
89. MMC representative, Mazlan Zam, with his speech.
90. The participants giving their attention.
91. A token of appreciation from the Society to MMC.

PERSIDANGAN TAHUNAN GEOLOGI '93
ANNUAL GEOLOGICAL CONFERENCE '93

PROGRAMME

▶ THURSDAY, 10th June, 1993

08.00 : PRE-CONFERENCE FIELDTRIP I
Southwest Langkawi

▶ FRIDAY, 11th June, 1993

08.00 : PRE-CONFERENCE FIELDTRIP II
Mainland Langkawi

▶ SATURDAY, 12th June, 1993

08.00 : Late Registration

08.30 : Welcoming Address by Dr. Lee Chai Peng
Organising Chairman of GSM Annual Geological Conference 1993

08.35 : Address by Mr. Fateh Chand
President, Geological Society of Malaysia

08.45 : Opening Address by YB Dato' Haji Zakaria Said, representing
YAB Menteri Besar Kedah Darul Aman

09.00 : COFFEE BREAK

SESSION I

09.30 : NURAITENG TEE ABDULLAH
The occurrence of Upper Permian foraminifers in Northwest Pahang

09.45 : MOHD. SHAFEEA LEMAN
Permian fauna and volcanic activity in the Padang Tengku area, Pahang

10.00 : BASIR JASIN & KAMAL ROSLAN MOHAMED
Significance of bedded chert at Bukit Kodiang, Kedah

10.15 : AZHAR HJ. HUSSIN
Re-interpretation of the stratigraphy of the Gunong Semanggol area, Perak Darul Ridzuan and its implication

10.30 : KAMAL ROSLAN MOHAMED & IBRAHIM ABDULLAH
Fasies batu kapur Formasi Semantan

10.45 : MARK ALEX-SANDERS
Tethyan/Indo-Pacific microfloral provincialism during the Late Jurassic/Early Cretaceous period

11.00 : UYOP SAID & KAMAL ROSLAN MOHAMED
Spora Kapur dari Paloh, Johor

11.15 : R.J. MORLEY, AZMI MOHD YAKZAN, AWALLUDIN HARUN & BAHARI MD NASIB
Biostratigraphic characterisation of stratigraphic sequences in the Malay Basin

11.30 : AHMAD MUNIF KORAINI
Tertiary palynomorphs from Batu Arang, Malaysia

11.45 : SHAMSUDIN JIRIN
Palynology of Late Quaternary sediments of piston-core KL-139 from Sabah Trough, East Malaysia

12.00 : AHMAD JANTAN, IBRAHIM ABDULLAH, CHE AZIZ ALI & JUHARI MAT AKHIR
The Nenering Sequence: Sedimentology, stratigraphy and probable basin initiation – A second opinion

12.15 : LEE CHAI PENG
The significicant occurrences of *Parateichichnus pilulacopia* and *Hydrancyclus paracaulis* (trace-fossils) in the Kudat Formation, Bengkoka Peninsula, Sabah and Temburong Formation, Labuan

12.30 : ISMAIL CHE MAT ZIN
Dent group and their subsurface equivalent in the offshore Kinabatangan area, East Sabah

12.45 : S. MAHMOOD RAZA, GHAZALA ROOHI & MOHAMMAD ARIF
Miocene giant rhinoceroted *Baluchitherium* from the Bugti Hills, Pakistan and its paleobiogeographic importance

01.00 : LUNCH

SESSION II

02.00 : LEONG LAP SAU, LIM TECK KEAN & MD. ANUAR RAZALI
Poisson's ratio of water saturated alluvium in Penang from shallow seismic refraction

02.15 : IZMAN HAMID & IDRUS MOHD. SHUHUD
Interpretation of seismic attributes in detecting fluid contact – case history: Tembungo Field

02.30 : MOHD. FIRDAUS ABDUL HALIM
Geothermics of the Malaysian Sedimentary Basins

02.45 : ABDUL GHANI RAFEK & ABDUL RAHIM SAMSUDIN
Penyiasatan tapak dengan bantuan kaedah kerintangan geoelektrik

03.00 : ABDUL RAHIM SAMSUDIN *et al.*
Geophysical study of Kuala Betis, Kelantan

03.15 : JUHARI MAT AKHIR
Geological applications of digitally processed thematic mapper data in Kuala Betis, Kelantan Darul Naim: a preliminary interpretation.

03.30 : COFFEE BREAK

SESSION III

03.45 : G.H. TEH, A.K. FAN & M.C. LEE
Analysis of geological material by Inductively Coupled Plasma Spectrometry (ICP-AES)

04.00 : TAN BOON KONG
Assessing the adsorption capability of a clay soil

04.15 : MUHINDER SINGH & MOGANA SUNDRAM
The application of engineering geological mapping in the design and construction of roadways

04.30 : JOHN K. RAJ
Coal mining and ground surface subsidence at Batu Arang, Negeri Selangor Darul Ehsan

04.45 : UMAR HAMZAH, KHAIRUL ANUAR MOHD. NAYAN & ABD. RAHIM SHAMSUDDIN
Integration of geophysical and geotechnical techniques in site investigation: a case study of a karstic area

05.00 : TAN BOON KONG
The story of Gemencheh Dam II

07.30 : DINNER

▶ SUNDAY, 13th June 1993

SESSION IV

08.30 : H.D. TJIA
A pseudofossil in the Kayan Sandstone at Santubong, Sarawak

08.45 : MOHAMAD ALI HASAN
Geological and hydrogeological perspectives on the waste disposal systems in Terengganu and Pahang

09.00 : MOHD. FOR MOHD. AMIN
Classification of excavated material based on laboratory testings

09.15 : ANIZAN ISAHAK
The geomorphology of Southeast Johor

09.30 : AHMAD JANTAN & M.Z. FARSHORI
Preliminary study on the Pahang River Delta

09.45 : K.R. CHAKRABORTY
Chemical patterns and evolution of the batholiths of the Main Range Province, Peninsular Malaysia

10.00 : ASKURY ABD. KADIR
The magmatic differentiation sequence of the Palong Pluton, Negeri Sembilan/Pahang (Urutan pembezaan magma granitoid bagi Pluton Palong, Negeri Sembilan/Pahang)

10.15 : HAMZAH MOHAMAD & ROHAYU CHE OMAR
Penggunaan nombor Niggli untuk membezakan formasi-formasi metasedimen klastik gred sederhana (The use of Niggli numbers to differentiate medium to high grade clastic sedimentary formations)

10.30 : COFFEE BREAK

SESSION V

10.45 : MOHAMMAD YAMIN ALI & AMITA MOHD. ALI
Reactivated tectonic structural constrols on morphological development of the Central Luconia carbonates

11.00 : LIEW KIT KONG
Structural development at the West-Central Margin of the Malay Basin (Basement of Blocks PM 2 and PM 7)

11.15 : IBRAHIM ABDULLAH & KAMAL ROSLAN MOHAMED
The coaxial superimposed tectonic deformations onto the sedimentary folds of the Semantan Formation (Tindanan canggaan tektonik sepaksi ke atas lipatan sedimen Formasi Semantan)

11.30 : SITI ZAUYAH DARUS
Iron oxide mineralogy in saprolites and soils over some metamorphic rocks

11.45 : MUHAMAD BARZANI GASIM, DALE BRUNOTTE, SAHIBIN ABDUL RAHIM, SAHAT SADIKUN & SANUDIN TAHIR
Gunung Danum conservation area: geological and soil aspects

12.00 : MOHAMAD ALI HASAN & CHE IBRAHIM BIN MAT SAMAN
Kesan perlombongan besi terhadap alam sekitar – tinjauan kes Bukit Besi

12.15 : ZAITON HARUN
Zon sesar Bukit Berapit

12.30 : SYED SHEIKH ALMASHOOR
The northward extension of Baubak fault in Kedah and Perlis, Peninsular Malaysia

12.45 : NORUL ASHIKIN AB. KARIM & AHMAD TAJUDDIN IBRAHIM
Geologi sekitar Jongkok Batu, Ulu Dungun, Terengganu

01.00 : LUNCH

SESSION VI

02.00 : WAN FUAD WAN HASSAN
Relationships between Sn and Au mineralizations to the granites: an example from Kuala Pilah

02.15 : YEAP EE BENG & J.J. PEREIRA
The structure and gold mineralization in the Kim Chuan Gold Mine (former Raub Mine area), Bukit Koman, Pahang

02.30 : NIZARUL IKRAM ABDUL RAHIM & G.H. TEH
Pemineralan kawalan struktur dan bijih timah berpegmatit di lombong Rahman Hidraulic Tin Bhd. (RHTB), Klian Intan, Perak

02.45 : YEAP EE BENG
Style and characteristics of the primary gold mineralization in Peninsular Malaysia

03.00 : ZAHIR YAHYA & G.H. TEH
Penemuan batuan Formasi Semanggol di kawasan sempadan Malaysia-Thailand, Kroh, Perak

03.15 : COFFEE BREAK

SESSION VII

03.30 : NORAZHAR NGATIMIN & G.H. TEH
Geology of the G. Sumalayang area, Johor

03.45 : MAZLAN ABDULLAH & AHMAD TAJUDDIN IBRAHIM
Permodelan geomagnet badan gabro Ajil-Wakaf Tapai, Terengganu

04.00 : NOR ZAINI KARIM & G.H. TEH
Petrology and geochemistry of the granitoids of the Lumut-Segarai-Pantai Remis area, Perak

04.15 : CLOSING ADDRESS

PERSIDANGAN TAHUNAN GEOLOGI '93
ANNUAL GEOLOGICAL CONFERENCE '93

ABSTRACTS OF PAPERS

The occurrence of Upper Permian foraminifers in Northwest Pahang

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Limestones at the abandoned Modal Quarry situated at Gua Panjang (Northwest Pahang) is composed of two successions separated by a disconformity (Azhar, 1990).

The lower succession is dominated by wackestones containing varying amounts of skeletal remains of crinoids and brachiopods. Diagenetic changes have obliterated many of the microfossils and benthic foraminifers were especially susceptible. Nevertheless, benthic foraminifers that had escaped destruction were observed from the middle to upper parts of the lower limestone succession. The foraminiferal assemblage is composed of *Palaeofusulina*, *Reichelina* and *Colaniella*. This assemblage bears similarities with Upper Permian foraminiferal assemblages reported from South Kelantan (Aw *et al.*, 1977) and other places in mainland Southeast Asia (Sakagami & Hatta, 1982; Fontaine, 1986). Thus the occurrence of these microfossils in the lower succession of the Gua Panjang limestones indicates that the age of these limestones is Late Permian.

The upper limestone succession overlying the disconformity is composed mainly of algal boundstone containing varying amounts of corals. One of the limestone clasts within the algal boundstone contains *Colaniella* which indicates that parts of the Upper Permian succession were exposed and eroded prior to the deposition of the algal boundstone. This is consistent with the presence of a disconformable surface separating the two limestone successions here. The age of the algal boundstone is as yet unresolved due to the absence of diagnostic foraminifers. However, evidences of a regression separating Permian and Triassic sequences have been widely reported (Fontaine, 1986). Within the Central Belt of Semenanjung Malaysia, marine sedimentation resumed during the Triassic. Thus it is highly possible that the algal boundstone of Gua Panjang could be of Triassic age.

Permian fauna and volcanic activity in the Padang Tengku area, Pahang

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Pyroclastic rocks are widely distributed in the vicinity of Padang Tengku, Pahang. Agglomerates, volcanic breccia, lapili, lapili tuff and tuff of rhyodacitic to rhyolitic composition are commonly found associated with other tuffaceous sedimentary rocks. The tuffaceous sandstones and mudstones, and limestones are commonly overlain or interfingered with these pyroclastic rocks. Limestone clasts are also found as lithic fragments in pyroclastic rocks. Fossils are usually found in the overlying tuffaceous sandstones and mudstones. The fauna

consist of brachiopods, bivalves, corals, bryozoans and trilobites. These fauna indicate warm shallow water paleoenvironment and are comparable with the Upper Permian *Leptodus* shale fauna found in the Merapoh area. The volcanic activity in this area seems to have provided a breeding niche for the studied fauna.

Batuan piroklas didapati tersebar luas di kawasan Padang Tengku, Pahang. Agglomerat, breksi volkano, lapili, tuf lapili dan tuf berkomposisi antara riodasit hingga riolit seringkali ditemui berasosiasi dengan batuan sedimen bertuf yang lain. Batu pasir dan batu lumpur bertuf, dan batu kapur kerapkali menindih atau saling menjari dengan batuan piroklas ini. Klasta batu kapur turut ditemui sebagai serpihan batuan dalam batuan piroklas. Fosil selalunya ditemui dalam batu pasir dan batu lumpur bertuf. Faunanya terdiri daripada brakiopod, bivalvia, karang, briozoa dan trilobit. Fauna ini menunjukkan persekitaran cetek berair panas dan setara dengan fauna syal *Leptodus* berusia Perm Akhir yang ditemui di kawasan Merapoh. Kelihatan bahawa aktiviti volkano di kawasan ini telah menyediakan tapak bagi membiaknya fauna yang dikaji.

Significance of bedded chert at Bukit Kodiang, Kedah

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A chert unit is exposed at an abandoned limestone quarry at Bukit Kodiang, Kedah. The chert unit consists of interbedded chert and micritic limestone. The chert occurs as layers and nodules. The thickness of the chert layers varies from 2 cm to 10 cm. The chert exhibits a slump fold. Several chert samples were collected for geochemical analysis by the XRF method. Some chert samples were treated with hydrofluoric acid to retrieve the radiolaria. Several species of radiolaria were identified. They are *Capnuchosphaera* cf. *triassica*, *Capnuchosphaera tortousa*, *Capnuchosphaera* sp., *Perispongidium* cf. *tethyus*, *Xenorum flexum*, *Rhopolodictium* sp., *Canoptum laxum*, *Triassocampe sulovensis*, *Sontonaella* sp., *Canesium* sp., *Acanthocircus usitatus*, *Canoptum* sp., *Castrum* sp., *Xiphotheca* sp., *Pseudocrucella* sp., *Sarla* sp., *Spongostylus* sp., and *Hagiastrum augustum*. The occurrence of *Capnuchosphaera* cf. *triassica*, *Capnuchosphaera tortousa*, *Xenonum flexum*, *Acanthocircus usitatus*, *Triassocampe sulovensis*, and *Hagiastrum augustum* indicates a late Carnian age (Late Triassic). The occurrence of the chert unit in the Kodiang limestone is very interesting because both rocks represent two different environments. The environment of deposition of the chert unit will be discussed.

Re-interpretation of the stratigraphy of the Gunong Semanggol Area, Perak Darul Ridzuan and its implication

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Previous workers on the stratigraphy of the Gunong Semanggol area has interpreted this area as being underlain by one formation: the Semanggol Formation, which comprises the Conglomerate Member and the Rhythmite Member (turbidite sequence). A re-study of the same outcrops led to a re-interpretation of the stratigraphy as follows:

A) A **pre-Semanggol unit** composed of a coarsening upwards sequence of a lower succession of shale and quartzite beds which is gradually replaced upsequence by beds and lenses of silica-cemented, predominantly of chert clasts-bearing orthoconglomerates. Basal scours and low-angled truncation of underlying beds, large planar and trough cross-stratifications and pebble imbrications are commonly exhibited by these conglomerates. Recrystallised radiolarias are found in some of these chert clasts; thus, detailed identification is difficult. Paleocurrent determination from the cross-stratification suggests derivation from the southwest. About 80

meters thick sequence of this unit is exposed at the Pecah Batu Quarry on the eastern flank of Gunong Semanggol. This unit is interpreted to underlie the Semanggol Formation unconformably.

B) The **Semanggol Formation** consists of a lower conglomerate-pebbly sandstone sequence overlain by a turbidite sandstone-shale sequence. The clasts in the conglomerate and pebbly sandstones are more varied and include blocks of pre-Semanggol silica-cemented, chert-bearing orthoconglomerate. 1 m large planar cross-stratification are common on this lower sequence, from which paleocurrent determination indicate a westerly source. The upper turbidite sequence is well-exposed further to the north, where ammonites have been found near Kampong Kubu Gajah. Several thick conglomerate beds are present in the turbidite unit. Paleocurrent determinations from the flute marks of the turbidites indicate a westerly-directed flow which is similar with the paleocurrent determination from the asymmetrical ripple marks on the thinner sandstone beds.

An important implication of this re-interpretation of the stratigraphy is that there was a major tectonic event disrupting the deposition of an older chert sequence preceding the deposition of the pre-Semanggol unit. A significant time lapse was required to cement and lithify this pre-Semanggol sequence before part of it was subjected to be broken and incorporated as blocks into the Semanggol Formation.

Further work to date the chert clasts and the older part of the Semanggol Formation more precisely is being carried out so as to refine the timing of the events suggested here. Detailed petrographic study of the turbidites, the conglomerates and pebbly sandstones will be carried out to determine if there are more than one source areas as suggested by the paleocurrent determinations.

Fasies batu kapur Formasi Semantan
(Limestone facies of the Semantan Formation)

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Formasi Semantan terdiri daripada selang lapis batu pasir tuf dengan syal berkarbon dan batu lodak, dan juga konglomerat serta kekanta batu kapur. Kebanyakkan batu kapur yang terdapat dalam Formasi Semantan telah terhablur semula dan terdiri daripada hablur kalsit yang berbutir halus hingga sederhana, dan struktur dalamannya telah musnah oleh proses diagenesis. Fosil gastropod dan juga batang krinoid ada dilaporkan terdapat dalam fasies batu kapur ini. Batu kapur yang ada tidak memperlihatkan hubungan yang jelas dengan fasies lain yang terdapat dalam Formasi Semantan.

Satu singkapan baru yang mendedahkan fasies batu kapur Formasi Semantan terdapat di kawasan perindustrian Mentakab, di tepi jalan raya 'Mentakab-Temerloh by-pass'. Di sini, batu kapur tersingkap sebagai beberapa kekanta yang berselang lapis dengan syal dan juga batuan tuf Formasi Semantan. Kekanta batu kapur ini kelihatannya menipis pada kedua belah arah. Jurus fasies batu kapur ini sama atau selaras dengan kedudukan batuan syal yang terdapat di bawah dan atasnya.

Fasies batu kapur mempunyai sekurang-kurangnya dua jenis mikrofasies. Fasies pertama ialah batu kapur oosparit dan fasies kedua ialah batu kapur mikrit yang mempunyai fosil gastropod dan juga krinoid. Kewujudan batu kapur oosparit belum pernah dilaporkan terdapat dalam Formasi Semantan, dan akan dijelaskan di sini. Batu kapur oosparit ini mencadangkan sekitaran laut cetek. Ini menunjukkan tidak semua batuan Formasi Semantan terendap di sekitaran laut dalam seperti yang ditafsirkan sebelum ini.

Semantan Formation is comprised of a rapidly alternating sequence of carbonaceous shale, siltstone and tuffaceous sandstone with a few lenses of conglomerate and limestone. Most of the limestone facies was recrystallised and is composed of a mosaic of fine to medium-grained anhedral calcite, and internal structure was not clear or damaged due to diagenesis. Gastropods and crinoid stems were also reported in this limestone facies. The relationship between limestone and other facies of the Semantan Formation was not clearly demonstrated.

A new outcrop of limestone facies was exposed at 'Mentakab Industrial Park', near Mentakab-Temerloh by-pass. This lense of limestone was conformable and interbedded with shale and tuffaceous material of Semantan Formation. At least two limestone microfacies are recognised; oosparite limestone and micritic limestone. Oosparite limestone is interpreted as a shallow water limestone, and this indicates that not all of the Semantan Formation was deposited in the deep sea environment as previously interpreted.

Tethyan/Indo-Pacific microfloral provincialism during the Late Jurassic/Early Cretaceous period

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South-East Asia is situated in a transition zone when assessed in terms of Palaeozoic and Mesozoic palaeobiotic provincialism, and much work has been accomplished concerning both the palaeofloral and palaeofaunal affinities displayed by the fossil record within the region. Without exception, these studies have concentrated wholly upon the terrestrial affinities of the palaeoflora, or the oceanic affinities of neritic invertebrate faunas. No work to date has been published concerning the palaeo-floristic affinities of the marine benthic calcareous algae, an important group in the formation of Phanerozoic reef complexes.

Progress made to date in determining the palaeo-floristic affinities of the Mesozoic benthic calcareous algae found within various sub-neritic deposits of east and south-eastern Asia is detailed, together with the methods utilised for the recognition of such features within the assemblages examined. Palaeoclimatic and palaeobiogeographic influences most likely to have affected the dispersal and distribution of marine microflora within the region during Jurassic/Cretaceous times are then discussed, and the inferences drawn from this compared and contrasted with the known provincial affinities of the contemporaneous regional terrestrial and marine biotas. Finally, the possibility that the South-East Asian region constitutes a distinct microfloral subprovince within the Late Jurassic/Early Cretaceous Tethyan/Indo-Pacific transition zone is explored, and evidence supporting this concept expounded.

Spora Kapur dari Paloh, Johor

(Cretaceous spores from Paloh, Johor)

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Beberapa sampel batuan klastik di sepanjang jalan Paloh-Kluang telah dianalisis untuk mengkaji kandungan palinomorf di dalamnya. Kebanyakan palinomorf yang diperolehi terawet dalam keadaan hampir sempurna dan membolehkan kajian sistematik dilakukan. Himpunan spora yang dikenal pasti menunjukkan persamaan dengan Himpunan Stylosus (Dettmann, 1963) iaitu berusia Kapur Awal (Berriasian-Valanginian). Usia yang dicadangkan ini juga disokong oleh kehadiran *Cicatricosisporites australiensis*. Genus *Cicatricosisporites* bersama-sama dengan debunga juga dilaporkan oleh Muller (1968) dari Sarawak yang berusia Kapur Tengah (Albian-Cenomanian). Walau bagaimana pun, berdasarkan kepada kandungan debunga yang amat sedikit dalam sampel yang dikaji, himpunan spora ini adalah lebih mirip kepada Himpunan Stylosus. Penggunaan himpunan spora dalam kajian ini adalah satu langkah pilihan dan sebagai penyokong dalam penentuan usia batuan yang biasanya berdasarkan kandungan fosil makro.

Several clastic rock samples along Paloh-Kluang road were palynologically analysed. Most of the observed palynomorphs are fairly well-preserved and could be studied systematically. The identified spore assemblage shows some similarities with that of the Stylosus Assemblage (Dettmann, 1963) which is of early Cretaceous age (Berriasian-Valanmginian). The proposed age is also supported by the presence of *Cicatricosisporites australiensis*. The genus *Cicatricosisporites* together with several pollen from Sarawak of Mid-Cretaceous (Albian-Cenomanian) was also reported by Muller (1968). However, based on the scarcity of pollen in the present samples, the spore assemblage is comparable to that of the Stylosus Assemblage. The use of the spore assemblage in this study is an alternative method and as a supporting evidence to determine the age of the rock which was commonly based on the macrofossils content.

Biostratigraphic characterisation of stratigraphic sequences in the Malay Basin

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An important key to the successful prediction of new hydrocarbon plays in petroleum exploration is the accurate assessment of depositional systems within a sequence stratigraphic framework.

Many features of depositional systems are reflected by their biostratigraphic character, marine flooding surfaces may be indicated by abundance and diversity maxima of planktonic and benthonic foraminifera and also nannofossils, whereas lowstand, transgressive and highstand depositional systems may be distinguished on the basis of their miospore content.

This paper attempts to examine the biostratigraphic succession for the Malay Basin, and present suggestions as to how depositional systems there may be interpreted through the examination of biostratigraphic and wireline log data.

Tertiary palynomorphs from Batu Arang, Malaysia

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Tertiary coal bearing sequence of Batu Arang yielded abundant and well preserved palynomorphs. Analysis of the palynomorph assemblages indicate that the age of the coals is probably Eocene to Oligocene. Climatic conditions at the time when the coals were deposited were somewhat seasonal as suggested by the abundance of *Pinuspollenites sp.*, *Nyssapollenites sp.*, and *Lagerstroemia sp.* The environment of deposition was lacustrine as indicated by the abundance of the freshwater algae, *Pediastrum sp.*, and *Botryococcus sp.*

Palynology of Late Quaternary sediments of piston-core KL-139 from Sabah Trough, East Malaysia

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Five palynological assemblage zones were delineated; Zone SB-5 (1300-1100 cm), Zone SB-4 (1100-950 cm), Zone SB-3 (950-300 cm), Zone SB-2 (300-59 cm), and Zone SB-1 (59-0 cm).

Zone SB-5 represents a glacial period in the late Pleistocene. The climate was cold and dry, which led to the expansion of montane vegetation. Lowland cover contracted as precipitation was reduced. Sea level was low which led to the reduction of mangrove vegetation.

A sea level high represented in SB-4 zone, caused the mangrove cover to expand. The climate was warm and wet. Montane vegetation was reduced while lowland vegetation expanded. This zone probably represent an interglacial or interstadial period.

Zone SB-3 represents a subsequent extensive sea level fall during the last worldwide Pleistocene glacial period. The cooler and possibly drier climate caused montane forest to expand to lower altitudes. Expansion of lowland vegetation at the end of this period indicates climatic amelioration. Fern spore percentages increase are mainly associated with high fluvial activity.

A rapid sea level rise at the onset of Zone SB-2 could represent the Pleistocene-Holocene boundary. The mangrove cover expanded, lowland vegetation was established, and montane vegetation retreated to its present altitudinal range.

The Nenering Sequence: Sedimentology, stratigraphy and probable basin initiation – A second opinion

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Lithology, bedding shape and forms, sedimentary textures and structures suggest that the sedimentary sequence along Kg. Ayer Panas-Kg. Lalang road at the vicinity of Sungai Kuak, Keroh, Perak, was deposited by fast-flowing, short-lived (ephemeral), ever-changing through avulsion, kind of streams/gullies on the foot slopes of 'recently' uplifted terrain.

Grain and clast composition suggest that the materials making up the sedimentary sequence were derived predominantly from the erosion of granitoid terrain; sedimentary terrain constitute a minor provenance.

Although it is tempting to interpret this sedimentary sequence as of Tertiary age or even younger, its palynological study and disposition may suggest otherwise.

The northeast-southwest striking faults that are partly followed by Sungai Kuak were pre-Nenering and were still active during the deposition of the sequence.

The sequence has previously been interpreted by other workers as of Tertiary age.

The significant occurrences of *Parateichichnus pilulacopia* and *Hydrancyclus paracaulis* (trace-fossils) in the Kudat Formation, Bengkoka Peninsula, Sabah and Temburong Formation, Labuan

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Distinct large pelletiferous burrows preserved as sideritic concretions were first described from the Oligocene to Lower Miocene Temburong Formation turbidite claystone beds of south Kiam Sam and Rancha-Rancha in Labuan by Lee (1977). These were studied in detail and named *Parateichichnus pilulacopia* by Yap (1980). Another type of sideritic, cauliflower-like burrow, named *Hydrancyclus paracaulis* by Yap (1980), was also described from the distal turbidite beds of Labuan.

Both these very distinctive burrows were found together in mudstones interbedded with turbidite sandstones in the Kudat Formation in north Bengkoka Peninsula indicating a close relationship and correlation between the two formations.

Dent group and their subsurface equivalent in the offshore Kinabatangan area, East Sabah

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The field studies and seismic interpretation have recently been conducted on the Dent Peninsula and their offshore area, which is known as Exploration Block SB-6 of which Western Mining Cooperation (WMC) is the operator. The studies indicated that the deposition of the Dent group which consists of the Sabahat, Ganduman and Togopi formations are similar from west to east in the offshore as on the onshore area.

On the onshore Dent Peninsula, the Togopi Formation is mainly made up of marls. The Ganduman Formation displays well preserved outcrops of delta plain deposits grading to shallow marine deltaic and holomarine eastward. The argillaceous Sabahat Formation is interpreted to be of holomarine deposit. In the offshore, on seismic, the Ganduman Formation is represented by the well expressed topset, while the Sabahat is represented by the clinoform and downlap seismic packages. These formations are believed to be derived from an older formation which is not seen on the onshore Dent Peninsula but it is preserved in the offshore Kinabatangan area of Block SB-6. This formation is of age equivalent to the Tanjung Formation which formed the semi-circular basins onshore in Sabah.

Miocene giant rhinoceroted *Baluchitherium* from the Bugti Hills, Pakistan and its paleobiogeographic importance

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The Neogene vertebrate mammalian faunas from the Siwalik Group rocks of the Himalayan Foreland basin of Pakistan and adjoining regions of India documents several immigration events from Africa, Central

Asia and Europe along with *in-situ* speciation in some taxa. Five major immigration events have been recognised in the Miocene and Pliocene whereas *in-situ* speciation are well documented in Murids, Rhizomyids, Rhinocerotids, Bovids and Tragulids. One of the earliest immigration events in the earliest Miocene times (circa 20-22 Ma) brought several large mammal taxa mainly from Central Asia whose remains are found in the Chitarwata Formation of the Bugti Hills in Central Pakistan. The deposits suggest a peneplain landform near to the shore-line with climate supporting luxuriant forests. The vertebrate fauna recovered from the early Miocene Chitarwata Formation is dominated by rhinocerotids and antharacotheriids, most of which have affinites with Central Asia, Mangolia, and North Africa. This large-mammal dominated fauna from the Chitarwata Formation is replaced upwards by medium and small-sized mammals of mainly East African origin. Included in early Miocene/Chitawata fauna are the fossil remains of the largest land-mammal, the *Baluchitherium*, *Baluchitherium* from the Bugti Hills so far was mainly known from the limb bones, pelvic and podial fragments. Most of these collections came from the Chur Lando Quarry. The recent Geological Survey Expedition has discovered a well-preserved skull with associated mandible from an area perhaps close to the Chur Lando Quarry. This single cranium specimen from the Bugti Hills appears to be a bit smaller than the *Baluchitherium grangeri* from the Loh area, Mangolia. It has simple rhinocerotid molar and premolar patterns with a domal skull without nasal horns.

Poisson's ratio of water saturated alluvium in Penang from shallow seismic refraction

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Applications of shallow seismic refraction in groundwater modelling and engineering site investigation are limited, to a great extent, to P-wave energy recorded on single-component vertical geophones or pressure sensitive hydrophones. The use of explosive sources, and mechanical sources designed to mimic in some way explosive sources, the simplicity of single component seismometer recording data, and, the requirement of determining the transit time as best served by the early arriving P-wave seismic energy are reasons for this constrain. On the other hand the particle motion of transverse S-waves depends on different elastic parameters and thus can provide valuable independent information on the *in-situ* pore-fluid content and geotechnical properties of the ground.

The purpose of this study is to examine the characteristics of Poisson's ratio for three different alluvial soil units found in Penang: (a) clean bench sand, Teluk Kumbar (b) marine clays, Balik Pulau and (c) weathered granite soil cover, Bukit Gambir. Values of P and S-wave velocities are determined in the field by the refraction method using an engineering seismograph. Conventional shallow hammer seismics yield adequate signal resolution over a 50 meter line. Horizontal shear waves are generated by striking one end of a thick timber railway sleeper aligned perpendicular to the profile line. Enhanced coupling between the S-wave source and ground is achieved by bolting long metal spikes to the timber sleeper so that it can be driven into the ground. A horizontal geophone is used to record the SH-wave arrivals. A polarity switch feature on the seismograph aids in correct S-wave identification.

In (a) we distinguish a dry sand on top of the fully water saturated sand with Vp; Vs; Vp/Vs; and Poisson's ratio (σ) of 370 ms^{-1}, 1600 ms^{-1}, 180 ms^{-1}, 360 ms^{-1}; 2.03, 4.44, and 0.34, 0.47 respectively. For the marine clays in (b) we obtained a 2 layer dry-wet configuration with Vp = 350 ms^{-1}, 1400 ms^{-1}; Vs = 190 ms^{-1}, 510 ms^{-1}; Vp/Vs = 1.84, 2.96; and σ = 0.29, 0.42 for the first horizon and a fully water saturated second horizon respectively. For comparison, in (c), the gradational change of velocity with depth in weathered granite cover in a 2 layer model is characterised with Vp = 480 ms^{-1}, 830 ms^{-1}; Vs = 240 ms^{-1}, 420 ms^{-1}; Vp/Vs = 2.04, 1.97; σ = 0.34, 0.33 for the first and second velocity discontinuity respectively.

Our study suggests that in lithologic characterization, valuable information can be derived from values of both P and S-wave velocities. Poisson's ratio (σ) and the more simple and easier to use Vp/Vs ratios are sensitive to lithologic types and amount of water saturation or indirectly the porosity in it, and can prove useful in groundwater mapping. The combined use of P and S-wave velocities in depth estimation affords a more stringent control in the presence of intermediate velocity layers, especially in water saturated alluvium.

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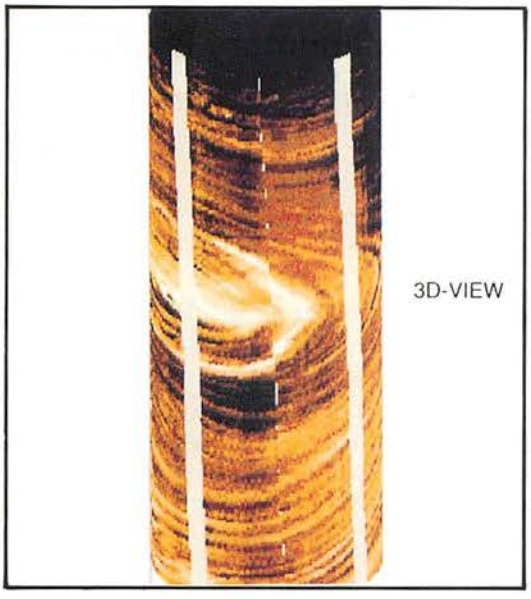
Fullbore Micro Imager*

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

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

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

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



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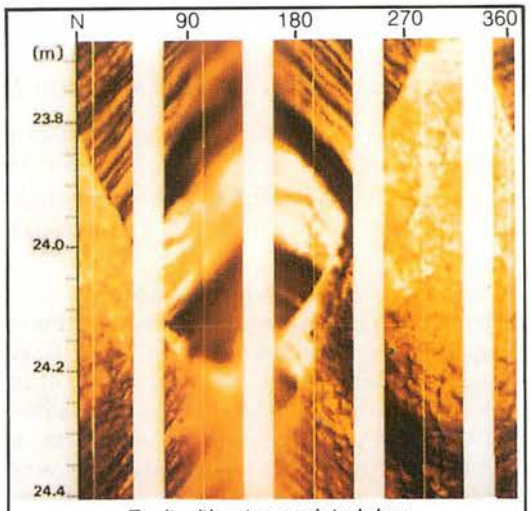

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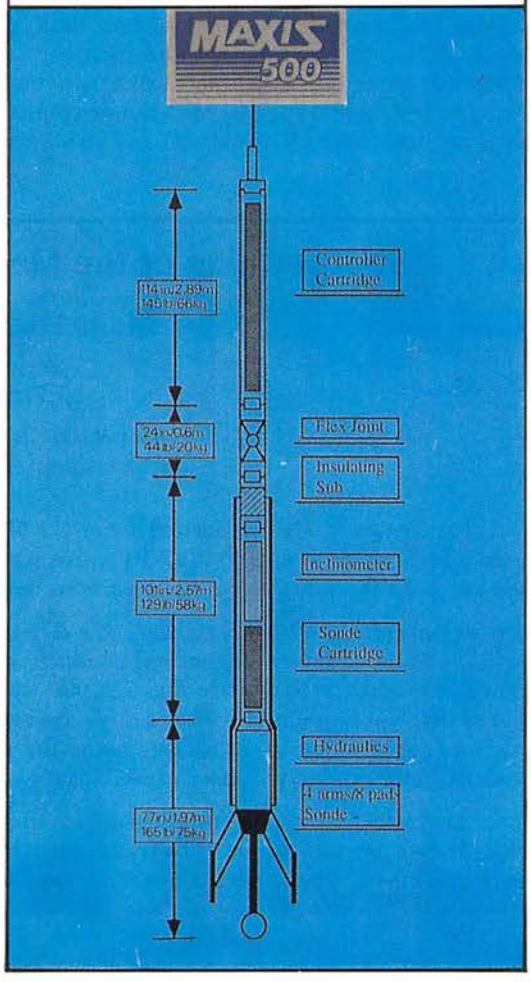

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Interpretation of seismic attributes in detecting fluid contacts – case history: Tembungo Field

IZMAN HAMID & IDRUS MOHD SHUHUD

Exploration Technology
E & P Research Division
PETRONAS Research & Scientific Services Sdn. Bhd.
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Tembungo Oil Field, which is located 75 km offshore, NW of Kota Kinabalu, Sabah, East Malaysia, in the water depth of 85 m, represents the only "turbidite play" reservoir in Malaysia to date. The field is a NE-SW trending anticline, dissected by several NNW-SSE normal faults. The major production of the field comes from the "Tembungo Sandstones". The sands are of turbidite/mass flow type, apparently deposited in a series of bifurcating channels of a lobe complex of a submarine fan. The deposition nature of Tembungo Sandstones, coupled with the poor quality of seismic data, especially in the zones of interest, make the prediction of hydrocarbon and fluid contacts in a reservoirs very challenging and subjective. This paper describes the usage of interactive seismic interpretation workstation, in extracting and displaying seismic attributes for stratigraphic interpretation.

Based on three-dimensional seismic data, direct hydrocarbon indicators (DHIs), including amplitude anomaly, phase change, flat spot and frequency attenuation zone which are associated with gas caps were investigated using full attributes extraction method. Interpretation of seismic data and integration of information from wells suggest that the existence and distribution of the DHIs in Tembungo Field and fluid contacts are controlled by structural and stratigraphic factors.

Geothermics of the Malaysian Sedimentary Basins

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A geothermics study was carried out on the Malay, Sarawak and Sabah basins. Establishing the thermal regimes and heat flow distribution in these sedimentary basins will assist in improving the geological knowledge and the evaluation of hydrocarbon resources potential.

A geothermal gradient database was constructed from well data and temperature data of over 400 exploration wells. Measured thermal conductivity data from previous work were revised, while recently measured thermal conductivities of post-1980 wells were incorporated into the database. In addition, the measured thermal conductivities were correlated with neutron porosity index, sonic interval transit time, bulk density and gamma ray, to obtain calculated thermal conductivities. This method was found to be viable in deriving thermal conductivities from well logs.

Geothermics maps, consisting of geothermal gradient, thermal conductivity and heat flow, were produced. Results reveal a decreasing heat flow trend, with the Malay basin showing the highest heat flow and the lowest in the Sabah basin. These results are consistent with previous work done by other authors.

Penyiasatan tapak dengan bantuan kaedah kerintangan geoelektrik
(Site investigation with the aid of geoelectrical resistivity method)

ABDUL GHANI RAFEK & ABDUL RAHIM SAMSUDIN

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Penggunaan kaedah kerintangan geoelektrik untuk penentuan keadaan bawah tanah boleh dikatakan sudah mencapai tahap routin dalam kerja-kerja penjelajahan geofizik kejuruteraan. Kedua-dua aturcara pengukuran iaitu pengukuran duga dalam kerintangan geoelektrik dan pemetaan atau pemprofilan kerintangan geoelektrik mendatar boleh digunakan untuk tujuan tersebut. Walau bagaimanapun kejayaan survei geoelektrik ini dipengaruhi oleh beberapa faktor, diantaranya ialah kesesuaian kaedah geoelektrik dari segi teori, keadaan bawah tanah dan keadaan di lapangan yang boleh mempengaruhi kejituan pengukuran. Dua contoh dipersembahan untuk menunjuk keberkesanaan kaedah kerintangan geoelektrik ini.

Dalam contoh pertama, kehadiran lapisan-lapisan lembut seperti lempung dan gambut dalam endapan Kuaterner perlu ditentukan. Lapisan Kuaterner ini berselang lapis dengan lapisan-lapisan pasir. Survei duga dalam kerintangan geoelektrik telah dijalankan di kawasan di mana terdapat lapisan lempung di bawah tanah dan juga di kawasan di mana lapisan tersebut tidak wujud. Dua jenis lengkung kerintangan ketara yang jelas berbeza diperolehi daripada kedua-dua kawasan tersebut. Kewujudan lapisan lempung dapat dikorelasikan dengan lengkung kerintangan ketara yang mempunyai ciri-ciri tertentu.

Bagi contoh kedua, duga dalam survey kerintangan geoelektrik dapat mengesan kewujudan lapisan batuan dasar terluluhawa yang tidak dapat dikesan oleh kaedah seismos biasan. Lapisan tersebut dapat dikesan kerana nilai kerintangan spesifiknya berbeza daripada batuan dasar dan lapisan-lapisan Kuaterner yang meliputinya.

The geoelectrical resistivity method can be considered as having achieved the status of a routine method in engineering geophysics for the determination of subsurface conditions. Both types of survey techniques, that is the geoelectrical resistivity sounding and horizontal resistivity profiling or mapping can be applied. The success of these techniques however is influenced by several factors, amongst them the theoretical suitability of the method, subsurface conditions and field conditions that can influence the accuracy of measurements. Two examples are presented here to illustrate the effectiveness of the geoelectrical resistivity method.

In the first case, the presence of soft clay and peat layers within Quaternary sediments had to be determined. These Quaternary layers were interbedded with sand layers. Geoelectrical resistivity soundings were conducted in those areas where clay layers were present and also where no clay layers were present. Two distinct apparent resistivity curves were obtained from the two different areas. The presence of clay layers could be correlated with a specific and characteristic apparent resistivity curve.

In the second example, resistivity soundings enabled the detection of a weathered rock layer which was not detected by refraction seismics. This layer was detected because its specific resistivity was different from the bedrock itself as well as the Quaternary sediment overlying it.

Geophysical study of Kuala Betis, Kelantan

ABDUL RAHIM SAMSUDIN *et al.*

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Gravity and magnetic traverses were conducted along two logging tracks in the vicinity of the Kuala Betis area. The traverses run almost perpendicular to the regional NS strike and lithological boundary of the Triassic and Palaeozoic rocks in the study area. The gravity and magnetic profiles indicate the presence of a few kilometre wide anomalous zone at the boundary between the two rock types. This feature could be related to the suture zone of the Malay Peninsula widely known as the "Bentong Suture".

Geological applications of digitally processed thematic mapper data in Kuala Betis, Kelantan Darul Naim: a preliminary interpretation

(Penggunaan data Landsat "Thematic Mapper" yang diproses secara digit untuk kajian geologi di Kuala Betis, Kelantan Darul Naim: satu tafsiran awalan)

JUHARI MAT AKHIR

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This paper describes the use of digitally processed Landsat Thematic Mapper (TM) data for geological applications in Kuala Betis, Kelantan. The area includes Paleozoic metamorphic rocks in the western part while Permian-Triassic sequences of sediment-pyroclasts of the Gua Musang Formation cover the eastern side. Landsat Thematic Mapper data was digitally processed with the objective of producing more interpretable images. The processes include contrast enhancement, rationing, principal component analysis, filtering and the combination of images as colour composites. A combination of spectral and textural characteristics was used to identify the main rock types in the area. Geological structures, especially linear features, were best shown by digital convolution using a filtering technique. The enhanced images reveal new prominent lineaments, probably faults which have not been reported before.

Kertas ini membincangkan tentang penggunaan data Landsat "Thematic Mapper" (TM) yang diproses secara digit bagi tafsiran geologi kawasan Kuala Betis, Kelantan. Kawasan kajian amnya terdiri daripada batuan metamorf berusia Paleozoik di bahagian barat dan jujukan sedimen-piroklas Formasi Gua Musang berusia Perm-Trias di sebelah timur. Data Landsat TM telah diproses secara digit bagi menghasilkan imej yang baik untuk tafsiran geologi. Beberapa teknik pemprosesan yang terlibat termasuk paparan imej warna, penisbahan, analisa komponen utama serta penapisan. Paduan antara cirian spektrum dan tekstur telah digunakan untuk mengenali batuan utama di kawasan kajian. Maklumat struktur, terutamanya fitur linear, dipaparkan dengan jelas menggunakan teknik penapisan. Imej Landsat TM yang telah diserlahkan memperlihatkan beberapa lineamen utama yang mungkin mewakili sesar yang belum dilaporkan terdahulu.

Analysis of geological material by Inductively Coupled Plasma Spectrometry (ICP-AES)

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Inductively coupled plasma-atomic emission spectrometry (ICP-AES) is a well-established multi-element technique which is routinely used for geochemical analysis.

Using international standards and Malaysian geological materials, it is demonstrated that all the major elements and a wide range of trace elements can be determined by ICP-AES.

The technique displays excellent sensitivity for many low atomic member elements like B, Be, Li, P and S; the alkali earths like Ca, Mg and Sr; refractories like Al, Ti and Zr; the rare-earth elements (REEs), Sc and Y. The number of elements determinable varies depending on the sample type and preparation procedures used.

The ICP-AES technique compares favourably with AAS and XRF for the determination of major and trace elements in a wide range of matrices.

Assessing the adsorption capability of a clay soil

TAN BOON KONG

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The "sanitary landfill" method is **the** method used world-wide for the proper disposal and management of solid wastes, including municipal solid wastes and toxic wastes. A key component in the "sanitary landfill" is the underlying clay liner which acts both as a physical barrier to impede or retard leachate migration, as well as a medium for the adsorption or retention of chemical or microbial pollutants. The suitability of a candidate clay soil that is to be considered for use as a clay liner depends on, among other factors, the adsorption capability of the soil.

This paper discusses two laboratory methods that are commonly used in the assessment of the adsorption capability of a clay soil, namely: the batch equilibrium method, and the leaching column test. The batch equilibrium method involves shaking a sample of the clay soil in a chemical solution (or leachate solution) and measuring the amount of pollutants adsorbed by the soil. The leaching column test involves passing a chemical solution (or leachate) through a compacted soil column, and monitoring the migration of the particular chemical species of interest as flow proceeds. Results from both methods can then be used to assess the adsorption capability of the clay soil.

Several examples are provided to illustrate the use of these two methods.

The application of engineering geological mapping in the design and construction of roadways

MUHINDER SINGH[1] & MOGANA SUNDRAM[2]

[1]Pengurusan Lebuh Raya Berhad
[2]G.E.M. Exploration Sdn. Bhd

Engineering geological mapping is necessary for the planning, design and construction of civil engineering works, especially for major roadways.

The types and detail of the mapping should always be directed towards providing information sufficient for understanding the relationship between the geologic environment and the engineering requirement of the works.

This paper describes the identification of the mapping requirements, the processes in acquiring the relevant data and the interpretation of such information. The benefit of experience and geological training in such undertakings are also discussed.

A worked example is presented to highlight the pertinent aspects of the mapping works.

Coal mining and ground surface subsidence at Batu Arang, Negeri Selangor Darul Ehsan

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Coal mining has been carried out at Batu Arang for some 45 years, from 1915 to 1960, with both surface and underground workings. The coal was mined from two main seams; the Upper Seam (some 15 m thick) and

the Lower Seam (about 8 m thick). These seams, which are stratigraphically some 65 m apart, are interbedded with shales, clays, siltstones and sandstones of a Late Oligocene to Miocene age that have been termed the "Coal Measures". These gently dipping sedimentary rocks outcrop in the form of a plunging syncline and unconformably overlie meta-sedimentary rocks of mainly quartzites and phyllites of an Upper Palaeozoic age. The "Coal Measures" are unconformably overlain by a probable Pleistocene sequence of boulders, pebbles and sub-angular fragments of quartzite in a sandy to gravelly matrix that have been termed the "Boulder Beds". The strata of the "Coal Measures" are cut by a few normal faults and contain closely spaced joints that are mostly developed perpendicular to bedding.

Mapping of past and present features of ground surface subsidence, including depressions and sinkholes (pits), and their effects on man-made structures, shows that their development is closely related to the underground coal workings. Depressions have developed as a result of the gradual down-warping (or convergence) of overburden into underground openings, whilst sinkholes have formed where the caved overburden material has been able to move laterally into adjacent openings.

The most recently occurring depressions and sinkholes have developed over the shallower, earliest underground coal workings, as well as those made during the Second World War, and in a few cases, over some post-War workings. Depressions and sinkholes developed in earlier periods also show a similar relationship and this is to be expected in view of the limited roof support and stowage in the underground workings. In some cases, depressions and sinkholes have developed over bricked or timbered workings.

Several factors are responsible for the development of the depressions and sinkholes, though the most important factor has been the decrease (with time) of the strengths of the coal seams and overburden materials. In view of this temporal relationship, it is considered that several sites in the area will continue to be affected by the development of depressions and sinkholes.

Integration of geophysical and geotechnical techniques in site investigation: A case study of a karstic area

UMAR HAMZAH, KHAIRUL ANUAR MOHD. NAYAN &
ABD. RAHIM SHAMSUDDIN
Institut Kerjaraya Malaysia

An integrative approach of geophysical and geotechnical techniques have been applied to the site investigation of the subsurface karstic area in Ipoh. The vertical electrical sounding, profiling and the pole-dipole resistivity methods were integrated with the shallow seismic refraction survey. Comparisons were made with results from the boreholes and the JKR probes.

The study found that the method most suitable to detect cavity was the pole-dipole technique. The vertical electrical sounding was more accurate in locating the water table and the shallow seismic refraction was more accurate in locating the bedrock boundary.

Both the standard penetration test and the JKR probe blow count decreases before bedrock was reached at areas where cavities were found.

The story of Gemencheh Dam II

TAN BOON KONG
Jabatan Geologi
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The Gemencheh Dam is planned to provide domestic and industrial water for the central and eastern region of Negeri Sembilan up to the year 2015. It will consist of an earthfill dam 40 m high spanning the Gemencheh river 8 km upstream from Gemencheh township.

Two possible damsites were investigated, namely the original proposed damsite (p.d.s.) and the alternative damsite (a.d.s.) about 300 m downstream from the original proposed damsite. In addition, a small dyke or saddle dam located at the Johol estate was also investigated. Other investigations include possible quarry sites and borrow pits.

The p.d.s., the a.d.s. and the Johol dyke are all located within the Pilah Schists with quartz-mica schist predominating at the damsites, and quartzite predominating at the Johol dyke. At the damsites, the foundation substrata comprise: alluvium (thin), residual soils of Pilah Schists, and bedrock (schists or quartzite). The bedrock is weathered to various degrees ranging from grade II to III. Depth to bedrock ranges from 20-25 m in the valley and up to about 40 m on the abutments. Permeability values for the residual soils of the Pilah Schists at the dam foundations range from 10-4 to 10-7 cm/sec; while permeability values for the bedrock range from 0 to 43 Lugeon units, with many values exceeding 10 Lugeon units, i.e. high permeabilities. The frequent occurrencs of "core loss" sections within the bedrock would indicate numerous fractures or highly weathered zones within the bedrock, hence high permeabilities.

Suitable granitic rocks and soils are available in the granite hills (Main Range Granite) – 2 km west of the damsites. The uppermost 1-3 m of clayey soils within the granite residual soil profiles are particularly sourced for use as clay-core material. Unfortunately, the quantity of river sand available appears to be limited, and recourse may have to be sought in using quarry fines (e.g. from existing quarry) for filter material.

A pseudofossil in the Kayan Sandstone at Santubong, Sarawak

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A thin interbed of iron-rich mudstone within thick-bedded, fine to medium grained Kayan Sandstone at the west side of the Santubong peninsula has been differentially weathered and abraded into a large sword-like outcrop. Regular segmentation of the structure by cross fractures and a thin envelope of wavy crust cause the feature to resemble a reptilian tail. To the discoverers (who are non-geologists) the large dimensions of the "tail" seem to represent part of a dinosaur or a crocodile.

The sandstone is in right-side up position and has abundant medium-sized, irregularly shaped trough laminations. Closer inspection reveals loadcasted sand balls and penecontemporaneous slump foldlets on the structure, consistent with hydroplastic conditions in rapidly deposited sand. The unusual appearance of the outcrop has also been enhanced by differential weathering and by wave abrasion that had obliquely cut across the slanting interbed and sandstone.

Geological and hydrogeological perspectives on the waste disposal system in Terengganu and Pahang

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Field investigations and desk studies on the various accessible sites of the waste disposal system in Terengganu and Pahang proved that little or no geological and hydrogeological consideration have been undertaken in determining the present sites. Although much information and experience in landfill design and operation has been obtained in recent years, only a few landfill sites have been investigated to meet the current standards for an environmentally acceptable landfill. In view of the increasing public concern and professional understanding of the waste (domestic) disposal problems, the standards for current practices of landfilling of domestic wastes need to be improved even further within the immediate year(s) to come.

It is in this context, that this brief presentation will touch upon the following themes:-

(i) A broad overview of the waste disposal system currently being practised in Malaysia.
(ii) Assessment of the management and controls of waste disposal system.
(iii) Geological and hydrogeological perspectives of the existing waste disposal sites – The case of Terengganu and Pahang.
(iv) Environmental aspects of waste disposal system.
(v) Conclusion and suggestions.

Through the above presentation, it is hoped that the public at large will be more responsive and conscious of the need to participate actively in safe guarding the environment through the existing/chosen waste disposal system. Others who are responsible for the proper care of the waste disposal system, should take the necessary steps and controls, so as not only to ensure the cleanliness and beautification of the waste disposal sites but also the environment and the resources as a whole.

Classification of excavated material based on laboratory testing

MOHD FOR MOHD AMIN
Jabatan Geoteknik & Pengangkutan
Fakulti Kej. Awam
Universiti Teknologi Malaysia
Skudai

During the past decade the norm of contract specification on earthwork is to classify the method of excavation based on two categories of materials, either soil or rock. The problem arises from an unclassified intermediate material which does not fit the description as documented in the contract specification. Failure to address this problem in the contract document may result in delays and an increase in project cost is unavoidable. Thus, there is an urgent need for a more detailed and comprehensive contract specification, particularly pertaining to the engineering properties of excavated material.

Three types of tests are proposed to assess the engineering properties of the material which are related to the mode of excavation. The tests consist of Schmidt rebound hammer test, sonic velocity test and point-load test.

Data obtained from these tests were plotted against standard charts used by the construction machinery supplier and the plotted values may serve as guidelines in selecting the suitable method of excavation.

The geomorphology of southeast Johor

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A geomorphological study of southeast Johor was conducted to assess the influence of environment on landform. The study showed that the present geomorphic expression of southeast Johor is a result of several dynamic processes operating in the present and in the past. The geological structure and lithology of the region exert a strong influence on the drainage network, relief expression and the shape of the coastline. The structural directions that have the strongest influence on landforms are the northwest and north-northwest regional strike directions as well as the west-northwest direction corresponding to the Mersing fault zone.

Gentle and discontinuous tilting due largely to the isostatic adjustment of the landmass was also noted. Tilting was in small blocks of landmass. Major tilt directions are in the southwest, north-northeast and northwest directions. West and north tilt directions were also noted.

Sea-level changes occurred on several occasions. Abrasion terraces occurring at 4-5 m are considered to

be the result of the marine transgression at 5,000-6,000 y BP. Higher levels of flat surfaces are due to a combination of the effect of sea-levels and tilting of the landmass.

Preliminary study on the Pahang River Delta

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A short, preliminary site study of the present-day Pahang River delta indicates that although marine wave regimes are dominant as exhibited by the cuspate-shaped delta, tidal and fluvial influences are substantial as evident from the within-channel bar morphology and bedforms. Further detail studies are necessary to understand the interacting influences of the waves, longshore current drag, tidal surge, and fluvial flows, in order to build a sedimentary model for this rather unique system.

Brief preliminary topographic map and satellite imagery studies indicate that the Pahang River was not static. It has undergone at least two avulsion; the present day delta is in the middle, the one prior to it flowed northeast along the almost abandoned Sungai Pahang Tua, and the earliest traceable one flowed southwest, probably along the abandoned Sungai Miang; together they make up the Pahang Delta System.

The Pahang River Delta System makes a unique yet challenging case study of a tropical/equatorial dominantly wave-dominated delta system, but it calls for strong financial and manpower support for acquiring, among other data, sedimentary cores and shallow seismic investigations.

Chemical patterns and evolution of the batholiths of the Main Range Province, Peninsular Malaysia

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Minor and trace element variations in the granitoid batholiths of the Main Range Province are examined using available data with particular attention given to the relatively immobile elements such as Ti, Zr, P, Nb, Y. A number of distinctive granitic suites are identified on the basis of the inter-element relationships and their variation patterns. These suites are not equivalent to or the same as the plutons/suites delineated in the Main Range Province by earlier workers.

Each suite is a genetic unit comprising a group of rocks formed primarily by crystallization-differentiation of a parental magma batch. Most of the suites appear to have evolved along broadly parallel paths from different batches of magmas representing different crustal melt fractions. Inter-suite chemical differences reflect the initial compositional differences of respective parental magmas due primarily to differing degrees and conditions and partial melting.

The suites are at different stages of evolution, and the extent of differentiation varies from suite to suite. A group of suites define a common evolutionary trend implying a direct genetic link. During magmatic evolution Ti, Zr, V, Sr behaved as compatible elements while P, Rb, Nb, Y, Sn behaved differently in different suites.

There is no systematic spatial variation in the chemical characteristics of the suites, and also compositionally similar suites occur in geographically separated areas suggesting a common crustal source.

The magmatic differentiation sequence of the Palong Pluton, Negeri Sembilan/Pahang

(Urutan pembezaan magma granitoid bagi Pluton Palong, Negeri Sembilan/ Pahang)

ASKURY ABD. KADIR

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The Palong Pluton located along the Negeri Sembilan-Pahang border covers an area of about 250 km². This north-south trending pluton is surrounded by Triassic sediments of the Gemas Formation. It can be broadly divided into three main types, viz: Kemayan Granite (medium-grained megacrystic biotite granite), Lui Granite (medium-grained equigranular biotite granite) and the Serting Granite (Leucogranite).

Petrochemically, these granite types are peraluminous as indicated by the mol $Al_2O_3/(CaO + Na_2O + K_2O) > 1$ and $Al - (K + Na + 2Ca) > 0$.

The chemical variation diagrams show the distinctive order of magmatic differentiation. SiO_2, TiO_2 and Zr are used as differentiation index to indicate the fractional crystallization. The stages of evolution are from primitive Kemayan Granite through Lui Granite and finally, to the highly evolved Serting Granite. The triangular diagrams of Rb-Ba-Sr, U-Sr-Rb and Zr-U-Th are used to explain the progress of magmatic differentiation. The magmatic fractional crystallization is best shown in the Palong Pluton, which is relatively free from hydrothermal alteration.

The Palong Pluton is classified as an I-type granite. The magnetic susceptibility ranges from 0.05 to 6.7 x 10^{-3} SI Unit. The magnetic susceptibility values are relatively high, on the whole, and this pluton is considered as magnetite-series granite. The immobile elements, such as Rb, Y and Nb are used in the Pearce diagram to determine the tectonic setting of granite. It, thus, appears that the Palong Pluton was emplaced in the domain of syn-Collisional Granite (syn-COLG) and Within Plate Granite (WPG).

Penggunaan nombor Niggli untuk membezakan formasi-formasi metasedimen klastik gred sederhana hingga tinggi

(The use of Niggli numbers to differentiate medium to high grade clastic sedimentary formations)

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Dengan menggunakan data geokimia metasedimen klastik dari terain metamorf Tanah Tinggi Scotland dan Kompleks Metamorf Pranburi-Hua Hin, Thailand, trend akibat pengendapan masih dapat dikenal meskipun batuan-batuan tersebut termetamorf pada gred sederhana hingga tinggi. Parameter ujian yang digunakan ialah nilai-nilai Niggli *si* melawan *al-alk*, *si* melawan *alk*, *si* melawan *fm* dan *si* melawan *fm/(fm+alk)*. Parameter-parameter ini telah digunakan untuk menguji kesamaan atau kelainan sifat tiga formasi metasedimen klastik di Semenanjung Malaysia yang dikatakan berusia protolitos berlainan iaitu syis Grik-Jeli (Ordovisi-Silur), formasi Kenny Hill (Devon-Karbon) dan Syis Taku (Perm-Trias). Didapati ketiga-tiganya berbeza seperti yang ditunjukkan oleh kecerunan lengkung perkaitan-perkaitan di atas, juga perbezaan julat nombor Niggli. Teknik ujian yang sama mungkin boleh digunakan untuk menentukan status formasi-formasi metasedimen klastik yang masih diliputi kontroversi, seperti misalnya syis Dinding, syis Kuala Lumpur, syis

Pilah dan syis Jelebu. Ia juga boleh digunakan bagi mencadangkan taraan sedimen bagi formasi-formasi metamorf gred sederhana hingga tinggi, bagi membantu pengkaitan stratigrafi.

Geochemical data of clastic metasediments from Scottish Highlands metamorphic terrain and Pranburi-Hua Hin Metamorphic Complex, Thailand have been utilised to show that geochemical trends due to sedimentation are still recognisable despite metamorphism at medium to high grade. The test parameters are Niggli numbers *si* vs *al-alk*, *si* vs *alk*, *si* vs *fm*, and *si* vs *fm / (fm+alk)*. These parameters were also used to reveal the similarity or difference between three clastic metasedimentary formations, of different protolith age, which occur in Peninsular Malaysia, i.e. Grik-Jeli schist (Ordovician-Silurian), Kenny Hill formation (Devonian-Carboniferous) and Taku schist (Permian-Triassic). The test shows that the formations differ from each other, as shown by the different gradients of the correlations, as well as the ranges of the Niggli numbers. It is possible to extend the use of the same technique to ascertain the status of some controversial clastic metasedimentary formations, such as Dinding schist, Kuala Lumpur schist, Pilah schist and Jelebu schist. It can also be used to infer the sedimentary equivalent of a medium to high grade metamorphic formation, to ease stratigraphic correlation.

Reactivated tectonic structural controls on morphological development of the Central Luconia carbonates

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A broad platform of the Central Luconia Province is characterised by extensive development of the Miocene carbonates. Faultings that had taken place during the Oligocene to the Middle Miocene produced 'basins and highs' which controlled the distribution of subsequent carbonate growth. Platform-type buildups tend to concentrate on fault-bounded regional highs, whereas pinnacle-type buildups are distributed within the basinal areas.

A current study suggests that the low and high reliefs of the pinnacle buildups are strongly controlled by tectonic structures underneath the buildups which were reactivated during the carbonate deposition. These reactivated thrust faults which were active until end of Late Miocene have caused further uplifting. Larger part of the buildups has continuously developed over the uplifted areas, whereas other buildups sitting on structurally stable areas tend to die off as they cannot keep pace with a sudden rise in sea-level.

Structural development at the west-central margin of the Malay Basin (basement of Blocks PM 2 and PM 7)

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The regional elements in the west-central margin of the Malay Basin largely comprise a platform area and a hingeline zone which runs parallel (NW-SE) to the basin margin. The majority of the basement faults within PM 7 (southern portion of the study area) runs NW-SE downthrowing to the northeast. Two grabens run NNW-SSE through the central portion of PM 7. The basement of the grabens comprise northwest-southeast regional trending faults interconnected by north-south oblique faults. The northern portion of PM 7 is more intensely faulted and is an area of variable basement topography. Towards PM 2 (northern portion of the study area), the faults progressively trend north-south downthrowing to the west. Within the southwest flank of the

platform area in PM 2, basement highs and their associated faults trend NW-SE. To the west of this area (inner platform area), similar features trend NNE-SSW.

The grabens in PM 7 were probably formed during Eocene-Oligocene as evidenced by the onlap of Oligocene lacustrine sediments on ?Cretaceous basement. Within the platform area, basement faults were active since Jura-Cretaceous. Jura-Cretaceous conglomeratic sediments as well as Oligocene alluvial plain and braided channel sediments overlie Permo-Carboniferous sediments with an angular unconformity. The probable causative stress system will be presented.

The coaxial superimposed tectonic deformations onto the sedimentary folds of the Semantan Formation

(Tindanan canggaan tektonik sepaksi ke atas lipatan sedimen Formasi Semantan)

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The rocks of the Semantan Formation around Temerloh-Mentakab was folded into a series of synclines and anticlines, with the axes plunging towards 330° to 350°. Cleavages are not clear especially in the fresh rocks. In general the limbs of the folds are gentle. Nevertheless, at some places the folds are more complex with one of the limbs nearly vertical or even overturned. Gently dipping slaty cleavage are clearly developed.

Field observation shows that there are sedimentary of slump folds in this formation around this area, with the axes plunging towards north-northwest directions. Therefore the structural complexity at some places are interpreted as the result of the superimposition of the tectonic deformation on to the pre-existing slump folds. As a result, slump folds were becoming more tight and slaty cleavage were pronouncely developed. Reversed faulting was also occurred on the planes parallel to the slaty cleavages due to the deformation. Furthermore, planes of the sedimentary origin fault have been activated to produce normal fault during the last stage of the tectonic deformations involving the rocks of this formation.

Batuan Formasi Semantan di sekitar Temerloh-Mentakab telah terlipat membentuk siri antiklin dan sinklin yang menunjang ke arah 330° hingga 350°. Ira yang terbentuk pada batuan ini sangat tidak jelas terutama pada batuan yang segar. Secara umum, sayap-sayap lipatan berkeadaan agak landai. Walau bagaimanapun, pada sesetengah tempat, keadaan lipatan menjadi agak rencam. Di sini boleh didapati keadaan perlapisan yang hampir tegak dan ada juga yang terbalik. Ira sabak yang berkedudukan agak landai terbentuk dengan jelas.

Cerapan lapangan menunjukkan terdapat lipatan-lipatan nendatan atau sedimen pada batuan Formasi Semantan kawasan ini, yang juga mempunyai paksi ke arah utara-baratlaut. Kerencaman struktur di sesetengah tempat itu ditafsirkan sebagai akibat daripada pertindanan canggaan tektonik ke atas lipatan nendatan yang dahulu. Dengan itu, lipatan nendatan tersebut menjadi semakin ketat dan ira sabak terbentuk dengan baiknya. Di atas satah ira sabak, berlaku sesaran songsang akibat daripada canggaan tersebut. Selain daripada itu, satah-satah sesar berasalan sedimen yang berkedudukan hampir utara-selatan diaktifkan balik menjadi sesar normal diperingkat akhir canggaan tektonik yang melibatkan batuan formasi ini.

Iron oxide mineralogy in saprolites and soils over some metamorphic rocks

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Iron oxides are important constituents in saprolites and soils formed over rocks which contain iron-bearing minerals. In this study, three weathering profiles developed over amphibole schist, quartz-mica schist and phyllite were sampled.

Undisturbed samples were collected for thin section study and scanning electron microscopy while bulk samples were collected for XRD analysis. Iron oxides were concentrated from the clay fractions obtained from the bulk samples for detailed characterisation from XRD analysis.

The alteration of biotite grains to kaolinite and iron minerals can be observed in thin sections of the saprolites of the quartz-mica schist and phyllite. The cryptocrystalline iron oxides occur on the fringes of the biotite grains. Under the scanning electron microscope, goethite discoids were observed on the edges of the lamellae as well as on the surfaces of the biotite.

The iron oxides in the saprolite of the amphibole schist were formed from the alteration of actinolite. The actinolite crystals leave framework structures which under the SEM can be seen to be composed of goethite. Globules of hematite were disseminated in the groundmass.

Detection of goethite and hematite in the soil samples was through XRD analysis of the iron oxide concentrates. In thin sections, they occur disseminated in the fine fabric. XRD results show that goethite is the dominant mineral in all the samples. The mean crystallite dimension (MCD) perpendicular to the (110) decreases from saprolite (30 nm) to soil (12 nm). These goethites show a high aluminium substitution, ranging from 14 to 31% more.

Gunung Danum Conservation area: geological and soil aspects

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The Gunung Danum Conservation area consists of (i) Sabah's oldest crystalline basement rocks, composed of peridotite, amphibolite, and basalt (ii) the Middle Miocene mélange, occupying the low lying areas and is composed of exotic blocks embedded in a sheared pelitic matrix. The major blocks consists of chert, sandstone, basalt, conglomerate and ultramafic rocks.

The rock association is also widely distributed in the east coast of Sabah. The relationship between the crystalline basement and the mélange is interpreted as a shear zone contact in which the basement rock was upthrusted toward the north. Locally, the contact between the mélange and the basalt consists of gouge material and is believed to be a normal fault dipping to the south.

The high concentration of Ni and Cr in the stream sediments reflects the high content of the elements in the ultrabasic bedrocks of the Gunung Danun area. The Cr is probably present as clastic grains of high density chromite, whereas Ni and Zn are partly transported in solution and partly as suspended particles.

The distribution of the soil in the Gunung Danum and the neighbouring areas can be classified into three types, namely: the Bidu-Bidu Association, the Mentapok Association and the Bang Association. The Bang Association of mudstone and sandstone origin occupies the low lying areas, while in the Gunung Danum area,

an ultramafic stock is classified as the Bidu-Bidu Association. The soil type in between is the Mentapok Association of which the parent materials are basic and intermediate igneous rocks.

Extensive recent muddy alluvium can be traced along the Sungai Danum and Sungai Sabran, especially in the rainy seasons.

KESAN PERLOMBONGAN BESI TERHADAP ALAM SEKITAR — TINJAUAN AWAL KES BUKIT BESI

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Adalah tidak dinafikan, perlombongan bijih besi di Bukit Besi merupakan penyumbang utama pendapatan negeri Terengganu selama lebih kurang 40 tahun (dari tahun 1930 hingga pertengahan tahun 1971). Pada sekitar tahun 1960an, lombong besi di Bukit Besi ini menyumbang sebanyak 1/3 daripada pendapatan keseluruhan negeri tersebut. Kegiatan perlombongan ini telah menyediakan peluang pekerjaan yang agak besar di mana pada tahun 1935, jumlah pekerjanya adalah seramai 3,000 orang dan meningkat kepada seramai 3,900 orang pada tahun 1940. Pada penghujung operasinya iaitu pada tahun 1971, jumlah pekerjanya adalah seramai 2,000 orang. Kegiatan perlombongan di Bukit Besi ini juga adalah pendorong kepada kepesatan kegiatan ekonomi dan pertambahan penduduk bagi bandar Dungun yang merupakan bandar pelabuhan bagi mengeksport bijih besi tersebut. Pertambahan penduduk di bandar Dungun amat ketara pada awal dan pertengahan aktiviti perlombongan, di mana pada tahun 1947 jumlah penduduknya adalah seramai 4,300 orang meningkat hingga mencapai 12,500 orang pada tahun 1957 iaitu penambahan hampir 300% dalam masa 10 tahun.

Walaupun perlombongan besi telah merupakan penyumbang pendapatan ekonomi penduduk yang utama, tetapi secara amnya aktiviti perlombongan tersebut telah menimbulkan beberapa kesan negatif terhadap alam sekitar secara fizikal dan kemanusiaan. Kesan-kesan negatif yang jelas diperhatikan adalah seperti pandangan darat kawasan lombong dan sekitarnya yang gondol dengan runtuhan tanah yang luas, perubahan dan gangguan terhadap regim air dan aliran sungai, penghasilan air yang berasid (ada kolam yang pH airnya bernilai sehingga 2.8), suhu yang lebih tinggi daripada persekitaran (di mana suhu musim panasnya mencapai 38°C), dentuman petir yang lebih kerap serta kesan terhadap flora dan fauna.

Memandangkan kawasan Bukit Besi ini akan dibangunkan semula, adalah diharapkan agar aspek geologi persekitaran diambil kira di dalam perancangan tersebut. Beberapa syor dikemukakan (di samping penjelasan tentang kesan negatif perlombongan besi) agar pembangunan kawasan bekas lombong besi ini akan berkekalan (mampan) sebaik mungkin serta memberi faedah kepada semua yang terbabit.

Zon sesar Bukit Berapit

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Di tepi lebuhraya Ipoh-Cangkat Jering tersingkap jalur granit tersesar dalam granit porfir. Jalur sesar dicirikan oleh milonit dan breksia sesar. Milonit mengandungi kekanta asimetri, berjurus hampir T-B dan sesar berjurus serupa, memotong milonit tersebut sehingga menerbitkan pola jalinan.

Porfiroklas kuarza dan feldspar bertindak sebagai butiran yang tahan terhadap canggaan mempamerkan beberapa kriteria yang boleh digunakan untuk penentuan hala pergerakan sesar. Ciri-ciri mikrostruktur yang terpamer itu sesuai ditafsirkan sebagai metamorf fasies skis hijau.

The northward extension of Baubak fault in Kedah and Perlis, Peninsular Malaysia

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The northernmost mappable location of Baubak (Bok Bak, old spelling) fault has generally been accepted to end near Bukit Perak in south Kedah. Further up north over other parts of Kedah and Perlis the terrain is made up of low hills over flat areas. Augmented by deep tropical weathering, it probably made the detection of the northward extension of the fault difficult. This paper reports on a study carried out to locate the Baubak fault north of Bukit Perak to the boundary areas between Malaysia and Thailand.

A geomorphological study of the area between Jitra and Pokok Sena in north-central Kedah has defined a strong lineament that conforms with the attitude (320°) of Baubak fault. The lineament is offset by eight kilometres to the east of the straight-line extrapolation of the fault near Bukit Perak. Follow-up field visits have confirmed that the lineament is a major sinistral wrench fault.

In Perlis an approximate contact between Setul and Chuping formations has been located not far southwest of Bukit Chuping. This contact lies exactly on the northward extension of Baubak fault in the Jitra-Pokok Sena area.

The Baubak fault is further extrapolated to the boundary areas of Perlis and Thailand, landmarked by Bukit Wang Keluang, where the lineament coincides with a few linear rivers.

The Lower Paleozoic Setul formation provides a reliable means of estimating the displacement caused by Baubak fault, which is between $13\frac{1}{2}$ and, more favourably, 10 km.

Geologi sekitar Jongok Batu, Ulu Dungun, Terengganu

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Kawasan ini seluas lebih kurang 70 km persegi dilandasi dua jenis batuan utama iaitu batuan metasedimen (70%) dan batuan igneus (30%). Batuan metasedimen terdiri daripada sabak, sabak berkarbon, sabak berkiastolit dan kuarzit bersaling lapis dengan metatuf. Metasedimen ini telah dipetakan sebagai perlapisan Sungai Perlis oleh Chand (1978) dan diberikan anggaran umur Karbon Bawah. Kajian ini telah menemui fosil-fosil brakiopoda di dalam sabak, dikenalpastikan sebagai Schellwienella (Devon-Karbon) dan Spirifer (Karbon Bawah-Karbon Atas) menyokong umur yang telah dicadangkan terdahulu. Tangkai krinoid dan kesan riak juga dijumpai di batuan ini. Batuan metasedimen ini didapati berkomposisi pelit dan dipercayai dienapkan dipersekitaran laut cetek.

Batuan igneus terdiri daripada dua badan rejahan utama yang berasingan. Di sebelah barat terdapat granit-biotit sementara di sebelah tenggara yang lebih menarik, terdapat satu kompleks gabro-kuarza diorit-tonalit.

Granit-biotit didapati berbutir sederhana kasar dan berwarna kelabu keputihan, leukokratik dan takberporfir. Analisis geokimia mencadangkan ianya berjenis S iaitu terbentuk daripada perleburan kerak bumi. Kompleks gabro-kuarza diorit-tonalit pula bersaiz halus hingga sederhana kasar dan berporfir. Analisis geokimia mencadangkan mereka berjenis I terhasil dari proses penghabluran fraksinasi. Hasil penyiasatan awal ini mencadangkan dua badan rejahan ini berasalan dari dua magma induk yang berbeza.

Relationships between Sn and Au mineralizations to the granites: an example from Kuala Pilah

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Relationship between Sn mineralization and the granite, from the works of previous authors, is clear, but between Au mineralization and the granite is not clearly understood. For a long time Emmon's (1876) view that "the association of Au lodes with igneous rocks is practically universal" went unchallenged. Recent works by a number of authors seem to indicate that gold in the lodes and veins does not come from the igneous rocks. In the present study, some results of a small study on the heavy mineral distribution in the drainage sediments and some geochemical study from the Kuala Pilah area is presented in support of the idea that Au in contrast to Sn does not originate from the granite.

The structure and gold mineralization in the Kim Chaun Gold Mine (former Raub Mine area), Bukit Koman, Pahang

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Recent extensive opencut soft rock mining in the Bukit Koman, Bukit Jellis and Bukit Melaka areas of the former Raub Gold Mine have exposed structural and mineralization features that have not been previously described. The gold mineralization represented by gold-quartz-sulphide veins and disseminations hosted in marble/limestone, graphitic schists and other metasediments, consists of a main zone, and several subsidiary zones east and west (minor) of the main zone which had been largely mined out by the previous underground method. Several generations of epigenetic veining could be recognised in the main lode zone and though, striking parallel (350°) to the beddings of the metasediments, they discordantly cut the vertical to almost vertical dips of the latter. The early quartz veins which are deformed by ductile shear/translational movements parallel to the beddings of the metasediments carry the highest gold values. Later veins, carrying quartz, calcite and siderite, not deformed by the ductile movement are generally barren.

The main lode zone of the gold mineralization occupies the core zone of an anticlinorium (or fan-shaped fold) which shows intense ductile shearing with vertical to high angle reverse movement resulting from a sustained lateral compression directed along 080°-260°. Cleavage folding recognised in the field probably represents an earlier phase of folding prior to shortening and development of ductile deformation of the veins.

Pemineralan kawalan struktur dan bijih timah berpegmatit di lombong Rahman Hidraulic Tin Bhd.

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Pemineralan bijih timah kawalan struktur di kawasan lombong Rahman Hidraulic Tin Bhd. (RHTB), Klian Intan, Perak adalah terhad kepada kawasan di antara dua sesar mengiri yang dinamakan sesar Intan I dan II. Penafsiran semula arah daya pembentukannya adalah dari arah Baratlaut-Tenggara yang mempakan arah daya utama pembentukan struktur kawasan Klian Intan-Kroh.

Penemuan hablur-hablur kasiterit yang berbentuk dwipiramid order pertama {111} di kawasan lombong RHTB ini merupakan tambahan kepada sifat-sifat kasiterit Gunung Paku yang mempunyai bentuk, saiz dan warna hablur yang berbagai. Hablur kasiterit dwipiramid ini belum pernah dilaporkan penemuannya di kawasan ini dan telah ditafsirkan sebagai mempunyai asalan pegmatit.

Style and characteristics of the primary gold mineralization in Peninsular Malaysia

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Based on their distribution, style and characteristics, the primary gold mineralization in Peninsular Malaysia can be divided into 4 distinct belts which run parallel to the main structural trend of the country. Belt I which coincides with the western portion of the Main Range region is found mainly in the alluvial form, the sources of which have seldom been located. Belt II forms a narrow zone east of the Raub-Bentong Suture and is marked by the Chinong-Chupan lodes in the north (Kelantan), to Buffalo Reef, Selinsing and Raub-Bukit Koman in the centre (Pahang), to Kadanak and Chindras in the south (Negeri Sembilan). The mineralization in this Belt consists mainly of 340° to 350° gold-quartz-sulphide veins, reefs and disseminations in brittle to ductile shear zones hosted by strongly folded metasediments and schists. Belt III which occurs east of Belt II is a broad belt showing diverse mineralization styles consisting of submarine volcanogenic exhalative gold-sulphide (and barite) type to gold-quartz-sulphide veins (striking 350°, 080° and 310°) in marble and metasediments to skarn and infillings of shear and late joints in granite and syenite. Belt IV is marked by gold-quartz-sulphides lodes and veins striking 345° in folded metasediments from Lubok Mandi (Terengganu) stretching south to Mersing (Johor).

Penemuan batuan Formasi Semanggol di kawasan sempadan Malaysia-Thailand, Kroh, Perak

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Di sepanjang jalan sempadan Malaysia-Thailand, Kroh, Perak, dari km 14 hingga km 18, suatu siri jujukan batuan terdedah dipercayai Formasi Semanggol. Jujukkan batuan terdiri dari saling lapis graywak masif dengan batuan syal yang dihimpit oleh saling lapis batuan cert dan syal dan sedikit konglomerat intraformasi. Bersebelahan lapisan cert dan syal terdapat batuan breksia terdiri dari klas cert.

Formasi Semanggol, dipercayai sambungan daripada kawasan Thailand, mempamirkan lapisan ritmit yang ditunjukkan oleh saling lapis batu pasir dan syal dan saling lapis batuan cert dan syal yang nipis.

Kehadiran struktur mendatan dan breksia mengambarkan lembangan pengenapan yang tidak stabil. Struktur tektonik seperti lipatan rebah dan struktur pengenapan seperti kesan beban dan kesan riak menunjukkan lapisan terbalik. Ini mencadangkan singkapan ini merupakan suatu sayap lipatan rebah yang besar. Litologi dan struktur sedimen ini mencadangkan pengenapan oleh aliran turbidit seperti Formasi Semanggol di kawasan lain di baratlaut Semenanjung Malaysia.

Geology of the G. Sumalayang area, Johor

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The study area can be divided into 3 formations which were deposited during 2 different Eras, namely,

a) Late Palaeozoic Era
   i. Dohol Formation – Middle Permian
   ii. Sedili Volcanic Formation – Late Permian

b) Late Mesozoic Era
   i. Tebak Formation – Early Cretaceous

The Dohol Formation consists of argillaceous, calcareous and tuffaceous rocks. The fossiliferous limestone, the Sumalayang Limestone Member, contains fusulinid (family: *Fusulinidae* and *Schwagerinidae*). The fossil occurrence and rock types suggest a shallow marine depositional environment.

The Sedili Volcanic Formation overlies conformably the Dohol Formation. Composition of the pyroclastic rocks range from acid to intermediate, that is rhyolite to rhyodacite. From petrographic studies the constituents of the tuff are quartz, K-feldspar, plagioclase, muscovite and chlorite with quartz dominance (>70%) indicating high silica content.

The Tebak formation is a continental deposit with subhorizontal sandstone beds with the grains ranging from fine to coarse and the presence of pebbly-sandstone.

Based on structure analysis the study area shows 2 types of folds, namely open and closed folds plunging moderately 40° to the northwest.

Permodelan geomagnet badan gabro Ajil-Wakaf Tapai, Terengganu

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Geologi kawasan ini telah memetakan kehadiran batuan igneus (Permian(?)-Jurasik) bersama sedikit metasedimen (Karbon Bawah-Permian(?)). Batuan igneus terdiri dari badan gabroid diwakili oleh hornblend gabro (Permian(?)), kumpulan granitoid diwakili oleh hornblend biotit granodiorit, granodiorit berporfir, biotit hornblend adamelit, biotit adamelit dan biotit granit merah jambu (Permian-Triasik), dan daik hiperbasal diwakili oleh dolerit dan basalt berporfit (Jurasik).

Badan gabro tidak kelihatan sebagai suatu singkapan. Banyak bolder gabro ditemui di beberapa tempat. Survei magnetik ini dijalankan untuk memetakan hubungan sempadan gabro dengan batuan berjiran. Peta geologi menunjukkan badan gabro ini menjurus utara-selatan dengan anggaran panjanganya 4 km dan lebarnya 2.5 km.

Kajian magnetometer terperinci diaras permukaan bumi dijalankan di kawasan jangkaan lingkungan badan gabro. Penzonan peta magnet dilakukan untuk memudahkan pentafsiran kualitatif. Secara kualitatifnya terdapat kehadiran banyak anomali tempatan yang ditafsirkan dipengaruhi oleh bahagian-bahagian badan atau bolder besar gabro berkedudukan berhampiran permukaan bumi. Peta magnet terhasil menunjukkan kehadiran zon anomali positif (utara) dan negatif (selatan) melitupi kawasan badan gabro yang dijangkakan.

Pentafsiran semikuantitatif memberikan kedalaman badan gabro 500 meter di bawah permukaan. Keadaan lapangan dan topografi setempat tidak memungkinkan zon peluluhawaan sedalam itu. Pengubahsuaian

kedalaman model dilakukan sehingga persetujuan anomali lapangan dan anomali kiraan dicapai terutamanya di bahagian sempadan temuan.

Pentafsiran kuantitatif di mana model badan secara dua dimensa dikemukakan merupakan kaedah utama yang digunakan. Lima profil dipilih dari peta berdasarkan ciri anomali yang ditunjukkan. Tiga daripada model terpilih tersebut memberikan permukaan badan gabro berbumbong manakala dua lagi memberikan bentuk 'lurah'. Kedalaman badan gabro yang dimodelkan juga berbeza, dari 300 meter yang paling dalam ke hanya 40 meter yang tercetek.

Berdasarkan permodelan ini dua keadaan struktur badan gabro dicadangkan:

1. Badan gabro berpemukaan bermiring curam kearah barat, atau
2. Kemungkinan terdapat sesar yang memotong badan gabro dengan jatuhan blok di sebelah barat.

Secara amnya pengukuran bentuk badan gabro dari kelima-lima model memberikan kepanjangan 3.5 km (utara-selatan) dan lebar 2.5 km.

Petrology and geochemistry of the granitoids of the Lumut-Segari-Pantai Remis area, Perak

NORZAINI KARIM & G.H. TEH

Department of Geology
University of Malaya
59100 Kuala Lumpur

Based on texture and mineralogy the granitoids of the Lumut-Segari-Pantai Remis area can be divided into 4 units.

Unit 1 (porphyritic biotite adamellite) covers almost all of the study area. This unit is characterized by its coarse grained highly porphyritic to medium grained slightly porphyritic texture. Biotite is the main mafic mineral with some primary muscovite.

Unit 2 (coarse grained porphyritic biotite granite) can be found along road cuts approximately one km from Lumut town. Modal analyses show that the feldspar ratio exceeds 0.66. Biotite is the main mafic mineral. A number of shear zones are found in this unit.

Unit 3 (coarse to medium grained porphyritic tourmaline adamellite) is characterized by the presence of tourmaline. This unit outcrops at the northern part of the study area and it shows a higher differentiation index value compared to units 1 and 2.

Unit 4 (non porphyritic granite) consists of micro-granite and aplite is characterized by the absence of phenocrysts. Aplite is present as dykes. Generally this unit is a moderate to fine grained leucogranite.

Based on $^{87}Rb/^{86}Sr$ ratio, Bignell and Snelling (1977), suggested that the age of the granitoid in the Lumut-Segari-Pantai Remis area is late Triassic.

Geochemical and petrographical studies of all the 4 units suggest that the granitoids of the area originated from the same magma. There is a relative decrease in the degree of differentiation from Unit 4 to 3, 2 and 1. The granitoid in the area is peraluminous and classified as S-type and the granitic magma of the area is believed to be derived from the melting of sediments with high Na_2O. Variation diagrams show that the minimum melting temperature of the granitic magma is 685°C at 2 kbar pressure.

Xenoliths that are present are metasediments and congeneric. The petrographical and geochemical studies of the rock units and their relationships with the xenoliths suggest that there was only one phase of granitoid intrusion in the Lumut-Segari-Pantai Remis area.

BERITA-BERITA PERSATUAN
News of the Society

KEAHLIAN (Membership)

The following applications for membership were approved:

Full Members

1. Muhinder Singh
   6 Floor, Menara 2, Faber Towers, Jalan Desa Bahagia, Taman Desa, 58100 Kuala Lumpur
2. Lawrence P. James
   c/o BHP Minerals Exploration, 39/F Bank of China Tower, 1 Garden Road, Central, Hong Kong
3. Abd. Rashid b. Jaafar
   15, Jalan Joran 19/24, Seksyen 19, 40000 Shah Alam
4. Hoh Swee Chee
   Petronas Carigali, P.O. Box 12407, 50776 Kuala Lumpur
5. Warren C. Leslie
   Petronas Carigali, P.O. Box 12407, 50776 Kuala Lumpur

Student Members

1. Zahir Yahya
   Lorong Sri Tanjung, Kg. Masjid, Bongor, Baking, 09100 Kedah
2. Aimee Aida bt. Arbak
   Jabatan Geologi, Universiti Malaya, 59100 Kuala Lumpur
3. Ahmad Ridzuan Mohd Tahir
   Lot 5377, Kampung Sungai Serai, Batu 11, 43100 Hulu Langat, Selangor
4. Shahrizad Ismail
   1026, Jalan Tengku Putra, Teluk Air Tawar, 13050 Butterworth
5. Abd. Rahman b. Omar
   K2D–115, Kamsis Dato Onn 1, Universiti Kebangsaan Malaysia, 43600 Bangi
6. Uzir b. Alimat
   d/a Alimat b. Mat Ali, Cawangan Foto, Ibu Pejabat Polis Daerah, 41000 Klang
7. Ariffin Suhaidi b. Mat Saad
   Jabatan Geologi, Universiti Malaya, 59100 Kuala Lumpur
8. Mohd. Ghazali b. Haji Yahya Zikri
   Jabatan Geologi, Universiti Malaya, 59100 Kuala Lumpur
9. Ferdaus b. Ahmad
   Jabatan Geologi, Universiti Malaya, 59100 Kuala Lumpur
10. Abdullah b. Sulaiman
    Jabatan Geologi, Universiti Malaya, 59100 Kuala Lumpur

Institutional Member

1. Nippon Oil Exploration (M) Ltd.
   Letter Box no. 74, 34th Floor, UBN Tower, 10 Jalan P. Ramlee, 50250 Kuala Lumpur

Associate Members

1. Wong Mok Far
   Institut Kerja Raya Malaysia, Jalan Serdang, 43000 Kajang
2. James Wong Tet Foh
   25, Jalan Telawi 8, Bangsar Baru, 59100 Kuala Lumpur

PETUKARAN ALAMAT (Change of Address)

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

1. Rodziah Daud
   Petronas Carigali Sdn. Bhd., Peninsular Malaysia Exploration Department, 5th Floor, Wisma Peladang, Jalan Bukit Bintang, P.O. Box 12407, Kuala Lumpur
2. Kamaludin bin Hassan
   222 Staniforth Road, Sheffield S9 3FS, United Kingdom
3. Law Seng Keong
   24–3, Blk A, Pangsapuri Cantik, Jalan Senohong, Taman Cantik, 56100 Kuala Lumpur

PERTAMBAHAN BAHARU PERPUSTAKAAN (New Library Additions)

The Society has received the following publications:

1. AAPG Bulletin, vol. 77 /3, 77/4, 1993.
2. Science Reports of the Institute of Geoscience, University of Tsukuba, vol. 14, 1993.
3. Annual Report, Institute of Geoscience, University of Tsukuba, no. 18, 1992.
4. AAPG Explorer, April 1993.
5. Service Geologique de Belgique, Prof. Paper 1993/2, no. 260, vols. 1 & 2.
6. IMM Bulletin, no. 1010, 1993.
7. IMM Transactions, Section A, vol. 102, 1993.
8. SOPAC: Proceedings of the 21st session, 1992.
9. USGS Bulletin 1992:2018.
10. USGS Prof. Paper 1228–E, 1992.

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PP 169/12/87 ISSN 0126-5539

PERSATUAN GEOLOGI MALAYSIA

WARTA GEOLOGI

NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MALAYSIA

Jil. 14, No. 5 (Vol. 14, No. 5) Sep-Okt 1988

KANDUNGAN (Contents)

DIKELUARKAN DWIBULANAN

ISSUED BIMONTHLY

Warta Geologi (Newsletter of the Geological Society of Malaysia).
Price: M$5.00 (US$3.20)
(for non-members)
per bimonthly issue from July 1966.

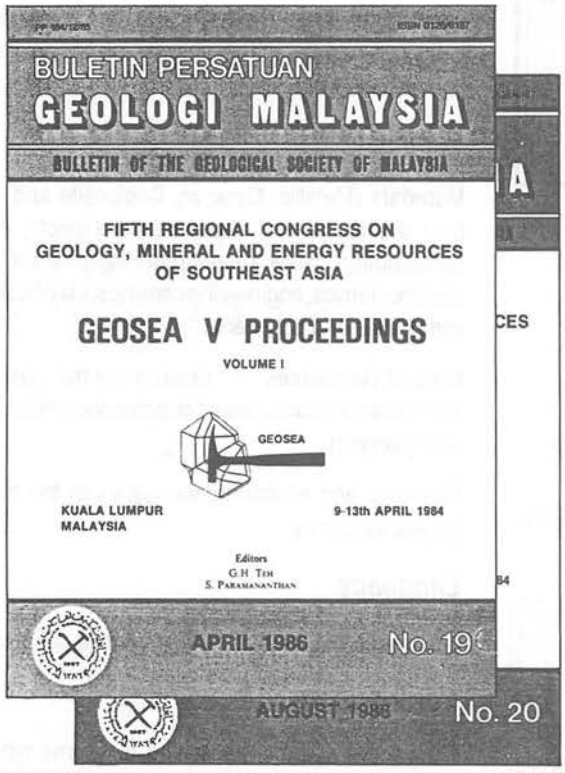
Orders should be addressed to: The Hon. Assistant Secretary
GEOLOGICAL SOCIETY OF MALAYSIA
c/o Dept. of Geology
University of Malaya
59100 Kuala Lumpur, MALAYSIA

GEOLOGICAL SOCIETY OF MALAYSIA

GEOSEA V PROCEEDINGS

VOLUMES I & II

(Bulletin Geological Society of Malaysia Nos. 19 & 20)



Some of the articles appearing include:-

Massive sulphide deposits and their possible significance to other ores — R.W. Hutchinson; **Palaeogeographic development of west Sarawak** — Denis N.K. Tan; **Geological evolution of the Southern Philippines** — C.K. Burton; **Southeast Asia as a part of an early Palaeozoic Australian Gondwanaland** — C. Burrett & B. Stait; **Tertiary basins of S.E. Asia — their disparate tectonic origins and eustatic stratigraphical similarities** — C.S. Hutchison; **Late Palaeozoic palaeogeography of Southeast Asia: some stratigraphical, palaeontological and palaeomagnetic constraints** — I. Metcalfe; **The REE geochemistry of Lingshan W-Sn-bearing granites and their applications to petrogenesis of the granites** — Yuan Zhongxing *et al.*; **Chromite deposits of Papua New Guinea** — P.M. Afenya; **Recent advances in exploration modelling for tin deposits and their application to the SE Asian environment** — R.G. Taylor & P.J. Pollard; **Some thoughts on the development of the alluvial tinfields of the Malay-Thai Peninsula** — D. Taylor; **Base metal exploration in Sabah** — David T.C. Lee & H.S. Weber; **The nature and potential of gold mineralisation in Kelantan** — L.H. Chu & D. Santokh Singh; **Quaternary deposits of Thailand** — P. Dheeradilok & W. Kaewyana; **Soil landscapes in Peninsular Malaysia** — S. Paramananthan & S. Zauyah; **Aspects of the geochemistry of Malaysian cassiterites** — W. Fuad Hassan; **Geological evolution of the Indonesian Archipelago** — H.M.S. Hartono & S. Tjokrosapoetro; **The nature, distribution and genesis of certain authigenic minerals in the stanniferous alluvial deposits of S.E. Asia** — K.F.G. Hosking; **Global tectonics and resources** — W.S. Fyfe; **Tin/tungsten-bearing granites in S. China and their metallogenetic relations** — Xu Keqin & Zhu Jinchu; **Hydrogeological activities in Peninsular Malaysia and Sarawak** — F.S. Chong & Denis N.K. Tan; **Status of uranium exploration in Peninsular Malaysia** — L.H. Chu & F. Chand; **Directions of geologic transport in Peninsular Malaysia** — H.D. Tjia; **Cathaysia, Gondwanaland and the Palaeotethys in the evolution of Continental S.E. Asia** — Y.G. Gatinsky & C.S. Hutchison; **Marginal sea formation by rifting of the Chinese and Australian Continental Margins and implications for Borneo** — C.S. Hutchison; **Mesozoic and Cenozoic regional tectonics and metallogenesis in Mainland S.E. Asia** — A.H.G. Mitchell; **Coal potential and exploration in Sarawak** — S.P. Chen; **The succession of vertebrate faunas in the continental Mesozoic of Thailand** — E. Buffetaut & R. Ingavat; **Regional controls of hydrothermal ore localization in northern Thailand** — P. Asnachinda & S. Chantaramee; **Late Palaeozoic glacial marine facies in S.E. Asia and its implications** — P.H. Stauffer & C.P. Lee. **Cretaceous melange in West Kalimantan and its tectonic implications** — P.R. Williams *et al.*; **Recent advances in the knowledge of geology, mineral and energy resources of Singapore since 1981** — Ansafur Rahman & P.P. Wong; **The integration of remote sensing, terrain evaluation and engineering geology in Southeast Asia** — Beaumont, T.E. & Hunt, T; **Recent advances in the knowledge of geology and mineral resources of Vietnam since 1981** — Le Thai Xinh & Nguyen Xuan An.

This 2-volume GEOSEA V PROCEEDINGS of about 500 pages each contains 95 articles presented at the Fifth Regional Congress on Geology, Mineral and Energy Resources of Southeast Asia held in Kuala Lumpur, April 1984.

To: Hon. Assist. Secretary
Geological Society of Malaysia,
c/o Department of Geology,
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59100 Kuala Lumpur, MALAYSIA.

Date: .....

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BERITA-BERITA LAIN
Other News

INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN MATERIALS AND MINERAL RESOURCES (RAMM '94)

In Commemoration of the Silver Jubilee of Universiti Sains Malaysia

3rd-5th May 1994
Penang, MALAYSIA

Organised by

School of Materials and Mineral Resources Engineering,
Universiti Sains Malaysia, Perak Branch Campus,
31750 Tronoh, Malaysia.

First Circular & Call for Papers

Introduction

Universiti Sains Malaysia (USM) was established in 1969 in Penang. The School of Applied Sciences was started in 1972 with Mineral Science and Technology as one of the disciplines. In 1984, the name was changed to School of Engineering Sciences and Industrial Technology. In 1986, the Engineering Faculty of the University was relocated at a new branch campus in the state of Perak with the School of Materials and Mineral Resources Engineering as a part of this faculty. Malaysia which is rich in mineral resources is also experiencing substantial growth in the manufacturing area. The School is the only one of its kind in Malaysia and caters to the growing demands for materials and mineral engineers. The conference will focus on the needs of the industries in the fast changing technological environment. Since USM is celebrating its 25th anniversary, the conference is a fitting tribute to the institution.

Conference Objective

There have been rapid advances in the techniques and understanding of the mechanisms for the development of materials and the economic development of mineral resources. The conference is intentionally kept broad based in order to bring academicians, researchers and practising engineers together to exchange ideas and to provide future directions. The conference will involve several parallel sessions and panel discussions. There will be lectures by experts from the industries and search institutions on the topics of special relevance to Malaysia.

Topics

Materials (Metallic, Ceramic, Composite and Polymer) – both theoretical and experimental aspects, especially in solidification, alloy developments, powder metallurgy, electroceramics, engineering ceramics, clay-based ceramics, composites and polymers.

Mineral Resources – process control, expert systems, direct and continuous reduction processes, industrial minerals and quarrying.

Economic and environmental issues in the materials and mineral industries.

Language

The official language of the Conference is English.

Contribution

Prospective authors are invited to submit typed abstracts limited to one A4 paper. Abstracts should be sufficiently detailed to enable evaluation by the Scientific Programme Committee. The abstract must contain the title of the paper and the name(s) and affiliation(s) of the author(s).

Deadline for receipt of abstracts:
31st October 1993.

Authors will be notified on acceptance of their papers before **15th December 1993** and will receive instruction for preparation of manuscripts.

For Further Information:

*The Secretariat of the International Conference on Recent Advances in Materials and Mineral Resources (**RAMM '94**),*
School of Materials and Mineral Resources Engineering,
Universiti Sains Malaysia,
Perak Branch Campus,
31750 Tronoh,
Perak, MALAYSIA.

(Attn: DR. ZAINAL ARIFIN AHMAD)

GDMB BM imm

EMC '94

Second European Metals Conference
From Agricola to the Present
A Meeting between West and East
14–18 June 1994
Dresden and Freiberg

EMC'94 is the second European Metals Conference, the major series initiated in 1991 in Brussels and organized at the European level with the aim of bringing together all those concerned with the extraction and processing of non-ferrous metals from mining to fabricated products.

The programme will develop such themes as:

- Modern mining and metallurgy
- Future metal markets and areas of production
- Recycling and waste avoidance

Contributions are invited, *inter alia*, on the following topics:

R & D - Low-waste technologies - Valuable metals from treatment of residues - Clean-up of soil contamination and the environmental inheritance - Mining and beneficiation of raw materials - European environmental legislation - Ecological balances - New alloys and applications - Novel techniques - Plant descriptions

Programme Preview

The conference will consist of one day of technical visits and three days of lectures. Social events will include a welcoming reception, the Freiberg miners parade, a visit of the Semper-opera, a boat party on river "Elbe" and a ladies programme.

Conference Languages and Publications

English, German and French are the official conference languages. Papers to be presented at the technical sessions will be printed in book form from camera-ready manuscripts. The conference volumes - referring to mining or metallurgy - will be available on registration.

Technical Visits

A selection of one-day visits will be arranged to mining and metallurgical plants and R & D-centers as well as historical sites.

Call for Papers

Prospective authors should submit abstracts of 250 to 300 words of their proposed papers to one of the organizing bodies **before 1 March 1993**, and the final manuscripts will be required by **1 January, 1994**, for publication in the conference volume.

For further information:

The Institution of Mining and Metallurgy
Conference Office
44 Portland Place
London W1N 4BR
England
Tel: 44 71 580 3802
Telex: 261410
Fax: 44 71 436 5388

KALENDAR (CALENDAR)

1993

→→→ July 1993←←←

July

ENVIRONMENTAL CONTEXT OF HUMAN EVOLUTION (International Scientific Congress and Exhibition), The Netherlands and Indonesia. (Dr. Hans Beijer, Geological Survey of The Netherlands, P.O. Box 157, NL-2000 AD Haarlem, The Netherlands. Telefax: 31 23 351614

July 5–8

ROCK FRAGMENTATION BY BLASTING (4th International Symposium), vienna, Austria. (Dr. H.P. Rossmanith, Institute of Mechanics, Technical University Vienna, Wiedner Haupstraße 8–10/325, A–1040 Vienna, Austria. Phone: (222) 588 01 5514 or 5519; telefax: (222) 587 5863)

July 5–9

FLUVIAL SEDIMENTOLOGY (5th International Conference), Brisbane, Australia. (Continuing Professional Education, The University of Queensland, Queensland 4072, Australia. Phone: 61 7 365 7100; telefax: 61 7 365 7099; telex: UNIVQLD AA40315)

July 5–16

VERY LOW GRADE METAMORPHISM: MECHANISMS AND GEOLOGICAL APPLICATIONS (IGCP Project 294 Thematic Meeting and Field Excursions), Xi'an, People's Republic of China. (Dr. Wu Hanquan, Xi'an Institute of Geology and Mineral Resources, 116 Easy Youyi Road, Xi'an 710054, People's Republic of China)

July 17–24

GEOLOGICAL AND LANDSCAPE CONSERVATION, int'l. mtg., Great Malvern, U.K. (Margaret Phillips, The Company, St. John's innovation Centre, Cowley Road, Cambridge C84 4WS. Phone: (0223) 421124. Fax: (0223) 421158

July 18–23

INTERNATIONAL FEDERATION OF SCIENCE EDITORS, mtg., Santa Maria Imbaro, Italy. (c/c n 17171/1, Consorzio Mario Negri Sud, Cassa di Risparmio Provincia di Chieti, Succursale di Lanciano (Chieti) - Italy) (December '92)

July 18–23

CLAY CONFERENCE (10th International Conference in conjunction with Commission VII of the International Soil Science Society), Adelaide, South Australia. (Dr. Tony Eggleton, Geology Department, ANU, GPO Box 4, Canberra, ACT 2601, Australia)

July 25–30

ORIGIN OF PARENTAL ANORTHOSITE MAGMAS, TECTONIC AND METAMORPHIC PROCESSES IN THE EVOLUTION OF ANORTHOSSITES (Conference), Kadalaksha, Kola Peninsula, Russia. Sponsored by International Geological Correlation Programme Project 290. (Michael Higgins, Sciences de la Terre, Université du Québec à Chicoutimi, Chicoutimi, Québec G7H 2B1, Canada. Phone: (418) 545–5012)

→→→ August 1993←←←

August

INTRAPLATE VOLCANISM: THE POLYNESIAN PLUME PROVINCE (International Workshop), Tahiti, French Polynesia. (Workshop Tahiti 1993, C. Dupuy, Centre Géologique et Géophysique, Case 060, Université de Montpellier II, place E. Bataillon, 34095 Montpellier Cedex 5, France. Phone: (33) 67–634–983; telefax: (33) 67–523–908)

August 1–5

HYDROMETALLURGY, int'l mtg., Salt Lake City, by Society for Mining, Metallurgy, and Exploration, and the Minerals, Metals, and Materials Society. (SME, Box 625002, Littleton, Colo. 80162. Phone: 303/973-9550. Fax: 303/979-3461

August 1–6

GEOCHEMISTRY OF THE EARTH SURFACE (3rd International Symposium), University Park. Pennsylvania, USA. (Lee Kump, Department of Geosciences, Pennsylvania State University, 210 Deike Bldg., University Park, PA 16802, USA. Phone: (814) 863–1274; telefax: (814) 865–3191)

August 4–7

PALEOZOIC MICROVERTEBRATES (IGCP Project-328) (2nd International Symposium), Berlin, Germany. In conjunction with the birthday anniversary of Professor Walter Gross. (Dr. S. Turner, Queensland Museum, P.O. Box 3300, South Brisbane, Qld 4101, Australia. Telefax: 617 846 1918. Or Prof. H. Jaeger, Museum fur Naturkunde, Invalidenstr. 43, 00–104 Berlin, Germany)

August 8–12

STRATIGRAPHIC RECORD OF GLOBAL CHANGES: CLIMATE, SEA LEVEL, AND LIFE (SEPM Meeting), University Park, Pennsylvania, USA. (Mike Arthur, Department of Geosciences, Pennsylvania State University, University Park, PA, 16802, USA. Phone: (814) 865–6711)

August 11–15

GEOSCIENCE IN URBAN DEVELOPMENT (International Conference), Beijing, China. (Professor Wang Sijing, Chairman LANDPLAN IV, Institute of Geology, Academia Sinica, P.O. Box 634, Beijing 100029, China. Phone: 86–1–2027766; telefax: 86–1–4919140; telefax: 22474 ASCHI CN c/o Institute of Geology)

August 15–19

CARBONIFEROUS TO JURASSIC PANGEA: A GLOBAL VIEW OF ENVIRONMENTS AND RESOURCES (International Symposium), Calgary, Alberta, Canada. (Dr. Benoit Beauchamp or Dr. Ashton Embry, Geological Survey of Canada, 3303 33rd St. NW, Calgary, Alberta T2L 2A7, Canada. Phone: (403) 292–7190; telefax: (403) 292–4961

August 23–29

GEOMORPHOLOGY (3rd International Conference), Hamilton, Ontario, Canada. (3rd International Geomorphology Conference, Department of Geography, McMaster University, Hamilton, Ontario L8S 4K1, Canada. Phone: (416) 525–9140, ext. 4535; telefax: (416) 546–0463; E-mail: GEOMORPH)

August 23–29

COASTAL SEDIMENTOLOGY (Meeting), Hamilton, Ontario, Canada. (William F. Tanner, Dept. of Geology B-160, Florida State University, Tallahassee, FL 32306, USA) Phone: 904/644-3208)

August 28–September 15

LANDSLIDES (International Meeting and Workshop), Czech and Slovak Federal Republic. (ICFL–C.S. Landslides '93, c/o NOVOSAD IG/EG, I. Sekaniny 1801, CS–70800 Ostrava 4, Czechoslovakia. Phone: (42–69) 473028; telefax: (42–2) 381848)

→→→ September 1993←←←

September 5–11

NUCLEAR-WASTE MANAGEMENT, int'l mtg., Prague, Czech and Slovak Federal Republic, by American Society of Mechanical Engineers. Czech and Slovak Mechanical Engineering Society, and the Czech and Slovak Nuclear Society. (Radovan Kohout, Ontario Hydro (H11 A2), 700 University Ave., Toronto, Ontario M5G 1X6. Phone: 416/592-5384. Fax: 416/592-4485)

September 6–8

STRUCTURES AND TECTONICS AT DIFFERENT LIGHOSPHERIC LEVELS (International Conference), Graz, Austria. (Wolfgang Unzog, Department of Geology, University of Graz, Heinrichstrasse 26, A–8010 Graz, Austria. Phone: 43 316 380 5584; telefax: 43 316 38 28 85)

September 8–13

JURASSIC GEOLOGY (Arkell International Symposium), London, UK. (Dr. Stewart Brown, Conference Secretary, Petroleum Science and Technology Institute, 25 Ravelston Terrace, Edinburgh EH4 3EX, UK. Phone: 031 451 5231; telefax: 031 451 5232)

September 8–17

LAYERING IN IGNEOUS COMPLEXES – WAGER AND BROWN 25th ANNIVERSARY COMMEMORATIVE MEETING (Symposium), Johannesburg, South Africa. (Professor R. Grant Cawthorn, Department of Geology, University of the Witwatersrand, P.O. Wits 2050, Republic of South Africa. Phone: 11 716 2711 or 2608; telefax: 11 339 1697 or 430 1926)

September 14–16

AFRICAN GEOLOGY (16th International Colloquium), Ezulwini, Swaziland. (The Chairman or Secretary, Organizing Committee, 16th Colloquium of African Geology, P.O. Box 9, Mbabane, Swaziland. Phone: 42411; telefax: 45215; telex: 2301 WD; telegram: GSM)

September 15–17

MINING DEVELOPMENT, int'l mtg., Philadelphia, by Society for Mining, Metallurgy, and Exploration. (SME, Meetings Department, Box 625002, Littleton, Colo. 80162. Phone:303/973-9550. Fax: 303/979-3461

September 21–23

ANDEAN GEODYNAMICS (2nd International Symposium), Oxford, UK. Sponsored by University of Oxford and Institut Francais de Recherche Scientifique pour le Développement en Coopération (Orstom). (Pierre Soler, ISAG 93, Orstom, CS1, 213 rue Lafayette, 75480 Paris Cedex 10, France. Telefax: 33 1 48 03 08 28)

September 25–October 1

INTERNATIONAL ASSOCIATION OF VOLCANOLOGY AND CHEMISTRY OF THE EARTH'S INTERIOR (Meeting), Canberra, Australia. (IAVCEI ACTS, GPO Box 2200, Canberra ACT 2601, Australia. Phone: 61 6 257-3299. Fax: 61 6 257-3256)

September 27–30

ENVIRONMENTAL BIOGEOCHEMISTRY (11th International Symposium), Salamanca, Spain. (Dr. J.F. Gallardo Lancho, I.E.T./CSIC, Aptdo. 257, Salamanca 37071, Espana, Spain. Phone: (923) 219606; telefax: (923) 219609)

September 27–29

GLOBAL BOUNDARY EVENTS (Interdisciplinary Conference of IGCP Project 293, Geochemical Marker Events in the Phanerozoic), Kielce, Poland. (Barbara Studencka, Muzeum Ziemi PAN, A1.Na Skarpie 20/26, 00–488 Warszawa, Poland. Phone: (4822) 217–391; telefax: (4822) 297–497. Or Helmut H.J. Geldsetzer, Geological Survey of Canada, 3303–33rd St. NW, Calgary, Alberta T2L 2A7, Canada. Phone: (403) 292–7155; telefax: (403) 292–5377)

September 28–October 1

ENVIRONMENTAL POLLUTION (International Conference), Barcelona, Spain. (ICEP Conference Office, ICTR Secretariat, 11–12 Pall Mall, London SW1Y 5LU, UK. Phone: 44 71 930–6825; telefax: 44 71 976–1587; telex: 925312 REICO)

→→→ October 1993←←←

October 4–9

BASIN INVERSION (International Conference), Oxford, UK. (James G. Buchanan, British Gas Exploration and Production Limited, 100 Thames Valley Park Drive, Reading, Berkshire RG6 IPT, UK. Phone: 0734–353222; telefax: 0734–353484; telex: 846231)

October 10–15

INTERNATIONAL ASSOCIATION FOR MATHEMATICAL GEOLOGY (Silver Anniversary Meeting), Prague, Czechoslovakia. (John C. Davis, Kansas Geological Survey, University of Kansas, Lawrence, KS 66047, USA. Phone: (913) 864–3955; telefax: (913) 864–5317; E-mail: john_davis.moore_@msmail.kgs.ukans.edu. Europe, Africa, and Asia: Jan Harff, Institute for Baltic Sea Research, Seestr. 15, 0–2530 Warnemuende, Germany. Phone: 49 381 58 261; telefax: 49 381 58.336; E-mail: harff@geologie.io-warnemuende.dbp.de)

October 11–24

INTERGEMS '93 (2nd International Symposium on Precious and Decorative Stones), Prague, Czechoslovakia. Sponsored by Czech and Slovak Geological Services and Museums. (Secretariat INTERGEMS, Malostranske nam. 19, CS–11821 Praha 1, Czechoslovakia. Phone: 535 357; telefax: 533 564)

October 17–20

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (International Meeting), The Hague, The Netherlands. (AAPG, Box 979, Tulsa, OK 74101, USA. Phone: (918) 584–2555; telefax: (918) 584–0469)

October 18–23

NEW DEVELOPMENTS IN GEOTHERMAL MEASUREMENTS IN BOREHOLES (Meeting), Klein Koris, Germany. (Prof. E. Hurtig, GFZ Potsdam, Telegrafenberg A45, 0–1561 Potsdam, Germany. Phone: 49 331 310 347; telefax: 49 331 310 610; E-mail: gth@gfz-postsdam.dbp.de)

October 25–28

GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Boston, Massachusetts, USA.

(Vanessa George, GSA, P.O. Box 9140, Boulder, CO 80301, USA. Phone: (303) 447–2020)

October 27–28

PALYNOLOGY, CLIMATE AND SEQUENCE STRATIGRAPHY OF THE PLIOCENE, mtg., Baton Rouge, La., by the American Association of Stratigraphic Palynologists. (John Wrenn, Amoco Production Co., Box 3092, Houston, 77253. Phone: 713/556-2297. Fax: 713/584-7468). Deadline for abstracts: Aug. 31.

→→→ November 1993←←←

November 5–21

CIRCUM-PACIFIC AND CIRCUM-ATLANTIC TERRANE, Int'l mtg., Guanajuato, Mexico. (David G. Howell, USGS, MS 902, 345 Middlefield Road, Menlo Park, Calif. 94025. Fax: 415354-3224)

November 15–30

INTERNATIONAL GEOLOGICAL CORRELATION PROGRAMME, mtg., Santiago, Chile. (M. Vergara, Universidad de Chile, Departmento de Geologia y Geofisica, Casilla 13518-Correo 21, Santiago, Chile. Fax: 56-2-6963050)

November 15–30

LOW TEMPERATURE METAMORPHISM: PROCESSES, PRODUCTS AND ECONOMIC SIGNIFICANCE (IGCP Project 294 Thematic Meeting), Santiago, Chile. (Professor M. Vergara, Universidad de Chile, Departmento de geologia y Geofisica, Casilla 13518-Correo 21 Santiago, chile. Telefax: 56 2–6963050)

1994

Jan 27–28

DYNAMIC GEOTECHNICAL TESTING, symposium, Reno, Nev. (Dorothy Savini, American Society for Testing and Materials, 1916 Race St., Philadelphia, 19103-1187. Phone: 215/299-5413)

June 5–11

GEOCHRONOLOGY, COSMOCHRONOLOGY AND ISOTOPE GEOLOGY (ICOG-8), mtg., Berkeley, Calif. (Garniss H. Curtis, Institute of Human Origins-Geoochronology Center, 2453 Ridge Road, Berkeley, 94709. Phone: 415/845-4003. Fax: 415/845-9453)

June 6–10

EUROPEAN ASSOCIATION OF EXPLORATION GEOPHYSICISTS (56th) Annual Meeting and Exhibition), Austria Center, Vienna, Australia. (Evert Van der Gaag, Business Manager, European Association of Exploration Geophysicists, Utrechtseweg 62, NL-3704 HE Zeist, the Netherlands. Phone: (03404) 56997; telefax (03404) 62640; telex:33480)

June 12–15

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS, ann. mtg., Denver. (AAPG, Box 979, Tulsa, Okla. 74101. Phone: 918/584-2555. Fax: 918/584-0469)

July 1–5

HYDROMETALLURGY, int'l mtg., Cambridge, England, by Society of Chemical Industry and Institution of Mining and Metallurgy. (SCI, 14/15 Belgrave Square, London, England SW1X8PS. Phone: 071 235 3681. Fax: 017 823 1698) [December '92]

Aug 21–24

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS. Int'l. mtg., Kuala Lumpur, Malaysia. (AAPG Box 979, Tulsa, Okla. 74101. Phone: 918/584-2555. Fax: 918/584-0469)

1995

Mar 5–8

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS, ann. mtg. Houston. (AAPG, Box 979, Tulsa, Okla. 74101. Phone: 918/584-2555. Fax: 918/584-0469)

May 29–June 2

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

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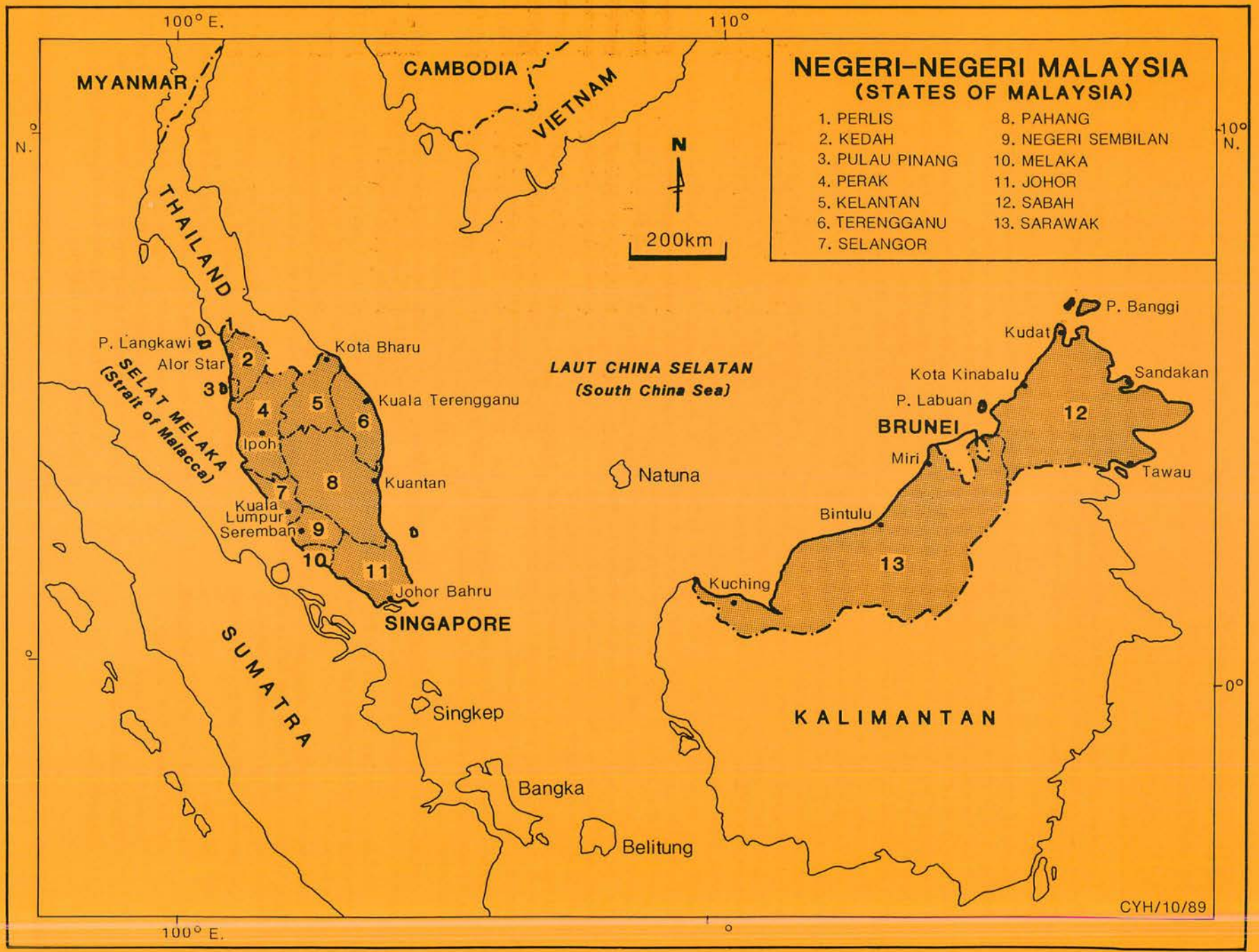
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