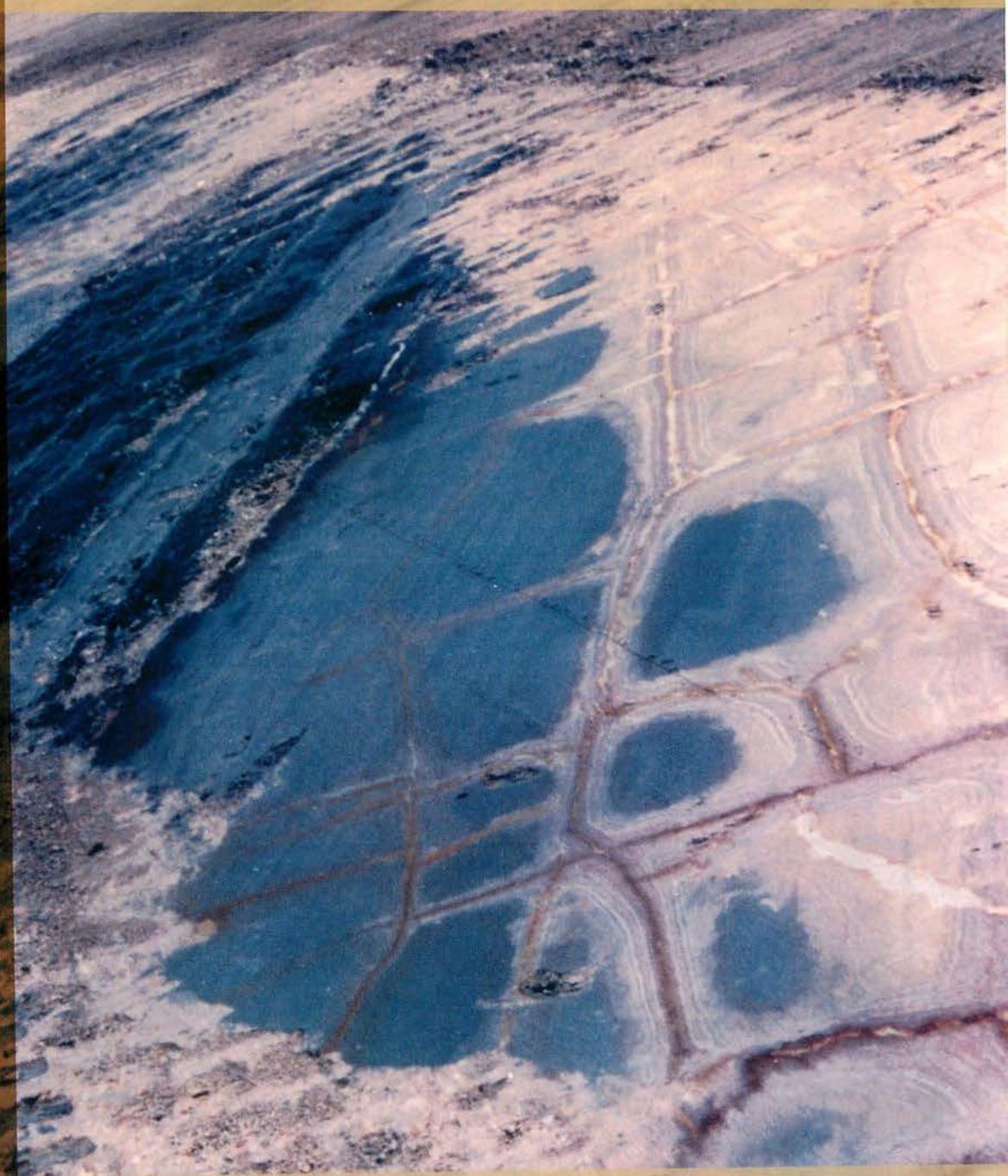
PP 2509/2/2004 ISSN 0126-5539

PERSATUAN GEOLOGI MALAYSIA

WARTA GEOLOGI

NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MALAYSIA



May – Jun 2003

Jilid 29 No. 3

DIKELUARKAN DWIBULANAN
ISSUED BIMONTHLY

Volume 29 No. 3

PERSATUAN GEOLOGI MALAYSIA
Geological Society of Malaysia

About the Society

The Society was founded in 1967 with the aim of promoting the advancement of earth sciences particularly in Malaysia and the Southeast Asian region.

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

Published by the Geological Society of Malaysia,
Department of Geology, University of Malaya, 50603 Kuala Lumpur.
Tel: 603-7957 7036 Fax: 603-7956 3900 E-mail: geologi@po.jaring.my

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

CATATAN GEOLOGI
GEOLOGICAL NOTES

On the occurrence of *Pleurodictyum* in the Jentik Formation of Kampung Guar Jentik, Beseri, Perlis

MEOR HAKIF HASSAN AND LEE CHAI PENG
Department of Geology
University of Malaya
50603 Kuala Lumpur, Malaysia

Abstract: The tabulate coral *Pleurodictyum* is for the first time reported from Devonian rocks of Malaysia. The tabulates were found in red mudstone recognized as part of Unit 3 of the newly proposed Jentik Formation, in Kampung Guar Jentik, Beseri, Perlis. The presence of *Pleurodictyum* supports a Middle Devonian age for at least part of Unit 3 of the Jentik Formation.

INTRODUCTION

Three specimens of the Devonian tabulate coral *Pleurodictyum* were recovered from an earth quarry identified in Meor and Lee (2002) as Hill A, Guar Sanai, in Kampung Guar Jentik, Beseri district of Perlis. This is the first reported occurrence known to the authors of this taxa from Devonian rocks of Peninsular Malaysia.

AGE AND STRATIGRAPHY

The *Pleurodictyum* fossils were found within an approximately 1.3 m thick bed of sparsely fossiliferous red mudstone recognized as part of Unit 3 (also known as the Langgun Red Beds) of the Jentik Formation (coordinates 6°33.168'N, 100°12.432'E, also known as Section 1 in Meor and Lee, 2002). The site is located just south of the limestone hill identified as Hill A, which contains fossils of scyphocrinoid loboliths (Lee, 2001) and identified as part of the Upper Setul Limestone (Fig. 1). Its stratigraphic position is also observed to be below black laminated shales of Unit 1, Jentik Formation, containing abundant dacryoconarids and calymenid trilobites. The *Pleurodictyum* bed is overlain by a 1.6 m thick sequence of weathered, light brown coloured mudstone interbedded with flatbottom quartzite beds (Fig. 2). These mudstones contain abundant *Posidonomya* fossils. Previous paleontological studies have stressed on a Late Devonian, or even Early Carboniferous age for the red mudstone of Jentik Formation (Hamada, 1969 and 1973, in which the older name Langgun Red Beds was used for the red mudstone of Jentik Formation; Meor and Lee, 2002). This age maybe true for the upper part of Unit 3, but the base of the unit may be older. The *Pleurodictyum* bed is located close to Upper Silurian-Lower Devonian, Upper Setul Limestone and the base of the Jentik Formation, and *Pleurodictyum* is restricted to rocks of Middle Devonian age. A Middle to Late Devonian age for Unit 3 of the Jentik Formation is also supported by ostracod data (Hanai in Hamada, 1973). *Pleurodictyum* may also be found in other localities in northwest Peninsular Malaysia, as Siti Hajar (*pers. comm.*) has reported similar fossils from Kampung Binjal, in Utan Aji district of Perlis.

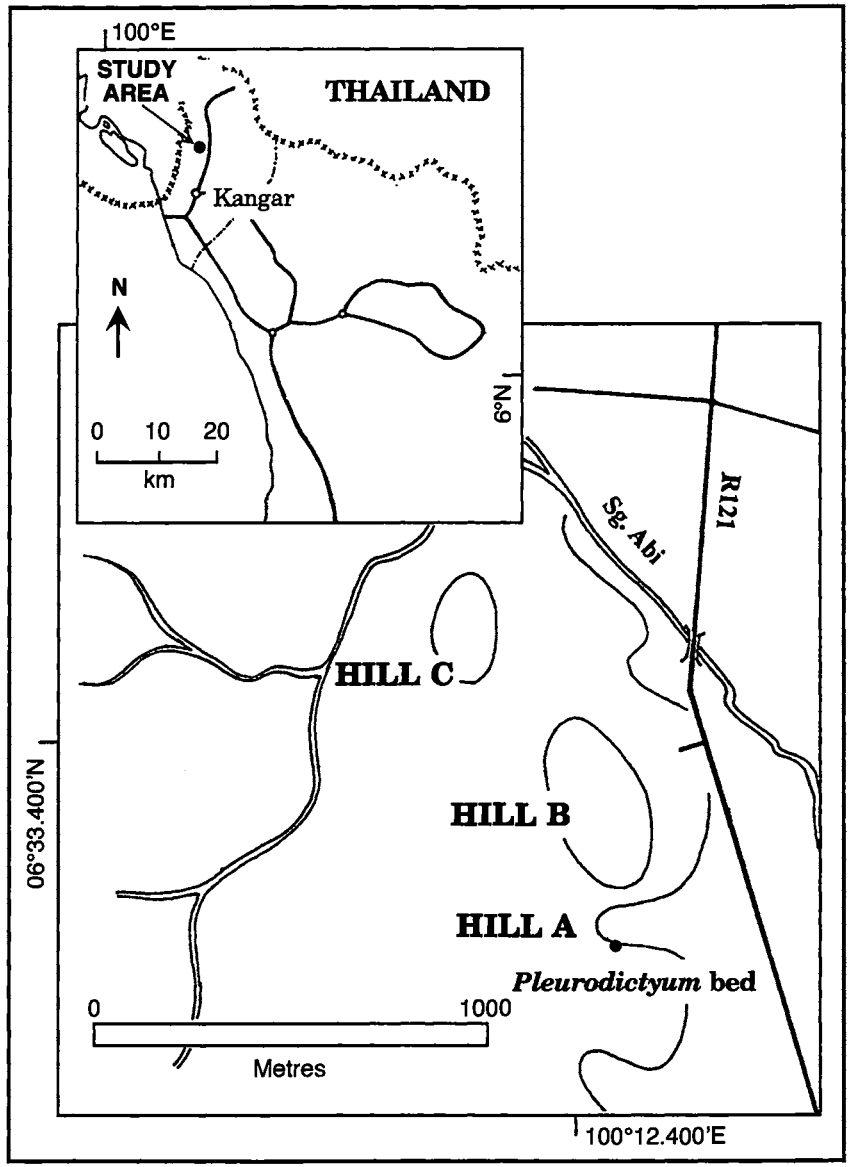


Figure 1. Map showing location of the study area and the *Pleurodictyum* bearing bed.

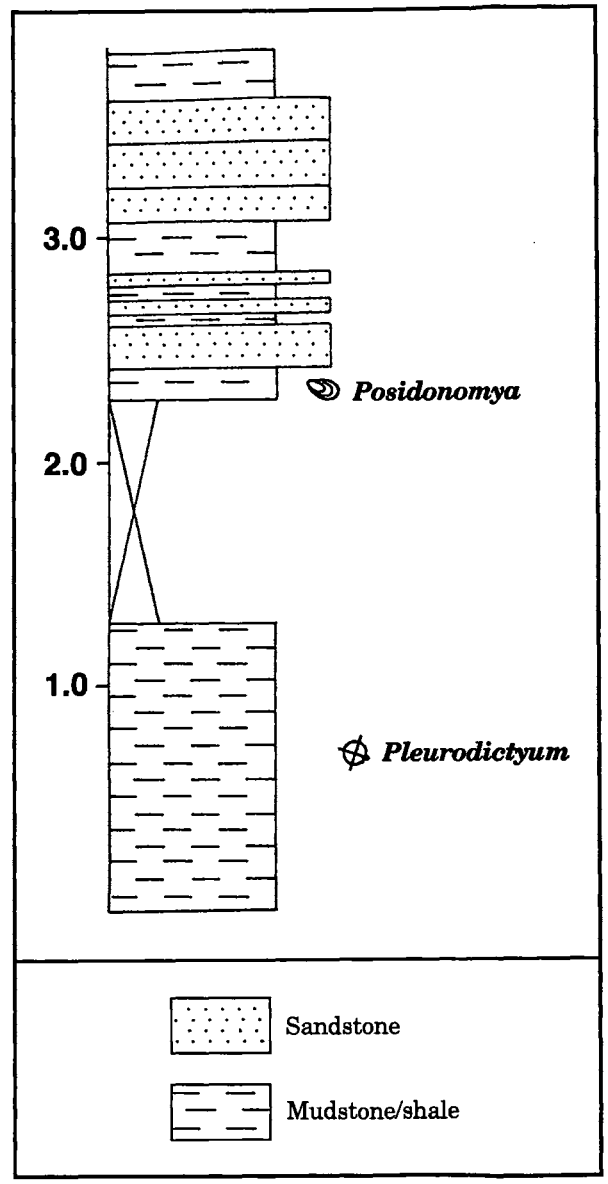


Figure 2. Logged section of the study area marked in Figure 1. Shown are the position of the collected fossils.

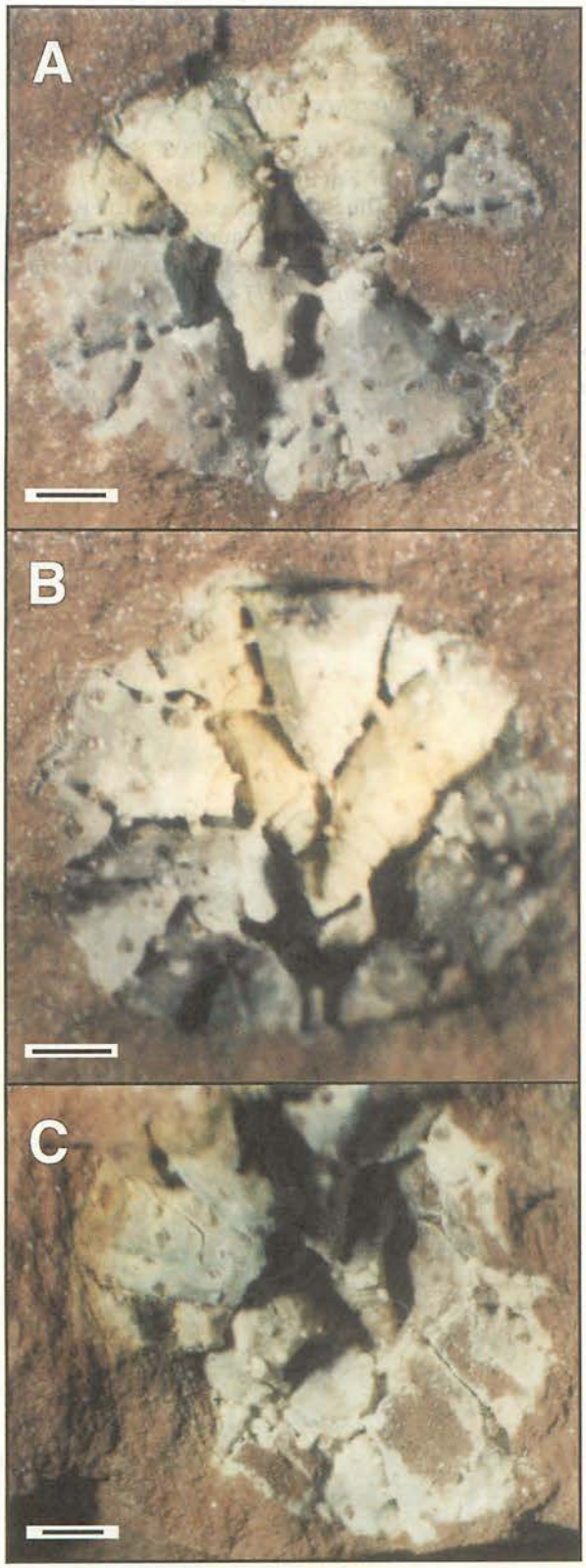


Figure 3. *Pleurodictyum* fossils from Guar Jentik. (A) SA001; (B) SA002; (C) SA003. Scale bars are 1 mm each.

SYSTEMATIC PALEONTOLOGY

Phylum CNIDARIA
Class ANTHOZOA Ehrenberg, 1834
Order TABULATA Milner-Edwards & Haine, 1850
Family FAVOSITIDAE Dana, 1846
Subfamily MICHELININAE Waagen & Wentzel, 1886
Genus *Pleurodictyum* Goldfuss, 1829
Pleurodictyum sp. (Figure 3)

Material

3 specimens from red mudstone of Hill A, Guar Sanai, Beseri district, Perlis (Catalogued as SA001, SA002 and SA003 in the collection of the Geology Department, University of Malaya).

Description

Small corallum, discoidal and ovate in shape, diameter ranging from 6–9 mm. Corallites flaring, few in number, relatively large and prismatic. Mural pores are tunnel-like and irregularly distributed on corallites.

Discussion

The specimens are only internal molds and do not show much of the form of the animal. The arrangement of the corallites, flaring from a central point, with the basal corallites horizontal, suggest that the corals were probably flatbottomed. The specimens are interestingly small, and may indicate that their habitat were in deeper waters, far from sunlight. Detailed study of the genus *Pleurodictyum* is still lacking, therefore specific identification of the specimen cannot be done.

ACKNOWLEDGEMENTS

This is part of the ongoing research for Meor Hakif's MSc. Thesis, supervised by Assoc. Prof. Dr. Lee Chai Peng at the University of Malaya, Kuala Lumpur. The authors would like to thank Anuar Hj. Ismail, Ahmad Tarmizi and Mr. Drasman for their help in the field.

REFERENCES

HAMADA, T., 1969. Late Palaeozoic brachiopods from redbeds in the Malayan Peninsula. *Geology and Palaeontology of Southeast Asia, 6*, 251–264.

HAMADA, T., 1963. Cyrtosymbolids (Trilobita) from the Langgun Red Beds in Northwest Malaya, Malaysia. *Geology and Palaeontology of Southeast Asia, 12*, 1–28.

LEE, C.P., 2001. Occurrences of *Scyphocrinites* locoliths in the Upper Silurian Upper Setul limestone of Pulau Langgun, Langkawi, Kedah and Guar Sanai, Beseri, Perlis. *Proc. Geol. Soc. Malaysia Annual Geological Conference 2001*, 99–104.

MEOR HAKIF HASSAN AND LEE, C.P., 2002. Stratigraphy of the Jentik Formation, the transitional sequence from the Setul Limestone to the Kubang Pasu Formation at Guar Sanai, Kampung Guar Jentik, Beseri, Perlis — a preliminary study. *Bull. Geol. Soc. Malaysia, 42*, 171–178.

Manuscript received 23 October 2002

CATATAN GEOLOGI
GEOLOGICAL NOTES

Evidence of fractional crystallization in the Western Belt granite magma

AZMAN A. GHANI
Department of Geology
University of Malaya
Kuala Lumpur 50603
Kuala Lumpur

Abstract: The Peninsular Malaysian granites have been grouped into two granite provinces namely Western and Eastern Belt granite. Two groups can be identified in the Western Belt granite. The first group covers about 90% of the total Western Belt granite volume. The main rock type is a coarse to very coarse grained megacrystic biotite muscovite granite. Distinct mineralogy of this group is high Al biotite, muscovite (may be primary, Miller *et al.*, 1981) and Mn rich garnet. The second group corresponds to the amphibole bearing granite found in several granitic bodies at the northern part of the Western belt granite. Common mineralogical assemblages of this group is low Al biotite + sphene ± actinolitic hornblende. The latter have lower SiO_2 content (65.95 to 70.63%; mean 69.15%) compared to the amphibole free rocks (67.44 to 77.44%; mean: 73.16%). Major and trace elements plot suggest the importance of fractional crystallization in the magmatic evolution of the Western Belt magma. The continuous trend shown by both amphibole free and amphibole bearing granites in nearly all geochemical plots suggest that a connection exists between all the rocks at some stage of their magmatic evolution.

INTRODUCTION

The Western Belt granites of the Peninsular Malaysia is characterized by a huge mountain range extending from Malacca in the south to Thailand in the north (Cobbing *et al.*, 1992). The country rocks penetrated by the granites are predominantly isoclinally folded phyllitic Lower Paleozoic metasedimentary rocks including marble, and less strongly folded Upper Paleozoic formations. The Peninsular Malaysian granites are distributed into three parallel belts, i.e. Western, Central and Eastern belts. They have been grouped into two granite provinces; a Western province consisting of granites confined to the Western Belt with an age range from 200 to 230 Ma and the Eastern province consisting of granites from both the Eastern and Central belt and aged from 200 to 264 Ma (Cobbing *et al.*, 1992). The Western belt granites is characterised by a huge mountain range extending from Malacca in the south to Thailand in the north which covers the area exceeding 15,000 km^2. Two groups can be identified in the Western Belt granite. The first group covers about 90% of the total Western Belt granite volume. The main rock type is a coarse to very coarse grained megacrystic biotite muscovite granite. Distinct mineralogy of this group is high Al biotite, muscovite (may be primary) and Mn rich garnet. The second group is the amphibole bearing granite found in several granitic bodies at the northern part of the Western belt granite. Common mineralogical assemblages of this complex is low Al biotite + sphene ± actinolitic hornblende.

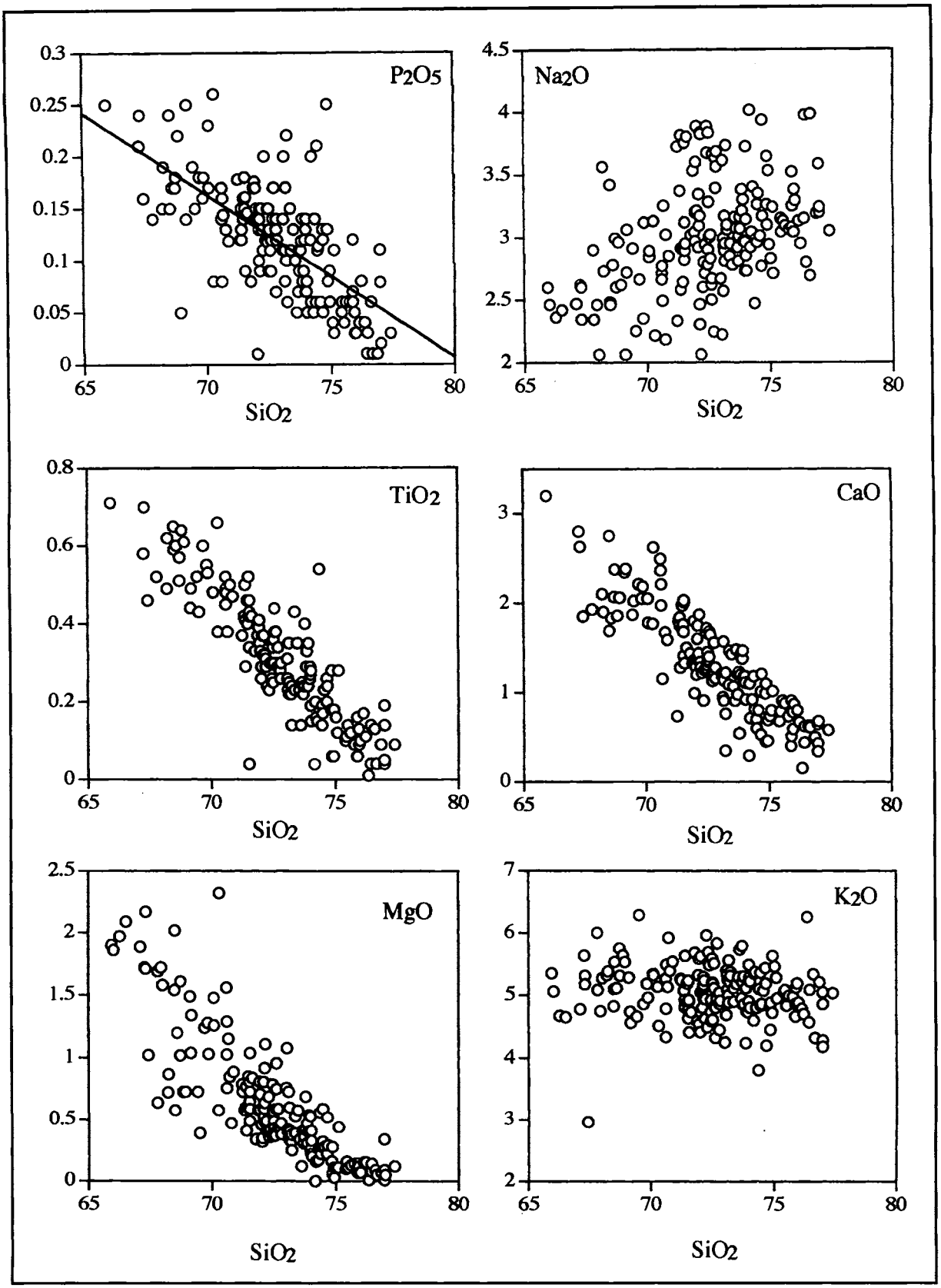


Figure 1. Selected Harker diagrams for major elements in the Western Belt granite.

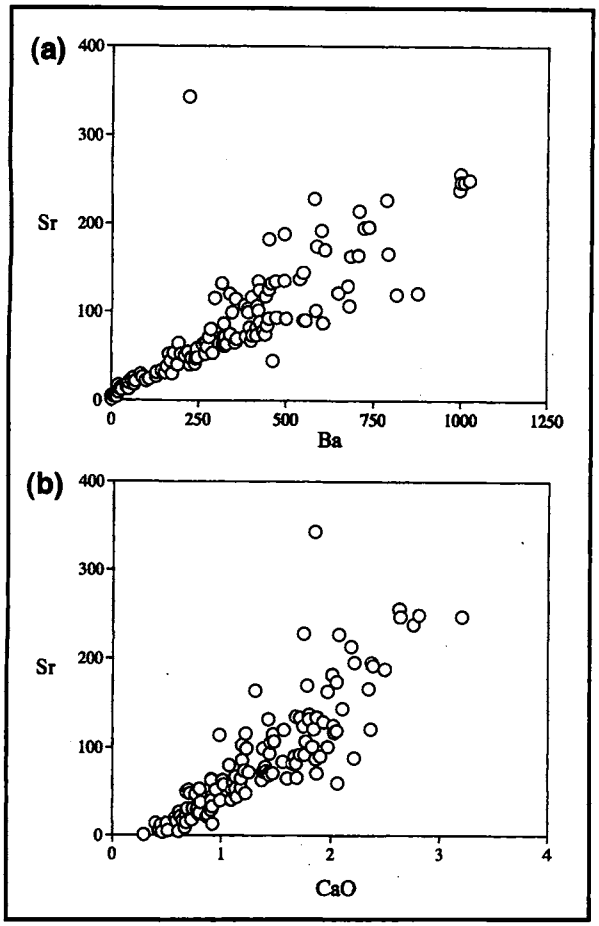


Figure 2. (a) Sr vs Ba, (b) Sr vs CaO diagrams for the Western Belt granite.

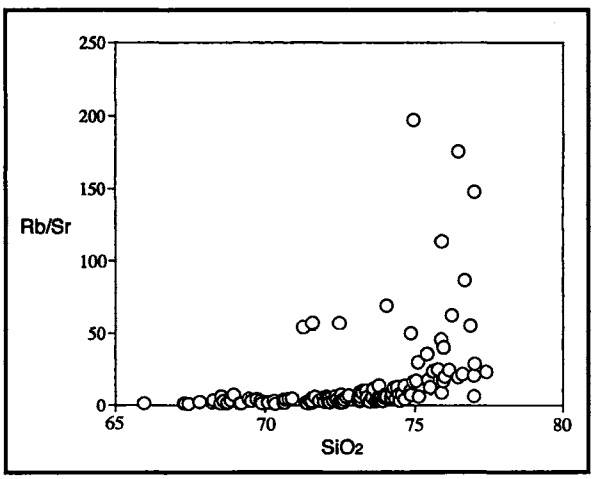


Figure 3. Rb/Sr vs SiO_2 diagram for the Western Belt granite.

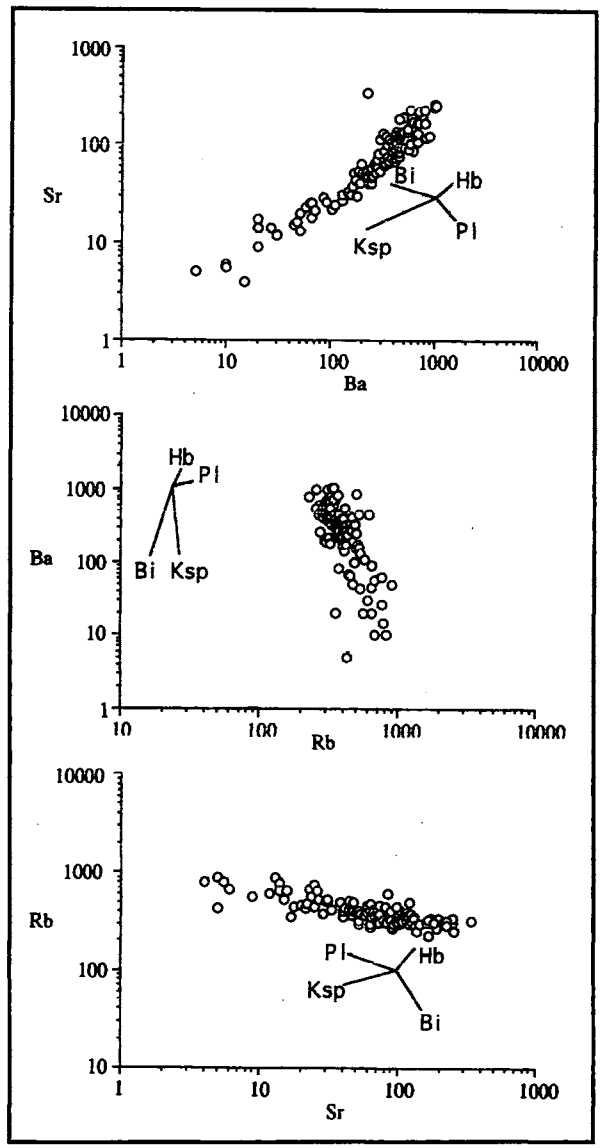


Figure 4. Large ion lithophile elements modelling of the Western Belt granite. Mineral vectors indicate paths of evolved liquids for 20% of mineral precipitating. Ksp = K-feldspar; Pl = Plagioclase; Bi = Biotite and Hb = Hornblende.

PETROLOGY

The Western Belt granite consists of syenogranite and monzogranite with subordinate granodiorite. Mineralogy of the granite in decreasing abundance are K-feldspar, quartz, plagioclase, biotite, muscovite, allanite, zircon, sphene, apatite, secondary epidote, tourmaline, ilmenite, amphibole, andalusite and garnet. Amphibole found in the northern part of the Western Belt granite is mainly actinolitic hornblende in composition with an atomic Mg/(Mg+Fe) range from 0.5 to 0.6. Large K-feldspar phenocrysts up to 7 cm long are common. Compositions of the analyzed K-feldspar range from Or_{90} to Or_{100} Plagioclases display a variety of habits with composition ranges from An_{52} to An_0. The most common plagioclase type is oligoclase. Quartz in the Western Belt granite is mostly anhedral and sometimes occurs as subgrains. It is generally interstitial to all other minerals especially plagioclase. Biotite may occur as discrete plates, as ragged shreds in mafic clots and as small flakes associated with granoblastic aggregates of quartz and plagioclase. Available geochemical data indicate that the biotites from Kuala Lumpur granite (Central part of the Western Belt) is similar to those crystallized from peraluminous melt which is characterized by high Al_2O_3 content (17–21%). Muscovite may occur as texturally primary flakes in the basic members and as large interstitial plates in leucogranite and microgranite.

GEOCHEMISTRY

The Western belt granite is characterised by highly evolved rocks with SiO_2 ranging from 65.95 to 77.4% (Fig. 1). Amphibole bearing rocks have lower SiO_2 content (65.95 to 70.63%; mean 69.15%) compared to the amphibole free rocks (67.44 to 77.44%; mean: 73.16%). The ACNK value for the Western Belt granites range from 0.92 (mildly metaluminous) to 1.18 (peraluminous). The decrease of Ba concomitant with Sr suggests that K-feldspar, biotite and plagioclase are being removed in the differentiation sequence (Fig. 2a). Positive slope of Sr vs. CaO supports that plagioclase is being removed in the differentiation sequence (Fig. 2b). Precipitation of plagioclase is also evidenced from Rb/Sr vs SiO_2 plot (Fig. 3). The plot show a 'J' shaped trend which suggests the important of fractional crystallisation process with plagioclase as the major precipitating phase.

The importance of K-feldspar, biotite and plagioclase in the differentiation is consistent with large ion lithophile (LIL) modelling. Inter-element LIL variation diagram for pairs Rb-Sr, Ba-Sr and Ba-Rb are shown in Figure 4. Also shown in each of the diagram is the vector diagram representing the net change in composition of the liquid after 30% Rayleigh fractionation by removing K-feldspar, hornblende, plagioclase or biotite. In all diagrams the trends are consistent with fractionation of plagioclase, K-feldspar and biotite. Thus the LIL log-log plot suggest that crystal fractionation plays an important role in the magmatic evolution of the Western Belt magmas. The continuous trend shown by both amphibole free and amphibole bearing granites in nearly all geochemical plots suggests that a connection exists between all the rocks at some stage of their magmatic evolution.

REFERENCES

COBBING E.J., PITFIELD, P.E.J., DARBYSHIRE, D.P.F. AND MALLICK, D.I.J., 1992. The granites of the South-East Asian tin belt. *Overseas Memoir 10*, British Geological Survey.

Manuscript received 27 February 2003

PERTEMUAN PERSATUAN
MEETINGS OF THE SOCIETY

Annual Geological Conference 2003

Hilton Hotel, Kuching, Sarawak

24–26 May, 2003

Laporan

Persidangan Tahunan Geologi 2003 ke-17 telah berjaya diadakan pada 24–26 Mei 2003 di Hotel Hilton, Kuching, Sarawak yang dirasmikan oleh YB Datuk Haji Awang Tengah Ali Hassan, Menteri Muda Di Pejabat Ketua Menteri Sarawak.

Sejumlah 121 peserta berdaftar telah mengikuti persidangan yang terdiri daripada ahli-ahli Geologi dari jabatan-jabatan kerajaan, institusi-institusi pengajian tinggi kerajaan dan pihak swasta. Sejumlah 4 kertas utama dan 76 kertas kerja teknikal dalam pelbagai subbidang geosains telah dibentangkan secara lisan dan poster. Kertas Utama yang dibentangkan oleh YB Dr. James Dawos Mamit dari Lembaga Sumber Asli dan Alam Sekitar Sarawak (NREB) yang bertajuk "*Geoscience in the context of environmental management in Sarawak*" amat menarik perhatian. Ia telah dibentangkan oleh seorang tokoh politik terkenal Sarawak dan telah memberi harapan dan dimensi baru kepada ahli geologi. Beliau meminta agar sebarang isu berkaitan dengan geosains dapat diajukan kepada beliau untuk perbahasan di parlimen.

Hasil komitmen Jawatankuasa Kecil Penyuntingan, semua kertas kerja telah diedit dengan teliti dan diterbitkan sebagai Buletin 46 (May 2003) yang juga digunakan sebagai prosiding persidangan kali ini. Memandangkan kertas kerja yang diterima terlampau banyak, Jawatankuasa Penganjur terpaksa menjalankan pembentangan lisan secara selari dengan penetapan kepada subbidang tertentu atau kombinasi dari pelbagai subbidang dengan 8 sesi pembentangan teknikal secara lisan dan 2 sesi pembentangan poster. Walau bagaimanapun, terdapat sedikit perbezaan bilangan pendengar dalam kedua-dua bilik persidangan tersebut bergantung sepenuhnya kepada populariti subjek yang dibentangkan.

Secara keseluruhan, topik berkaitan dengan geologi kejuruteraan, geologi alam sekitar, hidrogeologi serta peralatan geosains dan teknik merupakan medan popular kepada pendengar selaras dengan tema persidangan iaitu "*Perserverence in geoscience towards sustainable development*". Pihak jawatankuasa penganjur ingin memohon maaf kepada pembentang-pembentang poster kerana kedua-dua sesi pembentangan terpaksa dijalankan dalam waktu yang amat singkat dan terhad disebabkan faktor masa. Pembentang tidak berpeluang meletakkan poster masing-masing dalam jangkamasa yang lama untuk tatapan semua peserta.

Lawatan lapangan (Pre-conference fieldtrip) ke Serian-Tebakang-Tebedu telah menarik minat 24 orang peserta yang mana terdiri daripada Kumpulan Warisan Geologi Malaysia (KWGM) yang telah mengadakan Persidangan Kebangsaan Warisan Geologi Malaysia Ke-III pada 21–22 Mei 2003. Sebahagian peserta sempat membeli-belah di Entikong, Kalimantan untuk dibawa pulang. Sementara 'Mid-Conference Field Trip" yang julung kali diadakan telah memikat hati 33 orang peserta ke kawasan Santubong. Kedua-dua kerjalapangan telah berjaya mendedahkan peserta kepada geologi bahagian barat Sarawak yang jauh berbeza dengan Semenanjung Malaysia.

Secara amnya, persidangan telah berjalan dengan lancar dan berjaya yang mana kebanyakan pembentang mematuhi masa yang ditetapkan dan memberi peluang kepada peserta untuk membeli-belah beraneka buah tangan untuk dibawa balik kepada keluarga dan rakan taulan di Semenanjung. Walaupun, suasana SARS belum reda, namun begitu peserta tidak menunjukkan kebimbangan tentang wabak tersebut dan masih dapat menyempurnakan persidangan sehingga penghujungnya.

Saya bagi pihak Jawatankuasa Penganjur ingin memohon maaf di atas sebarang kekurangan dan ketidakpuas-hatian semua peserta sepanjang persidangan berlangsung. Saya juga ingin merakamkan ucapan syabas dan jutaan terima kasih kepada jawatankuasa kecil dari Jabatan Mineral dan Geosains Malaysia Sarawak yang membantu untuk menjayakan persidangan ini.

Askury Abd. Kadir
Setiausaha Jawatankuasa Penganjur
Persidangan Tahunan Geologi 2003

Annual Geological Conference 2003

Hilton Hotel, Kuching, Sarawak

24–26 May, 2003

Ucapan Alu-aluan oleh En. Alex Unya Ambun, Pengerusi Jawatankuasa Penganjur Persidangan Tahunan Geologi 2003

Saudari Pengerusi Majlis,

Yang Berhormat Datuk Haji Awang Tengah Ali Hassan, Menteri Muda di Pejabat Ketua Menteri/ Menteri Muda Perancangan dan Pengurusan Sumber/Menteri Muda Pembangunan Perindustrian dan menteri Muda Pembangunan Luar Bandar dan Kemajuan Tanah Sarawak yang mewakili Y.A.B. Datuk Patinggi Tan Sri Dr. Haji Abdul Taib Mahmud, Ketua Menteri Sarawak,

Yang berusaha Profesor Madya Dr. Abdul Ghani Rafek, Presiden Persatuan Geologi Malaysia,

Yang Berbahagia Tuan Haji Isa bin Kassim, Setiausaha Persekutuan Sarawak,

Ahli-ahli Yang Berhormat,

Ketua-ketua jabatan persekutuan dan negeri,

Dif-dif kehormat,

Tuan-tuan dan Puan-puan serta hadirin yang dihormati sekelian,

Selamat pagi dan salam sejahtera.

Bagi pihak Jawatankuasa Penganjur, saya mengalu-alukan dan mengucapkan Selamat datang kepada tetamu jemputan dan peserta persidangan ke majlis kita pada pagi ini.

Ribuan terima kasih ditujukan khas kepada Yang Berhormat Datuk Haji Awang Tengah Ali Hassan, Menteri Muda di Pejabat Ketua Menteri yang mewakili Y.A.B. Datuk Patinggi Tan Sri Haji Abdul Taib bin Mahmud, Ketua Menteri Sarawak kerana sudi hadir pada pagi yang mulia ini dan seterusnya merasmikan persidangan kali ini.

Persidangan Tahunan Geologi 2003 di Kuching ini merupakan persidangan Tahunan Persatuan Geologi Malaysia Ke-17 dan tema yang dipilih pada persidangan kali ini ialah "Perserverance in geosains towards sustainable development". Pemilihan tema tersebut menggambarkan komitmen dan keprihatinan warga geosaintis sejajar dengan aspirasi kerajaan yang menjanjikan pembangunan mesra alam. Beberapa kertas bertema akan dibentangkan untuk menunjukkan betapa pentingnya sumbangan geosains dalam perkara berkaitan.

Tuan-tuan dan Puan-puan,

Memandangkan sambutan yang menggalakkan, persidangan kali ini akan dijalankan dalam 8 sesi pembentangan teknikal secara selari dan 2 sesi pembentangan poster. Sejumlah 86 kertas kerja telah diluluskan untuk pembentangan terdiri daripada 4 kertas utama, 52 kertas teknikal dan 30 poster yang merangkumi pelbagai bidang geosains. Selaras dengan persidangan ini, Jawatankuasa Penganjur telah mengaturkan dua lawatan lapangan telah

diatur, iaitu 'Pre-conference fieldtrip' ke Serian – Tebakang – Tebedu telah diadakan semalan, dan 'Mid-conference fieldtrip' akan diadakan besok di sekitar Santubong. Semoga kedua-dua lawatan tersebut akan memberi pengetahuan kepada peserta-peserta persidangan tentang geologi bahagian barat Sarawak.

Tuan-tuan dan Puan-puan,

Pada kesempatan ini saya ingin merakamkan ucapan terima kasih yang tidak terhingga kepada Kerajaan Negeri Sarawak atas sokongan dan kerjasama untuk menjayakan persidangan ini. Terima kasih juga ditujukan khas kepada Sarawak Shell Berhad, Petronas, syarikat-syarikat perlombongan dan pengusaha-pengusaha kuari di Sarawak dan juga Semenanjung Malaysia kerana memberikan sumbangan untuk menampung sebahagian daripada kos persidangan. Terima kasih ditujukan kepada pembentang kertas utama khasnya kepada kepada YB Dr. James Dawos Mamit, Naib Pengerusi, Lembaga Sumber Asli dan Alam Sekitar Sarawak (NREB) untuk membentangkan kertas utama bertajuk "Geoscience in the context of environmental management in Sarawak" , Dr. Chu Ling Heng, Ketua Pengarah JMGM mengenai "Some impediments affecting the performance of the local non-metallic mineral based industry", Profesor John Kuna Raj dari Universiti Malaya mengenai "Guidelines to prevention of slope failure related disasters in granitic bedrock areas in Malaysia" dan Dr. H.D. Tjia dari Petronas mengenai "Northwest Sabah overthrust system".

Sebagaimana tahun sebelumnya, prosiding persidangan telah dicetak sebagai buletin yang mana merupakan produk penerbitan penulis. Saya ingin merakamkan ucapan terima kasih kepada penyumbang kertas, penyemak (reviewer) dan ahli jawatankuasa kecil penyuntingan yang bertungkus lumus menyiapkan prosiding untuk diagihkan kepada semua peserta serta semua ahli persatuan. Terima kasih ditujukan kepada penganjur bersama : Jabatan Mineral dan Geosains, Universiti Malaya, Universiti Kebangsaan Malaysia, Universiti Malaysia Sarawak, Universiti Sains Malaysia, Universiti Malaysia Sabah, Lembaga Sumber Asli dan Alam Sekitar Sarawak (NREB) dan Institut Geologi Malaysia atas kerjasama yang diberikan dalam menjayakan persidangan ini.

Terima kasih saya juga ditujukan khas kepada ahli Jawatankuasa Penganjur yang penuh komited dan dedikasi demi menjayakan persidangan ini.

It is my fervent hope that all participant will have a very fruitful deliberation of the scientific programme. At the same time, I wish all participants (especially foreign participants), a pleasant stay and enjoyable stay in the city of Kuching. As the Dayak community in Sarawak will be celebrating Hari Gawai Dayak soon, I would urge you all to take time off to join the celebration and at the same time enjoy the many natural and scenic beauties while you are here.

Akhir kata, saya sekai lagi ingin mengucapkan terima kasih kepada Yang Berhormat Datuk Haji Awang Tengah Ali Hassan, Menteri Muda di Pejabat Ketua Menteri yang mewakili YAB Datuk Patinggi Tan Sri Haji Abdul Taib bin Mahmud, Ketua Menteri Sarawak kerana sudi meluangkan masa untuk hadir dalam majlis ini dan merasmikan Persidangan Tahunan Geologi 2003 kali ini.

Sekian, terima kasih.

Annual Geological Conference 2003

Hilton Hotel, Kuching, Sarawak

24–26 May, 2003

Ucapan Presiden Persatuan Geologi Malaysia, Prof. Madya Dr. Abdul Ghani Rafek

Bismillaahirahmaanirrahim,

Yang saya muliakan Puan Pengerusi Majlis,

Yang Berhormat Datuk Haji Awang Tengah Ali Hassan, Menteri Muda di pejabat Ketua Menteri/ Menteri Muda Perancangan & Pengurusan Sumber/Menteri Muda Pembangunan Perindustrian dan Menteri Muda Pembangunan Luar Bandar & Kemajuan Tanah Sarawak, mewakili,

Yang Amat Berhormat Dato Patinggi Tan Sri (Dr.) Haji Abdul Taib Mahmud, Ketua Menteri Sarawak,

Yang Berusaha, En. Alex Unya Ambun, Pengerusi JK Penanjur Persidangan Tahunan Geologi 2003,

Yang Berbahagia Tuan Haji Isa bin Kassim, Setiausaha Persekutuan Sarawak,

Para Pegawai Kanan Kerajaan Persekutuan dan Negeri,

Para jemputan, Rakan-rakan Geosaintis,

Tuan-tuan dan Puan-puan para hadirin yang dihormati sekalian,

Assalamualaikum warahmatullahi wabarakatuh dan salam sejahtera,

Terlebih dahulu izinkan saya memanjatkan kesyukuran ke hadrat Allah SWT kerana dengan limpah kurniaNya dapat kita berkumpul pada pagi yang indah ini untuk perasmian Persidangan Tahunan Geologi 2003. Saya mengucapkan ribuan terima kasih kepada Yang Berhormat Datuk Haji Awang Tengah Ali Hassan, Menteri Muda di pejabat Ketua Menteri/ Menteri Muda Perancangan & Pengurusan Sumber/Menteri Muda Pembangunan Perindustrian dan Menteri Muda Pembangunan Luar Bandar & Kemajuan Tanah Sarawak, yang mewakili, Yang Amat Berhormat Dato Patinggi Tan Sri (Dr.) Haji Abdul Taib Mahmud, Ketua Menteri Sarawak kerana sudi meluangkan masa daripada tugas-tugas beliau untuk bersama kita pada majlis yang berbahagia pagi ini dan seterusnya merasmikan Persidangan Tahunan Geologi tahun ini. Bagi pihak Persatuan Geologi, saya juga mengucapkan selamat datang ke persidangan tahun ini kepada tuan-tuan dan puan-puan yang dihormati sekalian.

Tuan-tuan dan Puan-puan,

Persidangan Tahunan Geologi 2003 merupakan persidangan yang ke-17 dalam siri ini dan juga merupa kali kedua diadakan di Kuching, Sarawak. Sambutan kali ini adalah sangat menggalakkan, dimana bilangan kertas kerja melebihi 80 buah dan memaksa diadakan pembentangan teknikal secara selari. Empat ucaptama yang akan dibentangkan mewakili subbidang penting dalam geologi, iaitu geologi sekitaran, geologi penjelajah mineral, geologi tulin dan geologi kejuruteraan. Satu lagi perkara yang baru pada persidangan kali ini ialah lawatan lapangan pertengahan persidangan, yang dijadualkan selepas sesi poster pagi esok.

Tuan-tuan dan Puan-puan,

Seperti juga pada tahun-tahun lepas, semua kertas kerja yang diterima untuk pembentangan diterbitkan dalam satu buletin khas persidangan yang diedarkan kepada semua peserta persidangan. Dan juga seperti tahun-tahun lepas, persidangan kita bercorak antarabangsa, dengan penyertaan dari luar rantau ini.

Tuan-tuan dan Puan-puan,

Pada kesempatan ini, saya merakamkan penghargaan dan mengucapkan terima kasih bagi pihak Persatuan Geologi Malaysia kepada semua pihak atas sokongan dan bantuan mereka untuk menjayakan persidangan ini, iaitu:

- Y.A.B. Ketua Menteri Sarawak dan kerajaan negeri Sarawak,
- Malaysia Mining Corporation,
- PETRONAS Carigali Sdn. Bhd. (Sarawak Operations),
- Sarawak Shell Bhd.,
- Specific Resources Sdn. Bhd.,
- Global Mineral Sarawak Sdn. Bhd.,
- Borneo Granite Sdn. Bhd.,
- Lucky Hill Mining Sdn. Bhd.,
- Bukit Yong Gold Mine Sdn. Bhd.,
- Holystone Quarry Sdn. Bhd.,
- Syarikat Sebangun Sdn. Bhd.,
- Kalimantan Enterprise Sdn. Bhd.,
- Sara Kuari Sdn. Bhd.,
- Genesis Force Sdn. Bhd.,
- Jabatan Mineral dan Geosains, Malaysia,
- Universiti Malaysia Sarawak,
- Universiti Malaya,
- Universiti Kebangsaan Malaysia,
- Universiti Sains Malaysia,
- Institut Geologi Malaysia,
- En. Alex Unya Ambun, dan JK beliau,
- Prof. Dr. G.H.Teh, Pengarang Kehormat Persatuan dan JK kecil penyuntingan,
- Semua penyumbang dan pembentang kertas kerja,
- Pentasyih sepakar,
- Dan semua peserta persidangan.

Akhir sekali, jika terdapat sebarang kekurangan semasa persidangan ini, saya memohon ma'af.

Sekian, wabillahitaufik walhidayah wassalamualaikum warahmatullahhi wabaraakatuh.

Annual Geological Conference 2003
Hilton Hotel, Kuching, Sarawak
24–26 May, 2003

Ucapan YAB Dato Patinggi Tan Sri Dr. Haji Abdul Taib Mahmud, Ketua Menteri Sarawak Sempena Majlis Perasmian Persidangan Tahunan Geologi 2003 yang dibaca oleh YB Datuk Awang Tengah Ali Hassan, Menteri Muda Di Pejabat Ketua Menteri Sarawak

Yang di Hormati, Puan Pengerusi Majlis,

Yang Berusaha Dr. Abdul Ghani Rafek, Presiden Persatuan Geologi Malaysia,

Yang Berusaha En. Alex Unya Ambun, Pengerusi Jawatankuasa Penganjur Persidangan,

Dato' -Dato', dif-dif kehormat, tuan-tuan dan puan-puan hadirin yang dihormati sekelian

Assalamualaikum WBT dan Salam Sejahtera.

Selamat Datang ke Bumi Kenyalang (The Land of Hornbill) Sarawak. Saya merasa amat gembira dan bangga kerana Persatuan Geologi Malaysia sekali lagi telah memilih Sarawak untuk bersidang pada kali ini, bertepatan dengan 2003 sebagai Tahun Pelancongan Sarawak. Saya turut merasa gembira kerana diberi kesempatan untuk berucap kepada para peserta persidangan yang terdiri daripada Ahli-ahli Geosains dari agensi kerajaan, universiti tempatan, badan-badan berkanun dan dari sektor swasta.

Saya difahamkan bahawa persidangan tahunan ini merupakan kali yang ke-17 dan kali kedua di Sarawak, setelah pertama kali diadakan pada Mei 1991 iaitu 12 tahun lepas. Ini bermakna roda putaran venue kembali sampai ke Sarawak. Persidangan kali ini dihadiri hampir 150 orang peserta dari dalam dan luar negara akan cuba menyelongkar ide-ide baru yang bernas demi meningkatkan kualiti akademik dan profesyen Ahli Geologi. Perkongsian maklumat setempat dan serantau akan memberi sumbangan yang bermakna ke arah pembangunan negara selaras dengan tema persidangan iaitu "Perserverance in geosciene towards sustainable development". Sebagaimana diucapkan oleh Pengerusi Penganjur Persidangan sebentar tadi, kertas-kertas kerja teknikal merangkumi semua aspek geologi akan dibentang dan dibincangkan, yang mana empat kertas utama dari NREB, Jabatan Mineral dan Geosains, Universiti Malaya dan PETRONAS akan dibentangkan mengikut kepakaran masing-masing.

Kehadiran dan komitmen tuan-tuan dan puan-puan bukan sahaja mempamerkan peri pentingnya persidangan kepada persatuan sebagai platfom percambahan keilmuan geologi, malah ia memberi manfaat kepada negara. Tidak dapat dinafikan bahawa tuan-tuan dan puan-puan merupakan tenaga penting yang terlibat secara langsung di dalam penjelajahan dan pembangunan sumber asli kekayaan negara seperti mineral, petroleum, gas, air tanah dan sebagainya. Memandangkan sumber asli tersebut kebanyakkannya tidak dapat diperbaharui,

maka sebahagian daripada tanggungjawab tuan-tuan dan puan-puan adalah untuk mempastikan supaya tidak berlaku kemajiran dan seterusnya sumber tersebut dapat digunakan secara optimum serta mampan agar mendapat manfaat generasi kini dan akan datang.

Saudara dan saudari sekelian,

Sebagaimana diketahui umum, Sarawak kaya dengan sumber semulajadi termasuk petroleum, gas, balak, arang batu, mineral perindustrian dan hasil pertanian serta laut. Telah banyak usaha dibuat dan akan diteruskan ke arah promosi industri berasaskan sumber, terutama sekali untuk pasaran eksport global. Antara industri berasaskan sumber yang telah dipromosi adalah industri berkaitan petroleum dan gas serta pemprosesan mineral perindustrian seperti pasir silika dan lempung. Umpamanya, projek pertama LNG telah menukar Bintulu dari perkampungan kecil menjadi sebuah bandar yang berkembang maju. Jelas sekali, petroleum dan gas merupakan pemangkin kepada pembangunan lain yang terdapat di Bintulu.

Program pembangunan industri seramik di negeri Sarawak telah bermula pada 1999, dengan mensasarkan kepada penghasilan produk seramik dari simpanan lempung bebola, kaolin dan pasir silika yang banyak di Sarawak. Dianggarkan Sarawak memiliki simpanan kaolin sebanyak 21.1 juta tan, 38 juta tan lempung bebola dan 57 juta tan pasir silika. Satu memorandum persefahaman dengan SIRIM Berhad telah ditanda-tangani untuk merancakkan lagi perkembangan sektor ini. Buat masa ini, Kerajaan Sarawak dalam proses meminda Ordinan Perlombongan Sarawak 1958 (SMO) untuk menggalakkan aktiviti-aktiviti perlombongan agar lebih berdaya-saing serta meningkatkan R&D dalam industri perlombongan, terutama sekali seramik. Oleh itu, kepakaran yang ada pada tuan-tuan dan puan-puan dalam penjelajahan dan penambah-baikan bahan juga amat diharapkan agar produk seramik Sarawak dapat dimartabat dan dinobatkan sebagai yang terbaik di Asia. Di samping itu juga, Kerajaan Sarawak sedang meneliti 'Quarry Rule' dalam pelbagai sudut dan aspek yang melibatkan perundangan sebelum diterima-pakai sepenuhnya. Ia merangkumi tatacara pengkuarian yang menitik-beratkan aspek keselamatan operasi dan penjaan alam sekitar sebagaimana dicadangkan oleh Kerajaan Persekutuan di bawah naungan Jabatan Mineral dan Geosains Malaysia.

Saudara dan saudari sekelian,

Air merupakan aset terpenting untuk kehidupan. Masyarakat perlu dididik dan diasuh untuk lebih peka akan peri pentingnya air dalam kehidupan seharian kita dan seharusnya cuba berjimat serta menghargai air. Bekalan air bersih merupakan cabaran terbesar kerajaan terutama sekali semasa musim kemarau, di mana penduduk pedalaman pesisir pantai yang hanya bergantung sepenuhnya kepada air hujan melalui 'rain harvesting' akan menghadapi masalah yang agak serius. Oleh itu, sumber air bawah tanah menjadi pilihan terbaik sebagai sumber terpenting. Sebagai contoh, bekalan air bersih Pulau Bruit untuk kegunaan domestik amat sukar dilaksanakan memandangkan kedudukan dan topografinya yang rendah serta ketiadaan akuifer pasir. Selaras dengan itu, sumber alternatif pengekstrakan air bawah tanah dari lapisan gambut telah direalisasikan dengan kepakaran yang ditunjukkan oleh ahli-ahli geologi dari Jabatan Mineral dan Geosains Sarawak. Penilaian dan pemantauan sumber air sebagai khazanah sewajarnya dilakukan secara berterusan agar tiada sebarang pencemaran serta mengawal agar tidak berlaku perejahan air masin ke dalam sistem akuifer. Saya ingin mengambil kesempatan untuk merakamkan penghargaan kepada Jabatan Mineral dan Geosains Sarawak kerana atas daya usaha mereka, sebahagian daripada perkampungan pesisir pantai telah menerima bekalan air bersih. Saya juga mengharapkan agar tuan-tuan dan puan-puan semua dapat mencari serta merumuskan alternatif lain sumber air bawah tanah untuk membantu kawasan bermasalah bekalan air dari kepakaran yang dimiliki.

Saudara dan saudari sekelian,

Mukah dan Betong telah diistiharkan sebagai bahagian ke-10 dan ke-11 di Sarawak masing-masing pada 1 Mac 2002 dan 26 Mac 2002. Pengistiharan ini akan mempercepatkan pembangunan secara keseluruhannya di tengah Sarawak menjana ke arah pembangunan mampan. Selaras dengan itu input geologi merangkumi kesesuaian tapak dari aspek geoteknikal dan sumber bahan binaan amat diperlukan sejajar dengan pembangunan agar hasrat dan aspirasi kerajaan negeri dapat direalisasikan demi kesejahteraan rakyat yang bakal menikmati kemudahan yang disediakan. Usaha yang dijalankan untuk membangun kawasan luar bandar merangkumi penyediaan prasarana dan kemudahan asas, secara langsung telah memberi semangat dan wajah baru kepada wilayah dan daerah yang dulunya terpencil. Ini telah dilaksanakan melalui program-program pembangunan seperti Pusat pertumbuhan Desa (Rural Growth Centre – RGC), pembagunan Tanah Adat (Native Customary Right –NCR), Projek Pembangunan Bersepadu (Intergrated Agriculture Development Project – IADB) dan Projek Pembangunan Kampung Bersepadu (Village Intergrated Development Project – VIDP). Ia berupaya meningkatkan taraf hidup rakyat luar bandar serta mempercepatkan pertumbuhan ekonomi.

Saudara dan saudari sekelian,

Alam sekitar berkualiti merupakan aset yang tidak ternilai. Sebagaimana lazimnya, komuniti sebagai penyumbang bahan buangan, secara tak langsung peruntukan kewangan dan kos untuk alam sekitar berkualiti akan meningkat dan terpaksa ditanggung kerajaan. Alam sekitar bersih adalah tanggungjawab setiap orang agar dapat dinikmati oleh generasi akan datang. Penglibatan tuan-tuan dan puan-puan amat bertepatan dalam menangani permasalahan agar setiap sumber, seperti air yang ada di permukaan dan bawah tanah tidak tercemar. Begitu juga dengan pengurusan bencana, ianya menjadi kritikal dan penting pada hari ini serta menjadi masalah sejagat. Pengurusannya juga memerlukan penglibatan dan komitmen daripada kerajaan, universiti, institusi latihan, sektor korporat dan masyarakat secara keseluruhannya. Saya mengharapkan agar kajian kemungkinan geobencana di kawasan sensitif dengan menggunakan elemen-elemen geologi kejuruteraan dapat dijalankan secara komprehensif untuk diguna-pakai oleh perancang secara keseluruhannya. Kita tidak mahu kejadian yang sama berlaku kepada orang awam akibat bencana alam sebagaimana kejadian tanah runtuh di Semunjan, Serian yang mengorbankan banyak nyawa.

Saudara dan saudari sekelian,

Saya difahamkan, tuan-tuan dan puan-puan juga sedang meneruskan usaha untuk mengenalpasti tapak-tapak geologi berpotensi di seluruh negara sebagai warisan geologi tabii untuk pemuliharaan atau dikenali sebagai geowarisan. Ia bakal menjadi dimensi baru dalam produk pelancongan dengan penekanan kepada asal kejadian membentuk batuan dan landskap dari perspektif geologi tabii tanpa dikaitkan dengan unsur mistik dan dongeng. Saya juga dimaklumi bahawa Persidangan Kebangsaan Warisan Geologi Malaysia III telah diadakan di Jabatan Mineral dan Geosains Malaysia, Sarawak pada 21 dan 22 Mei 2003 baru-baru ini. Ia dipelopori oleh Kumpulan Penyelidikan Warisan Geologi serta dianjurkan oleh Institut Alam Sekitar dan Pembangunan (LESTARI), UKM. Seiringan dengan itu, saya merasa amat bangga sekali apabila Gunung Mulu diistiharkan sebagai 'World Heritage' oleh UNESCO yang mana ianya mempamerkan keunikan tabii tersendiri gua batu kapur dan landskap yang tiada tolak bandingnya. Oleh itu, saya mengharapkan agar tuan-tuan dan puan-puan meningkatkan lagi usaha dalam penentuan dan pencirian tapak–tapak pembangunan warisan geologi untuk tujuan pemuliharaan di Sarawak ke arah pengiktirafan seterusnya agar dapat dinikmati dan dihayati generasi akan datang serta sebagai produk geopelancongan Sarawak.

Tuan-tuan dan puan-puan, perkara-perkara yang tuan-tuan dan puan-puan lakukan dalam skop kerja ini amat penting untuk pembangunan negara dan kesejahteraan masyarakat umum. Sumbangan tuan-tuan dan puan-puan juga tidak boleh diabaikan oleh kerajaan dalam usaha mencapai pembangunan mampan. Usaha tuan-tuan dan puan menyumbang secara terus kepada hasrat kerajaan negeri Sarawak untuk mencapai pembangunan mampan iaitu seimbang dari segi pertumbuhan ekonomi, kesejahteraan masyarakat dan pemuliharaan alam sekitar.

Justeru daripada itu, saya mengucapkan tahniah kepada pencapaian semasa dan menyeru supaya tuan-tuan dan puan-puan menggunakan peluang persidangan kali ini untuk mencungkil dan melahirkan ide-ide lebih bernas bagi menghadapi cabaran dalam membantu usaha pencapaian pembangunan mampan di Malaysia.

Buat pengakhir ucapan, saya sekali lagi mengucapkan ribuan terima kasih kepada pihak penganjur kerana sudi menjemput saya merasmikan persidangan ini. Dengan lafaz yang mulia Bismillahirahmannirahim, saya dengan sukacitanya menyempurnakan dan merasmikan Persidangan Tahunan Geologi 2003.

Sekian, selamat bersidang dan terima kasih.

Annual Geological Conference 2003

Hilton Hotel, Kuching, Sarawak

24–26 May, 2003

Annual Geological Conference 2003

Hilton Hotel, Kuching, Sarawak

24–26 May, 2003

Annual Geological Conference 2003

Hilton Hotel, Kuching, Sarawak

24–26 May, 2003

Annual Geological Conference 2003

Hilton Hotel, Kuching, Sarawak

24–26 May, 2003

Annual Geological Conference 2003

Hilton Hotel, Kuching, Sarawak

24–26 May, 2003

Programme

FRIDAY, 23 MAY 2003

0800 – 1700 **Pre-Conference Fieldtrip — Kuching-Serian-Tebedu**

SATURDAY, 24 MAY 2003

0800 – 0830 **Registration**

0830 – 0930 **Poster Session A**

Opening Ceremony

(Ballroom)

0945 – 1000 **Arrival of Participants and Guests**

1000 – 1010 **Arrival of Y.A.B. Datuk Patinggi Tan Sri (Dr.) Haji Abdul Taib bin Mahmud, Chief Minister of Sarawak**

1010 – 1020 **Welcoming Address by Mr. Alex Unya Ambun, Organising Chairman of Annual Geological Conference 2003**

1020 – 1030 **Address by Prof. Madya Dr. Abdul Ghani Rafek, President of Geological Society of Malaysia**

1030 – 1050 **Opening Address by Y.A.B. Datuk Patinggi Tan Sri (Dr.) Haji Abdul Taib bin Mahmud, Chief Minister of Sarawak**

1050 – 1120 ***Tea Break***

Scientific Programme

(Ballroom)

1120 – 1150 **KEYNOTE PAPER I — YB Dr. James Dawos Mamit**
Geoscience in the context of environmental management in Sarawak

1150 – 1220 **KEYNOTE PAPER II — Chu Ling Heng & Azimah Ali**
Some impediments affecting the performance of the local non-metallic mineral-based industry

1220 – 1250 **KEYNOTE PAPER III — H.D. Tjia**
Northwest Sabah overthrust system

1250 – 1320 **KEYNOTE PAPER IV — J.K. Raj**
Guidelines to prevention of slope failure related disasters in granitic bedrock areas of Malaysia

1320 – 1430 ***Lunch/Prayer Break***

Annual Geological Conference 2003

Hilton Hotel, Kuching, Sarawak

24–26 May, 2003

Programme

SATURDAY, 24 MAY 2003

Technical Session I (Ballroom I)

PETROLOGY & GEOCHEMISTRY

1430 – 1450 **Azman A. Ghani**
Geochemistry of tourmaline-bearing granite from Maras-Jong Terengganu, Peninsular Malaysia

1450 – 1510 **Mohd Rozi Umor, Wan Fuad Wan Hassan & Goh Swee Heng**
Kajian petrografi dan geokimia batuan igneus Bukit Tujuh, Kuala Lipis, Pahang

1510 – 1530 **Muhammad Barzani Gasim, Mohd. Md. Tan & Md. Zaidi Md. Zain**
Pencirian batuan andesit di sekitar Maran, Pahang

1530 – 1600 ***Tea Break***

1600 – 1620 **Mohd Azamie W.A. Ghani & Azman A. Ghani**
Petrology of granitic rocks along new Pos Selim to Kampung Raja highway (km 0 to km 22): identification of different granitic bodies, its field and petrographic characteristics

1620 – 1640 **Mohd Rozi Umor, Hamzah Mohamad, Osama A. Twaiq, Mohamad Md. Tan, Anizan Isahak & Baba Musta**
Kajian petrografi dan geokimia batuan ultrabes sekitar Ranau, Sabah

1640 – 1700 **Wan Zuhairi Wan Yaacob & Tan Boon Kong**
Migration of heavy metals through compacted soil columns

Technical Session II (Ballroom II)

ENGINEERING GEOLOGY & ENVIRONMENTAL GEOLOGY

1430 – 1450 **Chow Weng Sum & Zakaria Mohamad**
Debris slide at Kg. Sg. Chinchin, Gombak, Selangor

1450 – 1510 **Md Zoynul Abedin & Tang Lon Mood, Joseph**
An attempt to improve plantation road soils using an organic stabilizer

1510 – 1530 **V.L.W. Wong, J.J. Pereira & Mazlin Mokhtar**
Aggregate flows and its implications on the environment: a preliminary assessment

1530 – 1600 ***Tea break***

1600 – 1620 **Zakaria Mohamad & Chow Weng Sum**
Geological terrain mapping in Cameron Highlands District, Pahang

1620 – 1640 **Tajul Anuar Jamaluddin & Ismail Yusoff**
Influence of discontinuity on overbreaks and underbreaks in rock excavation — case study from Beris Dam, Kedah, Malaysia

1640 – 1700 **Yunus Abdul Razak, Chow Weng Sum & Jamaluddin Othman**
Sinkholes in the Bukit Chuping area, Kangar, Perlis

SUNDAY, 25 MAY 2003

0800 – 0940 **Poster Session B**

1000 – 1700 **Mid-Conference Fieldtrip — Kuching-Santubong**

Annual Geological Conference 2003

Hilton Hotel, Kuching, Sarawak

24–26 May, 2003

Programme

MONDAY, 26 MAY 2003

Technical Session III (Ballroom I)

ENGINEERING GEOLOGY & HYDROGEOLOGY

0800 – 0820 **Ibrahim Komoo & Lim C.S.**
Tragedi gelinciran tanah Taman Hillview (Taman Hillview landslide tragedy)

0820 – 0840 **Mohd For Mohd Amin, Khoo Kai Siang & Chai Hui Chon**
Reinforcement mechanisms of rock bolt — a laboratory investigation

0840 – 0900 **Abdul Ghani Rafek, Ng Cheong Keat & Abdul Rahim Shamsudin**
Pencirian geomekanik batuan syis grafit Bt. Bujang, Kuala Kubu Baru, Selangor Darul Ehsan

0900 – 0920 **Mohd Kamil Yusoff, Muhammad Firuz Ramli & Law Jiun Tau**
Soil erosion of a logged-over tropical forest, Pasoh, Negeri Sembilan

0920 – 0940 **Abd Rasid Jaapar**
Application of accurate rock core logging in engineering design process

0940 – 1000 **Rahman Yaccup, Mohd Shahid Ayub, Abdul Rahim Samsudin, Mohd Tadza Abdul Rahman, Lakam Mejus & Mohd Rifaie Mohd Murtadza**
Kaedah keberintangan geoelektrik profil dalam untuk kajian air tanah di lembangan Kuala langat, Banting, Selangor

1000 – 1030 ***Tea Break***

Technical Session IV (Ballroom II)

REGIONAL GEOLOGY & PALEONTOLOGY

0800 – 0820 **Zaiton Harun & Basir Jasin**
Some radiolarians from Dengkil, Selangor

0820 – 0840 **Meor Hakif Hassan & Lee Chai Peng**
The Sanai Limestone Member — a Devonian limestone unit in Perlis

0840 – 0900 **Uyop Said, Rasanubari Asmah Rahmah Abd. Hamid & Mohd Musryzal M. Ariffin**
Early Cretaceous palynomorphs from Kampung Tanah Runtuh, Kluang, Johor

0900 – 0920 **Basir Jasin, Zaiton Harun & Siti Norhajar Hassan**
Black siliceous deposits in Peninsular Malaysia: their occurrence and significance

0920 – 0940 **Mohd Shafeea Leman**
An Early Permian (Early Sakmarian) brachiopod fauna from Sungai Itau Quarry, Langkawi with comments on age of other Early Permian brachiopod horizons in Langkawi Islands

0940 – 1000 **Lee Chai Peng**
The Madai-Baturong seamount limestone of Sabah, East Malaysia

1000 – 1030 ***Tea Break***

Annual Geological Conference 2003

Hilton Hotel, Kuching, Sarawak

24–26 May, 2003

Programme

MONDAY, 26 MAY 2003

Technical Session V (Ballroom I)

GEOSCIENTIFIC TOOLS & TECHNIQUES

1030 – 1050 **Chai Ted Seng**
Review of digital geological mapping techniques

1050 – 1110 **Jasmi Ab Talib**
Probabilistic landslide susceptibility analysis and verification using GIS and remote sensing data at Penang, Malaysia

1110 – 1130 **Kamarudin Samuding, Mohd Tadza Abd Rahman, Johari Yusof**
Teknik nuklear dalam kajian aliran air tanah

1130 – 1150 **James Bachat, J.J. Pereira & Ibrahim Komoo**
Geoindikator tanah runtuh di kawasan pembangunan: kajian kes di daerah Hulu Langat

1150 – 1210 **Harith Z.Z.T. & Rosli B.S.**
The effectiveness of ground penetrating radar in detecting buried objects

1210 – 1230 **Umar Hamzah, Abdul Rahim Samsudin, Ismail C. Mohamad, Norhafizi Khalid & Shahimi Sali**
Pengukuran kemasinan air tanah di dataran pantai Pekan-Nenasi, Pahang dengan teknik geoelektrik dan geokimia

1230 – 1250 **Samsudin bin Hj Taib**
A microgravity survey over deep limestone bedrock

1250 – 1310 **Noraini Surip**
Groundwater quality assessment using remote sensing and related datasets

1310 – 1400 ***Lunch/Prayer Break***

Technical Session VI (Ballroom II)

MINERAL/ENERGY RESOURCES & CONSERVATION GEOLOGY

1030 – 1050 **Wan Fuad Wan Hassan**
On some ore and skarn minerals of Langkawi

1050 – 1110 **Azimah Ali**
The silica-based industry in Malaysia

1110 – 1130 **Goh Swee Heng, Teh Guan Hoe & Mohd Rozi Umor**
Fluid inclusions studies of Bukit Botak skarn deposit, Mengapor, Pahang

1130 – 1150 **Azemi Hj. Eki, Abdullah Sani H. Hashim & Radzali Othman**
Beneficiation of kaolin deposits from Telaga Air and Telagus, Sarawak

1150 – 1210 **Osama Twaiq, Hamzah Mohamad, Mohamad Md Tan, Anizan Isahak, Baba Musta & Mohd Rozi Umar**
The economic potential of ultrabasic soils at the vicinity of Ranau, Sabah

1210 – 1230 **Tanot Unjah, Ibrahim Komoo & Dana Badang**
Amber Merit Pila

1230 – 1250 **Kamar Shah Ariffin**
Prediction of energy consumption of geologically difference marble deposit in ground calcium carbonate (GCC) production

1250 – 1310 **Teh Guan Hoe & Hooi Woi Loon**
EPMA study of heavy minerals in the Tekka area, Perak

1310 – 1400 ***Lunch/Prayer Break***

Annual Geological Conference 2003

Hilton Hotel, Kuching, Sarawak

24–26 May, 2003

Programme

MONDAY, 26 MAY 2003

Technical Session VII (Ballroom I)

ENVIRONMENTAL GEOLOGY

1400 – 1420 **Azmi Mohd Yakzan**
Distribution of vegetation in present day wetlands: some applications in geoscience

1420 – 1440 **Baba Musta, Khairul Anuar Kassim, Mohd. Razman Salim & Z'aba Ismail**
Heavy metals migration through the clayey soil from Telipok, Sabah

1440 – 1500 **Mohd Tadza Abdul Rahman, Daud Mohamad, Roslanzairi Mostapa, Kamarudin Samuding, Mohd Rifaie Murtadza, Abdul Rahim Samsudin, Ismail Abustan & Ismail C. Mohamad**
Impak pencemaran air tanah daripada pengurusan sisa bandaran dengan menggunakan sistem kambus tanah sanitari (*sanitary landfill)*

1500 – 1530 ***Tea Break***

1530 – 1550 **Abdul Rahim Samsudin, Umar Hamzah, Wan Zuhairi Wan Yaacob, Bahaa-eldin ElWali Abdel Rahim & Loh Yean Sze**
Application of geophysical method to delineate contamination in waste disposal site of Ampar Tenang, Dengkil, Selangor D.E.

1550 – 1610 **Wan Nor Azmin Sulaiman, Mohd Firuz Ramli & Mohd Khair Kamaruddin**
Preliminary analysis of recession flow characteristics of granitic catchments

1610 – 1630 **Wan Zuhairi Wan Yaacob**
Heavy metal sorption capabilities of some soils from active landfill sites in Selangor area

1630 – 1700 ***Closing Ceremony*** (Ballroom)

Technical Session VIII (Ballroom II)

STRUCTURAL GEOLOGY & TECTONICS

1400 – 1420 **Mustaffa Kamal Shuib**
Transpression in the strata of Pulau Kapas, Trengganu

1420 – 1440 **Ibrahim Abdullah & Jatmika Setiawan**
The kinematics of deformation of the Kenerong Leucogranite and its enclaves at Renyok Waterfall, Jeli, Kelantan

1440 – 1500 **Kamaludin bin Hassan**
Mid-Holocene to recent sea level changes in Peninsular Malaysia: a tectonic implication

1500 – 1530 ***Tea Break***

1530 – 1550 **Ros Fatihah Muhammad & Tjia Hong Djin**
The morphostructures of Kinta Valley karst

1550 – 1610 **Jatmika Setiawan & Ibrahim Abdullah**
The structure and deformation history of the serpentinite bodies along the Bentong Suture: a case study at Bukit Rokan Barat

1610 – 1630 **Allagu Balaguru, Gary Nichols & Robert Hall**
Structural style and stratigraphy of southern Sabah, and the tectonic evolution of the 'Circular Basins' of Sabah, Malaysia

1630 – 1700 ***Closing Ceremony*** (Ballroom)

Annual Geological Conference 2003

Hilton Hotel, Kuching, Sarawak

24–26 May, 2003

Programme

POSTER SESSIONS

SATURDAY, 24 MAY 2003 (0830–0930)

Poster Session A (Foyer)

1. **Siow Soo Fei, Nazari Jaafar & Ismail Yusoff**
   A method to estimate groundwater recharge
2. **Wan Fuad Wan Hassan & Heru Sigit Purwanto**
   Analisis bendalir terkepung pada telerang kuarza yang mengandungi emas di kawasan Lombong Penjom, Kuala Lipis, Pahang dan Lubok Mandi, Terengganu, Semenanjung Malaysia
3. **Mustaffa Kamal Shuib & Azman A. Ghani**
   'Mantle Plume' type magmatism in the Central Belt of Peninsular Malaysia and its tectonic implications
4. **Wan Zuhairi Wan Yaacob & Anne Chong Shik Fong**
   Mekanisma pembantutan tabii ke atas logam berat Pb oleh tanah Formasi Bukit Kenny di kawasan Air Hitam, Puchong, Selangor
5. **Mohd Azamie W.A. Ghani & Azman A. Ghani**
   Granitic rocks from Pos Selim-Kampung Raja new road: petrochemistry of the Selim pluton (CH 0000 to CH 3370)
6. **Umar Hamzah, Mohd Tadza Abdul Rahman, Rahman Yaacup & Abdul Rahim Samsudin**
   Pencirian geofizik kejuruteraan batuan Formasi Bukit Kenny di cadangan tapak pembinaan MINT-Dengkil, Selangor D.E.
7. **Ibrahim Komoo & Lim, C.S.**
   Kompleks gelinciran tanah Kundasang: pemetaan terperinci di kawasan Sekolah Menengah Kebangsaan
8. **Teh Guan Hoe & Lee Heng Poh**
   EPMA characterization of the Fe-Cu-Sn mineralisation at Waterfall Mine, Pelepah Kanan, Johor
9. **Yusnizar Julaidi & Uyop Said**
   Sedimentology and palaeontology of Batu Arang area, Selangor
10. **Kamarulbahrin Hashim & Henry Litong Among**
    Geological Investigation on Ruan Changkul Landslide

SUNDAY, 25 MAY 2003 (0800–0945)

Poster Session B (Foyer)

1. **Baba Musta, Hamzah Mohamad, Mohamad Md. Tan, Anizan Isahak & Osama Twaiq**
   Kajian perlakuan larut lesap Cu, Cr, Ni, Pb dan Zn dalam tanah laterit dari Ranau, Sabah
2. **Anuar Ismail, Azman A. Ghani, Rozi Umor & Noran Alwakhir Shaarani**
   Field relation, petrochemistry and classification of the volcanic rocks from the eastern part of Tioman Island, Pahang
3. **Mohd Shafeea Leman**
   The discovery of trace fossil *Paleodictyon (Glenodictyum) minimum* Sacco from Early Palaeozoic sequence in Pulau Jemuruk, Langkawi, Malaysia
4. **Marilah Sarman & M.D. Kadderi**
   Pencirian bahan bergrafit dalam batuan metasedimen
5. **Abdul Hadi Abd. Rahman, Ismail Yusoff & Ahmad Farid Abu Bakar**
   Hydrological and sediment-transport systems within the Putrajaya Wetlands: design, functions and the effectiveness of their water-filtering and water-delivery mechanisms
6. **Guangfa Zhong, Jianhua Geng, Zuyi Zhou, How Kin Wong & Liaoliang Wang**
   Late Cenozoic history of sea level changes documented from high-resolution seismic data on the northern Sunda Shelf, South China Sea
7. **Bahaa-Eldin Elwali Abdel-Rahim, Wan Zuhairi Wan Yaacob, Abdul-Rahim Samsuddin & Abdul Ghani Rafek**
   Geo-environmental sampling: how good is a good practice?
8. **Ros Fatihah Muhammad & Ibrahim Komoo**
   The Kinta Valley karst landscape — a national heritage to be preserved
9. **Alsharef Albaghdady, Wan Hasiah Abdullah & Lee Chai Peng**
   An organic geochemical study of the Miocene sedimentary sequence of western Labuan Island, offshore Sabah, East Malaysia
10. **Khalid Ali Alshebani, Wan Hasiah Abdullah & Abdul Hadi Abd. Rahman**
    Biomarker characterisation and thermal maturity of Ganduman Formation of Sahabat area, Dent Peninsula, Sabah, Malaysia
11. **Jasmi Hafiz Abdul Aziz & Teh Guan Hoe**
    EPMA characterization and geochemistry of gold from Ulu Sokor, Kelantan
12. **Suharsono & Abdul Rahim Samsudin**
    The attenuation effect of surface-wave propagations on rockmass using SASW method
13. **Cheng Kwong Kiong & Teh Guan Hoe**
    EPMA characterization of amang minerals of Peninsular Malaysia — a preliminary study
14. **Lakam anak Mejus, Abdul Ghani Rafek, Abdul Rahim Samsudin, Umar Hamzah & Rahman Yaccup**
    Pencirian geologi kejuruteraan dan geofizik batuan Formasi Bukit Kenny di tapak Kamsis H, Universiti Kebangsaan Malaysia

Annual Geological Conference 2003

Hilton Hotel, Kuching, Sarawak
24–26 May, 2003

Abstracts of Papers

Some impediments affecting the performance of the local non-metallic mineral-based industry

CHU LING HENG AND AZIMAH ALI

Minerals and Geoscience Department Malaysia
19-22 Floor, Bangunan Tabung Haji
Jalan Tun Razak
50658 Kuala Lumpur

Downstream value-adding activities under the non-metallic mineral sector will continue to feature prominently in the Malaysian mineral industry. Their activities are necessary to sustain the country's pace of development; in addition, a substantial volume of the products will continue to be destined for the export market, thus providing foreign exchange earnings. However, based on surveys and interviews conducted by the Minerals and Geoscience Department Malaysia, there are certain impediments affecting the downstream sector's expansion. This paper identifies some of the issues raised among which are problems related to the quality of resource, competition from neighbouring countries, land issues, environmental concerns, coding problems, etc. Wherever appropriate, some suggestions to overcome these problems are offered.

Aktiviti-aktiviti hiliran yang bernilai-tambah didalam sektor mineral bukan metalik (mineral perindustrian) akan terus menerajui industri mineral di Malaysia. Aktiviti-aktiviti ini adalah penting untuk menyokong arus pembangunan negara; tambahan pula sebahagian besar produknya akan terus disasarkan untuk pasaran eksport, seterusnya menghasilkan pendapatan dari tukaran wang asing. Walaubagaimana pun, melalui soalselidik dan perbincangan yang dijalankan oleh Jabatan Mineral dan Geosains Malaysia, terdapat beberapa halangan yang mempengaruhi perkembangan sektor hiliran ini. Kertaskerja ini mengenalpasti beberapa isu yang dikemukakan, diantaranya yang menyebabkan masaalah yang berkaitan dengan kualiti sumber, persaingan dengan negara jiran, isu tanah, masaalah persekitaran, masaalah pengkodan, dan sebagainya. Dimana mungkin, beberapa cadangan bagi mengatasi halangan tersebut telah diberikan.

Northwest Sabah Overthrust System

H.D. TJIA

PETRONAS Carigali, Level 25, Tower 1, Twin Towers, 50088 Kuala Lumpur
and LESTARI, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor

The NE to NNE structural trends of West Sabah change drastically on approaching the Balabac fault and the West Baram Line. Outcrops show duplex and medium to large recumbent folds in the West-East Crocker and Trusmadi formations with general NW vergence that becomes northerly in northern Sabah. In the Baram area (Brunei and north Sarawak) the regional trend is represented by several strike-slip faults that bend to become N-S near the West Baram Line. In the offshore, a large "Lower Tertiary Thrust Sheet" was mapped next to the NW Sabah Trough. The combined indicators from outcrops and subsurface offshore suggest the existence of a major overthrust sheet measuring 700 km parallel to the shoreline and about 300 km in width. This rectangular Northwest Sabah Overthrust System is boxed in by the NW Sabah Trough, the Balabac fault in the NE, the West Baram Line in the SW, while the Kinabalu Suture closes off its SE corner. The character of its remaining boundary in the south is not known. Overthrusting occurred during the transition from Early to Middle Miocene and produced the Deep Regional Unconformity. In the vicinity of its flanking strike-slip faults, the NW surging overthrust

sheets were deformed by drag, the latter producing the prominent strike changes. The Northwest Sabah Overthrust System is planimetrically identical to the Pine Mountain Thrust Sheet at the tri-state border area of Kentucky-Tennesses-Virginia in the Appalachian Range of the United States.

Guidelines to prevention of slope failure related disasters in granitic bedrock areas of Malaysia

J.K. RAJ

Department of Geology
University of Malaya
50603 Kuala Lumpur

A variety of slope failures have occurred in the granitic bedrock areas of Malaysia; the more important of which are slump and debris flows that have sometimes led to considerable economic loss and loss of life. These failures have occurred at cut and fill slopes, as well as at natural ground slopes, having a varied vegetation cover ranging from primary and secondary forest to agricultural crops and grass. The failures have mainly involved weathered materials from morphological Zones I and II of the weathering profiles (or rock mass weathering grades 3 to 6) over granitic bedrock. Several factors are responsible for the failures, though the main cause is saturation and loss of negative pore water pressures within slope materials as the failures have mostly occurred during, or following, short periods (<3 hr) of intense rainfall (when total rainfall >70 mm), or longer periods (>1 day) of continuous rainfall.

In order to prevent slope failure related disasters, it is necessary to evaluate the various factors that give rise to the failures. The regional and local topographic settings of any site or area proposed for development needs to be first evaluated in order to allow recognition of the earth materials present and the earthworks that may be necessary. Evaluation of the local topographic setting is particularly important as the location of buildings and other structures needs to be considered with reference to the surrounding terrain. Surface and subsurface drainage patterns at the proposed site and surrounding area should then be evaluated as they influence variations in moisture contents and pore water pressures within slope materials. Stream channels and valleys also directly control the movement of debris flows in hilly to mountainous terrain. The rainfall at the proposed site and surrounding area also needs to be monitored in order to allow recognition of significant rainfall intensities and/or durations that increase the likelihood of slope failures. The vegetation cover at the proposed site and surrounding area also needs to be monitored as changes in this cover can also give rise to variations in moisture contents and pore water pressures within slope materials. The stability of cut and fill slopes associated with earthworks at the proposed site or area should finally be evaluated. Consideration and evaluation of all these factors will serve as guidelines that can prevent slope failure related disasters in the granitic bedrock areas of Malaysia.

Geochemistry of tourmaline-bearing granite from Maras-Jong, Terengganu, Peninsular Malaysia

AZMAN A. GHANI

Department of Geology
University of Malaya
50603 Kuala Lumpur

The Eastern Belt Granite of Peninsular Malaysia consists mainly of I-type granites with subordinate S-type granites. The monzo- to syenogranite Maras-Jong pluton in the Eastern Belt Granite show many S-type characteristics such as presence of tourmaline, garnet, similar texture (both granites are coarse grained primary textured sometimes dominated by K-feldspar phenocrysts) and high SiO_2 contents. However, using the previous granite classification, ACNK values below 1.1 and low Al biotite content, the Maras-Jong granite can be classified as I-type granite. It is suggested that the Maras-Jong granite is a felsic I-type granite.

Granit Jalur Timur di Semenenjung Malaysia mengandungi batuan granit jenis I dengan sedikit jenis S. Batuan Monzogranit dan syenogranit pluton Maras-Jong di dalam Granit Jalur Timur menunjukkan banyak cirri-ciri granit jenis S seperti kehadiran mineral tourmalin, garnet, persamaan tekstur (kedua-dua granit adalah berbutir kasar bertekstur primer kadang kala didominasikan oleh fenokris K-feldspar) dan kandungan SiO_2 yang tinggi. Walau bagaimanapun, menggunakan pengelasan yang terdahulu, nilai ACNK dibawah 1.1 dan mengandungi biotite kurang Al, Granit Maras-Jong boleh dikelaskan sebagai jenis I.

Kajian petrografi dan geokimia batuan igneus Bukit Tujuh, Kuala Lipis, Pahang

MOHD ROZI UMOR, WAN FUAD WAN HASSAN DAN GOH SWEE HENG

Program Geologi, Pusat Pengajian Sains Sekitaran dan Sumber Alam,
Fakulti Sains dan Teknologi, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor
e-mail: umor@pkrisc.cc.ukm.my

Granit Bukit Tujuh masih belum dikaji secara terperinci, terutama cirian geokimia bagi menentukan jenis magma pembentuk batuan dan asalan magma. Oleh itu, kajian dilakukan bagi menentukan cirian geokimia Granit Bukit Tujuh dan membandingkannya dengan batuan di Kompleks Granit Benta dan Suit Stong. Didapati ketiga-tiga unit batuan ini tergolong dalam batuan subalkali dengan siri magma kalk-alkali hingga shoshonit, dan dari granit jenis I, iaitu asalan igneus. Ia diperkuatkan dengan tren unsur nadir bumi yang menunjukkan tiada anomaly Eu seperti Suit Stong dan Kompleks Granit Benta. Oleh itu, disimpulkan batuan igneus Bukit Tujuh juga adalah hasilan pasca-orogenis.

Previous studies made of Bukit Tujuh granite is not in detail, especially on their geochemistry to determine the magma type and the origin of rock. This study was made to list their geochemical characteristics and make a comparison with Benta Granite Complex and Stong Suite. We found that all the units of rocks can be included as sub-alkaline rocks within calc-alkaline until shoshonite series, and classified as I-type granite, which is interpreted as of igneous origin. This argument is supported by the REE trend that depicted no Eu anomaly similar to Stong Suite and Benta Granite Complex. Therefore, we conclude that the granite of Bukit Tujuh is also post-orogenic.

Kajian petrografi dan geokimia batuan andesit di sekitar Maran, Pahang

MUHAMMAD BARZANI GASIM, MOHD. MD. TAN DAN MD. ZAIDI MD. ZAIN

Pusat Pengajian Sains Sekitaran dan Sumber Alam, Fakulti Sains dan Sumber Alam
Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor
E-mail: barzani@pkrisc.cc.ukm.my

Kedudukan andesit adalah secara tidak selaras di bawah Formasi Semantan dan Formasi Tembeling dan ketiga kumpulan batuan di sini adalah penyusun utama stratigrafi geologi kawasan Maran. Batuan andesit dianggapkan sebagai batuan yang tertua dalam kawasan kajian dan ditafsirkan berusia Perm Tengah-Akhir. Apabila segar berwarna hijau gelap dan berwarna merah gelap hingga coklat apabila terluluhawa. Batuan ini membentuk morfologi yang sederhana tinggi hingga dataran rendah (50-75 m) dengan kedudukan paksi lineamen yang berjurus utara-selatan. Batuan andesit ini dicirikan sebagai hipo habluran yang bertekstur kasar hingga porfiritik. Secara mikroskopik, kebanyakan mineral andesit terdiri dari olivin, piroksen, hornblend dan plagioklas, sedangkan matriks andesit dibina oleh mikrolit, plagioklas, klorit, oksida besi dan juzuk kaca. Olivin dan piroksen hadir sebagai mineral mafik. Fenokris plagioklas berbentuk euhedron hingga subhedron, berbutir sederhana dan mempunyai kembaran karlbat-albit. Sebanyak sepuluh unsur major telah dianalisa berdasarkan kajian geokimia, didapati bahawa perbezaan peratus kandungan unsur major diantara batuan dan tanah andesit adalah disebabkan terutamanya oleh proses luluhawa.

The andesite is unconformably positioned below the Semantan and Tembeling Formations and these are the main rock units in the Maran area. The Middle to Late Permian andesite is believed to be the oldest rock in the study area. Fresh andesite is dark green in colour but changed to dark red or brown soil when weathered. The andesite forms moderate to low morphological landform (50-75 m high) with north-south striking lineaments. The andesite can be characterized as hypocrystalline with coarse to porphyritic texture. Microscopic study indicates that it consists mainly of olivine, pyroxene, hornblende and plagioclase. The matrix consists of microlite, plagioclase, chlorite, iron oxides and glass. The mafic minerals present are olivine and pyroxene. Phenocrysts of plagioclase are euhedral to subhedral, medium-grained and show carlsbad-albite twinning. Ten major elements were analysed and there is indication that difference in the percentage of major elements between the rock and soil of andesite is due to weathering processes.

Petrology of granitic rocks along new Pos Selim to Kampung Raja highway (km 0 to km 22): identification of different granitic bodies, its field and petrographic characteristics

MOHD AZAMIE W.A. GHANI AND AZMAN A. GHANI

Department of Geology
University of Malaya
50603 Kuala Lumpur

Four granitic bodies have been identified along the Pos Selim-Kampung Raja Highway (0 to km 18). They are Selim granite (km 0 to km 5), Suku granite (from km 6 to km 11), Semerengol aplopegmatite (occur as granitic dykes intruded the metamorphic rocks at km 14 to km 15) and Regul granite (km 17 to km 18). The Selim granite consists of outer coarse grained porphyritic biotite granite and medium to fine grained granite. The Suku granite is characterized by the presence of xenoliths and other enclaves. Among the enclaves are biotite rich, quartz tourmaline pods and various types of xenoliths (metamorphic). The Regul granite at km 17 and 18 contains primary muscovite. The Semerengol aplopegmatite consists of tourmaline muscovite garnet granite and their aplopegmatite dykes found at km 14 and 15. Geochemical evidence showed that three granitic bodies (Selim, Suku and Regul granites) are different in term of their TiO_2, Fe_2O_3 and P_2O_5 contents. This supports our field observation and division of the granites along Pos Selim-Kampung Raja Highway.

Empat badan granitik telah dikenalpasti di sepanjang jalan Pos Selim-Kampung Raja (km 0 ke 18). Mereka adalah Granit Selim (km 0 ke km 5), Granit Suku (km 6 ke km 11), Semerengol aplopegmatite (wujud sebagai daik-daik granite yang menerobos batuan metamorfik di km 14 ke 15) dan Granit Regul (km 17 ke km 18). Granit Selim mengandungi granit biotit porfiritik berbutir kasar dan granite berbutur halus ke sederhana. Granit Suku di cirikan oleh kehadiran berbagai jenis xenolit dan 'enclave'. Di antara 'enclave' yang hadir ialah enclave kaya biotite, pod kuarza tourmaline dan berbagai jenis xenolit metamof. Granite Regul dijumpai antara km 17 dan 18 mengandungi muskovit primer. Semerengol aplopegmatit pula mengandungi granite tourmaline muskovit garnet dan daik-daik aplopegmatit dijumpai di km 14 dan 15. Bukti geokimia menunjukkan ketiga-tiga badan granit (Granit Selim, Suku and Regul) adalah dari magma yang berlainan berdasarkan kandungan TiO_2, Fe_2O_3 and P_2O_5. Ini menyokong pemerhatian lapangan dan pembahagian granit di sepanjang Jalanraya Pos Selim-Kampung Raja.

Kajian petrografi dan geokimia batuan ultrabes sekitar Ranau, Sabah

(Petrographic and geochemical study of ultrabasic rocks in the vicinity of Ranau, Sabah)

MOHD ROZI UMOR[1], HAMZAH MOHAMAD[1], OSAMA A. TWAIQ[1], MOHAMAD MD. TAN[1], ANIZAN ISAHAK[1] DAN BABA MUSTA[2]

[1]Program Geologi, Pusat Pengajian Sains Sekitaran dan Sumber Alam,
Fakulti Sains dan Teknologi, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor
e-mail : umor@pkrisc.cc.ukm.my

[2]Jabatan Geologi, Sekolah Sains dan Teknologi, Universiti Malaysia Sabah.
Beg Berkunci 2073, 88999 Kota Kinabalu, Sabah

Kajian ini dilakukan bagi menentukan petrografi dan cirian geokimia batuan ultrabes di sekitar Ranau, Sabah. Kajian petrografi menunjukkan batuan terdiri daripada serpentinit, peridotit dan dunit. Kajian geokimia pula menunjukkan batuan berasal daripada magma siri tholeitik rendah K menunjukkan ia jenis basalt lautan. Sekitaran pembentukannya dicadangkan di permatang tengah lautan (MORB). Unit batuan ini mengalami pengangkatan hasil rejahan batolitos Gunung Kinabalu.

This study has been carried out to determine the petrography and the geochemical character of the ultrabasic rocks at the vicinity of Ranau, Sabah. The petrographic study shows that the rocks are composed of serpentinite, peridotite and dunite. Geochemical study has revealed that the rocks are derived from the low K tholeitic magma series, indicating an abyssal type basalt. The tectonic setting is proposed as middle oceanic ridge basalt (MORB). The rock unit has been uplifted by the intrusion of Gunung Kinabalu batholith.

Migration of heavy metals through compacted soil columns

WAN ZUHAIRI WAN YAACOB AND TAN BOON KONG

Program Geologi, Pusat Sains Sekitaran dan Sumber Alam
Fakulti Sains dan Teknologi, Universiti Kebangsaan Malaysia
43600 Bangi, Selangor

Soils have different capability to function as engineered clay liner. The study was designed to evaluate the capability of soils for landfill liner materials and to investigate the behaviour of heavy metals in soils. The study has revealed that soil CEA3 has a better potential for liner material compared with soil MR1. Heavy metals are highly retained inside the soil particularly at the top part of the soil column, where Pb shows the highest retained in the soil column. Zn is more mobile compared with Cu and Pb. Confirmation studies of retention mechanisms using selective sequential extractions revealed that precipitation of heavy metals with carbonates and amorphous oxides/hydroxides was a dominant retention mechanism. This is followed by complexation with organic matter, adsorption into the soil mineral lattices and the ionic exchange onto the negatively charged of clay surfaces.

Tanah mempunyai kapasiti yang berbeza untuk berfungsi sebagai pelapik kejuruteraan lempung. Kajian ini bertujuan untuk menilai kebolehan tanah sebagai pelapik lempung dan juga untuk menyiasat sifat logam berat di dalam tanah. Kajian telah menjumpai bahawa tanah CEA3 mempunyai potensi yang lebih baik sebagai pelapik lempung berbanding dengan tanah MR1. Logam berat lebih banyak ditahan di bahagian atas turus tanah, di mana Pb paling banyak dibantutu dalam tanah. Zn pula adalah lebih mobil berbanding Cu dan Pb. Kajian pengesahan mekanisma penahanan logam berat menggunakan ujian ektraksi terpilih menunjukkan pemendakan logam berat dengan bahan berkapur dan bahan amorfus oksida/hidroksida merupakan mekanisma yang paling dominan. Ini diikuti oleh pengkopleksan dengan bahan organik, penjerapan ke dalam kekisi mineral primer, dan pertukaran ion di atas permukaan lempung yang bercas negatif.

Debris slide at Kampung Sg. Chinchin, Gombak, Selangor

CHOW WENG SUM AND ZAKARIA MOHAMAD

Jabatan Mineral dan Geosains Selangor
Lantai 6-7, Bangunan Darul Ehsan
No. 3, Jalan Indah Seksyen 14
40000 Shah Alam, Selangor

On 21st September 2001, at about 6.00 pm, a landslide occurred on the hill slopes of Bukit Guling Ayam at Sg. Chinchin at the 8th milestone of Jalan Gombak. In this incident, two houses were damaged and one person was killed.

Investigations carried out showed that the quartz reef along the top of the ridge at Bukit Guling Ayam intrudes into granite. The foot slopes of the hill are generally gentle to moderately steep, varying from 0° to 25°. The mid slopes are more steep with a gradient of 25° to 35° and towards the upper reaches of the slopes, the gradient is about 35° to 45°. The hill slopes are generally composed of colluvium with abundant boulders.

The landslide scar measured about 15 m wide near the crown and the sides of the scar had slumped about 1 to 1.5 m. Scouring by the slide debris which was estimated to be 4,000 cu metres in volume had left behind a scar of about 120 m long. The landslide was triggered off by the heavy rainfall which had occurred a few hours earlier.

The hillslopes in the vicinity of the landslide are potentially unstable as they are generally steep with gradients more than 30° and are underlain by colluvium. There are also some loose rock blocks in the quartz reef along the ridge which pose potential rockfall dangers.

Pada 21hb September 2001, jam 6.00 petang, satu geolongsoran tanah telah berlaku di tebing Bukit Guling Ayam, Kampung Sungai Chinchin, Batu 8, Jalan Gombak, dimana dua buah rumah telah musnah dan seorang terbunuh.

Hasil siasatan menunjukkan bahawa permatang kuarza sepanjang rabung Bukit Guling Ayam telah menerobos ke dalam batuan granit. Kecerunan di bahagian cerun kaki bukit tersebut didapati tidak begitu curam dengan kecondongan antara 0°hingga 25°, manakala di bahagian pertengahan cerun, kecuraman cerun adalah di antara 25°–35° dan kecuraman di bahagian atas cerun didapati berukuran antara 35°–45°. Bahan yang melandasi cerun bukit ini umumnya terdiri daripada koluvium dengan bongkah-bongkah batuan.

Kesan gelongsoran ini berukuran lebih kurang 15 m lebar di kawasan puncak runtuhan dengan penurunan di bahagian tepi diantara 1 m hingga 1.5 m. Kaukan tanah runtuh ini yang dianggarkan 4,000 meter padu telah meninggalkan satu kesan berukuran 120 m panjang. Gelongsoran tanah ini telah dicetuskan oleh hujan lebat yang turun beberapa jam sebelum kejadian.

Cerun-cerun bukit disekitar kawasan kejadian juga berpotensi untuk berlakunya kejadian geobencana tanah runtuh memandangkan kecuraman cerun yang umumnya melebihi 30° dan pada masa yang sama didasari oleh bahan koluvium. Terdapat juga blok-blok batuan longgar pada permatang kuarza disepanjang rabung Bukit Guling Ayam yang berpotensi untuk berlakunya kejadian geobencana jatuhan batuan.

An attempt to improve plantation road soils using an organic stabilizer

MD. ZOYNUL ABEDIN[1] AND TANG LON MOOD, JOSEPH[2]

[1]University Malaysia Sarawak
94300 Kota Samarahan, Sarawak
azoynul@feng.unimas.my
zabedin@ce.buet.ac.bd

[2]Jurutera Jasa (Sarawak) Sdn. Bhd., Sarawak
kuroni@tm.net.my

This paper reports the findings of an attempt to improve the strength properties and durability of plantation road soils using a liquid organic stabilizer. Laboratory investigations were done for CBR, and durability in terms of loss of weight in alternate wetting and drying, on five selected soil samples using various proportions of stabilizers. The study suggests that there is an optimum dilution ratio of the stabilizer for the improvement of these soils. Beyond this optimum dilution ratio the strength improvement occurs consistently, though not significant. Statistical analysis of the data obtained from the laboratory tests were also done. Correlation was obtained for CBR value as against the stabilizer dilution ratio.

Aggregate flows and their implications on the environment: a preliminary assessment

V.L.W. WONG, J.J. PEREIRA AND MAZLIN MOKHTAR

Institute for Environment and Development (LESTARI)
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor

Economic growth has propelled infrastructure development in Selangor and increased the demand for construction aggregates. Uncontrolled extraction of natural aggregates is depleting existing reserves, which is not sustainable for future development. Aggregate resource management is not holistic and systematic, as the resource is believed to be easily available and abundant. An assessment of the flow of aggregates, with respect to its utilization from extraction to disposal and taking into account dissipative losses to the physical environment, will be useful for formulating strategic interventions and managing this non-renewable resource in an effective manner. Preliminary results obtained using Selangor as a case study are encouraging, but there is much work to be done to address information gaps and develop a complete picture of the aggregate flow.

Pertumbuhan ekonomi telah menyumbang kepada pembangunan infrastruktur di Selangor dan meningkatkan permintaan untuk bahan binaan agregat. Pengeluaran sumber agregat secara tidak terkawal menyumbang kepada pengurangan sumber asli tersebut dan ini dijangka menjejas pembangunan secara lestari. Pengurusan sumber agregat tidak dilakukan secara holistik dan sistematik kerana agregat mudah diperolehi. Penilaian kitaran agregat berdasarkan aspek penggunaannya iaitu daripada pengeluaran kepada pembuangan dengan mengambilkira kesan terhadap alam sekitar fizikal, akan membantu pengurusan sumber ini secara lebih berkesan. Hasil awalan yang diperolehi daripada kajian kes di Selangor amat menggalakkan. Namun demikian lebih banyak maklumat diperlukan untuk memperolehi gambaran kitaran agregat yang lebih sempurna.

Geological terrain mapping in Cameron Highlands district, Pahang

ZAKARIA MOHAMAD AND CHOW WENG SUM

Jabatan Mineral dan Geosains Selangor
Lantai 6-7, Bangunan Darul Ehsan
No. 3, Jalan Indah Seksyen 14
40000 Shah Alam, Selangor

In the process of planning the landuse of an area, town planners require basic information such as the geology, topography, landform and zones which are potentially unstable. Terrain Classification Map and its derivative thematic maps such as Landform, Erosion, Physical Constraints, Engineering Geology and Construction Suitability Maps serve as useful tools for such a purpose.

Geological terrain mapping is carried out based on the evaluation of four attributes, namely, slope gradient attribute, terrain or morphology attribute, activity attribute and the erosion and instability attribute. To prepare the various derivative maps, a GIS system (using Arc Info or Arc View software) is used to analyse data from the four attributes.

Geological terrain mapping was conducted in the Cameron Highlands and the various derivative maps produced from the mapping programme are used in the planning and approval of development projects in the area.

Dalam proses perancangan gunatanah bagi sesuatu kawasan, perancang bandar memerlukan maklumat asas seperti geologi, topografi, bentuk muka bumi and zon-zon yang tidak stabil. Peta pengelasan terain and peta-peta tematik seperti bentuk muka bumi, hakisan, kekangan fizikal, geologi kejuruteraan dan kesesuaian pembangunan dapat berfungsi sebagai alat untuk mencapai tujuan berkenaan.

Pemetaan geologi terain yang dijalankan adalah berasaskan kepada penilaian empat atribut iaitu kecerunan cerun, terain atau morfologi, aktiviti yang dijalankan serta hakisan dan ketidakstabilan cerun. Untuk menyediakan berbagai peta tematik, sistem GIS (menggunakan perisian 'Arc Info' atau 'Arc View') digunakan untuk menganalisa data dari keempat-empat atribut tersebut.

Pemetaan geologi terain telah dilakukan di Cameron Highlands dan berbagai peta tematik yang telah dihasilkan dari program pemetaan ini sedang digunakan dalam perancangan dan kelulusan projek-projek pembangunan di kawasan berkenaan.

Influence of discontinuity on overbreaks and underbreaks in rock excavation — case study from Beris Dam, Kedah, Malaysia

TAJUL ANUAR JAMALUDDIN AND ISMAIL YUSOFF

Geology Department
University of Malaya
50603 Kuala Lumpur

Rock blasting excavation is largely controlled by discontinuities and the strength of the rock materials, although blasting factors are also equally important. This paper presents a case study from the Beris Dam project in Kedah, where a geologist was called upon to clarify a dispute between the contractor and engineers that excessive overbreaks at the Spillway and along the toe slab of the Main Dam were largely attributed to geological factors. To verify this issue, detailed mapping on the geological structures was carried out on the resulting exposures. Focus of the mapping was mainly on observing the nature of the rock failures (overbreaks) and collection of discontinuity data (joints, bedding, shear zones, fault). The discontinuity data were analysed kinematically by using stereographic projection to verify the mode of rock breakage. Results of the analyses indicated and conformed with the field evidences, that the overbreaks were clearly controlled by the unfavourable intersections of the bedding planes, joints, faults and shear zones with respect to the blasting lines. Overbreaks in the Spillway and the Main Dam usually occurred in wedge and planar mode of failures.

Kerja-kerja penggalian batuan sangat dipengaruhi oleh ketakselanjaran dan kekuatan bahan batuan, walaupun diakui bahawa dan faktor-faktor peletupan juga berperanan penting. Kertas kerja ini cuba menyajikan suatu contoh kajian kes daripada projek Empangan Sg. Beris, Kedah. Di dalam projek ini geologis profesional telah diundang untuk mengesahkan bahawa kejadian terlebih korek yang berlaku di tapak alur limpah dan kaki empangan utama disebabkan oleh faktor-faktor geologi. Untuk mengesahkan punca kepada masalah ini, pemetaan terperinci telah dijalankan di tapak-tapak berkenaan.

Pemetaan geologi tersebut tertumpu kepada pencerapan keadaan kegagalan bantuan dan pengumpulan data-data ketakselanjaran (kekar, perlapisan, sesar dan zon ricih). Data-data orientasi ketakselanjaran telah dianalisis secara kinematik dengan menggunakan unjuran stereografi untuk melihat potensi ragam kegagalannya. Hasil analisis jelas menunjukkan bahawa kejadian terlebih korek memang dikawal oleh ketakselanjaran kerana orientasi garis letupan batuan yang dipilih mendedahkan potongan cerun batuan kepada kegagalan baji dan satah.

Sinkholes in the Bukit Chuping area, Kangar, Perlis

YUNUS ABDUL RAZAK[1], CHOW WENG SUM[2] AND JAMALUDDIN OTHMAN[3]

[1]Minerals & Geoscience Department Headquarters
19-22 Floor, Bangunan Tabung Haji, Jalan Tun Razak, 50658 Kuala Lumpur

[2]Minerals & Geoscience Department, Selangor

[3]Minerals & Geoscience Department, Kedah, Perlis & Pulau Pinang

On the evening of 14th October 2000, four sinkholes with sizes varying from 8.5 m to 15.0 m in diameter and with depths varying from 5.0 m to 10.0 m suddenly formed in an area between Bukit Chuping and Bukit Cowder near Mata Ayer, Perlis. Investigations comprising aerial photography study, surface geological mapping, subsurface geological mapping (involving geophysical surveys and Mackintosh Probe study), hydrogeological study and ground vibration monitoring were conducted from 17th October to 2nd December 2000. Results showed that all sinkholes, incipient sinkholes and circular features related to sinkhole formation were within a zone about 350 m wide trending NE-SW in the study area. This zone, which is underlain by limestone, might be a continuation of a fault zone present at the southern end of Bukit Chuping. Monitoring of groundwater levels indicated that there was a general flow towards the central part of the study area, culminating in a depression near to the largest sinkhole in the study area. Monitoring of vibration due to blasting operations in the CIMACO Quarry revealed that the vibration levels recorded in the study area were low. There was also some other low, but more regular vibrations resulting from the movement of heavy vehicles in the study area. The light to moderate rainfall a few days before the occurrence of the sinkholes could have added extra weight to the thin soil roofs, which were present over some voids in the ground, and the collapse of these roofs resulted in the formation of the sinkholes. It is recommended that the sinkholes and the incipient sinkholes be refilled and buildings should not be sited over the sinkhole zone. Areas with circular features such as circular patches of green grass or areas with ponding of water should be constantly monitored for telltale signs, which might indicate the potential formation of sinkholes. Future development should be directed towards the southern part of the study area near to Bukit Cowder, which is underlain by sandstone.

Pada malam 14 Oktober 2000, empat lubang mendap yang mempunyai diameter berjulat dari 8.5 m hingga 15.0 m dan kedalaman berjulat dari 5.0 m hingga 10.0 m tiba-tiba terbentuk di kawasan antara Bukit Chuping dan Bukit Cowder berdekatan Mata Ayer, Perlis. Penyiasatan yang terdiri daripada kajian foto udara, pemetaan geologi permukaan, pemetaan geologi sub-permukaan (melibatkan survei geofizikal dan kajian alat Mackintosh), kajian hidrogeologi dan pemantauan getaran tanah telah dijalankan dari 17 Oktober hingga 2 Disember 2000. Keputusan kajian menunjukkan semua lubang mendap, lubang mendap permulaan dan ciri-ciri membulat yang berkaitan dengan pembentukan lubang mendap adalah terletak di dalam satu zon yang mempunyai kelebaran lebih kurang 350 m dan bercorak tenggara-barat daya dalam kawasan kajian. Zon ini yang didasari oleh batu kapur adalah berkemungkinan sambungan zon sesar yang wujud di bahagian hujung selatan Bukit Chuping. Pemantauan aras air tanah menunjukkan berlakunya aliran ke bahagian tengah kawasan kajian dan ianya semakin meningkat di kawasan rendah berhampiran lubang mendap yang terbesar di kawasan kajian. Pemantauan getaran terhadap aktiviti letupan yang dijalankan oleh Kuari CIMACO, merekodkan tahap getaran di kawasan kajian adalah rendah. Terdapat juga getaran dengan tahap rendah tetapi kerap berlaku disebabkan oleh pergerakan kenderaan berat di kawasan kajian. Kehadiran hujan yang kurang lebat ke sederhana lebat beberapa hari sebelum kewujudan lubang mendap ini mungkin menyebabkan pertambahan berat ke atas bumbung tanah yang nipis. Bumbung tanah yang nipis ini wujud di atas beberapa ruang kosong yang terdapat di dalam bumi dan keruntuhan bumbung ini menyebabkan pembentukan lubang mendap. Adalah disarankan supaya lubang mendap dan lubang mendap permulaan ini diisikan semula dan tiada bangunan yang boleh terletak di zon lubang mendap. Kawasan dengan ciri-ciri membulat seperti rumput hijau dengan tompok-tompok membulat atau kawasan takungan air haruslah dilakukan pemantauan yang berterusan untuk mengesan tanda-tanda mekanikal yang mungkin boleh menunjukkan potensi pembentukan lubang mendap. Pembangunan pada masa depan haruslah ditumpukan ke atas bahagian selatan kawasan kajian berhampiran Bukit Cowder yang didasari oleh batu pasir.

Tragedi gelinciran tanah Taman Hillview
(Taman Hillview landslide tragedy)

IBRAHIM KOMOO DAN LIM, C.S.

Institut Alam Sekitar dan Pembangunan (LESTARI)
Universiti Kebangsaan Malaysia
43600 UKM Bangi Selangor

Gelinciran Tanah Taman Hillview berlaku pada 20 November 2002 telah memusnahkan sebuat rumah banglo dan mengorbankan lapan nyawa. Ia merupakan jenis gelinciran tanah kompleks iaitu gabungan gelinciran putaran di bahagian kepala, gelinciran di bahagian tengah, disusuli dengan aliran di bahagian kaki. Panjang gelinciran mencapai 200 m dengan kelebaran maksimum 50 m dan melibatkan sekitar 25,000 meter padu bahan cerun yang terganggu. Walaupun hujan lebat yang berterusan mencetus gelinciran, faktor penting lain yang menyebabkan gelinciran ialah kedudukan dalam zon gelinciran lama, bahan permukaan yang mudah mengalami kegagalan, lineamen geologi yang menggalak gelinciran, bentuk lembangan yang mempermudahkan pengumpulan air tanah, perataan dan penteresan cerun di bahagian atas gelinciran, dan dinding penahan lama yang rosak yang telah menggalak penumpuan air permukaan. Tragedi ini merupakan peristiwa ulangan pada gelinciran tanah lama yang boleh dielakkan sekiranya kajian risiko geobencana dijalankan dengan teliti sebelum pembinaan rumah yang telah musnah.

The 20 November Taman Hillview landslide destroyed a bungalow house and eight lives were lost. The landslide was a complex landslide, i.e. a combination of rotation at the head and sliding in the middle which was followed by a flow occurrence at the toe. The landslide was up to 200 m long and 50 m at the maximum width, involving approximately 25,000 cubic metre of disturbed slope material. Even though continuous heavy rain triggered the sliding, various other important factors that contributed to the event were its location within an old landslide, surfacial material prone to failure, geological lineament that facilitated sliding, shape of the old landslide that aided the accumulation of ground water, levelling and terracing at the upper part of the landslide area, and an old damaged rubble wall that encouraged the concentration of surface water. The tragedy was a recurrence of an old landslide that could have been avoided if a detailed geohazard risk study had been undertaken prior to the construction of the affected residence.

Reinforcement mechanisms of rock bolt — a laboratory investigation

MOHD FOR MOHD AMIN, KHOO KAI SIANG AND CHAI HUI CHON

Faculty of Civil Engineering, Universiti Teknologi Malaysia
81310 UTM Skudai, Johor
e-mail: mohdfor@fka.utm.my

The use of rock bolts as rock reinforcement is becoming more popular in Malaysia. However, its effectiveness depends on a number of factors especially with regards to the technique on how the bolt is installed. Its reinforcement mechanism also restricts its application for certain modes of instability and types of rock. This paper highlights a laboratory investigation on the reinforcement mechanisms of rock bolts, specifically on bolt inclination, anchorage type and level of pre-tension. The investigation was conducted using a physical model of a rock bolt intersecting a joint. Results obtained show that a better reinforcement can be obtained if bolt is inclined at an angle so that it elongates upon joint displacement. Full-bonded bolt is more superior in terms of mobilising the anchorage capacity and consequently, this allows for immediate utilisation of the reinforcing element. Pre-tensioning of bolt induces clamping effect on joint surface consequently, helps to reduce joint dilatation and increases the inherent shear strength of the joint.

Penggunaan bolt batuan sebagai kaedah pengukuhan batuan semakin popular di Malaysia. Walaubagaimana pun, keberkesanan kaedah ini amat dipengaruhi oleh beberapa faktor terutama yang berkaitan dengan teknik pemasangan bolt. Mekanisme pengukuhan kaedah ini juga menyebabkan penggunaannya terhad pada jenis batuan dan ragam kegagalan tertentu. Kertas kerja ini membincangkan satu kajian makmal ke atas mekanisme pengukuhan bolt batuan khususnya, mengenai kesan orientasi bolt, jenis ikatan dan tahap pra-tegangan. Kajian dilaksanakan menggunakan satu model fizikal bolt batuan yang bersilang dengan satah kekar. Keputusan kajian menunjukkan tahap keupayaan pengukuhan meningkat apabila bolt dipasang secara condong dan mengalami pemanjangan apabila berlaku anjakan pada kekar. Bolt yang diturap sepenuhnya lebih baik dari segi menggerakkan keupayaan pengukuhan oleh yang demikian, kesan elemen pengukuhan

dapat dimenafaatkan serta merta. Pra-tegangan pada bolt dapat mengaruhkan kesan pengapitan pada permukaan kekar dan ini dapat mengurangkan dilatasi dan meningkatkan kekuatan ricih kekar.

Pencirian geomekanik batuan syis grafit Bt. Bujang, Kuala Kubu Baru, Selangor Darul Ehsan

(Geomechanical characterisation of a graphitic schist at Bt. Bujang, Kuala Kubu Baru, Selangor Darul Ehsan)

ABDUL GHANI RAFEK, NG CHEONG KEAT DAN ABDUL RAHIM SAMSUDIN

Pusat Pengajian Sains Sekitaran dan Sumber Alam, Fakulti Sains dan Teknologi
Universiti Kebangsaan Malaysia, 43600 UKM, Bangi, Selangor D.E.

Pencirian geomekanik batuan syis grafit dari Bt. Bujang, Kuala Kubu Baru, Selangor Darul Ehsan dilakukan dengan pemetaan profil luluhawa, survei seismos biasan, ujian pantulan tukul Schmidt, ujian indek kekuatan beban titik $I_{S(50)}$ [MPa] dan ujian kebolehtahanan pemeroian Id_2(%). Nilai halaju sebenar gelombang P, Vp bagi gred luluhawa I ialah diantara 2,000–2,500 ms^{-1}, gred II diantara 1,500–2,000 ms^{-1}, gred III diantara 900–1,500 ms^{-1}, gred IV diantara 750–900 ms^{-1}, gred V diantara 400–750 ms^{-1} dan gred VI diantara 250–400 ms^{-1}. Ujian mekanik batuan dilakukan atas bahan yang bersifat batuan, iaitu gred I, II dan II. Bagi gred I, nilai purata pantulan tukul Schmidt ialah 22, $I_{S(50)}$ ialah 0.99 MPa dan Id_2 ialah 90.32%. Masing-masing nilai purata bagi gred II ialah 16, 0.34 MPa dan 83.81% manakala untuk gred III ialah 11, 0.13 MPa dan 75.47%. Gabungan nilai indeks kekuatan beban titik dan kebolehtahanan pemeroian dapat membezakan tiga gred luluhawa ini secara kuantitatif.

The geomechanical characterization of a graphitic schist from Bt. Bujang, Kuala Kubu Baru, Selangor Darul Ehsan was carried out using weathering profile mapping, refraction seismic survey, Schmidt hammer rebound test, point load index strength $I_{S(50)}$ [MPa] and slake durability test, Id_2(%). The true P-wave velocity, Vp for weathering grade I was between 2,000–2,500 ms^{-1}, grade II between 1,500–2,000 ms^{-1}, grade III between 900–1,500 ms^{-1}, grade IV between 750–900 ms^{-1}, grade V between 400–750 ms^{-1} and grade VI between 250–400 ms^{-1}. The rock mechanics tests were conducted on rock material, that is grade I, II and III. For grade I, the average Schmidt hammer rebound value was 22, $I_{S(50)}$ was 0.99 MPa and Id_2 was 90.32%. For grade II these values were 16, 0.34 MPa and 83.81% and for grade III they were 11, 0.13 MPa and 75.47%. A combination of the point load index strength values and the slake durability values enabled a quantitative differentiation of the three weathering grades.

Soil erosion of a logged-over tropical forest, Pasoh, Negeri Sembilan

MOHD KAMIL YUSOFF, MUHAMMAD FIRUZ RAMLI, LAW JIUN TAU AND WAN NOR AZMIN SULAIMAN

Department of Environmental Sciences, Universiti Putra Malaysia
43400 UPM Serdang, Selangor
Email: mkamil@fsas.upm.edu.my

This study was conducted in the area of logged-over tropical forest in Pasoh Forest Reserve, Kuala Pilah, Negeri Sembilan. The attempt of this study was to investigate and observe soil erosion of a logged-over tropical forest. Soil erosion was monitored by using erosion pins at five unbounded research grids in a 100 m x 100 m research plot for 154 days. The occurrence of soil erosion and soil deposition were observed. Among the research grids, the maximum soil erosion was 14.6 mm and the maximum soil deposition was 7.2 mm. The forms of soil erosion that occurred were sheet erosion and splash erosion. Generally, the pattern of soil erosion varied significantly between one location and another within the plot. However, the pattern of erosion at one location did not change significantly with time.

Kajian ini dijalankan di kawasan hutan tropika yang pernah dibalak di Hutam Simpanan Pasoh, Kuala Pilah, Negeri Sembilan. Kajian ini bertujuan untuk mengkaji dan memerhati hakisan tanah di kawasan tersebut. Hakisan tanah diawasi dengan mengguna pin hakisan di lima lokasi grid bersaiz 100 m x 100 m untuk tempoh 154 hari. Hakisan dan pemendapan tanah telah diawasi. Di kalangan grid-grid kajian, hakisan tanah maksimum ialah 14.6 mm dan pemendapan tanah

maksimum ialah 7.2 mm. Jenis hakisan tanah yang berlaku ialah hakisan kepingan dan hakisan percikan. Secara umumnya, bentuk hakisan tanah berbeza di antara suatu lokasi dengan lokasi-lokasi yang lain di dalam plot kajian. Namun begitu, bentuk hakisan tanah di sesuatu lokasi tidak berubah dengan nyata mengikut masa.

Application of accurate rock core logging in engineering design process

ABD RASID JAAPAR

Soils & Foundations Sdn. Bhd.
23, Jalan Desa, Taman Desa
Off Jalan Klang Lama, 58100 Kuala Lumpur

Many engineering geologists devote a significant proportion of their time to the logging of boreholes and, specifically, to the interpretation of rock cores in engineering terms. A variety of techniques have been devised for logging such cores. In Malaysia, the common practices are often inadequate in relation to modern requirements. This paper reviews the application of accurate rock core logging in rock mechanics and in engineering design process. It tries to compile some of its applications as a design aid in rock engineering. It is intended for geologists who are involved in geotechnical engineering to understand the relationship between accurate rock core logging and the design process in rock engineering. The importance and relation of accurate rock core logging on rock mass classification and its application to engineering design is highlighted.

Kebanyakan ahli geologi kejuruteraan menghabiskan sebahagian besar masa mereka untuk mengelog lubang gerek terutamanya bagi mengintepretasi teras batuan dalam istilah kejuruteraan. Beberapa teknik telah wujud untuk mengelog teras batuan. Kertas ini mengulas penggunaan pengelogan tepat teras batuan dalam mekanik batuan dan proses rekabentuk kejuruteraan dan cuba untuk mengkompilasi sebahagian penggunaannya sebagai bahan rekabentuk dalam kejuruteraan batuan. Kertas ini juga ditujukan untuk ahli-ahli geologi yang terlibat dalam kejuruteraan geoteknik untuk memahami hubungan diantara pengelogan tepat teras batuan dengan proses rekabentuk dalam kejuruteraan batuan. Kepentingan dan hubungan pengelogan tepat teras batuan terhadap pengelasan massa batuan dan penggunaannya terhadap rekabentuk kejuruteraan diperjelaskan.

Geological investigation on Ruan Changkul landslide

KAMARULBAHRIN BIN HASHIM[1] AND HENRY LITONG AMONG[2]

[1]Minerals and Geoscience Department Malaysia Sarawak
Jalan Wan Abdul Rahman 93300 Kuching

[2]Minerals and Geoscience Department Malaysia Sabah
Jalan Penampang, 88999 Kota Kinabalu

Sarawak's worst landslide occurred when a catastrophic slope movement destroyed an eight-door long house and two nearby houses, and claimed sixteen lives in the incident at Ruan Changkul, Simunjan on the 28th January 2002. The landslide occurred in Serian Volcanic derived soils. The affected area was located within the hillslopes with angles ranging from 25° to 40°. Field inspection in the vicinity of the landslide area revealed small recently active landslides and slope failures, indicating slope instability.

Based on the site investigations and soils analyses, the contributory factors leading to the incident were determined. The landslide was triggered by prolonged torrential rainfall.

Satu kejadian gelongsoran tanah yang terburuk di Sarawak berlaku di Ruan Changkul, Simunjan yang telah memusnahkan sebuah rumah panjang lapan-pintu dan dua buah rumah yang berdekatan serta mengorbankan seramai enam belas orang. Gelongsoran tanah tersebut berlaku di tanah sisa yang terhasil dari peluluhawaan batuan Serian Volkanik. Kawasan yang terjejas terletak di atas cerun-cerun bukit dengan sudut yang berjulat dari 25° ke 40°. Pemeriksaan lapangan di sekitar kawasan yang terjejas mendapati beberapa kesan kejadian gelongsoran tanah dan kegagalan cerun yang baru, menggambarkan keadaan cerun yang tidak stabil.

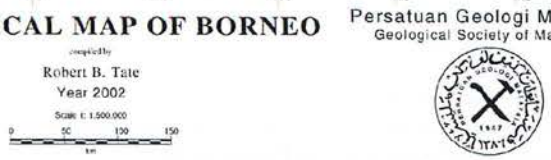
Berdasarkan kepada penyiasatan tapak dan analisis makmal faktor-faktor penyumbang kepada kejadian tersebut telah ditentukan. Hujan lebat yang berpanjangan merupakan pencetus kejadian gelongsoran tanah tersebut.

GEOLOGICAL MAP OF BORNEO

Persatuan Geologi Malaysia
Geological Society of Malaysia

compiled by
Robert B. Tate
Year 2002

Scale c. 1:1,500,000
0 50 100 150
km



LEGEND

- Q — Quaternary-Holocene coastal and river alluvium etc.
- Q — Quaternary-Holocene high-level alluvium
- Nv — Pliocene or younger basalt - East Sabah
- N(d) — Middle to Late Miocene volcanics - East Sabah
- Np — Pliocene sediments
- Npv — Neogene andesitic volcanic lavas & tuffs
- Nmab — Miocene andesite/basalt plugs, dykes & lavas
- Nmi — Miocene I type intrusives
- Nm(Br) — Miocene Brokan Formation (mélange)
- Nm — Miocene sediments
- Ml — Melinau Limestone (Eocene - Oligocene)
- Nmg — Miocene alkali granite
- Nmv — Miocene volcanics
- Po — Oligocene sediments
- Pox — Oligocene deepwater sediments
- Pe — Eocene sediments
- Pp — Paleogene sediments
- Pev — Paleogene volcanics
- Px — Paleogene deepwater sediments
- mélange - unsheared
- mélange - sheared
- limestone
- fault
- structural trend lines
- Kxu — Cretaceous ultrabasic rocks - harzburgite, serpentinite etc.
- Kx — Cretaceous deepwater sediments
- Kpx — Cretaceous Paleogene deepwater sediments
- Cy — Cretaceous "crystalline basement" (E. Sabah)
- Ku4 — Upper Cretaceous granite - granite, diorite
- Ku3 — Upper Cretaceous ultrabasic rocks - gabbro, minor diorite
- Ku2 — Upper Cretaceous volcanics - dacite to basalt lava, breccia, tuff etc.
- Ku1 — Upper Cretaceous granite - granite, quartz monzonite, alkali granite
- Kl4 — Lower Cretaceous volcanics - andesite lava, breccia, tuff etc.
- Kl3 — Lower Cretaceous granite - granite
- Kl2 — Lower Cretaceous granite - granodiorite, granite, tonalite
- Kl1 — Lower Cretaceous granite - tonalite, granodiorite; locally foliated
- K — Cretaceous sediments
- JK — Jurassic - Cretaceous sediments
- JKm — Jurassic - Cretaceous metamorphic rocks (Glaucophane schist, hornblende schist, garnet amphibolite etc. in Meratus Mts.)
- JKx — Jurassic - Cretaceous deepwater sediments
- Jx — Jurassic deepwater sediments
- Jx — Jurassic sediments
- TrJ — Triassic - Jurassic sediments
- Trv — Triassic volcanics
- Trg — Triassic granite
- PTr — Permo-Trias metamorphics
- CP — Carbo-Permian sediments
- PzM — Pre-Carboniferous Pinoh Metamorphics

South China Sea
Sulu Sea
Celebes Sea
Makassar Strait
Java Sea

EAST MALAYSIA
Sabah

EAST MALAYSIA
Sarawak

INDONESIAN
Kalimantan

No authority on international boundaries

Explanation of Legend

New publications from the Geological Society of Malaysia

Geological Map of Borneo

Scale 1:1.5 million

Printed on two sheets (each 950 mm x 680 mm) with an overlap of 50 mm between the two sheets. On glossy plain paper or waterproof laminated paper for field use. Together with accompanying notes, 12p A4.

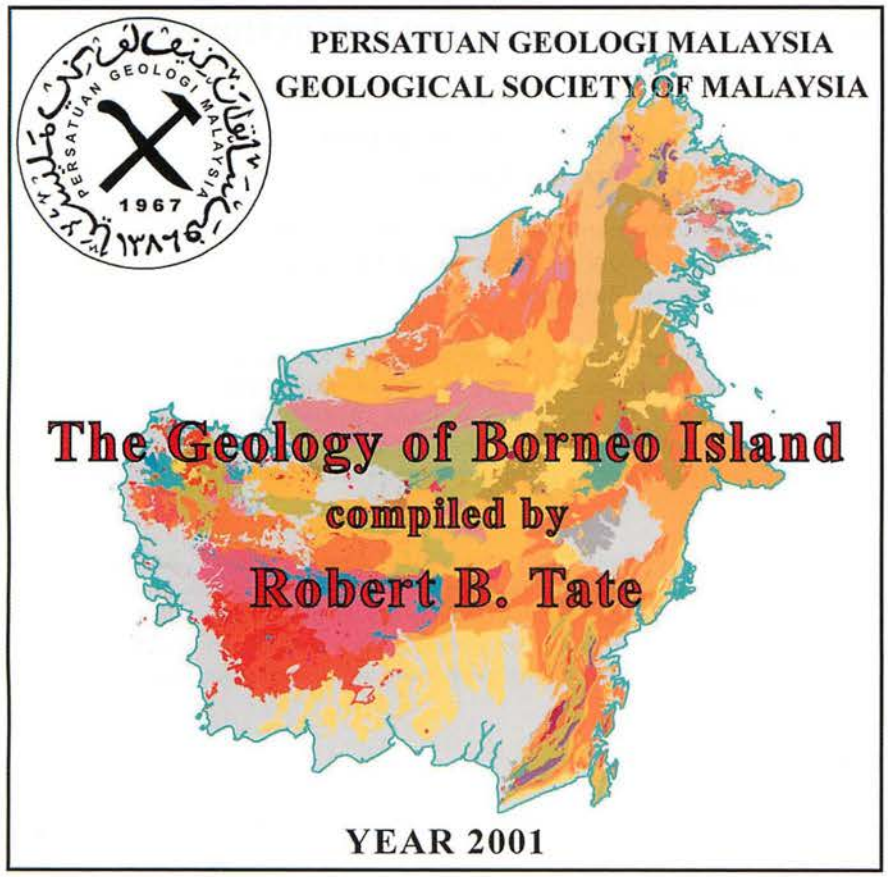
Price: Members: RM15.00; non-members: RM30.00
excluding postage and packing.

For overseas orders, please send your order to the

Geological Society of Malaysia
c/o Department of Geology, University of Malaya
50603 Kuala Lumpur, Malaysia
Tel: (603) 7957 7036 Fax: (603) 7956 3900 e-mail: geologi@po.jaring.my

to obtain a quotation of the total cost in the currency of your choice and stating the type of paper finish required.

Visit the Society website www.angelfire.com/la/gsm to view the maps and other recent publications.



The Geology of Borneo Island

compiled by

Robert Tate

on CD Rom

Price: RM60.00
exclusive of postage

Some radiolarians from Dengkil, Selangor

ZAITON HARUN AND BASIR JASIN

Program Geologi, Fakulti Sains dan Teknologi
Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor

An assemblage of radiolarians was discovered from a chert sequence exposed in Dengkil, Selangor. Three taxa were identified; *Astroentactinia* sp., *Entactinosphaera palimbola* Foreman, and *Duplexia? parviperforata* Won. This assemblage indicates an Early Carboniferous age.

Suatu himpunan radiolaria telah ditemui daripada satu jujukan rijang yang tersingkap di Dengkil, Selangor. Tiga taksa telah dapat dicamkan; Astroentactinia sp., Entactinosphaera palimbola Foreman and Duplexia? parviperforata Won. Himpunan tersebut telah menunjukkan usia Karbon Awal.

The Sanai Limestone Member — a Devonian limestone unit in Perlis

MEOR HAKIF HASSAN AND LEE CHAI PENG

Department of Geology
University of Malaya
50603 Kuala Lumpur

The name Sanai Limestone Member is proposed for the thin limestone unit located inside the Jentik Formation, previously known as Unit 4. Stratigraphically it is located near the top of the Jentik Formation, underlain by Mid or Late Devonian red mudstone beds of Unit 3, and overlain by light coloured to black mudstones interbedded with cherts of Unit 5. The lithology consists of planar bedded, grey micritic limestone, with thin shale partings and stylolites. The limestone contains abundant fossils of conodonts, styliolinids, straight cone nautiloids, and trilobites. The occurrence of the conodont *Palmatolepis glabra* indicates a Late Devonian, Fammenian age. The depositional environment of the Sanai Limestone Member is interpreted to be a deepwater pelagic limestone facies, located at the outer shelf to continental margin region.

Early Cretaceous palynomorphs from Kampung Tanah Runtuh, Kluang, Johor

UYOP SAID, RASANUBARI ASMAH RAHMAH ABDUL HAMID AND MOHD MUSRYZAL MOHAMED ARIFFIN

Geology Programme, School of Environmental and Natural Resources
Faculty of Science and Technology, Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor

Some fairly well-preserved Early Cretaceous palynomorphs were identified in a rock sequence at Kampung Tanah Runtuh, Kluang Johor. The rock sequence consists predominantly of mudstone, siltstone and cross-laminated fine- to medium-grained sandstone of various in thicknesses, and interpreted to be deposited in a fluvial environment. The observed palynomorphs are assigned to twelve genera which include the most commonly observed genera namely *Cicatricosisporites*, *Araucariacites* and *Concavissimisporites*. The identified palynomorph assemblage shows a close resemblance with the *Stylosus* Assemblage of Early Cretaceous age.

Beberapa palinomorf berusia Kapur Awal yang terawet baik telah dikenal pasti dari jujukan batuan di Kampung Tanah Runtuh, Kluang. Jujukan batuan didominasi oleh batu lumpur, batu lodak dan batu pasir berlaminasi silang berbutiran halus hingga sederhana dalam pelbagai ketebalan, dan ditafsir telah terendap di sekitaran fluvial. Palinomorf yang ditemui dikelaskan kepada dua belas genera yang merangkumi genera yang biasa ditemui iaitu Cicatricosisporites, Araucariacites *dan* Concavissimisporites. *Himpunan palinomorf yang dikenal pasti mempunyai persamaan yang rapat dengan Himpunan* Stylosus *yang berusia Kapur Awal.*

Black siliceous deposits in Peninsular Malaysia: their occurrence and significance

BASIR JASIN, ZAITON HARUN AND SITI NORHAJAR HASSAN

Program Geologi, Fakulti Sains dan Teknologi
Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor

Black Radiolarian cherts are found in the Setul, Mahang, Kubang Pasu formations. The occurrence of the cherts and carbonaceous material was related to high plankton productivity. The lithologic association of the chert represents the continental shelf rocks association. The geochemical data from the chert samples of the Setul, Mahang and Kubang Pasu Formations plotted on the Fe_2O_3/TiO_2 vs. $Al_2O_3/(Al_2O_3 + Fe_2O_3)$ discrimination diagram show most of the points are located in the field of older upper continental crust. The chert was deposited on a passive continental margin, which episodically received the supply of terrigenous material from the continent. During the Cambrian, both the Machinchang and Jerai Formations were deposited in a deltaic environment. The sea level rose in the Ordovician followed by deposition of the Setul and Mahang Formations. The Mahang basin was a faulted basin deeper than the Setul basin. The Singa and the Kubang Pasu Formations overlie the Setul and the Mahang Formations respectively. The radiolaria in the chert were deposited in a relatively shallow marine environment on the continental shelf.

An Early Permian (Early Sakmarian) brachiopod fauna from the Sungai Itau Quarry and its relationship to other Early Permian brachiopod horizons in Langkawi, Malaysia

MOHD SHAFEEA LEMAN

School of Environmental Sciences and Natural Resources
Faculty of Science and Technology, Universiti Kebangsaan Malaysia
43600 Bangi, Selangor Darul Ehsan

A rich brachiopod bed was discovered in a quarry exposure at Kampung Sungai Itau, Langkawi. At least twelve species of brachiopod were identified from this bed. The fauna is dominated by the heavily spinosed brachiopod genus *Spirelytha* and the large thickly shelled genus *Sulciplica*. The Kampung Sungai Itau brachiopod fauna exhibits strong correlation with those of Kilim in Langkawi Island and Ko Muk in south Thailand. The fauna can be assigned to the upper part of the *Arctitreta–Bandoproductus* assemblage Zone of Early Permian (Early Sakmarian). The stratigraphic position of other Early Permian brachiopod horizons in Langkawi Islands is revised herewith.

Satu lapisan kaya brakiopod telah ditemui dalam sebuah singkapan kuari di Kampung Sungai Itau, Langkawi. Sekurang-kurangnya empat belas spesies brakiopod telah dikenalpasti daripada lapisan ini. Fauna ini didominasi oleh brakiopod genus Spirelytha *yang berdeduri lebat dan* Sulciplica *yang bersaiz besar dan bercengkerang tebal. Fauna brakiopod Kampung Sungai Itau mempunyai korelasi yang sangat hampir dengan fauna brakiopod Kilim di Pulau Langkawi dan Ko Muk di Thailand selatan. Fauna ini boleh diletakkan pada bahagian atas Zon himpunan* Arctitreta–Bandoproductus *berusia Perm Awal (Sakmarian Awal). Kedudukan stratigrafi beberapa lapisan brakiopod berusia Perm Awal di Kepulauan Langkawi telah dinilai semula.*

The Madai-Baturong Limestone in eastern Sabah and its new interpretation as a seamount

LEE CHAI PENG

Department of Geology, University of Malaya
50603 Kuala Lumpur, Malaysia
E-mail: leecp@um.edu.my

The shallow marine Lower Cretaceous Madai-Baturong Limestone of east Sabah is surrounded by deep water ophiolitic rocks such as cherts, turbiditic greywackes and spilitic basalts belonging to the Chert-Spilite Formation. A new interpretation

that it is a seamount carbonate is proposed because of: the extreme purity of the carbonates and the lack of terrigenous detrital inputs into the limestone, its intimate relationship with the surrounding typical deep water ophiolitic rocks, and its large size and yet limited lateral extend. The development of fissures filled with younger Upper Cretaceous limestone breccias with volcanic input in its matrix enclosing blocks of the older limestone indicating exposure and erosion of the top of the limestone which must have remained near the paleosea-level lends further support to the hypothesis. The smaller limestone bodies interbedded with the Chert-Spilite Formation rocks could be blocks which have slumped off the topographically higher seamounts into the deeper parts surrounding them.

Review of digital geological mapping techniques

CHAI TED SING

Faculty of Information Technology, Universiti Malaysia Sarawak
94300 Kota Samarahan, Sarawak
36 Greenwood Park Phase 5, 9th Mile Kuching-Serian Road
93250 Kuching, Sarawak
Email: chaits@tm.net.my

The computer-assisted geological mapping becomes practical with the advancement in the computer technology. Field observation data can be recorded digitally and systematically using digital field data acquisition system. The incorporation of GPS technology to the system can help to speed up the field mapping in open areas. The digitally recorded field observation data can be used directly for the geological interpretation in the GIS environment. Geological interpretation can be performed more accurately and efficiently in GIS through effective use of spatial datasets from various disciplines, and the result can be used readily in the compilation of the geological map.

Pemetaan geologi berpanduan komputer dapat dilaksanakan dengan kemajuan dalam teknologi komputer. Data peninjauan kerja lapangan dapat direkod secara digital dan sistematik dengan menggunakan sistem pengambilan data digital. Pergabungan teknologi GPS dalam sistem itu boleh mempercepatkan pemetaan kerja lapangan di tempat yang luas. Data peninjauan itu dapat digunakan secara langsung untuk pentafsiran geologi dalam GIS. Pentafsiran geologi ini boleh dilaksanakan dengan lebih tepat and cekap melalui penggunaan data spatial yang terdapat dari berbagai bidang. Hasil pentafsiran itu boleh digunakan dengan mudah dalam penyusunan peta geologi.

Probabilistic landslide susceptibility analysis and verification using GIS and remote sensing data at Penang, Malaysia

JASMI AB TALIB

Malaysian Centre For Remote Sensing (MACRES)
No. 13, Jalan Tun Ismail, 50480, Kuala Lumpur, Malaysia
E-mail: jasmi@macres.gov.my

The aim of this study is to generate and evaluate the landslide hazard map for Penang Island using a Geographic Information System (GIS) and remote sensing techniques. Landslide locations were identified in the study area from imagery and aerial photograph interpretations followed by field surveys. The topographic and geologic data and satellite images were collected, processed and constructed into a spatial database using GIS and image processing. The factors that influence landslide occurrences such as topographic slope, topographic aspect, topographic curvature and distance from drainage were retrieved from topographic database whereas, geology and distance from lineament were retrieved from the geologic database; land use from TM satellite images and vegetation index value from SPOT satellite data. Landslide hazard areas were analysed and mapped using the landslide occurrence factors by probability – likelihood ratio method. Several areas are considered as hazardous, such as Paya Terubung, Bukit Relau, Bukit Gemuruh and Teluk Bahang. The results of the analysis then were verified using the landslide location data. The validation results showed satisfactory agreement between the hazard map and the existing data on landslide location.

Tujuan kajian dijalankan adalah untuk menjana dan menilai peta bencana tanah runtuh dengan menggunakan kaedah Sistem Maklumat Geografi (GIS) dan remote sensing. Data lokaliti tanah runtuh diperolehi dan dikenalpasti hasil interpretasi data-data satelit, foto-foto udara dan juga maklumat kerja lapangan. Data-data topografi, geologi dan juga

imej-imej satelit pula dikumpul, diproses dan dijana dengan menggunakan GIS dan kaedah pemprosesan imej serta disimpan di storan database. *Peta-peta parameter seperti peta cerun, peta* aspect, *peta bentuk cerun serta peta jarak daripada sungai dijanakan daripada* database *topografi manakala peta geologi dan peta jarak daripada lineamen dijanakan daripada* database *geologi. Disamping itu pula penggunaan data-data satelit menghasilkan parameter-parameter seperti peta nilai indeks tumbuhan yang diperolehi daripada data satelit SPOT dan peta guna tanah hasil interpretasi ke atas data satelit Landsat TM. Kesemua peta-peta parameter tersebut dianalisa dengan menggunakan kaedah kebarangkalian* likelihood. *Hasil pengkelasan jumlah kebarangkalian kesemua peta parameter tersebut menghasilkan peta bencana tanah runtuh. Di antara kawasan-kawasan yang dikenalpasti sebagai kawasan berpotensi tinggi bencana tanah runtuh ialah Paya Terubung, Bukit Relau, Bukit Gemuruh dan Teluk Bahang. Analisa selanjutnya mendapati bahawa kejituan peta bencana tanah runtuh yang dihasilkan ini adalah tinggi.*

Teknik nuklear dalam kajian aliran air tanah

KAMARUDIN SAMUDING, MOHD TADZA ABD RAHMAN AND JUHARI YUSOF

Institut Penyelidikan Teknologi Nuklear Malaysia (MINT)
43000 Bangi, Selangor

Sumber air tanah adalah salah satu daripada sumber air yang berpotensi untuk digunakan dimasa akan datang. Teknik nuklear dengan kaedah pencairan penyurih radioisotop digunakan untuk menentukan halaju dan arah aliran air tanah. Peralatan yang digunakan dalam kajian ini ialah sistem rheometer dan "Sistem Pemantauan Arah". Teknik nuklear ini melibatkan penyuntikan penyurih radioisotop di dalam lubang gerudi dan pemantauan ke atas kepekatannya dilakukan pada beberapa jangka waktu tertentu. Teknik nuklear yang berkaitan dengan aliran air tanah adalah merupakan teknik yang terbaik dalam mengenalpasti masalah kegagalan cerun di Klian Intan, Perak, tanah runtuh di Paya Terubong, Penang, dan migrasi bahan pencemaran di tapak pelupusan sistem terbuka Gemencheh, Negeri Sembilan.

Groundwater is one of the potential water resources for the future use. Nuclear technique with radioisotope tracer dilution method is used to determine the groundwater flow velocity and direction. The equipments used in this study are Rheometer system and "Direction Monitoring System". This technique involves the injection of radioisotope tracer into the borehole and monitor its concentration over a period of time. The nuclear technique, which is related to the groundwater flow, is a powerful tool in identifying slope failure problem in Klian Intan, Perak, landslide in Paya Terubong, Penang, and migration of contaminants at the Gemencheh municipal waste disposal site, Negeri Sembilan.

Geoindikator tanah runtuh di kawasan pembangunan: kajian kes di Daerah Hulu Langat

JAMES BACHAT, JOY JACQUELINE PEREIRA DAN IBRAHIM KOMOO

Institut Alam Sekitar dan Pembangunan (LESTARI)
Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor

Kajian ini memperkenalkan geoindikator untuk penilaian tanah runtuh di Daerah Hulu Langat. Parameter fizikal yang berkait rapat dengan kejadian tanah runtuh telah dikenalpasti dan dibincangkan dalam konteks kesesuaiannya sebagai geoindikator. Parameter tersebut ialah litologi, kecuraman cerun, ketumpatan saliran, litupan tanah dan ketumpatan lineamen. Setiap satu daripada parameter ini telah dibahagikan kepada beberapa kelas dan berdasarkan kepada nilai ini, taburan, bilangan dan kekerapan tanah runtuh telah ditentukan. Hasil awalan mendapati bahawa kedua-dua bilangan dan kekerapan tanah runtuh merupakan geoindikator yang sesuai dikaitkan dengan parameter litologi, kecuraman cerun, ketumpatan saliran dan litupan tanah, manakala ketumpatan lineamen tidak sesuai sebagai geoindikator tanah runtuh.

The paper focuses on the identification of potential geoindicators for the assessment of landslides in the District of Hulu Langat. Physical parameters related to landslide occurrences are identified and discussed within the context of their suitability as geoindicators. The parameters are lithology, slope gradient, drainage density, land cover and lineament density. Each parameter is divided into several classes where the number and frequency of landslides in each class was determined. Preliminary results indicate that both the number and frequency of landslides are useful geoindicators for parameters such as lithology, slope gradient, drainage density and land cover while lineament density has not yielded useful landslide geoindicators.

The effectiveness of Ground Penetrating Radar in detecting buried objects

HARITH Z.Z.T. AND ROSLI B.S.

Geophysics Section, School of Physics
Universiti Sains Malaysia, 11800 USM, Pulau Pinang

Reliable information such as the position of buried utilities underneath the ground is an important ingredient in any undertaking. The most difficult part of obtaining information about buried objects or utility lines is that very little is visible. Existing drawings, plans or information can sometimes be obtained from relevant parties but many times they are inaccurate, faulty or incomplete. A suitable technique such as GPR, ultrasonic, and IR Imaging has to be used to obtain the information from underground.

In this paper we are going to discuss the effectiveness of the Ground Penetrating Radar (GPR) to detect an underground objects such as concrete, voids, cavities, pipes, bones, etc. These objects were buried at a known depth and location. Data that collected can be interpreted after applying simple processing or data enhancement such as band-pass filter and AGC. Depth conversion was also done to convert the time to depth section. The result shows all the objects can be detected however an experience operator manages is needed to predict the depth and the width of each object.

Maklumat yang tepat berkaitan dengan kedudukan dan kedalaman objek-objek tertanam adalah penting sebelum sesuatu kerja pengorekan dilakukan. Maklumat ini sukar diperolehi. Kebiasaannya peta-peta atau rekod-rekod penanaman objek merupakan sumber rujukan awal, walau bagaimana pun rekod-rekod ini kadangkala ketinggalan zaman dan sukar diperolehi. Oleh itu teknik-teknik pengesanan seperti GPR, ultrasonic, dan Pengimejahan IR mestilah dilakukan terlebih dahulu.

Dalam kertas kerja ini, kami akan membincangkan keberkesanan teknik Radar Penembusan Bumi (Ground Penetrating Radar, GPR) bagi mengesan objek yang ditanam seperti kepingan kinkrit, lohong (tong plastik), batang paip dan juga tulang lembu. Bahan bahan ini ditanam terlebih dahulu dan rekod penanamannya seperti lokasi dan kedalaman direkodkan. Data yang diambil boleh ditafsirkan sebaik sahaja pemprosessan mudah seperti penurasan dan peningkatan signal dilakukan. Penukaran masa kedalaman juga dilakukan bagi mendapatkan maklumat kedalaman. Hasil kajian mendapati semua objek yang ditanam dapat dikesan, walau bagaimana pun kecekapan dan pengalaman diperlukan bagi mendapatkan kedalaman dan kelabaran yang tepat untuk setiap objek.

Pengukuran kemasinan air tanah di dataran pantai Pekan-Nenasi, Pahang dengan teknik geoelektrik dan geokimia

UMAR HAMZAH[1], ABDUL RAHIM SAMSUDIN[1], ISMAIL C. MOHAMAD[2], NORHAFIZI KHALID[1] DAN SHAHIMI SALI[1]

[1]Program Geologi, Pusat Pengajian Sekitaran & Sumber Alam
Fakulti Sains dan Teknologi, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor

[2]Jabatan Mineral dan Geosains Negeri Sembilan

Masalah kejatuhan paras air tanah dan peningkatan jumlah kemasinan dalam air tawar yang terdapat dalam aluvium di sekitar Pekan-Nenasi, Pahang telah dikesan melalui kerja-kerja pemantauan air bawah tanah. Sebahagian daripada input pemantauan termasuk data survei geofizik yang digunakan serentak dengan data hidrogeologi kawasan kajian. Survei geofizik yang digunakan dalam kajian pemantauan ini ialah teknik geoelektrik termasuk duga dalam dan pengimejan khususnya untuk menganggarkan sempadan zon-zon air tawar-payau-masin dalam enapan aluvium. Hasil survei yang dilakukan menunjukkan zon-zon konduktif yang mewakili kawasan pengaruh air masin-payau lebih tertumpu berhampiran dengan tepi pantai di sekitar 1-5 kilometer. Keputusan awal menunjukkan pencapaian yang diperolehi dari survei geoelektrik hanya terbatas pada kedalaman tidak melebehi 20-30 meter. Oleh itu kemasinan bahan yang terdapat di bahagian yang lebih dalam tidak dapat diselidiki dengan survei geoelektrik.

The lowering of groundwater levels and an increasing in salt content in the freshwater alluvial aquifer were detected during continuous monitoring works of the groundwater in Pekan-Nenasi coastal areas. Geophysical data are used in conjunction with the hydrogeological data for the monitoring processes. Geophysical surveys used in this monitoring study were both vertical electrical sounding and electrical imaging. They are specially employed in order to estimate boundaries of fresh-brackish-salt water in the alluvial aquifer. Results of the surveys show that areas influenced by salt-brackish water or the

conductive zones are concentrated in areas around 1-5 kilometres from the beach. Preliminary results show that maximum depth of investigation through geoelectrical surveys are only between 20-30 metres. Therefore water salinity at depth greater than 30 metres could not be investigated by these surveys.

A microgravity survey over deep limestone bedrock

SAMSUDIN BIN HJ TAIB

Department of Geology
University of Malaya, 50603 Kuala Lumpur

A microgravity survey had been carried out within a residential area. A total of 141 gravity values was obtained over an area of about 500 by 300 m^2. These data were obtained along the roads within the study site. The boreholes within the area indicate that the area is underlain mainly by fine grained material namely silty clay, silty sand, clayey silt and sandy clay. Near the bedrock coarser material such as pebble and gravel may be present. The density of this clayey material is 1.4 to 1.8 gc/m^3. The bedrock is limestone and has density of 2.64 to 2.75 gc/m^3. From the borehole data the limestone within the study area is at about 27 to 33 m deep.

A major problem within the study area is the presence of subsurface mass movement. This is indicated by the formation of large scale undulation on the ground both on the road and within the house areas and the cracks on the building structure including drains, walls and pillars. Both lateral and vertical movement occur on these structures indicating lateral and vertical mass movement. It has been suggested that collapsing of cavity roof within the limestone can be the cause. The microgravity survey was aimed at trying to determine the presence of the cavity. With the borehole data, the gravity modelling is very well constrained. The modelling indicates that the subsurface topography of the limestone is made up of a series of ridges and valleys. Possible occurrence of the cavity within the ridges has also been modelled.

Satu survey mikrograviti telah dijalankan di kawasan perumahan. Sejumlah 141 nilai gravity telah dikutip di kawasan seluas lebih kurang 500 x 300 $meter^2$. Data gravity ini dikutip di sepangang jalan yang terdapat di kawasan perumahan tersebut. Lubang gerudi di kawasan ini menunjukan kawasan ini dilapisi oleh bahan berbutir halus seperti lempong berlodak, pasir berlodak, lodak berlempong dan pasir berlempong. Berdekatan dengan batudasar bahan berbutir kasar seperti pebel dan gravel hadir. Ketumpatan bahan berlempung ini berjulat 1.4 hingga 1.8 g/cm^3. Batudasannya adalah batukapur dan mempunyi ketumpatan berjulat 2.64 hingga 2.75 g/cm^3. Dari lubang gerudi dalam kawasan ini kedalaman batukapur ini adalah di sekitar 27 hingga 33 meter.

Satu masalah besar dalam kawasan kajian adalah terdapatnya pergerakan jisim subpermukaan. Ini dikenalpasti dari pembentukan mukabumi yang beralun di jalan dan di kawasan rumah,dan retakan pada struktur bangunan termasuk parit, dinding dan tiang. Pergerakan tegak dan mendatar berlaku pada struktur struktur ini menandakan pergerakan jisim mendatar dan tegak telah berlaku. Ada cadangan mengatakan bahawa runtuhan bumbong lohong dalam batukapur adalah penyebabnya. Survei gravity adalah ditujukan untuk cuba menentukan kedapatan lohong dalam batukapur. Dengan adanya data lubanggerudi pemodalan gravity dapat di kawalan dengan baik. Ia membolehkan penentuan topografi batukapur yang terbentuk dari satu siri rabong dan lembah ditentukan. Kemungkinan adanya lohong dalam rabong batukapur tersebut juga telah di modelkan.

Groundwater quality assessment using remote sensing and related datasets

NORAINI SURIP

Pusat Remote Sensing Negara (MACRES)
13 Jalan Tun Ismail
50480 Kuala Lumpur

The study was carried out in Selangor and Kuala Lumpur for developing a model to assess groundwater quality using remotely sensed, borehole and ancillary datasets. Remote sensing data were useful in extracting groundwater contamination sources due to specific land usage such as agricultural activities and urbanization. They were also useful in generating digital elevation model (DEM) and extracting geological features including lineaments and faults, which influenced the movement of contamination sources to the aquifer. Borehole data providing relevant subsurface geological information such as aquifer media, vadose zone media, hydraulic conductivity and groundwater level. These information together with population census data formed the basis in formulating the suitable model to access the groundwater quality. The model was used to generate the groundwater contamination risk map. Urban and highly populated area having shallow limestone

aquifer identified as having the highest risk of groundwater contamination. On the contrary, groundwater located within forested mountainous aquifer was identified as having the lowest risk of contamination. Future groundwater quality was also modelled using predicted landuse changes and population density increased for the year 2010, 2020 and 2030.

Kajian untuk pemodelan penilaian kualiti air tanah telah dijalankan di Selangor dan Kuala Lumpur dengan menggunakan data remote sensing, data lubang gerudi dan data sedia ada. Data remote sensing telah digunakan untuk mengenalpasti punca pencemaran dari penggunaan tanah yang spesifik seperti aktiviti pertanian dan perbandaran. Data ini juga telah digunakan untuk membina DEM dan mengenalpasti fitur-fitur geologi seperti lineaments dan sesar yang diketahui boleh mempengaruhi pergerakan punca pencemaran ke dalam akuifer. Data lubang gerudi memberikan informasi geologi bawah permukaan seperti medium akuifer, zon vados, konduktiviti dan aras air tanah. Semua informasi ini berserta data kepadatan penduduk telah digunakan sebagai asas untuk menghasilkan model penilaian air tanah. Model tersebut seterusnya telah digunakan untuk menyediakan peta risiko pencemaran air tanah. Adalah didapati kawasan perbandaran yang berkepadatan penduduk dan mempunyai akuifer batu kapur yang cetek mempunyai risiko pencemaran air tanah yang tinggi. Sebaliknya, air tanah yang terletak di kawasan hutan tanah tinggi mempunyai risiko pencemaran air tanah yang rendah. Kualiti air tanah pada masa hadapan telah juga dimodelkan dengan menjangkakan perubahan guna tanah dan pertambahan penduduk untuk tahun 2010, 2020 dan 2030.

On some ore and skarn minerals of Langkawi

WAN FUAD WAN HASSAN

School of Environmental and Resource Sciences, Faculty of Science and Technology
Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor
wafutu@pkrisc.cc.ukm.my

This paper describes the sulphide and skarn mineral occurrences in Langkawi, formed with relation to the Triassic granite intrusions. The minerals are distributed along the granite-limestone contacts and are well developed in the southeastern part of the island, especially in Bukit Panchor and Teluk Apau for the sulphides and Bukit Panchor and Pulau Bumbon Besar for the skarns. The sulphides, of copper-bismuth type, consist of chalcopyrite, pyrite, galena, sphalerite, pyrrhotite, arsenopyrite, bismuth and bismuth sulphosalt of emplectite and joseite, while the skarn consists of tremolite-actinolite, diopside, grossularite-andradite garnet, vesuvianite, and occasionally accompanied by malayaite and scheelite.

Kertas ini memerihal kewujudan mineral-mineral sulfida dan skarn di Langkawi, terhasil daripada rejahan granit berusia Trias. Mineral-mineral tersebut tertabur sepanjang kawasan sentuhan antara granit-batu kapur dan jelas terbentuk di bahagian tenggara Langkawi, terutamanya di Bukit Panchor dan Teluk Apau bagi mineral sulfida, dan Bukit Panchor serta Pulau Bumbon Besar bagi mineral skarn. Mineral sulfida adalah jenis kuprum-bismut, terdiri daripada kalkopirit, pirit, galena, sfalerit, pirotit, arsenopirit, bismut dan sulfosalt bismut iaitu emplektit dan joseit, manakala mineral-mineral skarn pula terdiri daripada tremolit-aktinolit, diopsid, garnet grosularit-andradit, vesuvianit, dan kadang-kala malayait serta syilit.

The silica-based industry in Malaysia

AZIMAH ALI

Industry Relations Unit
Mineral Economics Division
Minerals and Geoscience Department Malaysia
19-22 Floor, Bangunan Tabung Haji
Jalan Tun Razak, 50658 Kuala Lumpur

Malaysia has an estimated resource of 640 Mt of silica sand, of which 148 Mt are natural silica and 492 Mt tailing sand. These sources can be exploited and beneficiated for various industrial uses.

Silica sand is one of the important industrial minerals in Malaysia. In 2001, the production of silica sand amounted to 575,105 tonnes which was valued at RM 23.9 million. A total of 511,161 tonnes amounting to RM9.7 million was imported and 120,723 tonnes worth RM5.8 million were exported. It is an essential mineral commodity for the local industries, namely, the foundry, glass manufacturing, water filter, silicon wafer fabrication, and the chemical industry in the manufacture of sodium silicate.

During 2001, the production value of sand-based products totalled RM2.6 billion. The exports of glass and glassware amounted to RM1.2 billion while imports totalled RM1.4 billion. Apparent domestic consumption is estimated to be in the region of RM1.4 billion.

Although some of the high-end products, for example the optical glass and the lense sector is unable to consume domestic material due to the inability of our local silica processor to meet their requirement, others like the float glass manufacturer was consuming local material. As such, it is pertinent to ensure that the supply is sufficient to meet demand.

The silica-based industry, like all other industries are facing rising labour costs, expensive infrastructure, and escalating raw materials costs. However, a technology-based manufacturing methods could help offset the effect. With the incentives given by the government, foreign investment and global market ventures, supported by the massive amount of local raw materials and highly skilled domestic workforce available locally, Malaysia would be able to face the challenges ahead.

Terdapat sebanyak 640 juta tan sumber pasir silika di Malaysia, dimana 148 juta tan adalah pasir silika semulajadi dan 492 juta tan adalah dari hasil sampingan industri perlombongan. Sumber-sumber ini boleh di eksploit dan dibeneficiated untuk pelbagai kugunaan industri.

Pasir silika adalah salah satu dari mineral perindustrian penting di Malaysia. Dalam tahun 2001, sebanyak 575,105 tan pasir silika bernilai RM23.9 juta dikeluarkan. Sebanyak 511,161 tan bernilai RM9.7 juta telah diimport dan 120,723 tan dengan nilai RM5.8 juta telah dieksport. Ia merupakan komoditi mineral penting untuk industi tempatan, anatara lainnya untuk industri-industri foundri, pembuatan kaca, penapis air, fabrikasi wafer silikon, dan industri kimia dalam pengeluaran sodium silikat.

Dalam tahun 2001, nilai pengeluaran produk berasaskan pasir silika adalah berjumlah RM2.6 billion. Eksport kaca dan barangan kaca dianggarkan bernilai RM1.2 billion manakala import produk yang sama berjumlah RM1.4 billion. Penggunaan domestik adalah dianggarkan bernilai RM1.4 billion.

Walaupun beberapa produk hiliran bernilai tinggi, contohnya dalam sektor kaca optikal dan kanta, tidak menggunakan pasir silika tempatan disebabkan ketidakupayaan pengeluar pasir silika tempatan memenuhi keperluan, pengeluar-pengeluar lain seperti pengusaha kaca kepingan telah menggunakan bahan tempatan sepenuhnya. Oleh itu, adalah penting mempastikan bekalan bahan mentah adalah mencukupi untuk memenuhi permintaan pengeluar.

Industri berasaskan silika, seperti juga kebanyakan industri lainnya, sedang menghadapi masaalah dari segi kos tenaga buruh, infrastruktur, dan bahan mentah yang meningkat. Walau bagaimanapun, kaedah-kaedah pembuatan yang berasaskan teknologi diharapkan boleh mengurangkan kesan tersebut. Dengan insentif oleh Kerajaan, pelaburan luar-negara dan pasaran global, disokong oleh bekalan bahan mentah yang mencukupi serta tenaga buruh tempatan yang mahir, Malaysia seharusnya dapat menghadapi cabaran-cabaran akan datang.

Fluid inclusions studies of Bukit Botak skarn deposit, Mengapor, Pahang

Goh Swee Heng[1], Teh Guan Hoe[2] and Mohd Rozi Umor[1]

[1]Program Geologi, PPSSSA, Fakulti Sains dan Teknologi
43600 UKM Bangi, Selangor
Universiti Kebangsaan Malaysia
[2]Department of Geology, University of Malaya
50603 Kuala Lumpur

The lithology of Mengapor area consists of Permian limestone, volcanic, metasediment as well as Triassic granodiorite. Bukit Botak comprises of at least 300 m of rhyolitic tuff at the upper part and adamellite intrusive at the lower portion. Four quartz veins samples from different levels of borehole M15 and M33A at Zone A (Cu-Au in skarn) were selected for fluid inclusion study. Fluid inclusion study indicated that the homogeneous temperature for M15 and M33A is ranging from 219.4°C to 313.7°C and 169.2°C to 221.4°C respectively. While the freezing point for M15 vary from -5.1°C to -1.4°C, giving the paleodepth from 232 m to 1,152 m. These inclusions are generally of low salinity (2.42 to 8.02 wt% NaCl equivalent), with a median salinity value of 5.0 wt% NaCl. However, the paleodepth for M33A is relatively shallow ranges from 52 m to 237 m with freezing point of -5.1°C to -2.2°C, the salinity in these inclusions is slightly higher than M15, recorded as 3.72 to 8.02 wt% NaCl. Result from Haas diagram also indicated that the trapping pressure for M15 is ranging from 22 to 98 bars, while M33A recorded as 6 to 23 bars. The homogeneous temperatures and salinities data suggest that the sources of fluids in quartz vein of borehole M15 (level 215 m) and M33A (level 166 m and 284 m) are probably the same. The salinity of fluid inclusion M15 at level 352 m is basically lower than 3.08 equiv. wt% NaCl, suggested to be meteoric origin. The overall salinity of inclusions in quartz samples is ranging from as low as 2.42 to 8.02 equiv. wt% NaCl, while the homogeneous temperatures range from 169.2 to 313.7°C indicated that this is a retrograde quartz in gold skarn formed during last stage of skarn evolution. Fluid inclusions study also suggested the Mengapor deposit as distal skarn which is located at relatively shallow depth, low salinity and low temperatures.

Beneficiation of kaolin deposits from Telaga Air and Telagus, Sarawak

AZEMI HJ. EKI[1], ABDULLAH SANI H. HASHIM[1] AND RADZALI OTHMAN[2]

[1]Minerals and Geoscience Department Malaysia (Sarawak)
Sultan Iskandar Building, 93656 Kuching, Sarawak, Malaysia

[2]School of Materials & Mineral Resources Engineering
Universiti Sains Malaysia, 14300 Nibong Tebal, Penang, Malaysia

Two kaolin deposits from the state of Sarawak were beneficiated using a laboratory hydrocyclone. The chemical, mineralogical and physical characteristics of the clays before and after a single pass through the hydrocyclone were studied. A comparison was made with a few kaolins from various sources. The Sarawak kaolin deposit from Telaga Air is reported to be derived from weathering of dacitic sills or dykes whilst the Telagus deposit is believed to be derived from sediments of the Sadong Formation. The main constituent minerals in both deposits are kaolinite and quartz, whilst the minor constituents are micaceous materials and feldspar. The hydrocyclone process is found to be very successful in the production of clay of finer particle-size distribution, increase the brightness values, removal of impurities such as feldspar and mica, and chemically increase the Al_2O_3 and reduce the SiO_2 (quartz) contents for both kaolins from Sarawak. It was found that with only a single run of the hydrocyclone process, the quality of both Sarawak kaolin samples are almost of the same quality as compared to commercial kaolin from overseas (except for the alumina content) but of better quality compared to a product from many of the local kaolin manufacturers. The analysis result indicated that both kaolin deposits in Sarawak offer a very promising potential to be mined and processed for high end quality products.

Dua longgokan kaolin dari Sarawak telah dibuat pencirian dengan menggunakan satu cara hidrosiklon bersaiz makmal. Kreteria-kreteria kimia, mineralogi dan fizikal bagi lempung sebelum dan selepas melepasi peringkat pertama melalui cara hidrosiklon telah dikaji. Satu perbandingan telah dibuat dengan beberapa jenis kaolin daripada pelbagai sumber. Longgokan kaolin dari Telaga Air di Sarawak telah dihasilkan melalui proses lulohawa intrusif sil batuan dasit atau dik manakala longgokan dari kawasan Telagus dipercayai berasal dari endapan Formasi Sadong. Kandungan mineral utama bagi kesemua longgokan adalah kaolinit dan kuarza, sementara kandungan secara minor terdiri dari bahan-bahan bermika dan feldspar. Proses hidrosiklon didapati sangat berjaya dalam penghasilan lempung dengan taburan saiz butiran halus, menambahkan nilai kecerahan, memisahkan benda-benda asing seperti feldspar dan mika.Secara kimia, ini menambahkan kandungan Al_2O_3 dan mengurangkan kandungan SiO_2 (kuarza) untuk kedua-dua jenis kaolin dari Sarawak. Didapati dengan hanya melepasi saringan peringkat pertama proses hidrosiklon, kualiti bagi semua sampel kaolin dari Sarawak kebanyakan nya mempunyai kesamaan kualiti dengan kemersial kaolin dari luar negara (kecuali untuk nilai alumina) dan menghasilkan kualiti yang lebih baik kalau dibandingkan dengan kebanyakan produk daripada pengeluar-pengeluar tempatan. Keputusan kajian, menunjukkan kedua-dua longgokan kaolin di Sarawak berpotensi untuk diekploit dan diproses untuk menghasilkan produk-produk hiliran yang sangat berkualiti.

The economic potential of ultrabasic soils in the vicinity of Ranau, Sabah

(Potensi ekonomi tanah ultrabes di sekitar Ranau, Sabah)

OSAMA TWAIQ[1], HAMZAH MOHAMAD[1], MOHAMAD MD TAN[1], ANIZAN ISAHAK[1], BABA MUSTA[2] AND MOHD ROZI UMAR[1]

[1]Program Geologi, Fakulti Sains dan Teknologi
Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia

[2]Sekolah Sains dan Teknologi, Universiti Malaysia Sabah
88999 Kota Kinabalu, Sabah, Malaysia

This paper investigates whether ultrabasic soils are profitable alternative resources of Cr, Co and Ni. A total of 55 holes have been bored through 3–20 metre thick in situ soils, at the pilot study area near Ranau, Sabah. The soil reserve of an approximately 1.1 km^2 area is 19.25 million tonne. X-ray diffraction study confirms the occurrence of goethite as the major

constituent, with occurrence of lesser amounts of gibbsite, kaolinite and rutile. Quantitative X-ray fluorescence study on 300 bulk samples gives the following average, in wt%: Cr 1.90 (0.80–2.20), Co 0.06 (0.04–0.10), and Ni 0.64 (0.20–1.40). Cr and Ni, with reserves of 365,000 tonne and 122,000 tonne respectively are believed to be profitable, if efficient and cost-effective extraction techniques with 80% recovery are available.

Kertas ini cuba menyiasat sama ada tanah ultrabes boleh dijadikan sumber alternatif yang menguntungkan bagi Cr, Co dan Ni. Sejumlah 55 lubang telah digerudi menerusi tanah setempat berketebalan 3–20 meter, di kawasan kajian pemandu berhampiran Ranau, Sabah. Rezab tanah bagi kawasan seluas lebih kurang 1.1 km² itu ialah 19.25 juta tan metrik. Kajian belauan sinar-X mengesahkan kehadiran goetit sebagai juzuk utama tanah, dengan gibsit, kaolinit dan rutil wujud dalam jumlah yang lebih sedikit. Kajian kuantitatif pendarflour sinar-X terhadap 300 samapel pukal memberikan purata berikut dalam % berat: Cr 1.9 (0.8–2.2), Co 0.06 (0.04–0.10), dan Ni 0.64 (0.20–1.40). Cr dan Ni yang rezab masing-masing ialah 365,000 dan 122,000 tan matrik dipercayai menguntungkan, dengan syarat teknik ekstraksi yang efisyen dan murah dengan nilai boleh peroleh 80% dapat dibangunkan.

Amber Merit Pila

TANOT UNJAH[1], IBRAHIM KOMOO[1] DAN DANA BADANG[2]

[1]Institut Alam Sekitar dan Pembangunan (LESTARI)
Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor

[2]Jabatan Mineral dan Geosains Sarawak

Amber Merit Pila dijumpai bersama-sama lapisan arang batu di dalam batuan sedimen Formasi Nyalau. Pada masa ini arang batu sedang dilombong dan amber telah dikeluarkan sebagai bahan sisa perlombongan. Amber Merit Pila merupakan satu-satunya lokaliti jumpaan amber yang bermakna. Kehadiran amber menunjukkan kepelbagaian yang tinggi, khususnya daripada aspek saiz, warna dan tekstur dalaman. Satu daripada amber seberat 23 kg telah dikeluarkan daripada lombong ini dipercaya yang terbesar di dunia. Amber Merit Pila bernilai warisan tinggi, terutamanya daripada perspektif saintifik dan estetik. Satu bentuk pemuliharaan berinovatif perlu diperkenalkan untuk menghindar kita dan generasi akan datang kehilangan sumber warisan negara yang unggul ini.

Merit Pila amber was formed together within a layer of coal in the Nyalau Formation. At present, as the coal is being mined, the amber is being extracted as a waste by-product. Merit Pila amber is an extremely significant discovery. The presence of the amber underlines its high diversity, specifically from the perspective of size, colour and internal texture. One of the ambers which has been extracted weighs 23 kg, believed to be the biggest in the world. As a heritage, Merit Pila amber has tremendous heritage value, especially from the scientific and aesthetic perspective. An innovative conservation method has to be developed to ensue that we and future generations will not be deprived of this unique earth heritage.

Prediction of energy consumption of geologically different marble deposits in ground calcium carbonate (GCC) production

KAMAR SHAH ARIFFIN

School of Materials and Mineral Resources Engineering
University Science Malaysia, Engineering Campus
14300 Nibong Tebal, Pulau Pinang

Ultrafine grinding to produce ground calcium carbonate (GCC) is an energy intensive process, even though only a small portion of the energy expended is directly applied to the size reduction of the particles. This study shows that the breakage rate is higher for coarser feedstocks, and that wet grinding reduces the tendency towards particle agglomeration. Material from Gunung Rimau (GR) requires more energy to grind than does material from Gunung Lano (GL). The difference can be attributed to the presence of minute size of flaky phlogopite crystals in the GR material. The Bond's Work Index (BWI) for GL and GR materials were measured at 32.16 and 31.6 kW/t respectively. General energy requirements for both fall within the range of 16 and 52 kWh/t, depending on the desired particle size distribution of the final product. The ultrafine grinding of GR material can consume as much as twice as much energy as does the ultrafine grinding of GL material, given identical final particle characteristics. Modeling of the process gives a good correlation between experimental vales, and

values calculated using the Charles' Size-Energy Reduction Theory. Differences in energy requirements, resulting from differences in the mineralogical composition of marbles, can therefore be significant, and should be taken into account when evaluating materials for exploitation.

Pengisaran dalam penghasilan serbuk kalsium karbonat (GCC) adalah proses yang memerlukan tenaga intensif dan hanya sejumlah kecil sahaja secara mekanik, akhirnya dimanfaatkan dalam proses pengurangan saiz. Kajian menunjukkan kadar penghancuran adalah tinggi bagi suapan bersaiz kasar. Kecenderongan zarah-zarah untuk tergumpal adalah sangat tinggi bagi pengisaran kering berbanding keadaan basah. Gunung Rimau (GR) dengan ciri-ciri fizikal berbeza sering memerlukan input tenaga pengisaran yang lebih tinggi berbanding Gunung Lano (GL). Ini dipercayai berpunca daripada kehadiran empingan-empingan kecil mika (palogofit) yang kaya dengan Mg, dan juga silika. Nilai Indek Kerja Bond bagi GL dan GR, masing-masing ialah 32.16 dan 31.6 kWh/t. Purata tenaga pengisaran bagi kedua-duanya ialah dalam julat 16 hingga 52 kWh/t, bergantung kepada saiz taburan zarah akhir. Tenaga pengisaran yang diperlukan oleh bahan GR adalah 1 hingga 2 kali ganda lebih tinggi berbanding GL dalam menghasilkan produk yang berciri serupa. Percubaan permodelan telah mendapati perhubungan yang baik antara nilai ujikaji dan kiraan empirikal berdasarkan teori pengurangan saiz-tenaga Charles. Adalah disimpulkan bahawa kedua-dua enapan marmar berlainan ini mempunyai keperluan tenaga pengisaran yang berbeza dan perlu diambil kira dalam proses penilaian.

EPMA study of heavy minerals in the Tekka area, Perak

TEH GUAN HOE AND HOOI WOI LOON

Geology Department
University of Malaya
50603 Kuala Lumpur

EPMA characterisation of heavy minerals in the tailings, *amang*, river concentrates and mineralised veins in the Tekka area in terms of their composition, abundances, distribution, inclusions and intergrowths have confirmed the presence of cassiterite, ilmenite, iron oxide, arsenopyrite, stannite, chalcopyrite, pyrite, sphalerite, galena, scorodite, and covellite. Further, the EPMA was able to differentiate rutile, topaz, xenotime, monazite, tantalite, columbite, wolframite and strüverite through X-ray mapping.

The EPMA was able to justify the occurrence of fine gold in fractures in cassiterite, wolframite and black tourmaline and identify lesser known minerals like stolzite ($PbWO_4$),enargite (Cu_3AsS_4) and yttrotungstite [$(Ce, Nd, Y)W_2O_6(OH)_3$] and report for the first time in the Tekka area the occurrence of native bismuth, bismuthinite (Bi_2S_3), matildite ($AgBiS_2$) and mimetite [$Pb(AsO_4, PO_4)Cl$].

The EPMA was able to identify inclusions of ilmenorutile, tapiolite, arsenopyrite and ilmenite in cassiterite besides confirming that the different colours of tourmaline found at Tekka is a reflection of their different Fe and Mg contents.

All the new information on the new mineral species and their related mineral associations have aided in the preparation of a more complete paragenetic sequence of the Tekka xenothermal deposit.

Pencirian EPMA mineral-mineral berat di dalam tailings, amang, *konsentrat sungai dan telerang pemineralan di kawasan Tekka terhadap komposisi, kelimpahan, taburan, inklusi dan salingtumbuhan mereka telah membuktikan kehadiran mineral-mineral seperti kasiterit, ilmenit, oksida besi, arsenopirit, stannit, kalkopirit, sfalerit, galena, scorodit, dan kovelit. Kajian lanjutan EPMA telah bezakan rutil, topaz, xenotim, monazit, tantalit, columbit, wolframit dan strüverit melalui pemetaan sinar-X.*

Peralatan EPMA telah sahkan juga kehadiran emas halus didalam retakan didalam kasiterit, wolframit dan tourmalin hitam dan kenalpastikan mineral kurang biasa seperti stolzit ($PbWO_4$), enargit (Cu_3AsS_4) dan yttrotungstit [$(Ce, Nd, Y)W_2O_6(OH)_3$] dan laporkan kali pertama di kawasan Tekka kehadiran bismut asli, bismutinit (Bi_2S_3), matildit ($AgBiS_2$) dan mimetit [$Pb(AsO_4, PO_4)Cl$].

EPMA juga camkan inklusi-inklusi ilmenorutil, tapiolit, arsenopirit, dan ilmenit didalam kasiterit selain daripada tunjukkan warna berbeza tourmalin yang dijumpai di Tekka cerminkan perbezaan kandungan Fe dan Mg mereka.

Semua maklumat ini tentang spesies mineral baru dan hubungan diantara mineral-mineral lain telah membantu menyediakan jujukan paragenesis yang lebih menyeluruh untuk mendapan xenoterma Tekka.

Distribution of vegetation in present day wetlands: some applications in geoscience

AZMI MOHD YAKZAN

PETRONAS Research & Scientific Services Sdn. Bhd.
Bangi, Selangor

Wetland vegetation occupies several unique habitats that are host for diverse flora and fauna. In this region, some of the common wetland habitats are freshwater swamp, mangrove, Nipa swamp and peat swamp. Some plants have developed adaptation such as special breathing root systems, a means to reduce excessive salinity, and mechanism to ensure successful propagation of young seedlings, to name a few.

Wetlands have important natural functions such as regulating flood flow, supply of water to reservoirs during dry season, filter pollutants from air and water, and breeding grounds for some marine live. Some wetland plants produce large quantities of pollen that become well preserved in fine-grained rocks. In this manner, the records of past vegetation history may be uncovered by retrieving the fossil pollen from the rocks. Based on these principles, records of fossil pollen have often been used to solve certain stratigraphic and geological issues.

The main aim of this paper is to demonstrate the vegetation distribution and pollen records from some selected present day wetland habitats in Malaysia and Borneo. Some applications of wetland-derived fossil pollen records in geo-science are briefly discussed.

Kawasan tumbuhan paya merangkumi beberapa habitat unik yang menjadi perumah kepada pelbagai flora dan fauna. Di rantau ini, beberapa habitat yang biasa ditemui adalah seperti paya air tawar, paya bakau, paya nipah dan paya gambut. Sesetengah tumbuh-tumbuhan ini telah mengalami perubahan adaptasi (penyesuaian) seperti sistem pernafasan akar yang khusus, sistem untuk mengurangkan lebihan garam/kemasinan dan mekanisme yang menjamin kejayaan pembiakan biji benih.

Kawasan paya memainkan fungsi semulajadi yang penting seperti mengawal aliran banjir, menjadi sumber air bagi takungan ketika musim kering, menapis bahan cemar dari air dan udara dan menjadi tempat pembiakan untuk sebahagian hidupan laut. Terdapat tumbuh-tumbuhan kawasan paya ini yang menghasilkan sejumlah debunga yang terawet di dalam batuan berbutir halus. Dengan itu, rekod mengenai sejarah tumbuh-tumbuhan masa lampau dapat diketahui dengan memperolehi fosil debunga dari batuan tersebut. Berdasarkan kepada prinsip-prinsip ini, rekod fosil debunga kerap kali digunakan untuk menyelesaikan isu-isu stratigrafi dan geologi.

Kajian ini bertujuan untuk menunjukkan taburan tumbuhan dan rekod debunga dari beberapa habitat kawasan paya masa kini yang terdapat di Malaysia dan Borneo. Beberapa kegunaan/aplikasi dalam geosains hasil dari fosil debunga kawasan paya juga dibincangkan secara ringkas.

Heavy metals migration through the clayey soil from Telipok, Sabah
(Pergerakan logam-logam berat melalui tanah berlempung daripada Telipok, Sabah)

BABA MUSTA[1], KHAIRUL ANUAR KASSIM[2], MOHD. RAZMAN SALIM[2] AND Z'ABA ISMAIL[2]

[1]School of Science and Technology, Universiti Malaysia Sabah
88999 Kota Kinabalu, Sabah, Malaysia

[2]Faculty of Civil Engineering, Universiti Teknologi Malaysia
81310 Skudai, Johor, Malaysia

The migrations of heavy metals namely Cu, Cr, Ni, Pb and Zn through the soil from weathered rock of the Crocker Formation in Telipok, Sabah were studied by means of leaching test. The leaching test conducted on soil samples shows that most of the heavy metals are retained at the top part of the leaching columns i.e. at the depth of 1.0 cm. All of the heavy metals concentration decreased with the increasing depth within the soil profiles. The leachate analysis indicated that all of the heavy metals except Pb achieved the breakthrough curves at the first 4 pore volume (PV). The breakthrough curve for Pb was achieved after 5 PV of leaching. From this study, based on the breakthrough curves and mass balance calculation, it can be concluded that variation occurs during migration or mobilisation of heavy metals. After leaching 7 PV of solution, the relative concentration (C_i/C_o) of Cu, Cr, Ni, Pb and Zn are maintained at 0.90, 0.82, 0.98, 0.94, and 0.80 respectively. The data obtained indicates that Zn has high mobility followed by Cu, Ni, Cr, and Pb. At the end of the leaching test, the

microstructural study showed the occurrence of micro cracks, high pore spaces and the forming of channels at the top part of the columns. Whereas, the bottom part shows tight structure with low pore spaces and low form of channels.

Perpindahan logam-logam berat iaitu Cu, Cr, Ni, Pb, dan Zn melalui tanah terluluhawa yang berasal daripada batuan Formasi Crocker di Telipok, Sabah telah dikaji melalui ujian larut lesap. Ujian larut lesap yang dijalankan ke atas sampel-sampel tanah menunjukkan logam berat kebanyakannya terperangkap di bahagian atas turus larut lesap iaitu pada kedalaman 1.0 cm. Kesemua logam-berat menunjukkan kepekatan yang berkurangan dengan bertambahnya kedalaman profil. Analisis air larut resapan menandakan bahawa kesemua logam-logam berat mencapai lengkung bulus pada empat isipadu pori yang pertama (4 PV), kecuali Pb. Lengkung bulus Pb dicapai selepas larut lesap 5PV larutan. Setelah larut lesapan 7 PV larutan, kepekatan relatif (C/C_o) bagi Cu, Cr, Ni, Pb dan Zn masing-masing adalah dikekalkan pada 0.90, 0.82, 0.98, 0.94, dan 0.80. Daripada kajian ini, disimpulkan bahawa berdasarkan lengkung bulus dan kiraan imbangan jisim didapati bahawa perpindahan atau pergerakan logam-logam berat adalah pelbagai. Data yang diperolehi menandakan bahawa Zn mempunyai pergerakan yang lebih pantas diikuti oleh Cu, Ni, Cr dan Pb. Pada akhir ujian larut lesap, kajian struktur mikro menunjukkan pembentukan retakan mikro, ruang-ruang pori yang besar dan pembentukan alur-alur pada bahagian atas turus. Manakala, bahagian bawah menunjukkan struktur yang padat dengan rendahnya ruang-ruang pori dan sedikit permbentukan alur-alur.

Impak pencemaran air tanah daripada pengurusan sisa bandaran dengan menggunakan sistem kambus tanah sanitari *(sanitary landfill)*

Mohd Tadza Abdul Rahman[1], Daud Mohamad[1], Roslanzairi Mostapa[1], Kamarudin Samuding[1], Mohd Rifaie Murtadza[1], Abdul Rahim Samsudin[2], Ismail Abustan[3] dan Ismail C. Mohamad[4]

[1]Institut Penyelidikan Teknologi Nuklear Malaysia (MINT), 43000 Bangi, Selangor

[2]Program Geologi, Universti Kebangsaan Malaysia, 43600 Bangi, Selangor

[3]Pusat Pengajian Kejuruteraan Awam, Universiti Sains Malaysia, 14300 Nibong Tebal, Penang

[4]Jabatan Mineral dan Geosains Malaysia, 70100 Seremban, Negri Sembilan

Kertas kerja ini menerangkan tentang sistem pengurusan sisa bandaran dengan menggunakan sistem kambus tanah sanitari dan metodologi yang melibatkan kaedah isotop dan pendekatan geofizik, hidrogeokimia dan biologi sebagai bukti sokongan kepada kewujudan pencemaran dalam sistem air tanah.

This paper describes the municipal waste management using sanitary landfill system and methodology that involved the isotope methods as well as hydrogeochemical, geophysical and biological approaches as supporting evidences of pollution occurrence in the water system.

Application of geophysical method to delineate contamination in waste disposal site of Ampar Tenang, Dengkil, Selangor D.E.

Abdul Rahim Samsudin, Umar Hamzah, Wan Zuhairi Wan Yaacob, Bahaa-eldin ElWali Abdel Rahim and Loh Yean Sze

School of Environment and Natural Resource Science, Faculty of Science & Technology
Universiti Kebangsaan Malaysia, Bangi, 43600, Selangor D.E.

A geophysical survey was conducted to investigate contamination in a domestic waste-disposal site, at Ampar Tenang, Dengkil, Selangor. The objectives of the survey were to delineate and identify pathways for contaminant migration. Surface geophysical method employing 2-D DC resistivity imaging technique was used to locate potential leachate plumes. A total of six lines of 2-D resistivity images were established with three of them located on the waste pile while the other three situated outside the boundary of the dumping site. The objectives were successfully met, including delineation of buried waste and identification of the positions of contaminated subsurface soil and groundwater. In general the result of the survey shows that the resistivity value of the decomposed waste material is relatively low compared to those of the uncontaminated

soil outside the dumping site. The electrically conductive anomaly on the dumping site was interpreted as leachate plumes which appears to have seeped at depth as far as 20 m below surface. Near surface low resistivity layer observed on the area east of the dumping site is interpreted to be associated with leachate runoff.

Preliminary analysis of recession flow characteristics of granitic catchments

WAN NOR AZMIN SULAIMAN, MOHD FIRUZ RAMLI, MOHD KHAIR KAMARUDDIN AND MOHD KAMIL YUSOFF

Department of Environmental Sciences, Universiti Putra Malaysia
43400, UPM Serdang, Selangor

Even though granite formation in Peninsular Malaysia has been generally known as poor aquifers, their ability to sustain river flow during periods of less or no rainfall has not been generally evaluated. Obviously, quantitative assessment about groundwater storages and their releasing rates especially during dry weather period form the basis for development and optimal utilization of our water resources.

The magnitude and variability of recession flows from a catchment depend upon many factors. However it has been commonly assumed that recession flows are less dependent upon precipitation and intensity distribution than physical storage of a catchment. Since, characteristically, these flows are more or less steady, it has been a common practice to represent them by general mathematical models. In this study an attempt has been made to evaluate the recession flow characteristics of two granitic catchments viz Sungai Lui (68.1 km^2) and Sungai Semenyih at Kg. Rinching in Selangor, (225 km^2). Both catchments have similar characteristics for soil cover which is derived from weathered granite or granite parent material

Basically, slopes of individual recession hydrographs were determined and based on selected 39 and 49 recession hydrographs for Sg. Semenyih, and Sungai Lui respectively, it was found that the average recession coefficient for the Sg Lui and Sungai Rinching is 0.0463 and 0.0315 day^{-1} respectively. The exponential function model used to the described the recession flow of the two rivers was $Q_t = Q_o e^{-\alpha t}$, where a is the recession coefficient.

Formasi granit di Semenanjung Malaysia diketahui umum sebagai akuifer yang kurang baik. Namun, maklumat tentang keupayaan formasi berkenaan sebagai penyumbang kepada aliran sungai semasa ketiadaan hujan atau kemarau panjang tidak diketahui dengan jelas. Penilaian secara kuantitatif terhadap simpanan air tanah dan kadar pelepasannya ke sungai terutama di musim kering merupakan asas kepada pembangunan dan penggunaan optimal sumber air.

Magnitud dan perubahan alir rosotan dari sebuah kawasan lembangan bergantung kepada banyak faktor. Walaubagaimana pun, andaian umum ialah alir rosotan kurang bergantung kepada pertaburan curahan dan keamatan hujan tetapi lebih kepada simpanan fisikal kawasan lembangan. Oleh kerana ciri-ciri aliran rosotan boleh dikatakan mantap, adalah menjadi kebiasaan ianya diwakili dengan model metamatik. Dalam kajian ini percubaan telah dilakukan untuk menilai ciri-ciri alir rosotan yang mewakili dua buah kawasan lembangan iaitu Sungai Lui (68.1 km^2) dan Sungai Semenyih (225 km^2). Kedua kawasan lembangan ini mempunyai ciri permukaan tanah yang sama iaitu terbitan dari granit terluluhawa atau bahan granit induk.

Pada asasnya, cerun setiap hidrograf rosotan ditentukan dan berdasarkan kepada 39 hidrograf rosotan bagi Sungai Semenyih dan 49 bagi Sungai Lui, didapati purata koefisien rosotan bagi Sungai Lui ialah 0.0463 $hari^{-1}$ dan Sg Semenyih ialah 0.0315 $hari^{-1}$. Model fungsi exponen yang diguna bagi menghuraikan alir rosotan bagi kedua sungai berkenaan ialah $Q_t = Q_o e^{-\alpha t}$, di mana a ialah koefisien sorotan.

Heavy metal sorption capabilities of some soils from active landfill sites in Selangor

WAN ZUHAIRI WAN YAACOB

Program Geologi, Pusat Sains Sekitaran dan Sumber Alam, Fakulti Sains dan Teknologi
Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor

In this study, various types of soils collected from or adjacent to active landfill sites in Selangor were tested against Pb, Cu and Zn using batch equilibrium tests. The results indicate that soil sample from Air Hitam in Puchong, Selangor (AHQ) has better sorption capability compared with other soils, i.e. river alluvium soil (SSC) and lateritic soil (SSC) from Sg. Sedu Landfill, lateritic soil from Taman Beringin in Gombak (TBL) and graphitic schist from Ampang Pechah in Hulu Selangor

(APS). Heavy metal sorption capability for these soils can be ranked as follow: AHQ>SSC>SSL>TBL>APS for all the heavy metals.

Dalam kajian ini, beberapa tanah yang diambil berdekatan dengan tapak aktiviti perlupusan sisa di negeri Selangor diuji terhadap Pb, Cu dan Zn dengan menggunakan ujian penjerapan berkelompok. Hasil kajian menunjukkan tanah di kawasan Air Hitam di Puchong, Selangor (AHQ) mempunyai kapasiti penjerapan yang lebih baik berbanding dengan sampel tanah alluvial (SSC) dan laterite (SSL) dari landfill Sg. Sedu di Banting, tanah laterite dari Taman Beringin di Gombak (TBL) dan tanah syis bergrafit dari Ampang Pechah di Hulu Selangor (APS). Kapasiti penjerapan logam berat (Pb, Cu dan Zn) untuk tanah-tanah ini boleh disusun seperti berikut: AHQ>SSC>SSL>TBL>APS.

Transpression in the strata of Pulau Kapas, Terengganu

MUSTAFFA KAMAL SHUIB

Jabatan Geologi
Universiti Malaya
50603 Kuala Lumpur

The Kapas Island has suffered two successive dextral transpressive deformation episodes that lead to the development of a dextral strike-slip basin where the Kapas Conglomerate was deposited. During the first phase of brittle-ductile deformation (D_1) a series of close to tight folds trending NNW-SSE to NS were formed in the Permo-Carboniferous metasdiment. These folds are commonly associated with NNW to NS axial plane parallel faults and shear zones with both strike-slip and reversed sense of displacement. The D_1 structures were reworked by D_2 events which amplified, rotated clockwise and refolded the earlier structures, along N-S D_2 dextral shear zones and NNW striking sinistral faults. This caused differential uplift and subsidence of the faulted blocks. Subsequent weathering and erosion of the metasediments caused deposition of the Kapas Conglomerate within the subsided blocks. Continued deformation during this deposition lead to the syn-sedimentary deformation of the conglomerate. If the conglomerate is Late Permian to Triassic in age, then this would imply that the D_1 and D_2 deformation must be of late Permian age with D_2 continuing into the Permo-Triassic. The D_1 and D_2 Late Permian dextral transpressive deformation, and rapid uplift followed by deposition of continental sediment in a strike slip basin is a major orogenic event which can be considered as part of a large scale deformation in the Eastern Belt that may relate to the oblique convergence of the two tectonic blocks of Peninsular Malaysia.

The kinematics of deformation of the Kenerong Leucogranite and its enclaves at Renyok waterfall, Jeli, Kelantan

IBRAHIM ABDULLAH AND JATMIKA SETIAWAN

Geology Program, School of Environment and Earth Resources Sciences
Faculty of Science and Technology, Universiti Kebangsaan Malaysia
43000, Bangi, Selangor

The Late Cretaceous Kenerong Leucogranite, a component of the Stong Complex exposed near TNB mini power station, at Renyok waterfall, Jeli, Kelantan consists of a sequence of leucogranite vein and metasedimentary enclaves. Here, varieties of structures developed in both rock types. Structural studies indicate the rocks here had undergone at least four phase of deformation. It is interpreted that the first deformation (D_1) with the compression from ESE, which was responsible in the development of foliation and reverse faults was related to the regional stress system during the Late Cretaceous time. The second and third deformation (D_2 and D_3) with the compression from NE sector, that was related to the formation of lateral faults system, pinch-and-swell, boudinage, drag folds and small-scale kink folds might be related to the stress system that were generated by the emplacement of the younger granite in the vicinity. The fourth deformation (D_4), which was responsible for the normal faulting by the reactivation of the preexisting faults, was probably related to the relaxation period after the granite intrusion of the area.

Leukogranit Kenerong yang berusia Kapur Lewat, satu komponen daripada Kompleks Stong yang tersingkap berhampiran stesen kuasa mini TNB di Air Terjun Sungai Renyok, Jeli Kelantan terdiri daripada satu turutan telerang leukogranit dan metasidimen. Di sini terdapat kepelbagaian structure telah terbentuk dalam kedua-dua jenis batuan, Kajian struktur menunjukkan batuan telah mengalami sekurang-kurangnya empat fasa canggan. Ditafsirkan bahawa canggaan pertama (D_1) dengan arah mampatan dari UTL yang bertanggung jawab dalam pembentukan foliasi dan sesar songsang adalah

berkaitan dengan system tegasan rantau semasa Kapur Lewat. Canggaan kedua dan ketiga (D_2 dan D_3) dengan mampatan daripada sector timur laut (TL) yang berkaitan dengan pembentukan system sesar mendatar, ramping-dan-ampul, boudinag, lipatan seret dan lipatan kercau berskala kecil boleh dikaitkan dengan system tegasan yang diakibatkan oleh penempatan granit yang lebih muda di kawasan berhampiran. Canggan ke-empat (D_4) yang bertanggung jawab dalam pembentukan sesar normal secara pengaktifan semula satah sesar yang sudah sedia ada mungkin berkaitan dengan tempoh pelepasan selepas rejahan granit di kawasan ini.

Mid-Holocene to recent sea level changes in Peninsular Malaysia: a tectonic implication

KAMALUDIN BIN HASSAN

Minerals and Geoscience Department Malaysia
Jalan Penampang, Locked Bag 2042, 88999 Kota Kinabalu, Sabah
e-mail: kamaludin@jmg.gov.my

This paper tries to analyse the Peninsular Malaysia mid-Holocene to recent relative sea level index points. 56 reliable sea level indicators are scrutinized and their relative sea levels corrected. Attempt is made to explain the relative sea level difference noted between the Peninsular Malaysia West and East coasts. A relative rate of sea level fall of 0.7 and 0.5 mm/ year respectively, are indicated from cumulative analysis of the West and East coasts index points. The significant dissimilarity in the rate of sea level fall suggests differential crustal movement between the two coasts. Explanation of hydro- and tectono-isostasy are put forward to explain the observed discrepancy.

The morphostructures of Kinta Valley karst

ROS FATIHAH MUHAMMAD[1] AND TJIA HONG DJIN[2]

[1]Institut Alam Sekitar dan Pembangunan (LESTARI),
Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor

[2]Petronas Carigali, Petronas Twin Towers KLCC, Kuala Lumpur

The trend of Kinta Valley karst structure is mainly along the 310°-350° with minor directions of about 030°, 040°, 055°, 070° and 085°. These trends originated from tectonic stresses and are observed to have controlled the formation of certain karst features such as dolines, wangs, caves and collapse.

Tren struktur kars Lembah Kinta yang utama adalah sepanjang 310°-350° dengan arah minor lebih kurang ke 030°, 040°, 055°, 070° dan 085°. Tren ini berasal dari tekanan tektonik dan diperhatikan telah mengawal pembentukan fitur-fitur kars tertentu seperti dolina, wang, gua dan runtuhan.

The structure and deformation history of the serpentinite bodies along the Bentong Suture: a case study at Bukit Rokan Barat

JATMIKA SETIAWAN AND IBRAHIM ABDULLAH

Geology Program, School of Environmental and Earth Resources Sciences
Faculty of Science and Technology, Universiti Kebangsaan Malaysia
43000, Bangi, Selangor

Along the boundary of the Western and the Central Belts of Peninsular Malaysia, there are a number of relatively small bodies of serpentinite outcrops. It is believed that these outcrops represent the serpentinised ultramafic rocks, which intruded the Lower Devonian rock formations. The serpentinite outcrop at Bukit Rokan Barat, Negeri Sembilan can be considered as one of the best that can be found in this area. The structure observed at this outcrop could represent the structure of the other serpentinite bodies situated along this boundary. Furthermore the deformation history, which is deduced from this structural study, may be used to describe the deformation history that took place along the boundary between the Western and Central Zones of Peninsular Malaysia.

The observed serpentinite body at Bukit Rokan Barat is well foliated, trending approximately in north-northwest and northwest direction and moderately to steeply dipping towards northeast. This rock body had suffered at least three phases of shearing, the earlier two (D_1 and D_2), were related to ductile, while the third (D_3) was related to brittle deformation. The ductile deformations are indicated by the presence of shear zones, foliations and crenulations folds (microfolds) and lenticular-shaped structures, and the brittle deformation by the lateral faults. The maximum principal paleo-stresses (s1) related to the ductile deformations (D_1 and D_2) were acting from NE and ENE directions respectively and the brittle deformation (D_3) from NNE direction. The approximately EW tension cracks developed within the lenticular shaped structures are interpreted as the last phase of deformation suffered by this rock body.

Di sepanjang sempadan antara Jalur Barat dan Tengah Semenanjung Malaysia, terdapat beberapa singkapan jasad-jasad kecil serpentinit. Singkapan-singkapan tersebut dipercayai mewakili batuan ultramafik yang telah berubah menjadi serpentinit, yang dahulunya merejah formasi batuan Devon Bawah. Salah satu singkapan yang terbaik didapati di Bukit Rokan Barat, Negeri Sembilan. Struktur yang dicerap di singkapan ini boleh mewakili struktur untuk jasad-jasad serpentinit lain yang terletak di sepanjang sempadan tersebut. Seterusnya sejarah canggaan yang ditafsirkan berdasar kepada kajian struktur di sini juga boleh digunakan untuk menjelaskan sejarah canggaan yang telah berl;aku di sepanjang sempadan zon Barat dan Tengah Semenanjung Malaysia.

Jasad serpentinit yang dicerap di Bukit Rokan Barat mempunyai foliasi yang sangat baik, berarah hampir utara-bratlaut hingga baratlaut. Jasad batuan ini mengalami sekurang-kurangnya tiga fasa ricihan, dua yang awal (D_1 dan D_2) berkaitan dengan canggaan mulur, manakala yang ketiga (D3) berkaitan dengan canggaan rapuh. Canggaan rapuh ditunjukkan oleh kedapatan zon ricih, foliasi, lipatan kerdut dan struktur berbentuk lentikular, manakala canggaan rapuh oleh sesar mendatar. Tegasan kuno utama maksimum (s1) yang berkaitan dengan canggan mulur (D_1) dan (D_2) masing-masing telah bertindak dari arah timurlaut dan timur-timurlaut dan canggaan rapuh (D_3) dari utara-timurlaut. Rekahan tensi berarah hampir timur-barat yang terbentuk pada jasad berbentuk lentikular merupakan canggan terakhir yang alami oleh jasad batuan di sini.

The origin of the 'circular basins' of Sabah, Malaysia

ALLAGU BALAGURU*, GARY NICHOLS AND ROBERT HALL

SE Asia Research Group, Department of Geology
Royal Holloway University of London, Egham, Surrey, TW20 0EX, UK

*Now at Minerals and Geoscience Department Malaysia Sabah
Locked Bag 2042, 88999 Kota Kinabalu, Sabah, Malaysia
E-mail: allagu@jmg.gov.my

Surface mapping, dating and radar image study of strata in southern Sabah (northern Borneo) have made it possible to revise the stratigraphy and reinterpret the structure and tectonic evolution of the area. Early Miocene regional unconformity may be equivalent to the Deep Regional Unconformity recognised offshore, below which the succession can be resolved into an Eocene accretionary complex age overlying an ophiolitic basement, and an upper Paleogene deep-water succession which formed in a forearc. The Paleogene deposits underwent syn-depositional deformation, including the development of extensive mélanges, all of which lie below the unconformity. Localised limestones were deposited followed after a period of uplift and erosion in the Early Miocene, followed by an influx of clastic sediments deposited in delta and pro-deltaic environments in the Middle Miocene. These deltaic to shallow marine deposits form two coarsening-upward successions, mapped as the Tanjong and Kapilit Formations. The total thickness of these two formations remaining in the southern Sabah Basin amounts to 6,000 m, about half of previous estimates.

The Early Miocene unconformity is interpreted to be the result of deformation and uplift following underthrusting of continental crust of the South China Sea which terminated Paleogene subduction beneath North Borneo. Renewed subsidence led to the development of a major Miocene depocentre above the older forearc accretionary complex. A new tectonic model is proposed for southern Sabah whereby a major transpressional deformation probably occurred during the Late Pliocene and the Tanjong and Kapilit Formations were deformed into broad NW-SE-trending synclines separated by narrow anticlines. The anticlines are sub-parallel to major faults and associated with high angle reverse faults, and positive flower structures. Secondary fold-faults formed oblique to the major faults. The structural style suggests that the NW-SE trending faults acted as major left-lateral transpressional zones and possibly produced large-scale contractional duplexes. The faults may in part be reactivated basement structures. This deformation uplifted the area and is termed here the Meliau Orogeny. Renewed extension during the Quaternary caused some sequence repetition and widened the original synclines. The 'subcircular- to elliptical-shaped basins' of the Meliau, Malibau and Tidung areas are structurally controlled synclines and interpreted as remnants of a single large basin, deformed in the NW-SE trending transpressional fault zones.

Annual Geological Conference 2003
Hilton Hotel, Kuching, Sarawak
24–26 May, 2003

Abstracts of Posters

A method to estimate groundwater recharge

SIOW SOO FEI[1], NAZARI JAAFAR[1] AND ISMAIL YUSOFF[2]

[1]Department of Geography, University of Malaya
50603 Kuala Lumpur
[2]Department of Geology, University of Malaya
50603 Kuala Lumpur

The conventional method of groundwater recharge estimation is reviewed and a computer program to ease the estimation is presented. The calculation takes into account precipitation, evaporation, soil moisture and the resultant recharge. The validity of the program is tested against MORECS data. An assessment of recharge to aquifer system in Langat river basin with the program suggests that preliminary annual recharge varies between 429.13 mm to 1,493.72 mm.

Keadah konvensional dalam menganggarkan imbuhan air tanah dinilai semula dan satu program komputer yang memudahkan penganggaran tersebut dipersembahkan. Pengiraan ini mengambilkira kerpasan, evaporasi, kelembapan tanih dan hasilan imbuhan. Ketepatan program ini telah diuji dengan data MORECS. Suatu penilaian imbuhan kepada akuifer dalam lembangan Sungai Langat dengan menggunakan program ini telah dijalankan dan mencadangkan anggaran awal imbuhan tahunan akuifer adalah di antara 429.13 mm dengan 1,493.72 mm.

Analisis bendalir terkepung pada telerang kuarza yang mengandungi emas di kawasan lombong Penjom, Kuala Lipis, Pahang dan Lubok Mandi, Terengganu, Semenanjung Malaysia

WAN FUAD WAN HASAN[1] DAN HERU SIGIT PURWANTO[2]

[1]Program Geologi, Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor
[2]Jurusan Geologi, Universitas Pembangunan Nasional Yogakarta
Indonesia

Penjom dan Lubok Mandi merupakan kawasan lombong emas yang aktif di Semenanjung Malaysia. Emas didapati pada telerang kuarza yang banyak memotong unit batuan lebih tua di kawasan Penjom dan Lubok Mandi. Telerang kuarza di kedua-dua kawasan dikelompokkan dalam jenis sulfida-kuarza. Bendalir terkepung terdiri daripada satu, dua dan tiga fasa bersaiz purata antara 3–5 μm. Bendalir terkepung yang terpencil ditafsirkan sebagai jenis primer manakala yang terorientasi selari mengikuti satah rekahan ditafsirkan sebagai sekunder. Bentuk bendalir terkepung biasanya tidak beraturan, iaitu memperlihatkan gejala berleher dan pecah-pecah. Daripada hasil analisis di kawasan Lombong Penjom ditafsirkan bahawa emas terbentuk pada suhu 201.9°C dengan kadar garam 5.5% berat NaCl, kedalaman purata 156 m dan tekanan 17 kbar. Pembentukan emas di kawasan Lubok Mandi pula ditafsirkan pada suhu 196.2°C, dengan kadar garam 4.2% berat NaCl, kedalaman purata 156 m dan tekanan 16 kbar. Kajian ini menunjukkan longgokan emas hidroterma di kedua-dua kawasan adalah jenis mesoterma rendah atau epiterma tinggi.

Penjom and Lubuk Mandi are two presently active mining areas in Peninsular Malaysia. Gold is found in the quart veins that cut earlier rocks in the area. The quartz veins in the two areas are classified as the quartz-sulphide type. Fluid

inclusions contain, one, two and three phases and have sizes from 3–5 μm. Isolated fluid inclusion is recognized as primary inclusion, and those oriented along fracture planes are regarded as secondary. The inclusions are of irregular shapes, from neck-down to decrepitation. Results of the analyses from Penjom indicate gold formation took place at a temperature of 201.9°C, having salinity of 5.5 wt% NaCl at a depth of 156 m, at a pressure of 17 kbar. Gold formation in Lubuk Mandi is interpreted as forming at 196.2°C, with a salinity of 4.2 wt%, at a depth of 156 m and a pressure of 16 kbar. This study shows that the hydrothermal gold deposits in the two areas are low mesothermal or high epithermal type.

'Mantle plume' type magmatism in the Central Belt of Peninsular Malaysia and its tectonic implications

MUSTAFFA KAMAL SHUIB AND AZMAN A. GHANI

Geology Department
University of Malaya
50603 Kuala Lumpur

None of the existing tectonic models of Peninsular Malaysia fully explains the spatial, age or geochemical characteristics of the Central Belt intermediate to basic igneous rocks. The Central Belt granitoids, which lie critically close to the Bentong-Raub Line, have distinct geochemical characteristics. They have very high LIL elements, i.e. Ba and Sr are nearly 1,000 times rock/mantle. The high Ba and Sr values may result from the penetration of the lower lithosphere by a small volume of mantle material that is enriched in those elements attributed to 'mantle plume' type magmatism. Other supporting evidences include the presence of bimodal magmatism, the presence of mafic enclaves of older granitoids in younger granitoids and the new age data indicated that there is a significant time interval (up to between 30 Ma) between the first mafic magmatism and the later felsic magmatism; the Central Belt plutons are post-orogenic and penecontemporaneus with rapid post-orogenic uplift, and erosion with the development of the Jurassic-Cretaceous continental deposits of the Central Basin; the presence of thin continental crust beneath the Central Belt; the Benom granite has yielded an initial $^{87}Sr/^{86}Sr$ ratio of 0.7079, which points to an origin in highly enriched lithospheric mantle; and the presence of mafic enclaves is consistent with a mafic lower crust beneath central belt formed by underplating. A model have been proposed that involved the oblique convergence of the two tectonic provinces of Peninsular Malaysia where slab breakoff which is the natural consequence of the attempted subduction of the continental crust is invoked to account for the 'mantle-plume' type magmatism of the Central Belt. The outcome of the slab breakoff is the long linear belt of single plutons characterized by high-K, shoshonitic granitoids with characteristic trace element signatures, specifically high Ba and Sr, which lie critically close to the Bentong-Raub Line. Other features include the bimodal association of mafic and felsic rocks, the low grade regional metamorphism, thinned continental crust, rapid uplift and erosion with the development of extensional/transtensional basins.

Mekanisma pembantutan tabii ke atas logam berat Pb oleh tanah formasi Kenny Hill di kawasan Air Hitam, Puchong, Selangor

WAN ZUHAIRI WAN YAACOB DAN ANNE CHONG SHIK FONG

Program Geologi, Pusat Sains Sekitaran dan Sumber Alam, Fakulti Sains dan Teknologi
Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor

Kajian mekanisma pembantutan tabii oleh beberapa komponen tanah formasi Kenny Hill di Air Hitam, Puchong, Selangor ke atas logam berat Pb dilakukan dengan menggunakan ujian penjerapan logam berat dan analisis ekstraksi jujukan terpilih. Ujian penjerapan logam berat Pb oleh sampel tanah Air Hitam menunjukkan peningkatan kadar penjerapan mengikut faktor masa (1, 7, 18 dan 24 jam). Hasil analisis ekstraksi jujukan terpilih secara kualitatif menunjukkan ion Pb^{2+} paling banyak dibantutkan menerusi mekanisma kation tertukarganti berbanding mekanisma pemendakan dengan karbonat dan bahan amorfus (hidroksida/oksida). Mekanisma pembantutan logam berat Pb dalam komponen tanah di Air Hitam paling banyak dibantutkan dalam fraksi kation tertukarganti dan didapati meningkat mengikut faktor masa penjerapan (1, 7, 18, 24 jam).

Selective sequential extraction (SSE) and batch equilibrium test (BET) were used in this study to determine the natural attenuation mechanisms of clay soil components from Kenny Hill formation in Air Hitam, Puchong, Selangor. The experimental results from BET shows that the adsorption rate for Pb^{2+} in Air Itam soil increased with time (1, 7, 18 and 24 hours). The heavy metals extraction for Pb^{2+} from selective sequential extractions indicates qualitatively that heavy metals retention via exchangeable mechanisms are more dominant and higher than heavy metals precipitated with

carbonates and amorphous materials (oxides/hydroxides). The natural attenuation mechanisms of Pb in the soil components from Air Hitam which are most highly retained via exchangeable mechanisms is found to increase with time (1, 7, 18 and 24 hours).

Granitic rocks from Pos Selim-Kampung Raja new road: petrochemistry of the Selim granite (a preliminary study)

MOHD AZAMIE W.A. GHANI AND AZMAN A. GHANI

Department of Geology, University of Malaya
50603 Kuala Lumpur

The Selim granite consists of coarse grained porphyritic biotite granite to medium to fine grained granite. The coarse grained porphyritic biotite granite has higher Fe_2O_3 and Na_2O and has lower FeO compared to the medium to fine grained granite. Both granites overlap in many of the major element contents especially SiO_2. However Ba and Rb increases from the coarse grained porphyritic granite to equigranular medium to fine grained granite. Both granites are controlled by the same mineral assemblage during magma evolution that is K-feldspar, plagioclase and biotite. REE profile show that both granites may represent the evolved part of the Western Belt granite.

Granit Selim boleh dibahagikan kepada dua jenis granit yang berbeza iaitu granit biotit porfiritik berbutir kasar dan granit berbutir halus ke sederhana. Kajian geokimia menunjukkan kedua-dua batuan granit mempunyai kandungan SiO_2 yang bertindih. Granit biotit porfiritik berbutir kasar mempunyai Fe_2O_3 dan Na_2O yang lebih tinggi dan kandungan FeO yang lebih rendah berbanding dengan granit berbutir halus ke sederhana.

Pencirian geofizik kejuruteraan batuan formasi Kenny Hill di cadangan tapak pembinaan MINT-Dengkil, Selangor D.E.

UMAR HAMZAH[1], MOHD TADZA ABDUL RAHMAN[2], RAHMAN YAACUP[2] DAN ABDUL RAHIM SAMSUDIN[1]

[1]Program Geologi, Fakulti Sains dan Teknologi
Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor

[2]Institut Penyelidikan Teknologi Nuklear Malaysia (MINT)
Bangi, Kajang, Selangor D.E.

Satu kajian geofizik kejuruteraan menggunakan teknik-teknik survei keberintangan geoelektrik menegak, pengimejan geoelektrik 2D dan seismos gelombang P-S telah dilakukan di tapak cadangan pembinaan MINT-Dengkil. Tujuan kajian adalah untuk mencirikan bahan-bahan subpermukaan berdasarkan nilai keberintangan dan halaju seismos serta mengkorelasikan data tersebut dengan log litologi dan indek ujian penusukan piawai. Kawasan kajian mempunyai keluasan 40 kilometer persegi terdiri daripada syal, sabak dan lodak formasi Kenny Hill. Survei geoelektrik menegak dan pengimejan 2D masing-masing menggunakan alat pengukur ABEM SAS300c dan SAS 4000 serta kabel dan multielektrod yang disusun mengikut tatacara Wenner dan Schlumberger. Survei-survei tersebut telah dilakukan berhampiran dengan 12 lubang gerudi dengan panjang maksimum kabel sebesar 200 meter. Survei seismos gelombang P juga telah dilakukan di setiap lubang gerudi manakala survei seismos gelombang S hanya dilakukan pada dua lubang gerudi sahaja. Kedua-dua survei seismos menggunakan tukul sebagai sumber tenaga gelombang seismos. Alat ABEM MK 3 dan 24 geofon 14 Hz telah digunakan sebagai perakam dan pengesan gelombang seismos. Pada amnya, halaju gelombang P bagi lapisan pertama yang terdiri daripada lodak berlempung ialah diantara 200-900 m/s manakala halaju gelombang S bagi lapisan tersebut ialah diantara 60-160 m/s. Halaju gelombang P bagi lapisan kedua yang terdiri daripada lodak berpasir ialah diantara 700-2,400 m/s manakala gelombang S ialah diantara 240-360 m/s. Halaju gelombang P mewakili lapisan ketiga yang terdiri daripada lodak bergravel keras ialah diantara 2,200-3,600 m/s. Halaju gelombang S mewakili lapisan ketiga tidak dapat dihitung. Hasil-hasil yang diperolehi telah dikorelasikan dengan log litologi dan indek ujian penusukan piawai bagi setiap lubang gerudi. Pada amnya sempadan diantara tanah penutup atau lempung dengan batuan metamorf terluluhawa dapat dicirikan dengan baik oleh kedua-dua survei ini tetapi sempadan diantara bahan terluluhawa dengan batuan dasar hanya dapat dicirikan oleh survei pengimejan sahaja. Ujian penusukan piawai memberikan bacaan indek N = 50 pada sempadan tanah-batuan terluluhawa bukan di sempadan batuan segar. Survei elektrik menegak mempuratakan bacaan bagi metasedimen terluluhawa dengan batuan segar.

An engineering geophysical survey using vertical geoelectrical resistivity sounding, 2D geoelectrical imaging and P-S seismic refraction techniques was carried out at a proposed development site at MINT-Dengkil. The aim of study was to characterize the subsurface materials based on geoelectrical resistivities and seismic velocities as well as to correlate these data with the lithologic logs and the standard penetration test index. The study area is about 40 km², consisting of shale, slate and siltstones of the Kenny Hill Formation. ABEM SAS300C and ABEM SAS4000 resistivity meters, multicore cables and 40 steel electrodes were used in the vertical geoelectrical sounding and 2D geoelectrical imaging surveys. The electrode arrangements follows Wenner and Schlumberger configuration in the electrical surveys. All surveys were carried out close to 12 boreholes with a maximum cable length of about 200 metres. P-wave seismic surveys were carried out at all boreholes while S-wave seismic surveys were carried out at only two boreholes. Both surveys used ABEM MK 3 and 24-14 Hz geophones to record and detect the seismic waves. P-wave velocities representing first layer consisting of silty clay are in between 200-900 m/s while S-wave velocities for this layer are in between 60-160 m/s. P-wave velocities for the second layer consisting of sandy silt are in between 700-2,400 m/s while velocities for the S-wave are in between 240-360 m/s. For the hard silt and gravel third layer the P-wave velocities are in between 2,200-3,600 m/s. S-wave velocities for the third layer could not be detected. Results for each borehole was correlated with the lithologic log and the standard penetration test index. In general the boundary of clay and weathered metasediment was well characterized by these two surveys but the boundary of weathered and fresh metasediment could only be characterized by electrical imaging survey. The standard penetration test gives a maximum value of N = 50 at the soil-weathered metasediment boundary but not at the weathered-fresh metasediment boundary. The vertical geoelectrical sounding survey averages out the resistivities of fresh and weathered metasedimentary rock.

Kompleks Gelinciran Tanah Kundasang: pemetaan terperinci di kawasan Sekolah Menengah Kebangsaan Kundasang

(The Kundasang Landslides Complex: a detailed mapping of the Kundasang National Secondary School area)

Ibrahim Komoo dan Lim, C.S.

Institut Alam Sekitar dan Pembangunan (LESTARI)
Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor

Kerosakan paling meluas akibat gelinciran tanah di Kundasang, Sabah berlaku di kawasan Sekolah Menengah Kebangsaan Kundasang dalam daerah tersebut. Pemetaan geologi kejuruteraan terperinci telah dilakukan di kawasan sekolah untuk menentukan faktor penyebab ketakstabilan tanah dan kerosakan pada beberapa struktur binaan. Hasil pemetaan menunjukkan ketakstabilan berpunca daripada pergerakan pada dua sistem gelinciran tanah berskala besar yang dinamakan sebagai K2 dan K5. Tapak sekolah ini terletak pada sempadan antara dua sistem tersebut yang juga merupakan sebahagian daripada kesatuan gelinciran tanah yang lebih besar yang dinamakan Kompleks Gelinciran Tanah Kundasang.

The most extensive damage incurred by the landslide at Kundasang, Sabah occurred at the Kundasang National Secondary School. A detailed engineering geological mapping of the school area was carried out to ascertain the causing factor for the ground instability and the extent of damage on several man-made structures. The results show that the instability arises from movement of two large scale landslide systems designated previously as K2 and K5. The school straddles the boundary between these two landslide systems which form a part of the large Kundasang Landslide Complex.

EPMA characterization of the Fe-Cu-Sn mineralisation at Waterfall Mine, Pelepah Kanan, Johor

Teh Guan Hoe and Lee Heng Poh

Geology Department
University of Malaya
50603 Kuala Lumpur

The electronprobe microanalyser (EPMA) is used, for the first time locally, to characterise the Fe-Cu-Sn mineralisation at the Waterfall Mines, Pelepah Kanan, Johor.

Evidences from the field, reflected light microscopy and EPMA studies show that the mineralisation at Pelepah Kanan is essentially a replacement body within a calc-silicate sequence or skarn of early magnetite-cassiterite-fluorite-quartz (Fe-Sn) mineralisation that is intruded by a later phase of copper mineralisation and that both these were later cut by an even later hydrothermal cassiterite-K-feldspar-quartz vein swarm along fissures, joints and faults.

The EPMA was also instrumental in identifying a number of new minerals that have yet to be reported from Pelepah Kanan and they include native bismuth, tennantite (Cu_3AsS_3), wittichenite (Cu_3BiS_3), cuprite (Cu_2O), native Cu and gold.

The variable pinkish nature of the feldspars in the cassiterite-K-feldspar-quartz veins was confirmed to be due to the alteration of Fe-Mn-O material infilling cleavages in the feldspars. In addition EPMA mapping of the dark bands in highly pleochroic cassiterites show that they contain higher amounts of Fe.

Finally EPMA mapping of tailings samples show that they are worth reassessing as a large portion of them still have high iron oxide contents (80-90%).

Peralatan EPMA (electronprobe microanalyzer) digunakan, kali pertama secara tempatan, untuk pencirian pemineralan Fe-Cu-Sn di Waterfall Mine, Pelepah Kanan, Johor.

Bukti-bukti lapangan, kajian mikroskopi cahaya terpantul dan EPMA menunjukkan bahawa pemineralan di Pelepah Kanan adalah jasad penggantian didalam jujukan kalk-silikat atau skarn yang mengandungi pemineralan awal magnetit-kasiterit-fluorit-kuarza yang direjahkan kemudian oleh pemineralan tembaga dan akhirnya kedua-dua pemineralan ini dipotong oleh telerang-telerang hidroterma kasiterit-K-feldspar-kuarza yang lebih lewat yang isikan fisur, kekar, dan sesar.

EPMA juga peralatan yang menentukan beberapa mineral baru yang belum dilaporkan di Pelepah Kanan, iaitu bismut asli, tennantit (Cu_3AsS_3), wittichenit (Cu_3BiS_3), cuprit (Cu_2O), tembaga asli dan emas.

Warna merah jambu feldspar didalam telerang kasiterit-K-feldspar-kuarza disahkan oleh kajian EPMA dihasilkan oleh perubahan bahan Fe-Mn-O khususnya oksida besi yang isikan ira-ira feldspar.

Kajian pemetaan EPMA menunjukkan bahawa jalur-jalur gelap didalam kasiterit yang amat pleokroik disebabkan oleh kandungan Fe yang lebih tinggi.

Akhirnya pemetaan EPMA sampel tailings menunjukkan bahawa mereka harus dikajikan semula oleh sebab bahagian besar mereka masih mengandungi oksida besi yang tinggi (80-90%).

Sedimentology and palaeontology of Batu Arang area, Selangor

YUSNIZAR JULAIDI AND UYOP SAID

Geology Programme, School of Environmental and Natural Resources
Faculty of Science and Technology, Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor

The sedimentary rock sequence at Batu Arang consists of several facies such as mudstone, siltstone, sandstone and conglomerate which can be divided into several subfacies representing different sub-depositional lacustrine environments. The overall rock sequence in the study area is a coarsening upward sequence with conglomerate as the youngest bed. The palaeontological study dealt mainly with the presence of plant fossils and palynomorphs and some leaf fossils found were identified as *Angiopteris erecta, Eugenia, Lindera* and *Macaranga.* Some palynomorphs found such as *Echitricolporites* sp., *Laevigatosporites* sp. and *Bombacacidites baumfalki* are assignable to the *Echitricolporites* Zone of Eocene-Miocene age

Jujukan batuan sedimen di Batu Arang terdiri daripada beberapa fasies iaitu batu lumpur, batu lodak, batu pasir dan konglomerat yang dapat dibahagikan kepada beberapa subfasies mewakili sub-sekitaran pengendapan yang berbeza di dalam sekitaran tasik. Berdasarkan log sedimen, jujukan batuan di sekitar kawasan ini merupakan jujukan yang mengkasar ke atas, di mana konglomerat merupakan lapisan yang termuda. Kajian paleontologi yang tertumpu kepada kehadiran fosil tumbuhan dan palinomorf juga dijalankan dan telah mengenal pasti beberapa fosil daun seperti Angiopteris erecta, Eugenia, Lindera dan Macaranga. Selain daripada itu, kajian palinologi mengenal pasti kehadiran palinomorf yang mewakili Zon Echitricolporites seperti Echitricolporites sp. Laevigatosporites sp. dan Bombacacidites baumfalki bersama-sama dengan Echitricolporites sp. yang berusia Eosen-Miosen.

Kaedah keberintangan geoelektrik profil dalam untuk kajian air tanah di lembangan Kuala Langat, Banting Selangor

RAHMAN YACCUP[1], MOHD SHAHID AYUB[1], ABDUL RAHIM SAMSUDIN[2], MOHD TADZA ABDUL RAHMAN[1], LAKAM MEJUS[1] DAN MOHD RIFAIE MOHD MURTADZA[1]

[1]Institut Penyelidikan Teknologi Nuklear Malaysia (MINT)
43000 Bangi, Selangor

[2]Program Geologi, Fakulti Sains dan Teknologi,
Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor

Survei Pengimejan Keberintangan Geoelektrik telah dilakukan untuk memperolehi profil keberintangan bahan untuk kedalaman sehingga 130 m dari permukaan. Dalam kajian ini sebanyak 5 garisan survei telah dibina menghala ke arah laut. Keputusan kajian menunjukkan terdapat lapisan keberintangan geoelektrik rendah (< 10 Wm) yang tebal yang terletak di bahagian atas profil. Ini mungkin berlaku akibat penerobosan air masin dari laut dan terdapatnya sistem akuifer bersifat separuh terkekang sehingga menyebabkan air masin dari permukaan menyusup lebih dalam ke bawah permukaan. Ketebalan lapisan berkerintangan rendah didapati semakin bertambah menghala ke arah laut. Pengukuran keberkonduksian elektrik untuk sampel air dari lubang gerudi, air sungai dan air laut dilakukan bagi membantu kajian. Disamping itu nilai keberkonduksian elektrik dari survei pengimejan keberintangan geoelektrik turut digunakan untuk pengukuran secara rantau. Hasil daripada penggunaan kaedah ini turut menyokong keputusan daripada kaedah pengimejan keberintangan geoelektrik.

Geoelectrical Resistivity Imaging Survey was conducted in order to profile the resistivity of materials down to a depth 130 m from the surface. In this study five transect lines, perpendicular to the shoreline were constructed. The result indicates the existence of a thick geoelectrical layer with low resistivity (< 10 Wm) at the upper portion of the profile. This may be due to saltwater intrusion from the sea, and the aquifer system behaves as semi confined layer(s) that causes the salty water from surface to penetrate downward. The thickness of the low resistivity layer is increasing toward the sea. Electrical conductivity measurement of water samples from boreholes, river and sea is undertaken to support this study. Furthermore, the regional conductivity values of the study area were derived from the geoelectrical imaging profile. Result from utilizing this technique also supports the result of geoelectrical resistivity imaging.

Kajian perlakuan larut lesap Cu, Cr, Ni, Pb dan Zn dalam tanah laterit dari Ranau, Sabah

(Study on leaching behaviour of Cu, Cr, Ni, Pb, and Zn in lateritic soil from Ranau, Sabah)

BABA MUSTA[1], HAMZAH MOHAMAD[2], MOHAMAD MD. TAN[2], ANIZAN ISAHAK[2] DAN OSAMA TWAIQ[2]

[1]Sekolah Sains dan Teknologi, Universiti Malaysia Sabah
88999 Kota Kinabalu, Sabah, Malaysia

[2]Fakulti Sains dan Teknologi, Universiti Kebangsaan Malaysia
43600 Bangi, Selangor, Malaysia

Perlakuan larut resap logam-logam berat iaitu Cu, Cr, Ni, Pb, dan Zn dalam tanah laterit dikaji dengan menggunakan ujian larut lesap. Sampel laterit dilarut lesapkan dengan asid pH 3.2 pada tekanan 15 psi. Kandungan kelimpahan logam-logam berat dalam laterit dan cecair larut resapan dianalisis menggunakan kaedah spektrometer serapan atom (AAS). Keputusan analisis profil migrasi bagi logam-logam Ni, Cr, Cu, Pb dan Zn menunjukkan nilai yang lebih tinggi pada bahagian bawah profil laterit. Ini menunjukkan ada berlakunya migrasi atau larut lesap logam-logam daripada bahagian atas kebahagian bawah. Ini juga disokong oleh analisis kandungan kepekatan cecair larut resap yang mana menunjukkan kandungan Cr dan Ni yang tinggi. Profil migrasi bagi Cu, Pb, dan Zn pula didapati sangat rendah kandungannya dalam cecair larut lesap kerana nilai dalam tanah lateritik asal yang sangat rendah. Analisis struktur miktro dalam tanah asal laterit menunjukkan kehadiran mineral bersudut yang kebanyakannya terdiri daripada goethit, hematit dan gibsit. Mineral-mineral tersebut didapati mengalami proses pelarutan dan jelas ditunjukkan oleh struktur permukaan yang berubah menjadi sub-bulat oleh mikrograf elektron pengimbas (SEM).

The leaching behaviour of heavy metals namely Cu, Cr, Ni, Pb and Zn in lateritic soil were studied using the leaching test. The lateritic soil were leached with acid pH 3.2 at the pressure of 15 psi. The concentration of heavy metals in lateritic soil and leachate were analysed using Atomic Absorption Spectrometer (AAS) method. The result of migration profiles analysis for Ni, Cr, Cu, Pb and Zn metals shows the heavy metals concentration was high in the bottom part. This indicates the migration or leaching process of heavy metals from the top to the bottom part. This is also supported by results from the analysis of leachate sample, which indicates the high concentrations of Cr and Ni. The migration profile of Cu, Pb, and Zn are very low in leachate due to the very low concentration in the original lateritic soil. The microstructural analysis on lateritic soil shows the appearance of angular minerals mainly goethite, hematite and gibbsite. These minerals are found to be dissolved and clearly seen with the formation of sub-angular on the surface structure in the scanning electron micrographs (SEM).

Field relation, petrochemistry and classification of the volcanic rocks from the eastern part of Tioman Island, Pahang

ANUAR ISMAIL[1], AZMAN A GHANI[1], MOHD ROZI UMOR[2] AND NORAN ALWAKHIR SHAARANI[3]

[1]Department of Geology, University of Malaya
50603 Kuala Lumpur

[2]Geology programme, School of Environmental and Natural Resources Sciences
Faculty of Science and Technology, University Kebangsaan Malaysia, 43600 Bangi, Selangor

[3]Mineral and Geosciences Department, Ipoh

The volcanic rocks from eastern part of the Tioman Island can be divided into volcanic lava and pyroclastic types. Geochemically volcanic lavas can be classified as andesite, dacite and rhyolite. The proportion of quartz, K-feldspar and plagioclase of the three rock types are: rhyolite (Quartz: 60–65%, K-feldspar: 10–15%, Plagioclase: 10–15%), dacite (Quartz: 40–50%, K-feldspar: 25–30%, Plagioclase: 15–25%) and andesite (Quartz + K-feldspar: 15–25%, Plagioclase: 55–65%). Both rhyolite and dacite may have a common origin. On the other hand, the andesite samples show a slight concave upward REE pattern which may be the result of minerals such as garnet, clinopyroxene and amphibole having remained residual in their source. The presence of garnet constraints the mafic source to be within the lower crust (deeper than 25 km) or upper mantle.

Batuan volkanik dari bahagian timur Pulau Tioman boleh dibahagikan kepada jenis lava dan piroklastik. Secara geokimia lava volkanik boleh dibahagikan kepada andesit, dacit dan riolit. Nisbah kuarza, K-feldspar dan plagioklas untuk tiga jenis batuan ialah: riolit (Kuarza: 60–65%, K-feldspar: 10–15%, Plagioklas: 10–15%), dacit (Kuarza: 40–50%, K-feldspar: 25–30%, Plagioklas: 15–25%) dan andesit (Kuarza + K-feldspar: 15–25%, Plagioklas: 55–65%). Kedua-dua riolit dan dacit mungkin berasal dari magma yang sama. Tetapi andesit menunjukkan corak plotan unsur nadir bumi yang mencadangkan mineral-mineral seperti garnet, klinopiroksin dan amfibol tertinggal dalam batuan puncanya. Kehadiran garnet mencadangkan punca mafik terletak di dalam kerak bawah (kedalaman lebih dari 25 km) atau mantel atas.

The discovery of a *Paleodictyon*-like trace fossil from the Late Cambrian Machinchang Formation in Pulau Jemuruk, Langkawi, Malaysia

MOHD SHAFEEA LEMAN

School of Environmental Sciences and Natural Resources, Faculty of Science and Technology
Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor

Closely spaced polygonal *Paleodictyon*-like trace fossil was recently discovered in Late Cambrian Machinchang Formation at Pulau Jemuruk, Langkawi. Each polygon is bounded by six segments of ridges forming unique hexagonal framework. The Jemuruk fossil has an epi-relief origin, contrary to the hypo-relief burrow *Paleodictyon*. The Jemuruk trace fossils formed in relatively shallower marine environment compared with other known *Paleodictyon*. This study shows that the *Kinneyia* structure found in the same layer originated from these *Paleodictyon*-like trace fossils.

Surihan berbentuk poligon menyerupai Paleodictyon telah ditemui dalam batuan Kambria Akhir Formasi Machinchang di Pulau Jemuruk, Langkawi. Setiap ruang fosil surih ini disempadani enam segmen permatang membentuk kerangka heksagon yang menarik. Fosil Jemuruk berasalan epi-jasatimbul manakala Paleodictyon adalah sejenis korekan hipo-jasatimbul. Fosil surih Jemuruk terbentuk pada sekitaran laut lebih cetek berbanding dengan Paleodictyon yang diketahui. Kajian juga menunjukkan bahawa struktur Kinneyia yang ditemui dalam lapisan yang sama adalah berasal daripada fosil surih seakan Paleodictyon ini.

Pencirian bahan bergrafit dalam batuan metasedimen

MARILAH SARMAN DAN KADDERI, M.D.

Pusat Sains Sekitaran dan Sumber Alam, Fakulti Sains dan Teknologi
Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor

Satu kajian telah dilakukan untuk mengenalpasti bahan berwarna hitam, yang telah dilaporkan sebagai bergrafit, di dalam batuan Syis Hawthornden disepanjang jalan baru Nilai-Sepang. Kajian mineralogi bahan yang dikatakan bergrafit ini dijalankan dengan menggunakan kaedah belauan sinar-X (XRD). Di samping itu penentuan unsur karbon, hidrogen, nitrogen dan sulfur juga telah dilakukan dengan menggunakan penganalisis automatik CHNS. Kajian mikroskopi cahaya balikan terhadap keratan juga dilakukan terhadap bahan berwarna hitam yang dikatakan bergrafit ini. Hasil kajian menunjukkan kandungan utama bahan berwarna hitam yang terdapat dalam batuan syis kuarza bergrafit menunjukkan ialah karbon. Bagaimanapun bahan berkarbon ini tidak bersifat hablur. Berdasarkan keputusan kajian setakat ini, bahan yang berwarna hitam bukan mineral grafit.

A study was carried out to determine the nature of the black material, previously reported as graphite in Hawthornden Schist outcrops along the Nilai-Sepang road. X-ray diffraction (XRD) and automatic CHNS analyser were employed to determine the mineralogical and geochemical characteristics of the black material. In addition, polished sections were also prepared for reflected light microscopy investigation. Results from this study suggest that the black material is predominantly carbon rich and non-crystalline in character. Therefore, this study suggests that the black material occurs as amorphous carbon. The non-crystalline nature of the material, based on the current results, indicates that the black material is not graphite.

Hydrological and sediment-transport systems within the Putrajaya Wetlands, Putrajaya

ABDUL HADI ABD. RAHMAN[1], ISMAIL YUSOFF[2] AND AHMAD FARID ABU BAKAR[2]

[1]Geophysics Group, School of Physics, University of Science Malaysia
11800 USM Penang

[2]Department of Geology, University of Malaya
50603 Kuala Lumpur

The Putrajaya Lake and Wetlands complex is the main and the biggest component of Putrajaya, the new Malaysian Government Administrative Centre. The lake, which covers an area of about 7.0 km^2, was artificially created to become the aesthetic centre of Putrajaya. Maintaining the water quality of the lake is the most important aim of the lake management programme. To maintain the good quality of water and aquatic life within the lake, the Putrajaya Corporation (Perbadanan Putrajaya) has created a monitoring and research unit, comprising the KLCC-UH (KLCC-Urusharta Sdn. Bhd., a private company) and a research team, to continuously monitor, investigate and report on all aspects of the Lake and Wetlands. This paper describes and discusses the results of the hydrological and sediment monitoring program for the months of October 2001 until May 2002 for Lake 1A and the Wetlands, focusing on the hydrological and sediment-transport systems within the wetlands.

Data on rainfall, water-discharge, TSS (Total Suspended Solid) and TSS-discharge for the months of October 2001 to May 2002 were analysed. The rainfall pattern shows two prominent modes, one around the month of November 2001 and another around the months of April-May 2002. The water discharge trends measured at all the wetland arms show prominent peaks at around November 2001 and April-May 2002 and closely correspond to the rainfall pattern. The results clearly indicate that water-discharge at the northern Putrajaya Wetlands is very much governed by rainfall.

The TSS concentration trends recorded at the different wetland arms show peaks which corresponds to the water-discharge peaks for the period October 2001 to May 2002. Erosion and transportation of earth's surface material becomes

more rapid during intensive events such as flooding and storms. High rainfall coupled with the availability of fresh sediment sources in upstream catchment areas, due to land clearing results in greater erosion and sediment yield, and sediment discharge in the wetland cells.

The TSS-concentration graphs also display other peaks during periods of low rainfall between November 2001 to April 2002, and these peaks indicate that there are other factors involved in determining the volume of TSS entering the wetlands. The TSS-discharge trends at the different wetlands closely resemble the water-discharge trends (and not the TSS-concentration trends). Water is the main medium that transports the TSS, downstream, along the wetlands. Thus, although the concentration of TSS may be high during months where rainfall is low, only a small volume is transported downstream, along the wetland cells, due to the low water-discharge volume.

Komplek Tasik dan Wetland Putrajaya adalah merupakan komponen yang utama dan terbesar di Putrajaya, yang merupakan pusat pentadbiran Kerajaan Malaysia yang baru. Tasik yang meliputi kawasan seluas 7.0 km² ialah tasik buatan manusia yang telah dibangunbina untuk menjadi pusat tumpuan estetika Putrajaya. Oleh itu, program pengurusan tasik memberi tumpuan utama dalam penjagaan kualiti air di tasik. Untuk memelihara dan mengekalkan kualiti air yang tinggi dan kehidupan akuatik yang baik didalam tasik, pihak Perbadanan Putrajaya (Putrajaya Corporation) telah membentuk suatu unit pengawasan dan penyelidikan, yang terdiri dari KLCC-UH (KLCC-Urusharta Sdn. Bhd., sebuah syarikat swasta) dan satu kumpulan penyelidik. Unit ini ditugaskan untuk mengawas, menyelidik dan melaporkan secara berterusan semua aspek Tasik dan Wetland. Kertaskerja ini memperihal dan membincangkan hasil keputusan program pengawasan hidrologi dan sedimen bagi bulan Oktober 2001 sehingga Mei 2002 untuk Tasik dan Wetland, dengan memberi tumpuan khusus kepada sistem hidrologi dan pengangkutan sedimen didalam wetland.

Analisa dilakukan ke atas data kerpasan (ukuran hujan), luahan air, TSS (Total Suspended Solid — Jumlah Pepejal Terampai) dan luahan TSS dari bulan Oktober 2001 sehingga Mei 2002. Corak hujan mempamerkan dua mod yang tertonjol, satu disekitar bulan November 2001 dan satu lagi disekitar bulan April-May 2002. Ukuran luahan di semua sayap wetland juga mempamerkan mod yang tertonjol disekitar bulan November 2001 dan satu lagi disekitar bulan April-May 2002, mirip kepada corak hujan. Keputusan-keputusan ini menunjukkan bahawa luahan air di Wetland Putrajaya bahagian utara adalah dikawal oleh hujan.

Corak graf kepekatan TSS yang direkod dari sayap wetland yang berbeza menunjukkan kemuncak-kemuncak yang berpadanan dengan corak luahan air bagi Oktober 2001 sehingga Mei 2002. Hakisan dan pengangkutan bahan-bahan tanih diperhebatkan semasa peristiwa-peristiwa keamatan tinggi seperti banjir dan ribut yang berkait dengan hujan lebat Hujan lebat di kawasan-kawasan di mana sumber enapan baru tersedia akibat kerja-kerja punggahan tanah, seperti di bahagian hulu Putrajaya akan mengakibatkan hakisan dan pengeluaran sedimen yang lebih tinggi, dan luahan sedimen yang meningkat di wetland. Graf-graf kepekatan TSS juga menunjukkan kemuncak-kemuncak lain pada ketikan kadar hujan lebih rendah antara bulan-bulan November 2001 sehingga April 2002. Kemuncak-kemuncak ini menunjukkan bahawa terdapat factor-faktor lain yang mengawal kemasukan isipadu TSS kedalam wetland.

Corak graf luahan TSS mirip kepada corak luahan air (dan bukan corak kepekatan TSS). Air adalah merupakan media pengangkut TSS yang utama ke hilir, melalui wetland. Oleh itu, walaupun kepekatan TSS tinggi semasa hujan adalah rendah, hanya isispadu yang sedikit dari TSS ini diangkut kehilir, sepanjang wetland, disebabkan kadar luahan air yang rendah.

Late Cenozoic history of sea level changes documented from high-resolution seismic data on the Northern Sunda Shelf, South China Sea

GUANGFA ZHONG[1], JIANHUA GENG[1], ZUYI ZHOU[1], HOW KIN WONG[2] AND LIAOLIANG WANG[3]

[1]Key Laboratory of Marine Geology of China Ministry of Education, Tongji University
Shanghai 200092, China

[2]Institute of Biogeochemistry and Marine Chemistry, Hamburg University
20146 Hamburg, Germany

[3]Guangzhou Marine Geological Survey, Ministry of National Land and Resources
Guangzhou 510760, China

In the paper, a quantitative model is presented to estimate the magnitudes of eustatic sea level rises and falls by seismic data in an effort to consider the variables such as erosion, subsidence, compaction, and paleo-water depth, etc. As an application of the model, a eustatic curve of sea level changes since Pliocene is deduced from high-resolution air gun seismic lines acquired by German Sonne 115 Cruise in 1997. On the curve, about 36 cycles of sea level changes can be recognized with

periods ranging from 0.08 Ma to 0.29 Ma, which are fallen into 4th order of sea level cycles. The curve is compared with the reprocessed deep-sea stable oxygen isotope data from benthic foraminifera on ODP sites 1,148 and 846 by resampling and filtering. Both of them matched well, which suggests that the 4th order of eustatic sea level changes during the last 5.33 Ma was probably controlled by changes in the sizes of the ice caps.

Geo-environmental sampling: how good is a good practice?

B.E. Abdel-Rahim, W.Z.W. Yaacob, Abdul Rahim Samsuddin and Abdul Ghani Rafek

Geology Program, School of Environmental Science and Natural Resources
Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor
E-mail: bahaa_wali@yahoo.com

Sampling procedures and strategies should be designed to meet the objectives of each specific investigation upon which an effective risk assessment has to be made to the impacts of waste disposal sites on the local environment. In this respect, extensive and comprehensive information has been extracted from the literature, which we hypothesize it can improve the quality and representativeness of geo-environmental samples, which are collected for chemical analysis. The main interference problems, which are encountered during sampling activities, are pointed out. Sampling procedures for soil, groundwater, surface water, and leachate are discussed in detail. It is found that the variations in procedures of sample preservation, storage and handling are attributed relatively to the media of sampling and parameters required for intended analysis.

The Kinta Valley karst landscape — a national heritage to be preserved (Lanskap kars Lembah Kinta — warisan kebangsaan yang perlu dipelihara)

Ros Fatihah Muhammad and Ibrahim Komoo

Institut Alam Sekitar dan Pembangunan (LESTARI)
Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor

Kinta Valley karst is of aesthetic, cultural and scientific importance. Many caves were built inside caves and some caves and wangs were developed as recreational parks. Geologic features such as notches and cave deposits are considered reliable indicators of past climatic conditions. In addition, the limestone is also being exploited for economic purposes. Therefore, a policy for a balance between conservation and exploitation activities in Kinta Valley karst is proposed.

Kars Lembah Kinta adalah amat penting dari segi estetik, kebudayaan dan saintifik. Kuil-kuil dibina di dalam gua-gua manakala taman-taman rekreasi dibina didalam wang. Fitur-fitur seperti takik dan enapan gua dianggap indikator yang baik untuk keadaan cuaca masa lampau. Akan tetapi, batukapur ini juga sedang aktif dieksploitasi untuk tujuan ekonomi. Satu polisi untuk mewujudkan keseimbangan di antara aktiviti pemuliharaan dan eksploitasi kars Lembah Kinta dicadangkan.

An organic geochemical study of the Miocene sedimentary sequence of Labuan Island, offshore western Sabah, East Malaysia

Alsharef Albaghdady, Wan Hasiah Abdullah and Lee Chai Peng

Department of Geology
University of Malaya
50603 Kuala Lumpur

Labuan is an island, located offshore west of Sabah, East Malaysia. The rocks on Labuan Island are divided into three main units; Temburong, Setap Shale and Belait formations. The relationship between these units is still unclear. An organic geochemical study was performed on ten samples from these main rock units. The main aim of this study was to determine the thermal maturity of these sediments and to differentiate between the formations based on organic geochemical

parameters. The study suggests the thermal maturity is early mature to mid mature for oil generation, the Belait Formation being least mature and Temburong the most mature. Based on organic geochemical parameters and supported by vitrinite reflectance data, the Layang Layangan Unit I should be grouped within the Belait Formation.

Labuan adalah sebuah pulau yang terletak di luar pesisir pantai di bahagian barat negeri Sabah, Malaysia Timur. Batuan di Pulau Labuan dibahagikan kepada tiga unit utama: Formasi Temburong, Syal Setap dan Formasi Belait. Hubungan di antara unit-unit ini masih kurang jelas. Suatu kajian geokimia organik dilakukan ke atas sepuluh sampel dari unit-unit utama batuan ini. Tujuan utama kajian ini ialah untuk menentukan tahap kematangan terma sedimen-sedimen ini dan untuk membezakan di antara formasi-formasi ini berdasarkan parameter-parameter geokimia organik. Kajian ini mencadangkan kematangan terma adalah diperingkat awal ke pertengahan bagi penjanaan minyak di mana Formasi Belait yang paling kurang matang dan Temburong yang paling matang. Berdasarkan parameter-parameter geokimia organik dan disokong oleh data dari pantulan vitrinit, Unit I Layang Layangan sepatutnya diletakkan di dalam Formasi Belait.

Biomarker characterisation and thermal maturity evaluation of Ganduman Formation, Sahabat area, Dent Peninsula, Sabah, Malaysia

KHALID ALI ALSHEBANI[1], WAN HASIAH ABDULLAH[1] AND ABDUL HADI ABD. RAHMAN[2]

[1]Department of Geology, University of Malaya
50603 Kuala Lumpur

[2]Geophysical Group, School of Physics
University of Science Malaysia, 11800 USM Penang

Pliocene sediments of the Ganduman Formation is characterized by thick sand bodies in the lower Maruap Member while the upper Ganduman Formation is dominated by shale and carbonaceous material. In this study, an assessment is made on the biomarker distributions of these sediments and of their thermal maturity. Based on this study, the sediments are interpreted to be deposited under oxic to anoxic conditions in a probable lacustrine to fluvial deltaic setting with considerable marine influence. The extracted shale and coal samples suggest that these sediments are still immature for hydrocarbon generation. However, it is interesting to note that the extract of one immature sandstone sample is thermally mature which suggests the presence of non-indigenous, migrated hydrocarbons.

Sedimen Pliosen Formasi Ganduman dicirikan oleh badan-badan batu pasir tebal dari bahagian bawah Ahli Meruap sedangkan bahagian atas Formasi Ganduman didominasikan oleh syal dan bahan-bahan berkarbon. Di dalam kajian ini, suatu penilaian dilakukan ke atas taburan biomarker dari sedimen-sedimen tersebut dan ke atas kematangan termanya. Berdasarkan kajian ini, sedimen-sedimen ini ditafsirkan sebagai dienapkan dalam keadaan oksik ke anoksik berkemungkinan dalam persekitaran lakustrin ke delta berfluvius dengan mengalami pengaruh marin yang agak tinggi. Bahan ekstrak dari sampel-sampel syal dan arang batu mencadangkan yang sedimen-sedimen ini masih tidak matang bagi penjanaan hidrokarbon. Walaubagaimanapun suatu yang menarik adalah terdapat satu sampel batu pasir yang tidak matang tetapi ekstraknya adalah matang secara terma, dengan ini mencadangkan kehadiran hidrokarbon yang bukan berasal dari batu pasir tersebut tetapi yang telah berhijrah ke dalam batu pasir tersebut.

Perbandingan pencirian EPMA dan geokimia emas primer dan emas sekunder di kawasan Ulu Sokor, Kelantan, Malaysia

JASMI HAFIZ BIN ABDUL AZIZ DAN TEH GUAN HOE

Jabatan Geologi, Fakulti Sains
Universiti Malaya, 50603 Kuala Lumpur
E-mail: jasimbrujita@hotmail.com

Kawasan Ulu Sokor adalah terletak di bahagian tengah Kelantan dan adalah lebih kurang 35 km barat daya daripada Tanah Merah. Emas Ulu Sokor adalah wujud dalam elektrum iaitu campuran emas (Au) dan perak (Ag). Sampel-sampel emas Sungai Liang yang merupakan sampel emas sekunder menunjukkan saiz yang lebih besar dengan nilai purata panjang 1.726 mm dan nilai purata lebar 0.948 mm, dan bersifat bundar. Emas dari Sungai Liang ini didapati wujud berasosiasi dengan mineral-mineral lain seperti pirit (FeS_2), bismuthinit (Bi_2S_3), ilmenit ($FeTiO_3$), rutil (TiO_2), zirkon ($ZrSiO_4$), monazit (Ce,

P, O), silikat (Si, Al, O), oksida besi (Fe, O) dan kuarza (SiO_2). Disebabkan emas Sungai Liang adalah emas sekunder yang mewarisi emas daripada punca-punca pemineralan yang berlainan terdapatnya perbezaan yang ketara dalam komposisi emas (Au) dan nilai *fineness*. Komposisi emas (Au) Sungai Liang adalah berjulat besar dari 58.9449 *wt%* hingga 97.7513 *wt%*. Manakala terdapat tujuh variasi nilai purata *fineness* iaitu 603.0439, 739.5476, 805.8375, 875.0454, 913.4387, 953.0279 dan 985.2428. Bagi emas adit New Discovery yang merupakan sampel emas primer, saiznya lebih kecil dengan nilai purata panjang 0.909 mm dan nilai purata lebar 0.615 mm, dan bersifat bersudut. Emas adit New Discovery ini berasosiasi dengan pirit (FeS_2), galena (PbS), silikat (Si, Al, O), oksida besi (Fe, O) dan kuarza (SiO_2). Seperti yang dijangkakan, sebagai emas primer tiada perbezaan ketara dalam komposisi emas (Au) dan nilai *fineness* sampel emas adit New Discovery. Komposisi emas (Au) berjulat kecil sahaja dari 97.7729 *wt%* hingga 98.7965 *wt%*, manakala nilai purata *fineness* adalah 983.5491. Ini membuktikan sampel adit New Discovery merupakan satu set telerang pemineralan emas.

Ulu Sokor area is located in the middle of Kelantan and approximately 35 km southwest from Tanah Merah. Gold in Ulu Sokor exists in the form of electrum which contains gold and silver as a mixture. Gold samples from Sungai Liang that represent secondary gold, show bigger sizes with average value of length of 1.726 mm and average value of width of 0.948 mm; and it is also rounded. Sungai Liang gold samples are associated with other minerals such as pyrite (FeS_2), bismuthinite (Bi_2S_3), ilmenite ($FeTiO_3$), rutile (TiO_2), zircon ($ZrSiO_4$), monazite (Ce, P, O), silicates (Si, Al, O), iron oxides (Fe, O) and quartz (SiO_2). There are differences in gold (Au) composition and fineness value of Sungai Liang gold because as secondary gold they inherited gold from various mineralization sources. Sungai Liang gold (Au) composition range widely from 58.9449 wt% to 97.7513 wt%. There are seven average fineness values i.e. 603.0439, 739.5476, 805.8375, 875.0454, 913.4387, 953.0279 and 985.2428. Gold from New Discovery's adit represents primary gold showing smaller sizes with average value of length of 0.909 mm and average value of width of 0.615 mm; and it is also angular. New Discovery's adit gold samples show association with pyrite (FeS_2), galena (PbS), silicates (Si, Al, O), iron oxides (Fe,O) and quartz (SiO_2). As expected, New Discovery's adit gold do not show any appreciable variation in gold (Au) composition and fineness value. Gold (Au) composition range from 97.7729 wt% to 98.7965 wt% with a average fineness value of 983.5491. This shows that the gold samples collected from New Discovery's adit belong to the same set of gold veins.

The attenuation effects of surface-wave propagations on rockmass using SASW method

SUHARSONO AND ABDUL RAHIM SAMSUDIN

School of Environment and Natural Resource Science, Faculty of Science and Technology
Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor DE

A considerable amount of research has been devoted to the subject of attenuation of motion resulting from the geometrical and material dampings on soil medium. However, there are very few studies available on the effect of attenuation of rockmass at the moment. In this study, the loss of the amplitude (A) or energy vibration due to the geometrical and material dampings of Rayleigh waves were estimated by SASW method. The results of measurements were analyzed in the frequency domain and the attenuation characteristics of rockmass were studied in term of a *frequency-independent* attenuation coefficient (α_o), by applying Bornitz equation. The experimental curve is fitted to a corresponding theoretical curve, in order to obtain a *frequency-independent* attenuation coefficient (α_o). The aim of this survey is to characterize the attenuation coefficient of surface waves on rockmass, as a result of discontinuity spacing using the SASW method.

EPMA characterisation of *amang* minerals of Peninsular Malaysia — a preliminary study

CHENG KWONG KIONG AND TEH GUAN HOE

Department of Geology
University of Malaya
50603 Kuala Lumpur

Samples of *amang* were collected from Upper Perak, Kinta Valley, Klang Valley and the Pelepah Kanan areas for characterisation, both physically and chemically, using the EPMA (Electronprobe Microanalyser).

This preliminary study shows that *amang* samples from Klian Intan show less ilmenite compared to the other areas. The Klian Intan samples, however, have higher contents of wolframite, pyrite, zircon, arsenopyrite, and rutile. The presence

of rooseveltite ($BiAsO_4$) is a significant characteristic for the Klian Intan *amang*. One rooseveltite sample shows inclusions of silica.

The *amang* samples from the Kinta Valley are very rich in ilmenite grains. Studies show 91% ilmenite in *amang* from Keramat and 93% ilmenite in *amang* from Air Kuning, and 91% in *amang* from Bidor. Struverite $[Fe_X^2(Ta, Nb)_{2X}Ti_{60-X}O_{120}]$ was found with exsolution bodies of wolframoixiolite $[(Nb, W, Ta, Fe, Mn)_3O_4]$ and columbite/tantalite. Wolframoixiolite is a black, opaque, monoclinic mineral. This is the first time it is found in Malaysian *amang*.

Amang from Bidor shows intergrowth relationships of ilmenite with monazite, xenotime and zircon. The studied *amang* sample from Dengkil, Klang Valley shows the highest content of ilmenite compared to the other areas. It contains 98% ilmenite, 1% xenotime, and 1% zircon. On the other hand, the wolframite concentrate from Tekka shows 53% wolframite, 33% ilmenite, 12% silicates, and 2% zircon. EPMA studies of *amang* sample from Pelepah Kanan shows 81% iron oxides, 8% silicates, 6% silica, and 5% cassiterite.

Sampel amang *telah dikutip dari kawasan-kawasan Perak Utara, Lembah Kinta, Lembah Klang dan Pelepah Kanan untuk pencirian, dari segi fizikal dan kimia, dengan dengan menggunakan EPMA (Electroprobe Microanalyser).*

Kajian awal menunjukkan sampel amang dari Klian Intan adalah kurang ilmenit berbanding dengan kawasan-kawasan lain. Sampel Klian Intan, walau bagaimanapun, mempunyai kandungan yang lebih tinggi bagi wolframit, pirit, zirkon, arsenopirit, dan rutil. Kehadiran rooseveltit ($BiAsO_4$) adalah satu ciri khas bagi amang Klian Intan. Satu sampel rooseveltit menunjukkan inklusi silika.

Sampel amang dari Lembah Kinta adalah sangat kaya dengan butiran ilmenit. Kajian menunjukkan 91% ilmenit di dalam amang dari Keramat dan 93% ilmenit di dalam amang dari Air Kuning, serta 91% di dalam amang dari Bidor. Struverit $[(Fe_X^2(Ta, Nb)_{2X}Ti_{60-X}O_{120}]$ telah dijumpai dengan badan-badan eksolusi wolframoixiolit $[(Nb, W, Ta, Fe, Mn)_3O_4]$ bersama-sama dengan columbit/tantalit. Wolframoixiolite adalah mineral hitam legap yang bersistem monoklin. Ini adalah pertama kali mineral ini dijumpai di dalam amang Malaysia.

Amang dari Bidor menunjukkan hubungan saling pertumbuhan ilmenit dengan monazit, xenotim dan zirkon. Sampel amang yang dikaji dari Dengkil, Lembah Klang menunjukkan kandungan ilmenit yang tertinggi berbanding dengan kawasan-kawasan yang lain. Ia mengandungi 98% ilmenit, 1% xenotim, dan 1% zirkon. Dalam pada itu, padatan wolframite dari Tekka menunjukkan 53% wolframit, 33% ilmenit, 12% silikat, dan 2% zirkon. Kajian EPMA bagi sampel amang dari Pelepah Kanan menunjukkan 81% oksida besi, 8% silikat, dan 5% kasiterit.

Pencirian geologi kejuruteraan dan geofizik batuan formasi Kenny Hill di tapak Kamsis H, Universiti Kebangsaan Malaysia

(Engineering geological and geophysical characterization of rocks of the Kenny Hill formation at Kamsis H, Universiti Kebangsaan Malaysia)

LAKAM ANAK MEJUS[1], ABDUL GHANI RAFEK[2], ABDUL RAHIM SAMSUDIN[2], UMAR HAMZAH[2] DAN RAHMAN YACCUP[1]

[1]Institut Penyelidikan Tenaga Nuklear Malaysia (MINT)
Bangi, 43000 Kajang, Malaysia

[2]Program Geologi, Pusat Pengajian Sains Sekitaran dan Sumber Alam
FST, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia

Penyiasatan bawah tanah adalah sesebuah peringkat kajian yang penting dalam menentukan kesesuaian sesuatu kawasan yang akan dibangunkan. Satu kajian pencirian jasad batuan formasi Kenny Hill yang menggabungkan kaedah geofizik dan geologi kejuruteraan telah dijalankan pada dua buah potongan cerun pada batuan filit, batuan kuarzit dan selang-lapis batuan filit dan kuarzit di tapak Kamsis H, Universiti Kebangsaan Malaysia (UKM). Kaedah geofizik yang digunakan adalah survei seismos biasan dan survei keberintangan geoelektrik, manakala kaedah geologi kejuruteraan melibatkan survei profil luluhawa. Berdasarkan data survei seismos biasan, empat lapisan dapat dikesan; lapisan pertama (penutup bumi) mempunyai nilai halaju sebenar gelombang P (Vp) yang berjulat antara 180 m/s-920 m/s, dengan kedalaman <1.5 m. Lapisan kedua mempunyai nilai Vp berjulat antara 510 m/s-1,280 m/s, pada kedalamannya di antara 0.5-4.0 m. Bagi lapisan ketiga nilai Vp ialah di antara 1,020 m/s-1940 m/s pada kedalamannya di antara 3.0 m-11.0 m manakala lapisan keempat mempunyai Vp berjulat di antara 1,860 m/s-3,150 m/s. Berdasarkan nilai halaju sebenar gelombang P (Vp) yang diperolehi, terdapatnya perbezaan yang jelas antara batuan filit dan kuarzit dengan nilai 1,800 m/s-2,500 m/s untuk batuan filit dan 2,500 m/s-3,200 m/s untuk batuan kuarzit. Bagi survei keberintangan geoelektrik, terdapat tiga zon keberintangan yang utama iaitu zon berkeberintangan rendah berjulat 20 Wm-1,000 Wm, zon berkeberintangan sederhana berjulat antara 1,000 Wm-3,500 Wm dan zon berkeberintangan tinggi iaitu >3,500 Wm. Daripada kajian profil luluhawa, enam gred luluhawa daripada gred I

hingga gred VI telah dapat dikelaskan dan dipetakan. Pengredan luluhawa ini dapat dibandingkan dan dikorelasikan dengan parameter geofizik.

Investigation of the subsurface conditions is one of the important factors that is needed for the determination of the suitability of an area for development. A study to characterize the Kenny Hill formation was conducted by using geophysical and engineering geological methods at two different slope cuts at Kamsis H, Universiti Kebangsaan Malaysia (UKM). The lithologies consist of phyllite, quartzite and interbedded phyllite and quartzite. The geophysical methods employed were seismic refraction and geoelectrical resistivity surveys. Engineering geological survey of the weathering profile was carried out. Based on the seismic refraction surveys, four subsurface layers have been determined. Each of the layers are characterized by different true P-wave velocities, Vp, that ranges from 180 m/s to 920 m/s for the first layer, 510 m/s to 1,280 m/s for the second layer, 1,020 m/s to 1,940 m/s for the third layer and 1,860 m/s to 3,150 m/s for the fourth layer. The thicknesses of each of these layers were determined as <1.5 m, 0.5-4.0 m and 3.0-11.0 m. Based on the distribution of true P-wave velocities, phyllite and quartzite have distinctly different true P-wave velocities, Vp, that are 1,800 m/s to 2,500 m/s for phyllite and 2,500 m/s to 3,200 m/s for quartzite. Geoelectrical resistivity results show three main zones of different specific geoelectrical resistivities ranging from 20 Wm-1,000 Wm, 1,000 Wm-3,500 Wm and >3,500 Wm. From the weathering profile, six weathering grades from grade I to grade VI were classified and mapped. Each of the weathered layers can be correlated with the geophysical parameters.

BERITA-BERITA PERSATUAN
NEWS OF THE SOCIETY

KEAHLIAN (Membership)

The following applications for membership were approved:

Full Members

1. Nor Ainulhuda Mazniz Nor Rahmat
   Menara Exxon-Mobil, KLCC, 50728 Kuala Lumpur.
2. Kamarulbahrin Hashim
   JMGM Sarawak, Jalan Wan Abdul Rahman, 93050 Kuching.
3. Yogwswaran Mailvaganam
   512 Lorong 5/1, Taman Hui Sing, 93350 Kuching.
4. Lim Choun Sian
   LESTARI, UKM Bangi, Selangor.
5. Amran Mohamad
   No. 34-5-1, jalan 2/101C, Cheras Business Centre, Batu 5, Jalan Cheras, 56100 Kuala Lumpur.
6. Ahmad Rosli Othman
   Geohan Sdn. Bhd., 40A Jalan Datuk Sulaiman, Taman Tun Dr. Ismail, 60000 Kuala Lumpur.
7. Ahmad Zaidi Hampden
   Fakulti Kejuruteraan Awam, UITM Kampus Samarahan, 94300 Kota Samarahan.
8. Zainol Husin
   JMGM Johor, No. 5, Blok A, Wisma Nanas, 81200 Johor Bharu.
9. Ropidah Mat Zin
   JMGM Johor, No. 5, Blok A, Wisma Nanas, 81200 Johor Bharu.
10. Noraini Basiri
    JMGM Johor, No. 5, Blok A, Wisma Nanas, 81200 Johor Bharu.
11. Nur Iskandar Taib
    Jabatan Geologi, Universiti Malaya, 50603 Kuala Lumpur.

Student Members

1. Mohd Haffize Husain
   Jabatan Geologi, Universiti Malaya, 50603 Kuala Lumpur.
2. Lee Chin Pin
   Universiti Sains Malaysia, Pulau Pinang.
3. James anak Bachat
   LESTARI, UKM Bangi, Selangor.
4. Victor Wong Lee Wee
   LESTARI, UKM, Bangi, Selangor.
5. Mohd Noor Zuwaimi Md. Yasin
   Universiti Malaysia Sabah, 88999 Kota Kinabalu.

Associate Member

1. Teo King Beng
   Fakulti Kejuruteraan Awam, UTM Skudai, Johor.

PETUKARAN ALAMAT (Change of Address)

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

1. Zahari bin Lambak
Ghthrie Ropel Berhad, Ladang Sembrong, K.B. No. 104, 81850 Layang-Layang, Johor.

2. Baba Musta
Program Geologi, Sekolah Sains & Teknologi, Universiti Malaysia Sabah, Beg Berkunci No. 2073, 88999 Kota Kinabalu, Sabah.

CURRENT ADDRESS WANTED

The GSM is seeking the address of the following member. Anyone knowing the new address please inform the Society.

1. Adnan A.M. Aqrawi
Smedvig Technologies AS, Gamle Forusvei 17, P.O. Box 172, N-4033 Stavanger, Norway.

PERTAMBAHAN BAHARU PERPUSTAKAAN (New Library Additions)

The Society has received the following publications:

1. University of Tsukuba, Institute of Geoscience, science reports, vol. 24, 2003.
2. 2000 Malaysian Science & Technology: Indicators Report, 2002.
3. AAPG Explorer, May & June, 2003.
4. Monthly statistics on mining industry in Malaysia, Jan & Feb 2003.
5. Quarrying — essential element in national development. Edited by Ghiathuddin Long *et al.*, 2003.
6. Symbiosis, June 2003.
7. Prosiding Dialog Kementerian Sains, Teknologi dan Alam Sekitar bersama Persatuan/organisasi bukan Kerajaan (NGO) S & T 2002.
8. Annales Academiae Scientiarum Fennicae: geologica-geographica, no. 164, 2003.

BERITA-BERITA LAIN
OTHER NEWS

KALENDAR (CALENDAR)

2003

July 8–10

CARBONATE SEDIMENTOLOGISTS (12th Bathurst Meeting), Dunham, UK. (Contact: Maurice Tucker or Moyra Wilson, Department of Geological Sciences, University of Durham, Durham DH1 3LE, U.K. Tel: +44-191 374 2524 or 2501; E-mail: M.E.Tucker@durham.ac.uk *or* Moyra.Wilson@durham.ac.uk; Website: www.dur.ac.uk/bathurst.2003/)

July 14–25

IGCP 450 MEETING AND FIELD EXCURSION (Proterozoic Sediment-hosted Base Metal Deposits of Western Gondwana: Intra and Intercontinental Correlation of Geological, Geochemical and Isotopic Characteristics, Southern Atlantic), Lubumbashi, D.R. Congo. (Contact: Dr. Jacques Cailteux, Organiser of the event, Groupe G. FORREST international, E.G.M.F., Lubumbashi, D.R. Congo. Fax: 243-23 42 275; Tel: 243-970 32 625; E-mail: egmf@forrestrdc.com)

July 23–31

INTERNATIONAL ASSOCIATION FOR QUATERNARY RESEARCH (INQUA) (16th Congress) "Shaping the Earth: A Quaternary Perspective", Reno Hilton, Reno, NV, USA. (Contact: Nick Lancaster, Desert Research Institute. Tel: +1-775 673 7304; E-mail: nick@dri.edu; Website: www.dri.edu/DEES/INQUA2003/inqua_home/htm)

July 30–31

GEODYNAMICS & METALLOGENY (International Conference), Ulaan Bataar, Mongolia. Organized by the Mongolian National Group of the International Association on the Genesis of Ore Deposits (IAGOD) and co-sponsored by IAGOD; post-conference expert fieldtrip 1–7 August 2003 to Oyu Tolgoy. (Contact: O. Gerel, E-mail: gerel@mtu.edu.mn)

August 9–21

FIELD CONFERENCE IN URUMQUI, CHINA, IGCP-473 annual field conference in Urumqui with excursion to Chinese Tienshan and Altay (Xinjiang). Sponsored by the International Association on the Genesis of Ore Deposits (IAGOD). (Contact: Prof. Mao Jingwen, CAGS Beijing. E-mail: jingwenmao@263.net; Website: www.nhm.ac.uk/mineralogy/cercams/index.htm)

August 10–13

GeoSciEd IV, Calgary, Canada. (Contact: Website: www.geoscied.org)

August 18–21

9TH INTERNATIONAL SYMPOSIUM ON THE ORDOVICIAN SYSTEM, 7TH INTERNATIONAL GRAPTOLITE, AND FIELD MEETING OF THE SUBCOMMISSION ON SILURIAN STRATIGRAPHY, San Juan City, Argentina. (Contact: ISOS: Guillermo L. Albanesi. E-mail: galbanesi@arnet.com.ar or Matilde S. Beresi. E-mail: mberesi@labocricyt.edu.ar; IGC-SSS field meeting: Gladys Ortega. E-mail: gcortega@arnet.com.ar or Guillermo F. Aceñolaza. E-mail: acecha@unt.edu.ar)

August 26–30

PRESENT STATE AND FUTURE EVOLUTION OF PALEOGENE STRATIGRAPHY, A symposium of the International Subcommission on Paleogene Stratigraphy, Leuven, BELGIUM. (Contact: Noël Vandenberghe, Dept. Geografie-Geologie, Afd. Historische Geologie, KU Leuven, Redingestraat 16, B-3000 Leuven Belgium. E-mail: noel.vandenberghe@geo.kuleuven.be; Website: www.uni-tuebingen.de/geo/isps/news)

August 29 – September 3

INTERNATIONAL GEOCHEMICAL EXPLORATION SYMPOSIUM (21st of the Association of Exploration Geochemists), Dublin, Ireland. (Contact: Eibhlin Doyle, Secretary LOC. E-mail: eibhlindoyle@gsi.ie; Website: http://www.aeg.org/)

September 5–6

TERRANE PROCESSES AT THE PACIFIC MARGIN OF GONDWANA (International Conference), Cambridge, England. Sponsored by the British Antarctic Survey and the Geological Society. (Contact: Dr. Alan P.M. Vaughan, British Antarctic Survey, Cambridge CB3 0ET, England. Tel: +44-1223 221419; Fax: +44-1223 221646; E-mail: a.vaughan@bas.ac.uk)

September 7–11

ENVIRONMENTAL GEOCHEMISTRY (6th International Symposium), Edinburgh, Scotland, UK. (Contact: John Farmer, Dept. of Chemistry, The University of Edinburgh, Kings Buildings, West Mains Road, Edinburgh EHP 3JJ Scotland. E-mail: J.G.Farmer@ed.ac.uk; Tel: 0131-650-1000; Fax: 0131-650-4757)

September 8–12

ORGANIC GEOCHEMISTRY (21st International Meeting), Krakow, Poland. Sponsored by the European Association of Organic Geochemists. (Contact: IMOG 2003, Society of Research on Environmental Changes "Geosphere", Al. Mickiewicza 30, 30-059 Kraków, Poland. Fax: +48-12 623 78 28; E-mail: imog@imog.agh.edu.pl; Website: http://www.imog.agh.edu.pl)

September 8–12

INTERNATIONAL CONGRESS ON ROCK MECHANICS "Technology Roadmap for Rock Mechanics" (10th of the International Society for Rock Mechanics), Sandton (Gauteng-Johannesburg), South Africa. (Contact: Mrs. Karen Norman, The Conference Co-Ordinator, Technology Roadmap for Rock Mechanics, P.O. Box 61127, ZA-2107 Marshalltown, South Africa. Tel: +27-11 8341273 or 8341277; Fax: +27-11 833 8156 or 838 5923)

September 15–18

INDUSTRIAL MINERALS AND BUILDING STONES — IMBS 2003, Istanbul, Turkey. (Contact: Erdogan Yüzer, Maden fakültesi, Ayazaga KampÜsÜ, 80626 Maslak/Istanbul, Turkey. Tel/Fax: 90 212 285 61 46; E-mail: yuzer@itu.edu.tr)

September 15–19

GROUNDWATER IN FRACTURED ROCKS (International Conference of IAH), Prague, Czech Republic. (Contact: Jiri Krasny. E-mail: krasny@natur.cuni.cz)

September 17–19

SEDIMENTOLOGY (22nd Annual Meeting of the International Association of Sedimentology), Opatija, Croatia. (Contact: Davor Pavelic, IAS-2003, Institute of Geology, HR-10000 Zagreb, Sachsova 2, Croatia. Fax: +385 1 6144718; E-mail: dpavelic@yahoo.com; Website: www.igi.hr/ias2003)

September 21–24

AAPG INTERNATIONAL CONFERENCE EXHIBITION, "CROSSROADS OF GEOLOGY, ENERGY AND CULTURES", Barcelona, Spain. Sponsored by the American Association of Petroleum Geologists. (Contact: AAPG Convention Department, P.O. Box 979, tulsa, OK, 74101-0979, USA. Fax: +1-918-560-2684; E-mail: convene@aapg.org; Website: www.aapg.org/)

September 22–26

1ST INTERNATIONAL CONFERENCE — GROUNDWATER IN GEOLOGICAL ENGINEERING, Ljubljana, Slovenia. (Contact: Slovene Committee of IAH, Andrej Juren, Kebetova 24, SI-1000 Ljubjana, Slovenia. E-mail: andrej.juren@siol.net or Nadja Zalar, E-mail: nadja.zalar@siol.net; Website: http://www.iah.org)

September 28 – October 3

SOCIETY OF EXPLORATION GEOPHYSICISTS (73rd Annual Meeting and International Exposition), Dallas, Texas, USA. (Contact: SEG Business Office, Tel: +1-918 497 5500; Fax: +1-918 497 5500; Fax: +1-918 497 5557; Website: seg.org/)

October 4–9

AMERICAN INSTITUTE OF PROFESSIONAL GEOLOGISTS (40th Annual Meeting), Glenwood Springs, Colorado, USA. (Contact: Tom Fails, 4101 E. Louisiana #412, Denver, CO 80246. Tel: +1-303 759 9733; Fax: +1-303 759 9731; E-mail: thomgeol@aol.com; Website: www.aipg.org/www.aipg.org/)

October 5–8

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (International Conference & Exhibition), London, UK. (Contact: AAPG Convention Department, P.O. Box 979, Tulsa, OK 74101-0979, USA. Tel: +1-918 560 2679; E-mail: Website: www.aapg.org)

October 24–27

INTERNATIONAL SYMPOSIUM ON HYDROMETALLURGY — IN HONOR OF IAN RITCHIE, Vancouver, British Colombia, Canada. (Contact: Courtney Young. Fax: 406 496 4133; E-mail: cyoung@mtech.edu; Website: cms.tms.org)

November 2–5

GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Seattle, Washington, USA. (Contact: GSA Meetings Dept., P.O. Box 9140, Boulder, CO 80301-9140, USA. Tel: +1 303 447 2020; Fax: +1 303 447 1133; E-mail: meetings@geosociety.org; Website: http://www.geosociety.org/meeting/index.htm)

December 8–12

AMERICAN GEOPHYSICAL UNION (Fall Meeting), San Francisco, California, USA. (Contact: San Francisco, California, USA. (Contact: AGU Meetings Department, 2000 Florida Avenue, NW, Washington, DC 20009 USA. Tel: +1 202 462 6900; Fax: +1 202 328 0566; E-mail: meetinginfo@agu.org; Website: http://www.agu.org/meetings)

2004

January 14–16

ASIAN MARINE GEOLOGY (5th International Conference), Bangkok, Thailand. (Contact: Thanawat Jarupongsakul, Department of Geology, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand. Fax: +(662) 2185464-5; E-mail: thanawat@sc.chula.ac.th)

March 27 – April 4

NATIONAL EARTH SCIENCE TEACHERS ASSOCIATION (Annual Meeting), Atlanta, Georgia, USA. (Contact: NESTA, 2000 Florida Ave., N.W., Washington, D.C. 20009, USA. Tel: +1-202 462 69 10; Fax: +1-202 328 0566; E-mail: fireton@kosmos.agu.org)

April 18–21

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS AND SOCIETY FOR SEDIMENTARY GEOLOGY (SEPM) (Joint Annual Meeting and Exhibition), Dallas, Texas, USA. (Contact: AAPG Conventions Dept., P.O. Box 979, Tulsa, OK 74119, USA. Tel: +1-918 560 2679; Fax: 1-918 560 2684; E-mail: convene@aapg.org; Website: www.aapg.org)

May 17–21

AMERICAN GEOPHYSICAL UNION AND CANADIAN GEOPHYSICAL UNION (Joint Meeting), Montreal, Canada. (Contact: AGU Meetings Department, 2000 Florida Avenue, NW, Washington, DC 20009 USA. Tel: +1 202 462 6900; Fax: +1 202 328 0566; E-mail: meetinginfo@agu.org; Website: http://www.agu.org/meetings)

June 27 – July 2

WATER-ROCK INTERACTION (11th International Symposium), Saratoga Springs, New York, USA. (Contact: Dr. Susan Brantley, Secretary General, Dept. of Geosciences, The Pennsylvania State University, 239 Deike Building, University Park PA 16802, USA. Tel: +1-814 863 1739; Fax: +1-814 863 8724; Website: www.outreach.psu.edu/C&I/WRI/)

July 4–9

INTERNATIONAL PALYNOLOGICAL CONGRESS (11th), Granada, Spain. (Contact: Technical Secretary. E-mail: eurocongres@eurocongres.es; Website: www.ugr.es/~bioveg/)

August 20–28

INTERNATIONAL GEOLOGICAL CONGRESS (32nd), "The Renaissance of Geology", Florence, Italy. (Contact: Ms. Chiara Manetti, Universitàdegli Studi di Firenze, Dipartimento di Scienze della Terra, Via La Pira, 4, 50121 Firenze, Italy. Tel/Fax: +39-055 238 2146; E-mail: cmanetti@geo.unifi.it; To request the First Circular, send e-mail to: 32igc@32igc.org or visit the Congress Website: www.32igc.org)

August 27 – September 4

VLADIVOSTOK-2004 INTERIM IAGOD CONFERENCE (Metallogeny of the Pacific Northwest: Tectonics, Magmatism & Metallogeny of Active Continental Margins), Vladivostok, Khabararovsk, Magadan, Russian

Far East, Russia. (Contact: Russian National IAGOD Group, Federal Far East Geological Institute, Far Eastern Branch of Russian Academy of Sciences, 159, Prospekt 100-letiya, Vladivostok, 690022, Russia. Tel: 7(4232)31-87-50; Fax: 7(4232)31-78-47; E-mail: iagodconf@fegi.ru or fegi@online.marine.su; Website: http://www.fegi.ru/IAGOD/index.htm)

September 11–19

TECTONICS, MAGMATISM AND METALLOGENY OF ACTIVE CONTINENTAL MARGINS (Interim International Conference on Metallogeny of the Pacific Northwest), Vladivostok, Russia. Sponsored by the Russian Academy of Sciences and The Society of Economic Geologists. (Contact: Far East Geological Institute, Far Eastern Branch of Russian Academy of Sciences, 159, Prospekt 100-letiya, Vladivostok, 690022 Russia. Tel: +7(4232)31-87-50; Fax: +7(4232)31-78-47; E-mail: iagodconf@fegi.ru or fegi@online.marine.su; Website: http://www.fegi./ru/IAGOD/)

September 15–17

SEDIMENTOLOGY (23rd Annual Meeting of the International Association of Sedimentology), Coimbra, Portugal. (Contact: Rui Pena dos Reis, uiversidade de Coimbra, Dpto. Ciências da Terra, Largo Marquês de Pombal, 3014 Coimbra, Portugal; E-mail: penareis@ci.uc.pt)

October 10–15

SOCIETY OF EXPLORATION GEOPHYSICISTS (74th Annual Meeting and International Exposition), Denver, Colorado, USA. (Contact: Debbi Hyer, 8801 S. Yale, Tulsa, OK 74137, USA. Tel: (+1-918) 497 5500; E-mail: dhyer@seg.org; Website: meeting.seg.org)

November 7–10

GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Denver, Colorado, USA. (Contact: GSA Meetings Dept., P.O. Box 9140, Boulder, CO 80301-9140, USA. Tel: +1 303 447 2020; Fax: +1 303 447 1133; E-mail: meetings@geosociety.org; Website: http://www.geosociety.org/meetings/index.htm)

December 13–17

AMERICAN GEOPHYSICAL UNION (Fall Meeting), San Francisco, California, USA. (Contact: AGU Meetings Department, 2000 Florida Avenue, NW, Washington, DC 20009 USA; Tel: +1 202 462 6900; Fax: +1 202 328 0566; E-mail: meetinginfo@agu.org; Website: http://www/agu.org/meetings).

GEOLOGICAL SOCIETY OF MALAYSIA PUBLICATIONS

Bulletin 1 (Feb 1968). 79 p. Studies in Malaysian Geology. Edited by P.H. Stauffer. A collection of papers presented at a meeting of the Geological Society on 31st January 1967. **Out of Stock**.

Bulletin 2 (Dec 1968). 152 p. Bibliography and Index of the Geology of West Malaysia and Singapore by D.J. Gobbett. Price: RM5.00.

Bulletin 3 (Mar 1970). 146 p. Papers in Geomorphology and Stratigraphy (with Bibliography supplement). Edited by P.H. Stauffer. Price: RM5.00.

Bulletin 4 (Jun 1971). 100 p. Papers in Petrology, Structure and Economic Geology. Edited by P.H. Stauffer. Price: RM5.00.

Bulletin 5 (Feb 1973). 70 p. The Search for Tungsten Deposits by K.F.G. Hosking. Price: RM5.00.

Bulletin 6 (Jul 1973). 334 p. Proceedings, Regional Conference on the Geology of Southeast Asia. A collection of papers, Kuala Lumpur, March, 1972. Edited by B.K. Tan. Price: RM5.00.

Bulletin 7 (Jun 1974). 138 p. A collection of papers on geology. Edited by B.K. Tan. Price: RM5.00.

Bulletin 8 (Dec 1977). 158 p. A collection of papers on geology. Edited by T.T. Khoo. Price: RM5.00.

Bulletin 9 (Nov 1977). 277 p. The relations between granitoids and associated ore deposits of the Circum-Pacific region. IGCP Circum-Pacific Plutonism Project Fifth Meeting. 12-13 November 1975, Kuala Lumpur. Edited by J.A. Roddick & T.T. Khoo. **Out of stock**.

Bulletin 10 (Dec 1978). 95 p. A collection of papers on the geology of Southeast Asia. Edited by C.H. Yeap. **Out of stock**.

Bulletin 11 (Dec 1979). 393 p. Geology of Tin Deposits. A collection of papers presented at the International Symposium of 'Geology of Tin Deposits', 23-25 March 1978, Kuala Lumpur. Edited by C.H. Yeap. Price: RM20.00.

Bulletin 12 (Aug 1980). 86 p. A collection of papers on geology. Edited by G.H. Teh. **Out of stock**.

Bulletin 13 (Dec 1980). 111 p. A collection of papers on geology of Malaysia and Thailand. Edited by G.H. Teh. Price: RM5.00.

Bulletin 14 (Dec 1981). 151 p. A collection of papers on geology of Southeast Asia. Edited by G.H. Teh. **Out of stock**.

Bulletin 15 (Dec 1982). 151 p. A collection of papers on geology. Edited by G.H. Teh. Price: RM10.00.

Bulletin 16 (Dec 1983). 239 p. A collection of papers on geology. Edited by G.H. Teh. Price: RM10.00.

Bulletin 17 (Dec 1984). 371 p. A collection of papers on geology. Edited by G.H. Teh. Price: RM10.00.

Bulletin 18 (Nov 1985). 209 p. Special Issue on Petroleum Geology. Edited by G.H. Teh & S. Paramananthan. Price: RM15.00.

Bulletins 19 (Apr 1986) **& 20** (Aug 1986). GEOSEA V Proceedings Vols. I & II, Fifth Regional Congress on Geology, Mineral and Energy Resources of SE Asia, Kuala Lumpur, 9-13 April 1984. Edited by G.H. Teh & S. Paramananthan. Price for both Bulletins 19 & 20: Members: RM30.00; Non-Members: RM60.00.

Bulletin 21 (Dec 1987). 271 p. Special Issue on Petroleum Geology Vol. II. Edited by G.H. Teh. Price: RM20.00.

Bulletin 22 (Dec 1988). 272 p. Special Issue on Petroleum Geology Vol. III. Edited by G.H. Teh. Price: RM20.00.

Bulletin 23 (Aug 1989). 215 p. A collection of papers on the geology of Malaysia, Thailand and Burma. Edited by G.H. Teh. Price: RM10.00.

Bulletin 24 (Oct 1989). 199 p. A collection of papers presented at GSM Annual Geological Conference 1987 and 1988. Edited by G.H. Teh. Price: RM10.00.

Bulletin 25 (Dec 1989). 161 p. Special Issue on Petroleum Geology Vol. IV. Edited by G.H. Teh. Price: RM20.00.

Bulletin 26 (Apr 1990). 223 p. A collection of papers presented at GSM Annual Geological Conference 1989 and others. Edited by G.H. Teh. Price: RM10.00.

Bulletin 27 (Nov 1990). 292 p. Special Issue on Petroleum Geology Vol. V. Edited by G.H. Teh. Price: RM20.00.

Bulletin 28 (Nov 1991). 292 p. Special Issue on Petroleum Geology Vol. VI. Edited by G.H. Teh. Price: RM20.00.

Bulletin 29 (Jul 1991). 255 p. A collection of papers presented at GSM Annual Geological Conference 1990 and others. Edited by G.H. Teh. Price: RM10.00.

Bulletin 30 (Apr 1992). 90 p. Annotated bibliography of the geology of the South China Sea and adjacent parts of Borneo by N.S. Haile. Edited by G.H. Teh. Price: RM10.00

Bulletin 31 (Jul 1992). 176 p. A collection of papers presented at GSM Annual Geological Conference 1991 and others. Edited by G.H. Teh. Price: RM10.00.

Bulletin 32 (Nov 1992). 283 p. Special Issue on Petroleum Geology Vol. VII. Edited by G.H. Teh. Price RM30.00.

Bulletin 33 (Nov 1993). 419 p. Proceedings Symposium on Tectonic Framework and Energy Resources of the Western Margin of the Pacific Basin. Edited by G.H. Teh. Price: RM40.00.

Bulletin 34 (Dec 1993). 181 p. Bibliography and Index — Publications of the Geological Society of Malaysia 1967-1993. Compiled by T.F. Ng. Edited by G.H. Teh. Price: RM20.00.

Bulletin 35 (Jul 1994). 174 p. A collection of papers presented at GSM Annual Geological Conference 1992 & 1993. Edited by G.H. Teh. Price: RM20.00.

Bulletin 36 (Dec 1994). 186 p. Special issue on Petroleum Geology Vol. VIII. Edited by G.H. Teh. Price: RM50.00.

Bulletin 37 (Jul 1995). 506 p. Proceedings AAPG-GSM International Conference 1994. Southeast Asian Basins: Oil and Gas for the 21st Century. Edited by G.H. Teh. Price: RM60.00.

Bulletin 38 (Dec 1995). 190 p. A collection of papers presented at GSM Annual Geological Conference 1994 and others. Edited by G.H. Teh. Price: RM30.00.

Bulletin 39 (Jul 1996). 258 p. Papers from Petroleum Geology Conference 1995, Annual Geological Conference 1995 and others. Edited by G.H. Teh. Price: RM50.00.

Bulletin 40 (Jul 1997). 247 p. A collection of papers presented at GSM Annual Geological Conference 1996 and others. Edited by G.H. Teh. Price: RM30.00.

Bulletin 41 (Dec 1997). 165 p. Papers from Petroleum Geology Conference 1996 and others. Edited by G.H. Teh. Price: RM50.00.

Bulletin 42 (Dec 1998). 268 p. Papers from Petroleum Geology Conference 1997, Seminar on Tertiary Basins of Peninsular Malaysia and others. Edited by G.H. Teh. Price: RM50.00.

Bulletin 43 (Dec 1999). 698 p. Papers from GEOSEA '98 (Ninth Regional Congress on Geology, Mineral and Energy Resources of Southeast Asia). Edited by G.H. Teh. Price: RM70.00.

Bulletin 45 (May 2002). 375 p. Annual Geological Conference 2002 Conference Issue. Edited by G.H. Teh, Ismail Yusoff, Azman Abdul Ghani & T.F. Ng. Price: RM50.00.

Field Guide 1 (1973). 40 p. A 7-day one thousand mile, geological excursion in Central and South Malaya. By C.S. Hutchison. **Out of stock**.

Abstracts of papers (1972). Regional Conference on the Geology of Southeast Asia, Kuala Lumpur, 1972. 64 p. 8 figs, 3 tables, many extended abstracts. Edited by N.S. Haile. Price: RM2.00.

Proceedings of the Workshop on Stratigraphic Correlation of Thailand and Malaysia Vol. 1. (1983). 383 p. Technical Papers. Price: Member: RM5.00; Non-member: RM15.00.

WARTA GEOLOGI (Newsletter of the Geological Society of Malaysia). Price: RM5.00 per bimonthly issue from July 1966.

Geological Evolution of Southeast Asia (1996) (Reprinted Edition) by C.S. Hutchison. 368 p. Price: Member: RM50.00; Non-member: RM100.00; Student: RM30.00.

Common Rocks of Malaysia (Colour Poster). Price: Member: RM8.00; Non-member: RM10.00; Student: RM7.00.

Malaysian Stratigraphic Guide (Dec 1997). 30 p. Price: Member: RM5.00; Non-Member: RM10.00; Student Member: RM2.00.

Proceedings Annual Geological Conference 2000. 435 p. Edited by G.H. Teh, Joy J. Pereira and T.F. Ng. Price: RM60.00.

Proceedings Annual Geological Conference 2001. 320 p. Edited by G.H. Teh, Mohd. Shafeea Leman and T.F. Ng. Price: RM50.00.

CD-Rom — Geology of Borneo Island (2001). Compiled by Robert B. Tate. Price: RM60.00.

PACKAGE DEAL A: General Geology/Malaysian Geology
Bulletins 3, 4, 7, 15, 16, 17, 24, 26, 29, 31 (10 books)
Member: RM60.00 — Student Member: RM40.00
Non-member: RM75.00 — Student Non-member: RM50.00

PACKAGE DEAL B: Bibliography
Bulletins 2, 30, 34 (3 books)
Member: RM20.00 — Student Member: RM10.00
Non-member: RM25.00 — Student Non-member: RM15.00

PACKAGE DEAL C: Southeast Asia
Bulletins 6, 13, 19 & 20, 23, 33, Strati. Correl. (7 books)
Member: RM60.00 — Student Member: RM40.00
Non-member: RM100.00 — Student Non-member: RM50.00

PACKAGE DEAL D: Petroleum Geology
Bulletins 18, 21, 22, 25, 27, 28, 32 (7 books)
Member: RM120.00 — Student Member: RM80.00
Non-member: RM150.00 — Student Non-member: RM100.00

PACKAGE DEAL E: Economic Geology
Bulletins 5, 11 (2 books)
Member: RM15.00 — Student Member: 5.00
Non-member: RM20.00 — Student Non-member: 10.00

PACKAGE DEAL 1: Bulletins 2, 3, 4, 5, 6, 7, 8, 11 (8 books)
Member: RM30.00 — Student Member: RM15.00
Non-member: RM40.00 — Student Non-member: RM25.00

PACKAGE DEAL 2: Bulletins 13, 15, 16, 17, 18 (5 books)
Member: RM30.00 — Student Member: RM15.00
Non-member: RM40.00 — Student Non-member: RM25.00

PACKAGE DEAL 3: Bulletins 19, 20, Strati. Correl. (3 books)
Member: RM30.00 — Student Member: RM20.00
Non-member: RM60.00 — Student Non-member: RM30.00

PACKAGE DEAL 4: Bulletins 21, 22, 23, 24, 25 (5 books)
Member: RM40.00 — Student Member: RM20.00
Non-member: RM60.00 — Student Non-member: RM30.00

PACKAGE DEAL 5: Bulletins 26, 27, 28, 29, 30 (5 books)
Member: RM40.00 — Student Member: RM20.00
Non-member: RM60.00 — Student Non-member: RM30.00

PACKAGE DEAL 6: Bulletins 31, 32, 33, 34, 35 (5 books)
Member: RM60.00 — Student Member: RM30.00
Non-member: RM100.00 — Student Non-member: RM40.00

All prices quoted are not inclusive of postage. Please write in for details on postage. Allow 8-10 weeks for delivery.

For orders, please write to the Society and you will be invoiced.

Cheques, money orders or bank drafts must accompany all orders.

Orders should be addressed to:

The Hon. Assistant Secretary
Geological Society of Malaysia,
c/o Dept. of Geology, University of Malaya,
50603 Kuala Lumpur,
MALAYSIA.
Tel: 603-79577036, Fax: 603-79563900, e-mail: geologi@po.jaring.my

ORDER FORM

GEOLOGICAL SOCIETY OF MALAYSIA PUBLICATIONS

Date: .....

The Assistant Secretary,
Geological Society of Malaysia,
c/o Department of Geology,
University of Malaya,
50603 Kuala Lumpur,
MALAYSIA

Dear Sir,

Please send me the following publications. I enclose US$/RM*..... in cheque/money order/bank draft.*

Item	No. of Copies	Price

Total: _____

Signature: _____

*Delete where applicable

Please mail to : _____

(Please print) _____

_____

_____

_____

GEOLOGICAL SOCIETY OF MALAYSIA PUBLICATIONS

General Information

Papers should be as concise as possible. However, there is no fixed limit as to the length and number of illustrations. Normally, the whole paper should not exceed 30 printed pages. The page size will be 204 x 280 mm (8 x 11 inches).

The final decision regarding the size of the illustrations, sections of the text to be in small type and other matters relating to printing rests with the Editor.

The final decision of any paper submitted for publication rests with the Editor who is aided by a Special Editorial Advisory Board. The Editor may send any paper submitted for review by one or more reviewers. Authors can also include other reviewers' comments of their papers. Scripts of papers found to be unsuitable for publication may not be returned to the authors but reasons for the rejection will be given. The authors of papers found to be unsuitable for publication may appeal only to be Editor for reconsideration if they do not agree with the reasons for rejection. The Editor will consider the appeal together with the Special Editorial Advisory Board.

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

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

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

One set of proofs will be sent to the author (if time permits), to be checked for printer's errors. In the case of two or more authors, please indicate to whom the proofs should be sent.

Twenty-five reprints of each article published are supplied free-of-charge. Additional reprints can be ordered on a reprint order form, which is included with the proofs.

Correspondence: All papers should be submitted to

The Editor (Dr. Teh Guan Hoe)
Geological Society of Malaysia
c/o Geology Department
University of Malaya
50603 Kuala Lumpur
MALAYSIA
Tel: (603) 7957 7036 Fax: (603) 7956 3900

Script Requirements

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

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

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

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

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

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

References cited in the text should be listed at the end of the paper and arranged in alphabetical order and typed double-spaced. The name of the book or journal must be in *italics*. The references should be quoted in the following manner:

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

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

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

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

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

Submission of electronic text. In order to publish the paper as quickly as possible after acceptance, authors are requested to submit the final text also on a 3.5" diskette. Both Macintosh and PC (DOS/Windows) platforms are supported. Main text, tables and illustrations should be stored in separate files with clearly identifiable names. Text made with most word processors can be readily processed but authors are advised to provide an additional copy of the text file in ASCII format. Preferred format for illustration is Encapsulated PostScript (EPS) but authors may submit graphic files in their native form. It is essential that the name and version of softwares used is clearly indicated. The final manuscript may contain parts (e.g. formulae, complex tables) or last-minute corrections which are not included in the electronic text on the diskette; however, this should be clearly marked in an additional hardcopy of the manuscript. Authors are encouraged to ensure that apart from any such small last-minute corrections, **the disk version and the hardcopy must be identical**. Discrepancies can lead to proofs of the wrong version being made.

PP 2509/2/2004 ISSN 0126-5539

WARTA GEOLOGI PERSATUAN GEOLOGI MALAYSIA

Newsletter of the Geological Society of Malaysia

Jilid 29, No. 3 • Volume 29, No. 3 • May–June 2003

KANDUNGAN (Contents)

CATATAN GEOLOGI (Geological Notes)

PERTEMUAN PERSATUAN (Meetings of the Society)

BERITA-BERITA PERSATUAN (News of the Society)

BERITA LAIN (Other News)

Cover photo: Pattern of rock weathering, North-South Expressway, Machap-Sedenak, Johor by Tan Boon Kong

Published by the GEOLOGICAL SOCIETY OF MALAYSIA
Department of Geology, University of Malaya, 50603 Kuala Lumpur, MALAYSIA
Tel: 603-7957 7036 Fax: 603-7956 3900 E-mail: geologi@po.jaring.my