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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.

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CATATAN GEOLOGI
Geological Notes

On the trail of Hang Tuah's footprint

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17, Orange St., Eastwood 2122
Australia

Abstract: The so-called Hang Tuah's footprint in a quartz vein at Cape Rachado, Port Dickson, is a solution cavity.

The stories of Hang Tuah and Zheng He (in modern *pinyin* but locally spelled as Cheng Ho) have fascinated and triggered the imagination of generations of Malaysians. These 15th century celebrities had not only left their marks on the pages of Malaysian history but their more avid fans believe that they had also left more permanent impressions as footprints on Malaysian rocks. At Cape Rachado, near Port Dickson, Hang Tuah was supposed to have left a footprint and it was reported in the Sunday Star (30th March 1986) that Zheng He had left even bigger footprints, one at Batu Maung (in granite), near the Penang International Airport and one in Langkawi (exact location not mentioned). The sites of these footprints are places of worship for believers, however misplaced as this note will attempt to show. Here, I shall only focus on the so-called Hang Tuah's footprint as I have made visits there over a period of more than 10 years when I had the opportunity of using the facilities of a nearby resort.

It is noted in the Sunday Star report mentioned above that good luck will be bestowed on the person lighting candles at the Batu Maung site. At the Cape Rachado site believers have also lit red candles on the rock where the so-called footprint is located. On one occasion I have seen the sacrifice of two live white goats. The prosperity of the Cape Rachado site fluctuates. It can be quite deserted with troops of monkeys scampering over the outcrop where the footprint is located and playfully waiting for the company of tourists. The site also has permanent shelters. A Chinese wok installed over a stove there is of the size seen in Chinese tin mines able to cater for 100 workers in one sitting indicating the site is well equipped for boom time.

I am as yet uncertain what sort of favours are solicited by the devotees. As Hang Tuah, a Lakxamana in 15th century Malacca, had a reputation for bravery and skills in combat, it is possible that the devotees believe the spirit of Hang Tuah could be prevailed upon to remove evil influences, if any, in the way of whatever is desirable. Also, according to the *Sejarah Melayu* (Malay Annals), Hang Tuah was a sort of 15th century sex icon who made such a favourable impression in Majapahit (Java) that *'wives and maidens alike were all a-flutter at the sight of the Lakxamana'* and *'such was the passion of the women of Majapahit for the Laksamana'* that they were advised to take sireh *'to allay the pangs of whole day's love'* (*Sejarah Melayu*, p. 69–70, translated by Brown, 1970). Perhaps this fact (or fiction) is also tantalizing to the gallants among the devotees. Appreciation of any perceived divine intervention in the gaining of wealth or assistance in acts of chivalry could have resulted in the sacrifices mentioned earlier and no doubt to be followed by the woking up of feasts at the site.

Geologists are familiar with the preservation as molds or casts of fossil footprints and tracks in soft sediments which have subsequently lithified. Fossil human footprints are also known in the literature and Figure 1 shows a 5,000 years old footprint of a barefooted early Australian in Holocene littoral dolomitic mudstone in South Australia (Belperio *et al.*, 1990). However, the so-called Hang Tuah's footprint is not so convincing. It is a hole in a hard quartz vein outcrop slightly less than 2 m thick (Fig. 2). The shape of the hole is not evident unless it is filled with water. Tourist guides routinely obtain water from drums of rain water nearby and pour it into the hole for the purpose. Pouring cold water over the myth is evidently not sacrilegious. The outline of the hole resembles that of a human wearing some kind of footwear owing to the absence of toes. Compared to the petit Size 6 in Figure 2, the footprint is estimated to be Size 10–12 befitting someone the stature of Hang Tuah perhaps. Unlike the soft sediment treaded upon by the early Australian whose footprint appears in Figure 1, any footprint to be so impressed on the hard quartz vein would require the quartz to be pulverized underfoot up to a depth of about 10 cm. This is not possible unless in the realm of *kung-fu* fantasy.

The hole in the quartz vein is a solution cavity. Twidale (1982) has given a very detailed account of the development of solution cavities in hard rocks like granites which are generally considered to be almost insoluble. The rocks are soluble albeit more slowly than the more familiar limestone. Solution cavities come in all shapes and sizes and they can develop anywhere in the rock where water persistently accumulate. Potholes like those developed in syenite-monzonite in Jeram Besu, Benta are solution cavities and deeper potholes which are cylindrical are called chimneys like those developed in granite at Telaga Tujuh waterfall, Langkawi. The upper waterfall behind the Merbok Museum, Kedah has a solution cavity in granite which has the shape and depth of a modern bath tub with fresh water flowing in at one end and out at the other (naturally, a favourite wallowing hole of the author!). Abrasion by sediments has little to even no role in the deepening of the solution cavities as is evident from the development of the rock chimneys. At Telaga Tujuh, one of the chimneys filled to the brim with water has a diameter of about 2 m and a depth of more than 5 m. Water at a depth of 2 m or more in the vertical chimney is dead still and sediments at the bottom rest in peace. Any deepening is clearly by solution and not abrasion.

Given that solution cavities can be of every possible shapes it will not be difficult to find other occurrences of the so-called footprints. Figure 3 is one such 'footprint' developed in granitic rock which the author chanced upon while doggedly rambling under the midday sun.

The recognition of the footprint to be a solution cavity adds to the list of geological features worshipped by some people in Malaysia. Exfoliated slabs of granite and weathering remains of granitic rocks, inselbergs and menhirs, in parts of Negeri Sembilan and Malacca, were and still are objects of worship and reverence. Peculiarly shaped dripstone deposits bearing some resemblance to the elephantine *Ganesha* and boulders of somewhat

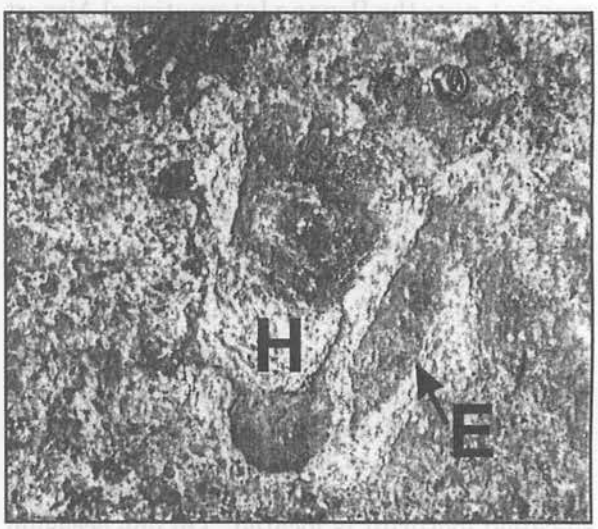

Figure 1. Holocene fossil footprint of an early Australian (H) overprinting footprint of an emu (E). Figure is from Belperio *et al.* (1990).

Figure 2. The so-called Hang Tuah's footprint in quartz vein at Cape Rachado, Port Dickson. W, patch of red candle wax beside the cavity.

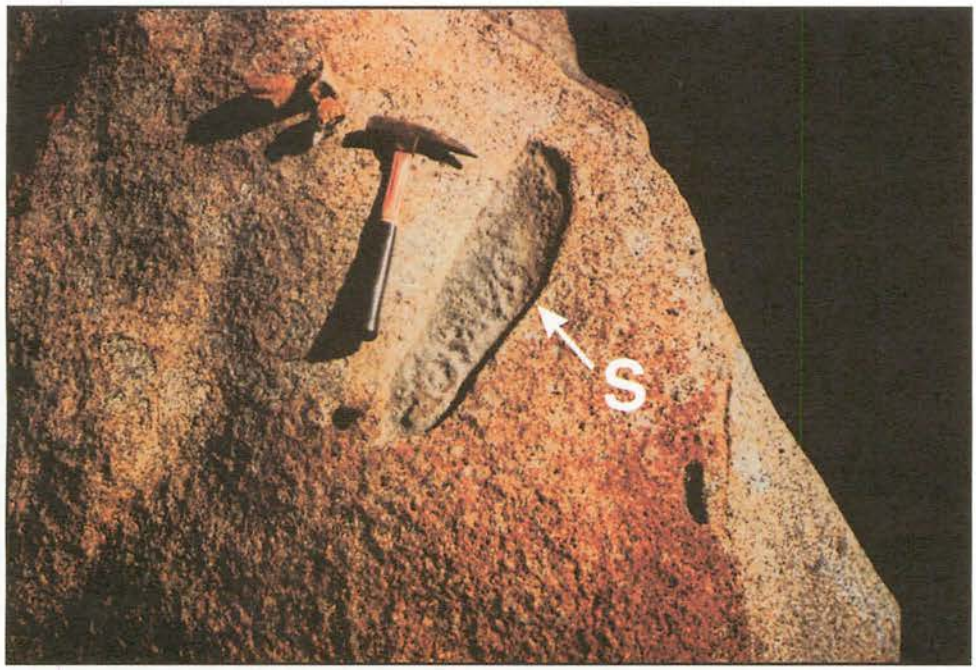

Figure 3. Solution cavity (S) developed in granite, Moruya, south coast New South Wales, Australia. Cavity fortuitously resembles a human footprint.

phallic appearance and thereby resembling the *linga* have also been worshipped as evidenced by offerings left at these features.

Solution cavities like the so-called Hang Tuah's footprint will predictably become bigger and deeper with time especially if tourist guides continue to religiously keep the hole filled to the brim with water. This predictable development will likely seed the further myth that the footprint is '**alive**' and therefore ought to be even more potent in answering to the wishes of the devotees. A myth like this especially if propagated with some success stories will quickly spread far and wide and no doubt the wok there will not see any rusty days in the aftermath. A myth like this usually and incredibly will have a long currency notwithstanding this article.

ACKNOWLEDGEMENTS

I am grateful for the use of facilities of the Department of Geology, University of Malaya to write this note. Staff of the Department of Applied Geology, University of New South Wales are thanked for the field visit to Moruya.

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PERTEMUAN PERSATUAN
Meetings of the Society

Ceramah Teknik (Technical Talk)

Malam Jurutera III , May 15th 2002, University of Malaya — Report

Landslides & remedial measures in the Johor Baru area

GUE, S.S.

Jet grouting for dam cut-off

OOI, L.H.

Some aspects of rock mass classification in geotechnical engineering in Malaysia

TING, W.H.

Three eminent geotechnical consultants gave talks to members of the Society during this "Malam" event.

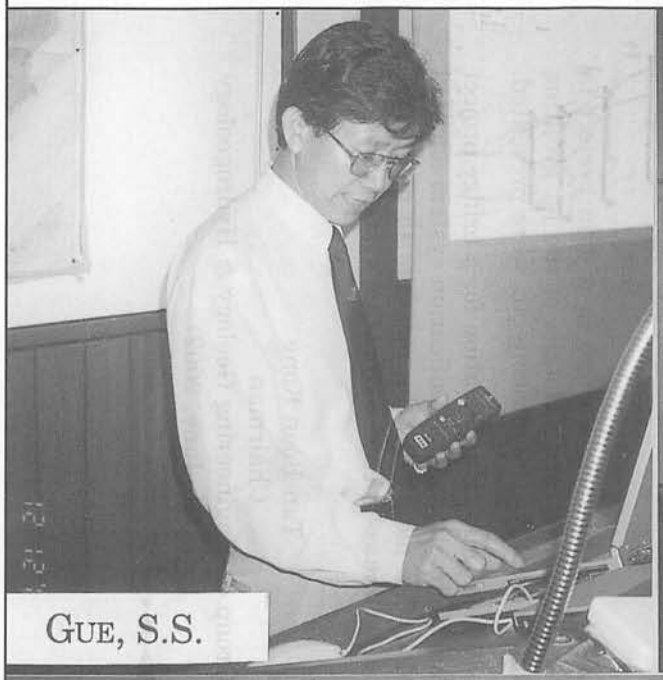
Dr. Gue presented a case study on landslide and remedial measures in the Johor Baru area. The materials involved were residual soils of gabbro. Causes of slope failures include some soft materials in the slope, steep slope and high water table. The remedial measures involved anchored contiguous bored piles.

Dr. Ooi gave a comprehension account of jet grouting for a ridge in a dam project in Kelantan, to reduce seepage losses through the ridge concerned. Details of the jet grouting operations, including materials, instrumentation, procedures, monitoring etc. were presented.

Dr. Ting presented a case study on the use of rock mass classification for a bridge project in Sarawak. In addition to grades of weathering, the rock mass classification system adopted must yield quantitative data for the design of bridge piers — the message to geologists: quantification of "numbers" needed for whatever rock mass/rock classification system adopted for it to be useful to engineers!

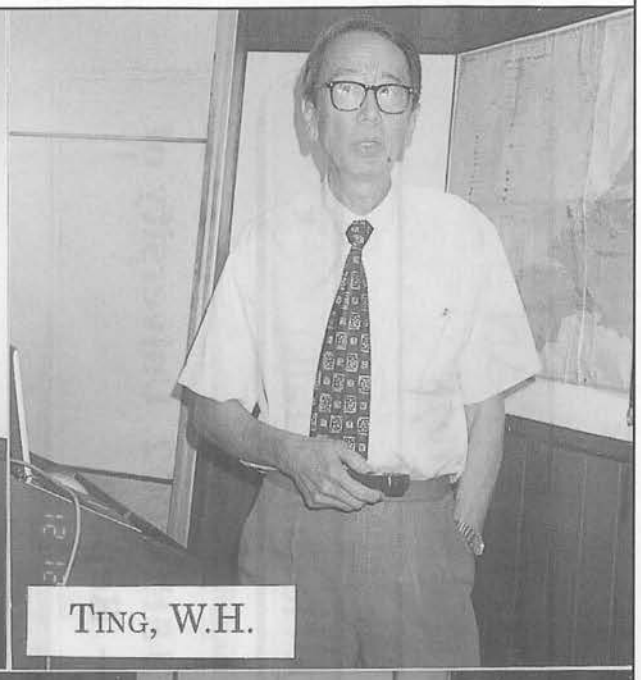
Tan Boon Kong
Chairman
Working Group on Engineering Geology & Hydrogeology
(11th June, 2002)

Malam Jurutera III



GUE, S.S.

OOI, L.H.



TING, W.H.

Annual Geological Conference 2002

Renaissance Hotel
Kota Bharu, Kelantan
26–27 May 2002

✻✻ Laporan ✻✻

Persidangan Tahunan Persatuan Geologi 2001 kali ke-16 telah diadakan dengan jayanya pada 26-27 May 2002 bertempat di Hotel Renaissance, Kota Bharu, Kelantan.

Persidangan kali ini telah disertai oleh 168 peserta terutamanya dari institusi pengajian tinggi awam dan pihak swasta. Penaja utama persidangan terdiri daripada Kerajaan Negeri Kelantan, Malaysia Mining Corporation, Specific Resources Berhad dan Soils & Foundations Sdn. Bhd. Perasmian persidangan telah disempurnakan oleh Y.A.B. Tuan Guru Dato' Nik Abdul Aziz Nik Mat, Menteri Besar Kelantan pada pagi Ahad, 26 May 2002. Beliau juga turut hadir untuk majlis makan malam anjuran Kerajaan Negeri pada 26 May 2002.

Persidangan kali ini berjaya memuatkan sebanyak 58 kertas persidangan di mana 28 kertas dibentangkan secara lisan dan 30 kertas secara poster. Persembahan kertas "Keynote" dilakukan oleh Prof. John Kuna Raj berkenaan hakisan tanah dan pengurangan aliran dasar sungai di beberapa sungai di Cameron Highlands. Ini bersesuaian dengan tema persidangan kali ini yang bertajuk "Geoscience for the betterment of environmental stewardship in Malaysia". Kertas persidangan juga meliputi semua aspek berkaitan geologi dan dipecahkan kepada lima sesi teknikal dan dua sesi poster.

Beberapa kelainan terdapat pada Persidangan Tahunan tahun ini. Buat pertama kalinya Menteri Besar hadir dalam kedua-dua majlis persatuan; majlis perasmian dan majlis makan malam. Menteri besar juga bersetuju memberikan sedikit tazkirah kepada peserta selepas majlis makan malam yang diadakan. Persidangan kali ini juga turut memendekkan masa persidangan di sebelah petang. Ini dilakukan bertujuan untuk membolehkan para peserta bersama keluarga mereka menikmati suasana percutian di Kelantan. Kebanyakkan keluarga peserta menggunakan peluang ini sebaik mungkin. Kita juga menerima seorang peserta dari negara Iran, Dr. Abdullah Taheri yang turut membentangkan sebuah kertas berkenaan kajian air tanah dalam batuan keras di Iran. Prosiding persidangan tahun ini juga telah ditukar nama kepada "Bulletin" memandangkan kesemua kertas yang dimuatkan adalah kertas penuh yang melalui beberapa saringan sebelum diterima untuk diterbitkan. Bulletin tahun ini dijilidkan sebagai "Bulletin 45 (May 2002)". Usaha ini telah meningkatkan imej persatuan kepada lebih profesional dan bertanggungjawab.

Secara amnya, persidangan berjalan dengan lancar. Walaubagaimana pun terdapat sebahagian besar peserta menghadapi masalah penghadaman. Pihak hotel telah diberitahu dan mereka telah menjalankan siasatan. Hasilnya, seperti telah diduga, mereka mengatakan tiada sebarang perlanggaran peraturan penyediaan makanan berlaku dan memohon maaf atas kejadian tersebut.

Bagi pihak penganjur, secara keseluruhannya persidangan kali ini berjaya menarik penyertaan ramai peserta dan dapat dilakukan seperti yang dijadualkan. Kepada kesemua ahli jawatankuasa diucapkan syabas dan terima kasih.

Dr. Ismail Yusoff
Pengerusi Pengajur
Persidangan Tahunan Persatuan Geologi Malaysia 2002

Annual Geological Conference 2002

Renaissance Hotel
Kota Bharu, Kelantan
26–27 May 2002

** Ucapan oleh Dr. Ismail Yusoff, Pengerusi Penganjur AGC 2002 **

Bismillaahirrahmaanirrahim

Assalamu'alaikum warahmatullah hiwabarakatuh

Selamat pagi dan salam sejahtera

Yang saya muliakan saudara pengerusi majlis

Yang saya hormati lagi kasihi Yang Amat Berhormat Dato' Nik Abdul Aziz Nik Mat, Menteri Besar Kelantan Darul Naim, terima kasih kerana sudi meluangkan masa pada pagi ini

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

Yang Berusaha En Yunus Abdul Razak, Timbalan Ketua Pengarah, Jabatan Mineral dan Geosains Malaysia

Yang saya hormati Para Pegawai Kanan Kerajaan Persekutuan dan Negeri

Yang saya raikan para peserta persidangan dan para hadirin sekelian

Selamat Datang ke Persidangan Tahunan Geologi 2002 dan Selamat Datang ke negeri Cik Siti Wan Kembang.

Persidangan Tahunan Geologi 2002 Kota Bharu ini adalah merupakan salah satu daripada siri persidangan tahunan Persatuan Geologi Malaysia yang diadakan semenjak tahun 1986. Persidangan tahun ini merupakan persidangan tahunan yang ke 16. Persatuan Geologi Malaysia terlibat secara langsung dalam mempromosikan kepentingan dan keperluan mempelajari bidang geosains khasnya kepada para pelajar sekolah, penuntut universiti dan amnya kepada orang awam di Malaysia.

Tema persidangan kali ini berbunyi *"Geoscience for the betterment of environmental stewardship in Malaysia"* atau dalam bahasa melayunya boleh diterjemahkan sebagai *"Geosains untuk memperelokan / mempertingkatkan pengelolaaan alam sekitar di Malaysia"*. Tema ini adalah kesinambungan daripada dua persidangan yang diadakan di Pulau Pinang pada tahun 2000 dan di Pulau Pangkor, Perak pada tahun 2001.

Memandangkan negara kita Malaysia sedang berusaha untuk menjadi sebuah negara maju menjelang tahun 2020, suatu perancangan peringkat nasional perlu diatur untuk mengatasi sebarang masalah pengelolaan alam sekitar yang boleh timbul akibat pembangunan yang tidak terkawal dan tidak bersifat mesra alam.

Sebarang gangguan kepada bumi kita ini jika dilakukan tanpa kajian yang mendalam akan megakibatkan masalah kepada penduduk dan generasi baru di Malaysia pada masa akan datang. Masalah bencana alam seperti banjir kilat, tanah runtuh, pencemaran sungai dan

tiadanya bekalan air bersih sudah terlalu hampir dengan kita dan mungkin menjadi suatu aspek biasa dalam hidup penduduk Malaysia di masa akan datang.

Jesteru itu, persidangan ini bertujuan membolehkan para ahli geosains mengenegahkan penemuan saintifik dan pengalaman mereka dan meletakkan keperluan ahli geosains sebagai salah satu aset penting dalam mengelola masalah alam sekitar negara.

Dalam persidangan tahun ini, terdapat 5 sesi pembentangan teknikal secara lisan dan 2 pembentangan secara poster. Sebanyak 58 kertas persidangan akan dibentangkan. Kita berasa bertuah kerana pada persidangan tahun ini, adanya penyertaan dari Negara Iran, saudara Dr. Abdullah Taheri, beliau adalah seorang hidrogeologist dan akan membentangkan hasil kajian beliau tentang sumber air tanah dalam batuan keras di Iran. Satu kerjalapangan selepas persidangan juga diaturkan. Saya selaku Pengerusi Penganjur Persidangan memohon maaf kerana kerja lapangan ini tidak melibatkan lawatan ke Selatan Thailand seperti yang dirancangkan kerana terdapat beberapa masalah terutama dari segi kerjasama dengan pihak Persatuan Geologi Thailand. Kerja lapangan sebelum persidangan juga terpaksa dibatalkan atas sebab-sebab yang tidak dapat dielakkan.

Kelainan yang terdapat dalam persidangan tahunan tahun ini adalah sesi pembentangan teknikal di sebelah petang dipendekkan. Ini dilakukan bagi mebolehkan para peserta persidangan menikmati keindahan negeri Cik Siti Wan Kembang ini bersama keluarga. Banyak tempat menarik yang boleh dikunjungi. Pihak hotel juga menyediakan perkhidmatan bas ke Pusat Bandar. Kelantan juga terkenal sebagai pentas Politik terbuka di Malaysia. Saya sebagai anak Kelantan berasa bangga dengan kemajuan negeri ini di bawah pimpinan YAB Dato' Nik Aziz. Syabas Tok Guru!

Akhir sekali, saya ingin merakamkan ucapan terima kasih sekali lagi kepada YAB Dato Menteri Besar, para peserta persidangan dan para hadirin sekelian atas kerjasama yang diberikan dalam menjayakan Persidangan Tahunan Persatuan Geologi Malaysia 2002, Kota Bharu. Kepada kesemua ahli jawatankuasa penganjur, saya ucapkan ribuan terima kasih kerana membantu saya menganjurkan persidangan tahun ini yang julung kali diadakan di negeri Kelantan.

"Selamat Bersidang"

Sekian, wabillahitaufik walhidayah assalamu'alaikum warahmatullah hiwabaraakatuh.

Annual Geological Conference 2002

Renaissance Hotel
Kota Bharu, Kelantan
26–27 May 2002

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

Bismillaahirrahmaanirrahim,

Yang dihormati Tuan Pengerusi Majlis,

Yang Amat Berhormat Dato' Nik Abdul Aziz Nik Mat,

Menteri Besar Kelantan Darul Naim,

Yang Berusaha, Dr. Ismail Yusoff, Pengerusi Jawatankuasa Penganjur, Persidangan Tahunan Geologi 2002,

Yang saya hormati, Tuan Haji Yunus Abdul Razak, Timbalan Ketua Pengarah, Jabatan Mineral dan Geosains Malaysia,

Para Pegawai Kanan Kerajaan Persekutuan dan Negeri,

Para Jemputan,

Rakan-rakan Geosains,

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

Assalamualaikum warahmatullahi wabarakatuh, Selamat pagi dan salam sejahtera.

Saya bersyukur ke hadrat Allah SWT kerana dengan limpah kurniaNya dapat kita bersama pada pagi yang mulia ini. Saya mengucapkan ribuan terima kasih kepada Yang Amat Berhormat Dato' Nik Abdul Aziz Nik Mat, Menteri Besar Kelantan Darul Naim kerana sudi meluangkan masa untuk bersama kita pada majlis yang berbahagia pagi ini dan seterusnya merasmikan Persidangan Tahunan Geologi 2002. Selamat datang ke Persidangan Tahunan Geologi 2002 juga saya mengucapkan bbagi pihak Persatuan kepada tuan-tuan dan puan-puan yang saya hormati sekalian.

Persidangan Tahunan Geologi 2002 merupakan persidangan ke 16 dalam siri persidangan tahunan Persatuan Geologi Malaysia dan merupakan kali pertama diadakan di negeri Kelantan.

Tuan-Tuan dan Puan-Puan,

Bidang geologi dan kerja serta kegiatan geologis sedang mengalami satu anjakan paradigm. Pada masa dahulu usaha utama geologis adalah penjelajahan dan penerokan mineral dan sumber bumi bernilai ekonomi dan pengeksploitasiannya. Sejak kebelakangan ini penggunaan sumber bumi secara berterusan tanpa musnah dan mesra alam bertambah penting. Bersesuaian dengan keadaan ini, Persatuan Geologi Malaysia menjadikan aspek Sekitaran salah satu tema penting persidangan tahunan.

Dalam persidangan tahun ini sebanyak 58 kertas kerja akan dibentangkan. Semua kertas kerja ini telah diterbitkan dalam Prosiding Persidangan yang diedarkan kepada semua peserta persidangan. Persidangan kita ini juga mula bercorak antarabangsa dengan penyertaan dari luar rantau ini.

Tuan-Tuan dan Puan-Puan,

Persidangan seperti ini tidak dapat diadakan tanpa sokongan dan bantuan beberapa pihak. Pada kesempatan ini, izinkan saya merakamkan penghargaan dan terima kasih kepada:

- Y.A.B. Dato' Menteri Besar Kelantan,
- Kerajaan Negeri Kelantan,
- Soils and Foundations Sdn. Bhd.,
- Specific Resources Sdn. Bhd.,
- Malaysia Mining Corporation Bhd.,
- Jabatan Mineral dan Geosains Malaysia,
- Universiti Malaya,
- Universiti Kebangsaan Malaysia,
- Universiti Sains Malaysia,
- Institut Geologi Malaysia,
- Dr. Ismail Yusoff dan jawatankuasa beliau,
- Semua penyumbang dan pembentang kertas kerja,
- Pentasyih sepakar,
- Dan semua peserta persidangan.

Akhir sekali, saya memohon ma'af atas segala kekurangan persidangan ini.

Sekian terima kasih.

Annual Geological Conference 2002

Renaissance Hotel
Kota Bharu, Kelantan
26–27 May 2002

** Ucapan Perasmian Persidangan Tahunan Geologi 2002 oleh Y.A.B. Dato' Tuan Guru Haji Nik Abdul Aziz Nik Mat, Menteri Besar Kelantan Darul Naim **

Bismillahirahmanirrahim,
(Doa & Salawat)

Yang DiMuliakan;

- *Tuan Pengerusi Majlis (Saudara Mohd Rozi Umor)*
- *Pengerusi Penganjur Persidangan Tahunan Geologi Malaysia (Dr. Ismail Yusof)*
- *Presiden, Persatuan Geologi Malaysia (Prof. Madya Dr. Abdul Ghani Rafek)*
- *Timbalan Ketua Pengarah Jabatan Mineral & Geosains Malaysia (En. Yunus Abdul Razak)*
- *Ahli-ahli Jawatankuasa Pengajur Persidangan*
- *Tuan-tuan & Puan-puan yang dihormati sekelian*

Assalamualaikum, w.b. dan Salam Sejahtera;

Terlebih dahulu saya memanjatkan rasa syukur ke hadrat Allah Subhanahuwata'ala, kerana dengan limpah rahmat dan nikmatNya dapat kita berhimpun di dalam majlis yang mulia ini, iaitu Majlis Perasmian Persidangan Tahunan Geologi Malaysia 2002.

Saya difahamkan bahawa Persidangan ini merupakan Persidangan Tahunan kali ke 16 Persatuan Geologi Malaysia yang telah dianjurkan sejak tahun 1986 dan bertempat dari sebuah negeri ke sebuah negeri di Malaysia, termasuk Sabah dan Sarawak. Pada tahun 2002 ini, dan buat pertama kalinya kini ia diadakan di negeri Kelantan. Ini bermakna bahawa inilah julung kalinya Persatuan ini yang ahli-ahlinya terdiri daripada pakar Sains Bumi daripada Seluruh Malaysia dan juga luar negara, datang dan berhimpun di Kota Bharu Kelantan, untuk bersidang, berbincang dan bertukar-tukar pendapat mengenai hasil penyelidikan masing-masing, demi untuk meningkatkan lagi pengetahuan dan kefahaman mengenai Bumi ciptaan Allah, segala proses dan kandungannya. Ilmu Sains Bumi atau Bidang Geologi ini amat penting, bukan sahaja kerana Bumi sebagai habitat atau tempat kita berpijak, malah ilmu mengenal bumi sudah pastinya akan membawa kita untuk mengenali ciptaan Allah dan seterusnya mendekatkan diri kepadaNya.

Tuan-Tuan/Puan-Puan;

Sebagai Ahli Geologi atau Saintis Bumi, tuan-tuan amat bertuah kerana termasuk di dalam segolongan manusia yang mendapat pendidikan khusus untuk memahami bahan Bumi ciptaan Allah, seperti tanah, batu, air dan api. Dan bahan-bahan Bumi ini merupakan bahantara keperluan terpenting untuk kehidupan manusia. Sebutkan apa sahaja yang berada di sekeliling kita, pasti kebanyakannya ada kaitan langsung dengan bahan geologi. Contohnya,

gelas, cawan, pinggan mangkuk, cip-cip komputer. Kesemuanya diperbuat daripada bahan bumi seperti mineral silika dan lempung (clay). Jam tangan, pen, kunci yang di dalam poket kita, kenderaan yang kita naiki, kerusi -meja dan sebagainya, kalaupun tidak semua, sebahagian komponennya diperbuat daripada logam-logam yang dilombong dari kerak Bumi. Malah hingga kepada barang-barang perhiasan emas dan perak, alat-alat solek seperti bedak dan celak yang dipakai oleh kaum wanita, juga diperolehi daripada kerak bumi. Begitu juga dengan air, keperluan paling utama untuk setiap makhluk yang bernyawa; adalah merupakan 2/3 daripada kandungan Bumi. Saya percaya, Tuan-Tuan dan Puan-Puan yang berada di dalam Dewan ini adalah golongan profesional yang berperanan sangat penting, untuk menasihati dan mendidik masyarakat awam tentang bagaimana untuk memperolehi dan memanfaatkan sumber bahan Bumi ini secara berkesan.

Tuan-Tuan/Puan-Puan yang dihormati;

Dalam kesempatan ini, izinkan saya untuk berkongsi ilmu Geologi dengan tuan-tuan dari perspektif Islam. Untuk pengetahuan kita semua, ilmu Geologi telah lama diajar oleh Islam. Tinggal lagi ia disampaikan dalam bentuk yang tersirat, agar kita berfikir dan terus-menerus melakukan penyelidikan. Umpamanya, saya difahamkan bahawa dalam Geologi ini ada suatu teori yang mengatakan bahawa kerak bumi ini hidup atau bergerak. Dan teori ini hanya diketemukan dan dibahaskan sekitar tahun 1940an-50an. Itupun oleh geologis-geologis Barat. Sebenarnya teori "Hanyutan Benua" atau "Continental Drift" ini telahpun tersirat di dalam Al-Quran, sejak lebih 1400 tahun yang lalu di dalam sepotong ayat yang bermaksud:

> *"Dan engkau melihat gunung-ganang, engkau kira bahawa dia tetap (tidak bergerak), padahal dia berjalan kencang sebagaimana awan berjalan. Begitulah, perbuatan Allah, yang membuat segala sesuatu dengan kukuhnya; sesungguhnya Dia mengetahui betul apa yang kamu kerjakan"*
>
> (Surah An-Naml, Ayat 27/88)

Sebenarnya banyak lagi ayat-ayat berkenaan Geologi (gunung-ganang, batuan, tanah, air) di dalam Al-Quran. Contohnya:

> *"Bukankah Kami telah jadikan Bumi sebagi hamparan (terbentang luas). Dan gunung-gunung sebagai paksinya. Dan kamu kami ciptakan berpasangan".*
>
> (Surah An-Naba', Ayat 78/6-8)

Di dalam sepotong ayat yang lain pula diberitahu pada kita bahawa Bumi itu boleh kembang; "air mineral" boleh didapati dekat gunung...

> *"Dan bumi sesudah itu dikembangkanNya. DikeluarkanNya dari situ airnya dan padang rumputnya. Dan gunung-gunung diletakkanNya dengan teguh"*
>
> (Surah An-Nazi'at, Ayat 79/30-32)

Pendapat tentang Bumi ini kembang bukanlah sesuatu yang baru, sebagaimana yang cuba diketengahkan oleh Profesor-Profesor Geologi dari Barat. Ini kerana kenyataan bahawa Bumi ini boleh "kembang-kuncup" telahpun lama dinyatakan di dalam AlQuran;

> *"Dan langit, bagaimana ia ditinggikan? Dan gunung-gunung, bagaimana ia ditegakkan? Dan Bumi, bagaimana ia dikembangkan? Sebab itu berilah peringatan, kerana engkau hanya seorang pemberi peringatan"*
>
> (Surah Al-Ghasyiah, Ayat 88/18-21)

Jadi, sebagai orang yang telah banyak mengkaji dan memahami mengenai Bumi, berilah peringatan, nasihat dan panduan kepada kami masyarakat awam, bagaimana memanafaat dan menguruskan sumber bahan bumi ini.

Sebenarnya, terdapat berpuluh-puluh ayat lagi di dalam Al-Quran yang ada kaitan langsung

dengan Geologi. Tuan-tuan kajilah, semuga selepas ini muncul pula beberapa teori baru mengenai Geologi oleh orang Islam Malaysia.

Tuan-tuan/Puan-Puan yang dimuliakan;

Beberapa dekad yang lalu, terutama dalam tahun 1960an, 70an dan 80an, khidmat ahli geologi lazimnya dikaitkan dengan eksploitasi mineral-mineral ekonomi, seperti bijih timah, bijih besi, emas, perak, tembaga, arang batu dan petroleum. Kebanyakan negeri di Malaysia ini, sumber ekonomi utamanya bergantung kepada mineral-mineral bijih. Tetapi kini, dengan kejatuhan harga bijih timah dan oleh kerana semakin berkurangnya penggantungan negara kepada industri perlombongan, tumpuan ekonomi negara kini beralih pula kepada industri pembuatan dan pertanian. Ini tidak bermakna khidmat ahli geologi semakin dipinggirkan. Sebaliknya, tuan-tuan ahli geologi sekelian seharusnya semakin peka dan semakin kreatif menyesuaikan diri dengan keperluan semasa dan keperluan masa hadapan negara.

Seperti yang tuan-tuan sedia maklum, ekonomi Negeri Kelantan Darul Naim tidak terkecuali menerima sumbangan besar daripada sumber geologi. Mengikut Laporan oleh Jabatan Mineral dan Geosains Malaysia 1999, di Kelantan terdapat 130 Pengusaha mineral lempung, 101 Pengusaha pasir dan kerikil dari sungai dan pantai, 8 Pengusaha Kuari Granit, 2 kuari Batu Kapur, dan 1 pengeluar mineral Barit. Saya percaya, di bumi Kelantan yang masih luas dan kurang diterokai ini, masih banyak lagi tersembunyi khazanah-khazanah bumi yang berharga. Jadi di sini, saya dengan penuh takzim, mempelawa dan memohon kerjasama tuan-tuan untuk mempertingkatkan lagi peyelidikan geologi di negeri Kelantan. Sebagai contoh, di Daerah Gua Musang terdapat banyak perbukitan batu kapur atau marmar, yang mungkin boleh dibangunkan sebagai pusat penghasilan agregat batu kapur, batu demensi, jubin marmar, dan simen. Ataupun tidak semestinya dalam bentuk eksploitasi yang memusnahkan, sebaliknya mungkin perbukitan batu kapur tersebut mengandungi gua-gua dan landskap yang menarik untuk dibangunkan sebagai sumber ekopelancongan melalui gagasan Geologi Pemuliharaan dan Geopelancongan.

Seperkara lagi masalah air. Masalah air bukan sahaja dialami oleh negeri Kelantan, malah negeri-negeri lain seperti Selangor, Melaka, Wilayah Persekutuan Kuala Lumpur (Lembah Kelang) dan Johor. Di Kelantan, sebahagian besar sumber air datangnya dari air bawah tanah. Air ini dari segi kualitinya adalah dicemari secara semulajadi oleh kandungan besi (sehingga mencapai 30miligram per liter). Setakat ini Kerajaan Negeri hanya menggunakan teknik pembersihan biasa yang dicadangkan oleh beberapa agensi kerajaan. Tetapi kandungan besi masih juga tinggi. Adalah menjadi harapan saya suatu kajian yang lebih lanjut dilakukan untuk mengatasi masalah air bersih di Negeri Kelantan dan juga negeri-negeri lain di Malaysia. Kerajaan negeri sedia bekerjasama dengan para penyelidik di dalam perkara ini.

Tuan-Tuan dan Puan-Puan yang dikasihi;

Dengan semakin berkembang pesatnya pembangunan infrastruktur diseluruh negara, bermakna semakin banyak kawasan-kawasan baru yang telah, sedang dan akan diteroka. Tidak cukup dengan tanah yang rata, kini pembanguan merayap hingga ke kaki-kaki bukit dan kawasan pergunungan. Malah di sesetengah tempat (contoh terdekatnya Pulau Pinang, Singapura), kawasan berpaya dan laut pula ditambak untuk dijadikan tapak perumahan, industri perkilangan dan sebagainya.

Perbuatan memotong bukit-bukau dan gunung-ganang ini bukanlah sesuatu yang luarbiasa, dengan syarat ilmu kita cukup dan faham dengan kelakuan bahan-bahan bumi pada bukit atau gunung tersebut. Perkara ini pernah dilakukan oleh umat terdahulu, dan ada dikisahkan di dalam Al-Qur'an yang bermaksud:

"Dan kamu pahat bukit-bukit dengan amat rajinnya untuk membuat rumah"
(Surah As-Syu'ara, Ayat26/149)

"Dan mereka memahat bukit untuk dibuat rumah dengan aman"
(Surah Al-Hijr, Ayat 15/82)

Pembangunan duniawi manusia yang "tidak pernah puas" ini, sudah tentunya menimbulkan kesan sampingan yang kurang sihat. Ini terbukti dengan kejutan berita-berita kejadian geobencana, seperti tanah runtuh, banjir, banjir kilat, hakisan, tanah mendap dan sebagainya, yang semakin kerap kita dengar, malah mungkin pernah kita alami sendiri. Alam sekitar Bumi kita kini semakin terancam. Perkara ini telah diperingatkan oleh Allah s.w.t di dalam Al-Quran, yang bermaksud:

" Dan janganlah engkau berjalan di Bumi dengan sombong, kerana engkau tidak akan menembus Bumi ini, dan engkau tidak akan sampai setinggi gunung"
(Surah Al-Isra, Ayat 37)

".... Dan jangan lah kamu membuat keroskan di muka bumi ini dengan kejahatan".
(sumber ayat ???)

Masalah kemerosotan kualiti alam sekitar ini, sangat berkait rapat dengan eksploitasi yang agresif di permukaan bumi dan perubahan mendadak pada proses-proses geologi semulajadi di permukaan bumi akibat tindakan manusia itu sendiri. Dalam hal ini, bersesuaian dengan tema Persidangan pada kali ini, yang menitik beratkan tentang "pengelolaan/pengurusan alam sekitar dengan lebih baik"; maka seharusnyalah Tuan-Tuan dan Puan-Puan ahli geologi sekelian, memainkan peranan dengan lebih aktif dan kreatif, menasihati dan mengesyorkan langkah-langkah yang sesuai dan tepat untuk menangani masalah kemerosotan kualiti alam sekitar yang semakin mengancam dan begitu meruncing, terutamanya di bandar-bandar besar di seluruh negara.

Sebelum mengundurkan diri, saya sekali lagi, mewakili rakyat dan kerajaan negeri Kelantan, mengucapkan jutaan terima kasih di atas kesudian Persatuan Geologi Malaysia, yang berpusat di Kuala Lumpur, kerana memilih negeri Kelantan sebagai Tuan Rumah Persidangan. Saya difahamkan, sebanyak 58 buah kertas kerja akan dibentangkan dalam masa Persidangan dua hari ini. Ini termasuklah satu buah kertas kerja yang khusus mengenai geologi negeri Kelantan. Saya berharap banyak lagi kajian geologi dilakukan di negeri ini, sesuai dengan berkembangnya budaya ilmu masyarakat setempat di sini. Ini sesuatu yang membanggakan dan petanda baik bahawa ahli-ahli Persatuan Geologi Malaysia memang aktif menjalankan penyelidikan dan menulis.

Saya juga merasa amat terharu dan sukacita di atas kesudian tuan-tuan ke negeri Kelantan ini. Walaupun, seperti yang tuan-tuan sedia maklum, pelbagai tuduhan, tohmahan dan tekanan yang dilemparkan oleh Kerajaan Pusat kepada Kerajaan Negeri Kelantan khususnya dan Parti PAS amnya, sudi juga tuan-tuan berkunjung ke sini. Syukur Alhamdulillah, Jadi, ambillah peluang semasa kunjungan tuan-tuan/puan-puan ke sini untuk melihat dan menilai sendiri pembangunan dan perpaduan rakyat pelbagai kaum di negeri Kelantan ini. Saya yakin, tuan-tuan yang rata-rata terdiri dari golongan Profesional, mampu membuat penilaian yang adil dan saksama tanpa dipengaruhi oleh mana-mana fahaman politik. Jika ada kelapangan, sudilah kiranya untuk berkunjung lagi ke Kelantan. Negeri Kelantan juga tidak kurang hebatnya dari segi geologi.

Akhir kata, saya memohon berbanyak ampun dan maaf jika terdapat sebarang salah dan silap atau kekurangan di pihak tuan rumah, semasa berlansungnya Persidangan ini. Dengan lafadz Bismillahirahmanirrahim, saya dengan ini Merasmikan Persidangan Tahunan Geologi Malaysia 2002 dan Selamat Bersidang.

Sekian. Wabillahitaufiq, Wassalamualaikum warahmatullahi wabarokatuh.

Annual Geological Conference 2002

Renaissance Hotel
Kota Bharu, Kelantan
26–27 May 2002

** Programme **

SUNDAY (26 May 2002)

08.30 : Arrival of Participants and Guests

08.40 : Arrival of Y.A.B. Dato' Nik Abdul Aziz Nik Mat,
Menteri Besar Kelantan Darul Naim

08.45 : Welcoming Address by Dr. Ismail Yusoff,
Pengerusi Jawantankuasa
Penganjur Persidangan Tahunan Geologi 2002

08.55 : Address by Prof. Madya Dr. Abdul Ghani Rafek,
Presiden Persatuan Geologi Malaysia

09.10 : Opening Address by Y.A.B. Dato' Nik Abdul Aziz Nik Mat,
Menteri Besar Kelantan Darul Naim

10.00 : *Tea Break* / Poster Session A

TECHNICAL SESSION I

ENGINEERING GEOLOGY & HYDROGEOLOGY

1100 – 1130 : **KEYNOTE PAPER** — Land use changes, soil erosion and decreased base flow of rivers at Cameron Highlands, Peninsular Malaysia
J.K. Raj

1130 – 1150 : Laterite revisited: mode of formation
Abd. Rashid Ahmad & Teh Guan Hoe

1150 – 1210 : Sifat geologi kejuruteraan batuan kuarzit di Bangi Golf Resort, Bandar Baru Bangi, Selangor D.E.
Abdul Ghani Rafek, Siti Rashidah Mohd Rasid & Abdul Rahim Samsudin

1210 – 1230 : Perubahan fasies hidrokimia dalam akuifer aluvium pantai: Kajian kes di kawasan Pekan-Nenasi, Pahang
Ismail C. Mohamad, Abdul Rahim Samsudin, Abdul Ghani Rafek & Mohd Tadza Abdul Rahman

1230 – 1250 : Physico-chemical properties of andesitic soils in the Kg. Awah area, Pahang
Tan Boon Kong & Yew Chee Kean

1250 – 1310 : Hydrogeological investigations by surface geoelectrical method in hard rock formation — A case study
Abdullah Taheri Tizro

1310 – 1420 : ***Lunch & Prayer Break***

TECHNICAL SESSION II

PETROLOGY & GEOCHEMISTRY

1420 – 1400 : High Ba igneous rocks from the Central Belt of Peninsular Malaysia and its implication
Azman A. Ghani, Ramesh, V., Yong, B.T., Khoo, T.T. & Shafari Muda

1400 – 1500 : Tren unsur-unsur nadir bumi (REE) Suit Stong, Jeli, Kelantan
Mohd Rozi Umor & Hamzah Mohamad

1500 – 1520 : Komposisi unsur surih dan major di sepanjang profil luluhawa syal Formasi Mahang di Sungai Merbok, Kedah
Habibah Hj Jamil & Wan Fuad bin Wan Hassan

1520 – 1540 : Organic petrological characteristics of limnic and paralic coals of Sarawak
Wan Hasiah Abdullah

1540 – 1600 : Kajian geokimia batuan igneus sekitar Gunung Pulai, Johor
Sia Chee Chuan & Mohd Rozi Umor

1600 – 1620 : EPMA characterisation of ilmenite from *amang* of the Kinta and Klang Valleys, Peninsular Malaysia
G.H. Teh & Irdawati Hj. Lokman

1620 – 1640 : ***Tea Break***

MONDAY (27 May 2002)

TECHNICAL SESSION III

ENVIRONMENTAL & CONSERVATION GEOLOGY, GEOTOURISM, TECTONICS & STRUCTURAL GEOLOGY & MINERAL RESOURCES

0830 – 0850 : Warisan geologi dan potensi geopelancongan Kepulauan Aman – Gedong, Pulau Pinang
Ibrahim Komoo & Tanot Unjah

0850 – 0910 : Shock structures in Peninsular Malaysia: evidence from Kedah and Pahang
H.D. Tjia & Mazlan Mohamad Zain

0910 – 0930 : Type deposits of primary gold mineralization in the Central Belt of Peninsular Malaysia
Wan Fuad Wan Hassan & Heru Sigit Purwanto

0930 – 0950 : Late Mesozoic-Early Tertiary Faults of Peninsular Malaysia
Zaiton Harun

0950 – 1010 : Holocene sea level changes in Peninsular Malaysia
Kamaludin bin Hassan

1010 – 1100 : ***Tea Break* / Poster Session B**

TECHNICAL SESSION IV

GEOSCIENCE TOOLS & TECHNIQUES

1100 – 1120 : The occurrence and classification of hard rock body in Putrajaya and its implication to construction activities
Abd Rasid Jaapar, Nuril Anwar Ahba & Azimah Hussin

1120 – 1140 : Penggunaan kaedah pengimejan keberintangan geoelektik dan isotop sekitaran dalam kajian air resapan di empangan Durian Tunggal, Melaka
Rahman b. Yaccup, Wan Zakaria b. Wan Muhamad Tahir & Mohd Khalid b. Nasir

1140 – 1200 : Geophysical mapping of saltwater intrusion in the Kerpan coastal area, Kedah
Abdul Rahim Samsudin, Bashillah Baharuddin, Masrita Mustapa & Sanisah Soed

1200 – 1220 : Prospecting for iron ore in the Bedong area, Kedah using geophysical techniques
C.Y. Lee & Abdoul-Fatah I.H.

1220 – 1240 : Penggunaan seismos biasan dalam pencirian tanah tambakan di tapak projek pembinaan Kamsis H UKM, Bangi
Khairul Anuar Mohd. Nayan, Mohd. Raihan Taha & Sri Atmaja PJNN Rosyidi

1240 – 1300 : Effect of lime on permeability and microstructure of soil
Baba Musta, Khairul Anuar Kassim & Mohd. Razman Salim

1300 – 1420 : ***Lunch & Prayer Break***

TECHNICAL SESSION V

SEDIMENTOLOGY/STRATIGRAPHY & PALEONTOLOGY

1420 – 1440 : Middle Miocene planktonic foraminifera and their implications in the geology of Sabah
Basir Jasin

1440 – 1500 : Early Permian sequence from Sungai Itau quarry, Langkawi: Its age, depositional environment and palaeoclimatic implication
Mohd Shafeea Leman & Asmaniza Yop

1500 – 1520 : 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
Meor Hakif Hassan & Lee Chai Peng

1520 – 1540 : Palynomorph assemblage from Keratong, Pahang: its age and emergence of angiospermlike pollen
Uyop Said

1540 – 1600 : **CLOSING CEREMONY**

1600 – 1630 : ***Tea Break***

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** Poster Presentation **

POSTER SESSION A

ENGINEERING GEOLOGY & HYDROGEOLOGY
PETROLOGY & GEOCHEMISTRY
ENVIRONMENTAL & CONSERVATION GEOLOGY, GEOTOURISM

1. Climate change and chalk aquifer groundwater resources in West Norfolk, UK
   I. Yusoff
2. Landskap geologi Kompleks Migmatit Stong Kelantan
   Tanot Unjah, Ibrahim Komoo & Hamzah Mohamad
3. Kajian geokimia batuan igneus di sepanjang Jalan Kulai-Simpang Layang-Layang, Kulai, Johor Darul Takzim
   Arshnah Durrah bt. Haji Arshad & Mohd Rozi bin Umor
4. Geokimia batuan granit di sepanjang jalan dari Kangkar Pulai ke Pekan Nenas, Pontian, Johor Darul Takzim
   Nor Ibtisam bt. Yunus & Mohd Rozi Umor
5. Description of some important textures and paired host-enclave geochemistry of mafic microgranular enclaves (MME) in the Eastern Belt granite, Peninsular Malaysia: preliminary observations
   Azman A Ghani
6. Magmatic epidote: probable absence and implication to the geobarometry of the granitic rocks from Peninsular Malaysia
   Anuar Ismail & Azman A. Ghani
7. Geochemistry of mafic dykes from Perhentian and Redang islands: an example of petrogenesis of the younger (dolerite) dykes from the Eastern Belt of Peninsular Malaysia
   Azman A. Ghani, Khoo T.T. & Grapes, R.
8. Geochemical characteristics of the granitic rocks from Boundary Range Batholith, Peninsular Malaysia
   A. Rashid Ahmad, Ismail Yusoff & Azman A. Ghani
9. Petrology of dioritic rocks from the Pemanggil Island, Johore
   Mohd Basri Ismail, Marzuki Asmuri, Azman A. Ghani, Mohd Rozi Umor & Mohd Anuar Ismail
10. Estimating limestone dissolution rates in the Kinta and Lenggong valleys using the micro erosion meter: a preliminary study
    Ros Fatihah Muhammad & Yeap Ee Beng
11. Mata air panas Sungai Mering, Lojing, Gua Musang, Kelantan
    Kamal Roslan Mohamed, Che Aziz Ali, Che Abd Rahman Jaafar & Azmi Ismail
12. Petrografi dan cirian mekanikal bahan aggregat di Kuari IJM, Labu, Negeri Sembilan
    Nurul 'Ashikin Mokmin, Azliana Azis & Azimah Hussin
13. EPMA characterisation and geochemistry of cassiterites from the Kuala Lumpur area
    G.H. Teh & Cheng Kwong Kiong

POSTER SESSION B

TECTONICS & STRUCTURAL GEOLOGY, MINERAL RESOURCES SEDIMENTOLOGY/ STRATIGRAPHY GEOSCIENCE TOOLS AND TECHNIQUES

1. Stratigrafi seismos Lembangan Penyu, Laut Cina Selatan
   Liw Yen Chai, Umar Hamzah, Wan Ismail Wan Yusuf & Abdul Rahim Samsudin
2. A sedimentological study at Bukit Belah, Batu Pahat, Johor
   Nur Syamsiah Abdul Majid & Uyop Said
3. Plant fossils from Bukit Belah, Batu Pahat, Johor
   S. Norizan Yaacub & Uyop Said
4. Sedimentary sequence in the subsurface of the Pekan coastal plain, Pahang
   Che Aziz Ali
5. Geological modelling for site characterization using sufficient and insufficient subsurface exploration data: lesson learned from case histories
   Abd Rasid Jaapar
6. Survei graviti di Ulu Melaka, Pulau Langkawi, Kedah
   Abdul Rahim Samsudin, Umar Hamzah & Lim Cheng Han
7. Teknik-teknik geoelektrik dalam Pemetaan air masin di Kuala Selangor
   Siti Zalipah Jumary, Umar Hamzah, Abdul Rahim Samsudin & Edna Pilis Malim
8. Compressibility and Young's modulus of a filled joint under uniaxial compression
   Mohd For Mohd Amin & Haryati Awang
9. Penggunaan teknik gelombang permukaan (SASW) dalam kajian geologi kejuruteraan
   Mohd Azmi Ismail, Abdul Rahim Samsudin, Khairul Anuar Mohd Nayan & Abdul Ghani Rafek
10. Taburan ketakselanjaran dalam profil luluhawa batuan metasedimen – Kajian kes cerun potongan CH11540 – CH11700 Lebuhraya Baru Pantai, Kuala Lumpur
    Tajul Anuar Jamaluddin
11. Detection of seismic phases from a major earthquake on a local seismogram
    Che Noorliza Lat
12. Struktur dan sejarah canggaan batuan di Pulau Kapas, Terengganu
    Ibrahim Abdullah
13. A meaningful correlation between shallow seismic refraction data to borehole data in site investigation work
    Samsudin bin Hj Taib & Ahmad Nizam Hasan
14. The effect of major faults and folds in hard rock groundwater potential mapping: An example from Langat Basin, Selangor
    Khairul Anam Musa, Juhari Mat Akhir & Ibrahim Abdullah
15. EPMA study of heavy minerals in the Annah Rais-Bayur area, Sarawak
    G.H. Teh & Donny Osmond Anak Julius
16. Palynological study on a rock sequence at Bandar Tenggara, Johor
    Yap Siew Fong & Uyop Said

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** Abstracts of Papers **

Land use changes, soil erosion and decreased base flow of rivers at Cameron Highlands, Peninsular Malaysia

J.K. RAJ

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The hydrological cycle within any drainage basin can be viewed simply as inputs of precipitation distributed through a number of storages by a series of transfers, leading to outputs of basin channel runoff, evapo-transpiration and outflow of groundwater. Changes in land use within the basin have a profound effect upon the hydrological cycle as they directly influence interception, surface and soil moisture storages, as well as infiltration and overland flow. In highland drainage basins, the most visible impact of changes in land use is soil erosion, whilst other impacts include the lowering of groundwater tables and the decreased base flow of rivers.

Changes in land use at Cameron Highlands between 1947 and 1974 involved mainly an increase in area of tea estates and orchards at the expense of forests, but between 1974 and 1982, an increase in area of market gardens and residential/urban centers at the expense of forests. Between 1982 and 1990, there was a further increase in area of market gardens and residential/urban centers, but at the expense of tea estates and orchards. These changes in land use from forests through tea estates and orchards to market gardens and residential/urban centers, have had successively greater impacts on the ground surface, resulting in increasing rates of soil erosion. The eroded sediments have been, and continue to be, deposited along river channels and diversion tunnels in the area as well as in the Ringlet Reservoir. Increasing overland flow as a result of the changes in land use is also reflected by the rising trend (relative to the annual rainfall) of the annual discharge of the Sg. Bertam at Robinson's Falls for the period 1964-1997; a trend that has led to decreased base flows of the Sg. Bertam during periods of several weeks without rain.

Laterite revisited: mode of formation

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During 1800 laterite was perceived as a rock. This idea persisted until the first quarter of the twentieth century. From then on laterite was accepted as iron precipitate and the accumulated

material could be remobilized under different conditions, which affected its concentration. The formation of laterite is termed as laterization or lateritization. These terms are defined as the process which involves additions of iron with movement of dissolved Fe from elsewhere, in ferrous form with oxidation and precipitation to produce an iron oxide enriched material, leading to the formation of plinthite and ironstone. The mechanisms by which iron moves and is precipitated in the lateritization process are not clear and probably vary in different situations. This paper attempts to discuss these processes by introducing a systematic approach to the requirements leading to the understanding of the formation of laterites. A number of laterite samples were taken from the field representing what was thought to be the various stages of laterite formation from plinthite to ironstone. The colours of the materials constituting the samples were noted. Photographs of the samples were taken as whole or cross-section. Parts of the samples were cut for thin sectioning followed by petrographical analysis. Photomicrographs of selected features in the thin section were taken. The samples were also prepared for EPMA analyses. The results of this study indicate that a number of conditions have to be satisfied before the formation of laterite can be initiated. The transformation of ferrous to ferric iron and precipitation of ferric oxides and hydroxide started to occur at the aerobic-anaerobic interface. Zones of different porosity may contribute to the formation of aerobic-anaerobic interface across which Fe^{2+} must be transported either by flow or diffusion. The mechanisms for iron movement were suggested. Oxygen is the main oxidant in the redox reaction. There must also be a continuous supply of reductants (Fe^{2+}) for the growth of laterite and for the progressive development of plinthite to ironstone. The source of iron primarily originated outside the laterite body. Intermittent anaerobic conditions may develop in the laterite body and ferric iron is reduced back to ferrous form. It can move out and be deposited on the surfaces of vesicles and with time filling up the vesicles. Silicate minerals should be dissolved so that partial or total replacement by iron oxide could occur. Evidence of silica dissolution was given. The precipitation process may be controlled by simultaneous diffusion and oxidation reaction. The evidence for this is the occurrence of periodic precipitation also known as Liesegang banding phenomenon as detected by EPMA. As more and more iron oxide accumulates in the laterite body it becomes more compact and its porosity declines. The influence of water on the development of anaerobic condition becomes less significant. During drier periods and higher temperatures water is lost from the laterite body and it becomes hardened.

Sifat geologi kejuruteraan batuan kuarzit di Bangi Golf Resort, Bandar Baru Bangi, Selangor D.E.

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Gabungan tiga ujian indeks, iaitu ujian pantulan tukul Schmidt, ujian indeks beban titik dan ujian penetrometer poket dapat membezakan bahan batuan kuarzit dengan gred luluhawa yang berbeza di kawasan Bangi Golf Resort, Bandar Baru Bangi, Selangor D.E. Kuarzit yang segar atau gred I yang berwarna keputihan cerah, mempunyai nilai pantulan tukul Schmidt di antara 22 hingga 33 dengan nilai kekuatan beban titik, $I_{s(50)}$ di antara 1.0–2.0 MPa. Batuan kuarzit gred II mempunyai jalur-jalur kemerahan sepanjang satah ketakselanjaran utama dengan nilai 13–22 bagi

nilai pantulan tukul Schmidt dan nilai $I_{s(50)}$ di antara 0.5–0.9 MPa. Bahan gred III masih menghasilkan bacaan tukul Schmidt, iaitu 10–12 dengan $I_{s(50)}$ di antara 0.15–0.45 MPa. Sebahagian besar bahan gred IV bersifat tanih kaku, tiada nilai pantulan tukul Schmidt dan $I_{s(50)}$ dan penetrometer poket menghasilkan bacaan antara 0.2–0.45 MPa. Survei seismos biasan menghasilkan nilai halaju sebenar gelombang P, Vp di antara 1,400–1,500 m/s bagi gred I dan II, 500–800 m/s bagi gred III dan IV dan nilai purata 400 m/s bagi gred V dan VI.

Perubahan fasies hidrokimia dalam akuifer aluvium pantai: kajian kes di kawasan Pekan-Nenasi, Pahang

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Kajian kimia air tanah telah dijalankan sebagai sebahagian daripada kajian hidrogeologi bagi mengenalpasti punca masalah peningkatan kadar kemasinan secara berterusan dalam akuifer air tawar di loji bekalan air awam Nenasi, Pekan, Pahang. Kajian di kawasan tersebut telah bermula pada tahun 1999 bagi tujuan menentukan sifat-sifat dan perlakuan akuifer aluvium pantai dari segi perubahan kimia air tanah kesan pengepaman tak terkawal di kawasan tersebut. Maklumat kajian ini menunjukkan bahawa berlakunya perubahan yang ketara terhadap kepekatan klorida terutamanya di kawasan loji bekalan air di Nenasi dan di kawasan ternakan belut di Tanjung Batu. Di kawasan Tanjung Batu, kepekatan klorida didapati melebihi had piawai air minuman yang ditetapkan oleh WHO. Kajian ini menunjukkan bahawa berlakunya penerobosan air masin yang serius di kawasan kajian.

Physico-chemical properties of andesitic soils in the Kg. Awah area, Pahang

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Residual soils of andesite in the Kg. Awah area, Pahang, have been analysed for their physico-chemical properties. Results indicate that the andesitic soils are characterised by their predominantly clayey nature, high plasticities, generally low compacted densities, slightly acidic pore fluids, and intermediate dispersivity behaviour.

Hydrogeological investigations by surface geoelectrical method in hard rock formation — a case study

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The major portion of Kermanshah, a state in the west of Iran, comprises hard rocks such as limestone, schist, marly limestone, slates, diorites and andesites. The sedimentary rocks are repeatedly folded and faulted. The depth of the basement topography is shallow to deep in hard rock terrain. The state occupies an area of 24,434 sq. km.

The present study aims at delineating the hydrogeological framework in hard rock terrain by using interpreted results of electrical resistivity data generated by the author in reconnaissance field visits. The VES was conducted at 50 locations.

High Ba igneous rocks from the Central Belt of Peninsular Malaysia and its implication

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Trace element characteristics of gabbro-monzonite-syenite from the Benom Igneous Complex, Sungai Ruan, Raub show that they are very high in large ion lithophile (LIL) elements. The rocks contain: Ba (2,401–10,744 ppm; mean: 4,590 ppm), Rb (257–434 ppm) and Sr (578–2,340 ppm; mean: 1,000 ppm) which is higher compared to the rocks from other areas. The strong enrichment of these elements (Ba and Sr) is probably related to transfer of enriched (hydrous?) fluids from the mantle into the lower crust and possibly initiated melting to form the rocks besides the possibility of being linked to mantle plumes.

Tren unsur-unsur nadir bumi (REE) Suit Stong, Jeli, Kelantan

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Tren geokimia unsur-unsur nadir bumi (REE) telah digunakan bagi mentafsir asalan dan proses evolusi batuan-batuan Suit Stong. Sebanyak 19 sampel daripada empat litodemik batuan yang dinamakan sebagai Tonalit Berangkat, Granit Noring, Mikrogranit Noring dan Leukogranit Kenerong telah dianalisis. Tren geokimia unsur-unsur nadir bumi menunjukkan arah pembezaan batuan adalah dari Tonalit Berangkat, Leukogranit Kenerong, Mikrogranit Noring ke Granit

Noring. Berdasarkan bandingan LREE dan HREE pula disimpulkan Mikrogranit Noring mengalami peleburan separa membentuk Granit Noring. Anomali normal Eu yang diperolehi menunjukan Tonalit Berangkat, Leukogranit Kenerong dan Mikrogranit Noring berasalan granit jenis I, sementara Granit Noring yang beranomali Eu negatif mencirikan asalan granit jenis S. Kajian ini merupakan satu dimensi baru bagi Suit Stong, memandangkan belum ada kajian terdahulu yang mengemukakan hasil analisis geokimia unsur-unsur nadir bumi.

Komposisi unsur surih dan major di sepanjang profil luluhawa syal Formasi Mahang di Sungai Merbok, Kedah

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Sebahagian besar daripada kawasan Sungai Merbok, Kedah terdiri daripada batuan Formasi Mahang. Unit batuannya terdiri daripada syal, sabak merah, sabak kelabu dan sabak hitam. Kajian mengenai taburan unsur-unsur surih dan major terhadap syal yang mengalami luluhawa telah dijalankan. Sampel profil luluhawa telah diambil pada potongan bukit di Ladang United Pillai. Komposisi unsur surih dan major di sepanjang profil luluhawa ditentukan menggunakan kaedah pendarfluor sinar-X (XRF). Unsur-unsur major dan surih mengalami pengkayaan dan pengurangan yang ketara pada dua kedalaman iaitu di sempadan tanih–lempung bersifat batuan (350 cm) dan lempung bersifat batuan–batuan segar (770–870 cm). SiO_2, K_2O dan MgO mengalami pengurangan di kedalaman 350 cm dan 770 cm manakala Fe_2O_3, Al_2O_3, TiO_2, Na_2O, P_2O, CaO dan MnO mengalami pengkayaan. Ba, Ce dan Pb mengalami pengkayaan pada kedalaman 350 cm dan 870 cm. Cr dan Cu mengalami pengkayaan di kedalaman 350 cm. Zn meningkat mengikut kedalaman di sepanjang lapisan tanih. Ia berkurang secara mendadak pada kedalaman 350 cm. Kemudian, ia meningkat semula mengikut kedalaman profil. Ba, Ce, Cu dan Zn kaya di dalam reranting dan nodul Mn oksida. Pb tidak berubah manakala Cr tidak dikesan. Komposisi unsur major dan surih di sepanjang profil syal bergantung kepada ketahanan dan mobiliti unsur tersebut disepanjang profil luluhawa. Aktiviti larut resap yang tinggi di kawasan ini menyebabkan unsur-unsur terlarut di permukaan profil dan berkumpul pada kedalaman tertentu di dalam profil.

Organic petrological characteristics of limnic and paralic coals of Sarawak

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An organic petrological study was performed on Tertiary coals from the Merit-Pila and the Mukah-Balingian coalfields of Sarawak. The main objective of this study was to determine the petrological characteristics of these coals in relation to their environment of deposition. The coals analysed were deposited in two distinct depositional settings. The Mukah-Balingian coals were deposited under paralic conditions of a lower coastal plain setting whilst the Merit-Pila coals were

deposited inland under limnic condition of a lacustrine setting. Differentiation of these depositional settings are based on the presence of diagnostic macerals, such as alginite, and on cross plots of gelification index (GI) versus tissue preservation index (TPI). While both sets of coals possess TPI values < 1, the paralic origin coals generally possess GI values > 10 whilst limnic coals possess GI values < 10.

Kajian geokimia batuan igneus sekitar Gunung Pulai, Johor

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Kawasan di sekitar Gunung Pulai terdiri daripada batuan igneus dan batuan sedimen. Batuan igneus terbahagi kepada batuan plutonik dan batuan volkanik. Granit merupakan batuan igneus yang utama terdiri daripada granit biotit dan granit hornblend. Selain itu, terdapat juga granodiorit yang berbutir sederhana hingga kasar. Kajian terdahulu menunjukkan bahawa usia bagi granit ini ialah Trias hingga Kapur Awal. Batuan volkanik merupakan Ahli Volkanik Gunung Pulai dalam Formasi Jurong. Batuan volkanik terdiri daripada riolit dan piroklas. Sepuluh unsur major dan minor yang ditentukan ialah SiO_2, TiO_2, Al_2O_3, Fe_2O_3, FeO, MnO, CaO, Na_2O, K_2O dan P_2O_5. Sementara itu, 12 unsur surih terdiri daripada As, Ba, Co, Cr, Cu, Ni, Pb, Rb, Sr, V, Zn dan Zr dianalisis. Hasil daripada analisis XRF, didapati bahawa purata (julat) peratus berat (wt %) unsur major dan minor bagi granitoid adalah: SiO_2 74.77 (67.84–79.92), TiO_2 0.18 (0.05–0.53), Al_2O_3 13.63 (11.21–15.93), Fe_2O_3 1.96 (0.63–4.97), MnO 0.05 (0.01–0.22), MgO 0.17 (0.02–1.06), CaO 1.54 (0.18–4.19), Na_2O 3.03 (2.56–3.58), K_2O 4.02 (2.74–4.82) dan P_2O_5 0.03 (0.01–0.12). Manakala purata (julat) unsur surih adalah: Ba 487 (0–744), Zr 140 (115–186), Sr 99 (40–191), Rb 206(123–336), Pb 28 (4–83), As 18 (11–26), Zn 25 (0–91), Cu 19 (13–38), Co 17 (0–42), Ni 5 (1–7), Cr 12 (7–22) dan V 17 (2–59). Dari kajian geokimia, granitoid ini dikelaskan sebagai jenis I dengan sifat batuan peralumina. Indeks alkali kapur bagi granitoid ini ialah 64. Hasil analisis geokimia menunjukkan batuan granitoid di kawasan kajian adalah hasil dari proses pembezaan magma dengan arah pembezaan dari batuan granodiorit ke granit. Manakala bagi riolit, peratus berat (wt %) bagi unsur major dan minor yang dianalisis ialah SiO_2 74.99, TiO_2 0.10, Al_2O_3 13.14, Fe_2O_3 1.28, MnO 0.02, MgO bdl, CaO 1.31, Na_2O 2.60, K_2O 4.42 and P_2O_5 0.01. Sementara itu, nilai kepekatan (ppm) bagi unsur surih pula ialah Ba 595, Zr 144, Sr 96, Rb 254, Pb 24, As 17, Zn bdl, Cu 16, Co bdl, Ni 3, Cr 9 and V 6.

EPMA characterisation of ilmenite from *amang* of the Kinta and Klang Valleys, Peninsular Malaysia

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Samples of heavy minerals concentrates were collected from the Kinta Valley and the surrounding areas of the Klang Valley to characterise ilmenite ($FeTiO_3$) both physically and chemically using the EPMA (electronprobe microanalyzer).

The ilmenite grains in both valleys are not homogeneous and are associated with other heavy minerals that include monazite, xenotime, zircon, rutile, cassiterite, wolframite and topaz. Common textures of the ilmenite grains include replacement by leaching, intergrowths and exsolutions. In addition interesting exsolutions involving monazite, xenotime and ilmenorutile were observed. Generally the *amang* from the Klang Valley has more ilmenite while that from the Kinta Valley has more monazite, xenotime, zircon, rutile and wolframite.

The ilmenite from the two valleys were analysed on the EPMA to show the variations of TiO_2 and FeO from the different localities. The TiO_2 content for ilmenite, on the average, is quite similar for the Kinta and Klang Valleys, 49.7875–65.4251% to 49.0360–65.6274% respectively. The results show that the *amang* from both valleys have TiO_2 ranging from 49.4118% to 65.5263%.

Warisan geologi dan potensi geopelancongan Kepulauan Aman – Gedong, Pulau Pinang

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Kepulauan Aman-Gedong memiliki sejumlah warisan geologi dan landskap yang bertaraf negeri. Sumber yang telah dikenalpasti ialah singkapan segar batuan Formasi Mahang, struktur antiklin Pulau Aman, turus laut Batu Payung, gua laut Gua Lanun, bukit berpermatang Pulau Gedong dan Pulau Aman, persisir berbatu Pulau gedong dan sistem landskap keseluruhan kepulauan ini. Cadangan pemuliharaan diperkenalkan dalam bentuk tapak terpelihara dan landskap berpemandangan indah, sementara geopelancongan di kemukakan dalam bentuk produk pelancongan.

Shock structures in Peninsular Malaysia: evidence from Kedah and Pahang

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Evidence of geology, morphology and gravity anomalies demonstrate that the double Mahsuri Rings in Langkawi are impact structures. Each of the partially superimposed rings is 2.4 km across, with centres at 0.6 km distance apart and depths of 107 m (eastern ring) and 45 m. From these rings in the southwest direction are two more circular structures of progressively smaller size: Temoyong and Tepor structures. Together the four structures probably represent the product of serial impacts of extraterrestrial projectiles arriving from the southwest. The impact event was post-granite of Gunung Raya (whose age is Triassic-Jurassic) if the topography was exhumed, but could be of Neogene age if the present landscape was never buried. The Paloh craters at the Pahang-Terengganu

border are associated with vein quartz containing planar deformations features and display mosaicism. At Beserah near Kuantan, 35 km southeast from Bukit Paloh, quartz megacrysts of partially weathered granite show naturally etched cleavage. It is not yet clear if the Paloh impact craters are in any way related to the shocked-metamorphose granitoids in the Kuantan area.

Type deposits of primary gold mineralization in the Central Belt of Peninsular Malaysia

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A study of gold mineralization of the Central Belt of Peninsular Malaysia was made, based on fluid inclusion, mineralogy and field observations. The gold mineralizations in the Central Belt can be divided into three types, viz., gold mineralization in quartz veins, gold mineralization in massive sulphides and gold mineralization in skarn. Of the three types, gold mineralization in the quartz veins is the most dominant and being actively mined while the others are limited and of less economic importance. Gold mineralization in quartz veins is distributed from Batu Melintang, Panggung Lalat in Kelantan, through Tersang, Selinsing, Kecau Tui, Penjom and Raub in Pahang to Gunung Ledang in Johor. This mineralization has two styles, viz., gold together with sulphides and gold together with base-metal and carbonate. Fluid inclusion studies indicate that gold –bearing quartz veins in Central Pahang are formed at 50–1,500 m depth, at a temperature range of 100–350°C and salinity of 0.5-4.8 wt% Gold-bearing quartz veins are steeply dipping fault and shear zones trending roughly north-south. Common associated sulphide minerals are pyrite and arsenopyrite while galena, chalcopyrite, sphalerite, tetrahedrite, stibnite and cinnabar are occasionally observed at certain localities. Gold mineralization in massive sulphide is found in Manson's Lode, Sokor, Kelantan and Tasik Chini in Pahang and its common associated minerals are galena, pyrite, sphalerite, chalcopyrite, pyrrhotite and hematite. This type of gold mineralization was once mined and is regarded as a Kuroko-type massive sulphide, formed in an underwater marine environment. Gold mineralization in skarn is not economically important and has been traced in Sungai Sok, Kelantan. The types of primary gold mineralization in the Central Belt are exemplified.

Late Mesozoic-Early Tertiary faults of Peninsular Malaysia

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Three samples of sheared granite were collected from two fault zones; the Bukit Berapit Fault and Bukit Tinggi Fault. The samples were dated by using the K/Ar method on the whole rock. Three isotope ages for the timing of fault movements were obtained i.e. 83.6 ± 4.2 Ma, 53.4 ± 2.7 Ma and 46.0 ± 2.3 Ma. The implication of the fault movements and the tectonic significance of resulting ages will be discussed.

Holocene sea level changes in Peninsular Malaysia

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In Holocene sea level study, the selection and identification of appropriate sea level indicator is a prerequisite in order that the sea level index points can be useful and significant. This requires the identification and determination of the indicative meaning. The indicative meaning of the sea level indicator is defined as the altitudinal relationship of the local environment in which it accumulated to the contemporaneous reference tide level.

This study identifies the sea level index points using the litho-, bio-, and chrono- stratigraphic approach. The sea level indicator is derived from the regressive contact of the intercalated peat and marine Holocene sequences from Meru and Mardi in Kelang and Penor in Kuantan, while the indicative meaning is estimated based upon the microfossil relationship between the fossil sea level indicator with contemporary samples from various present-day ecological environments.

Seven sea level index points identified in the study are compared to the corrected sea level indicator data from earlier works. In Peninsular Malaysia, a general trend of high sea level from about mid-Holocene to the present is depicted.

The occurrence and classification of hard rock body in Putrajaya and its implication to construction activities

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Putrajaya, the new federal administrative capital of Malaysia which is being designed as a paperless city, is still under construction. The geology of Putrajaya was reported as being underlain mainly by Hawthorden Schist and interbedded sandstone and shale of the Kenny Hill Formation with a localised granite body.

This paper discusses the occurrence of a very hard and abrasive rock body in Putrajaya. The name "Putrajaya Gneiss" is introduced for this rock body for discussion purposes for this paper based on preliminary study. Even though the distribution of this rock was only within a limited area, its occurrence was not expected, hence it created problems to the construction activities

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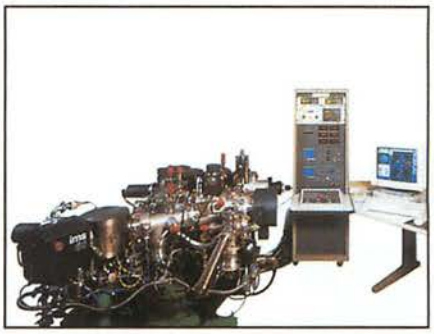

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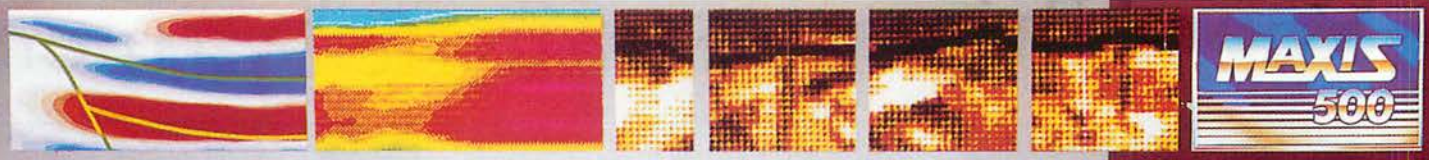

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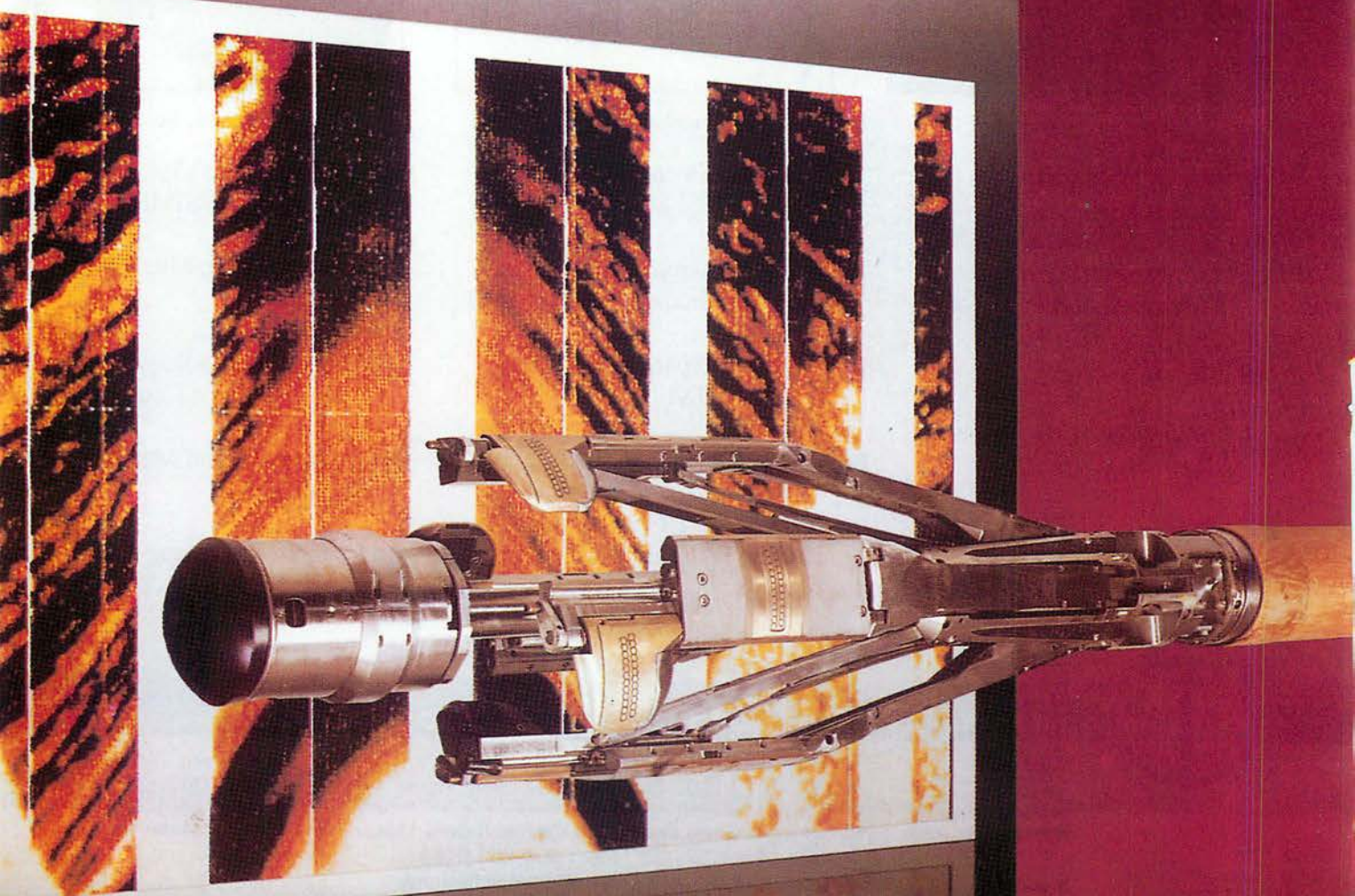

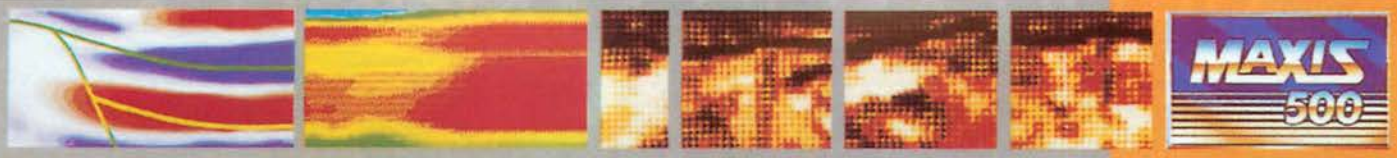

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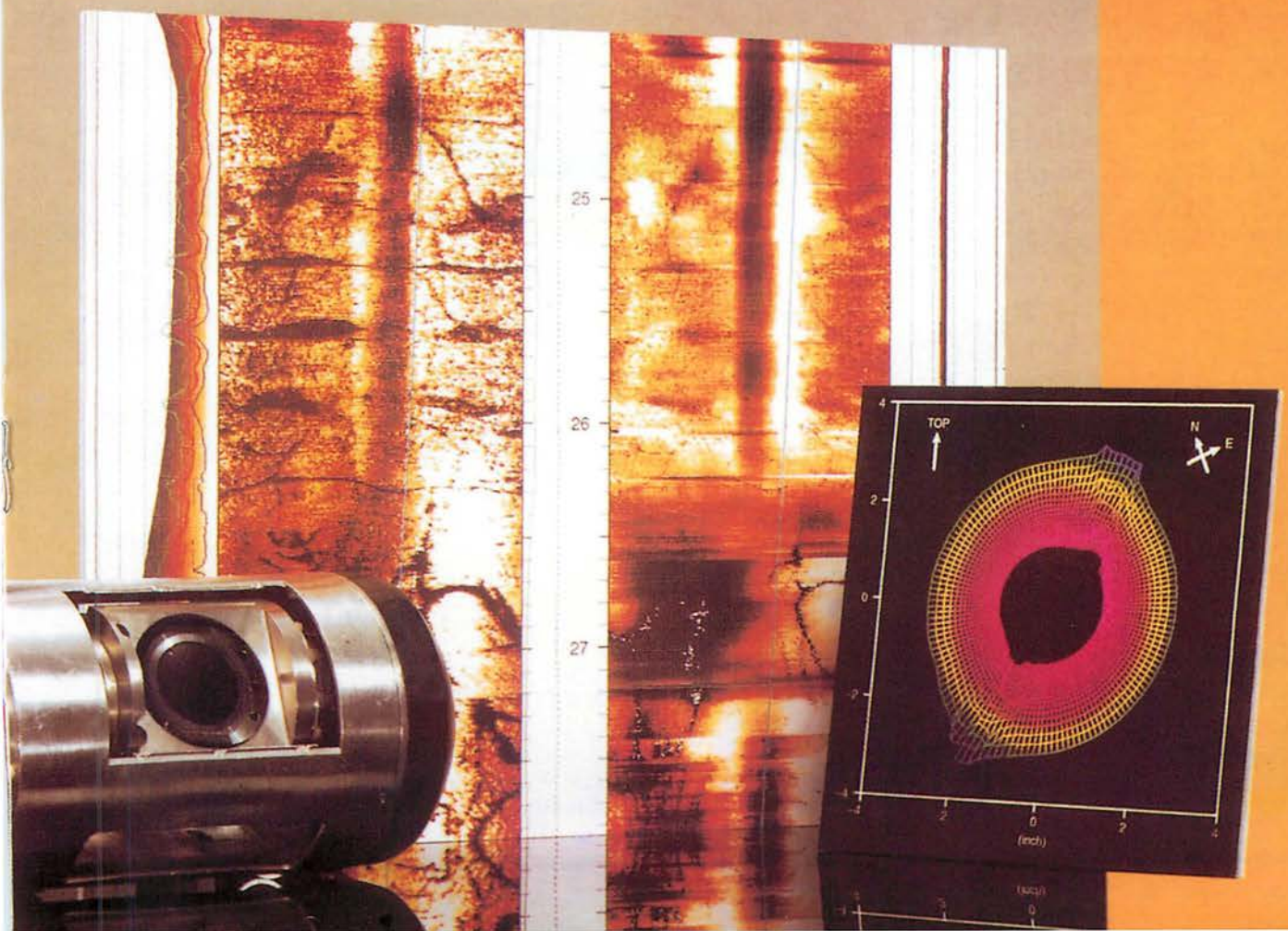

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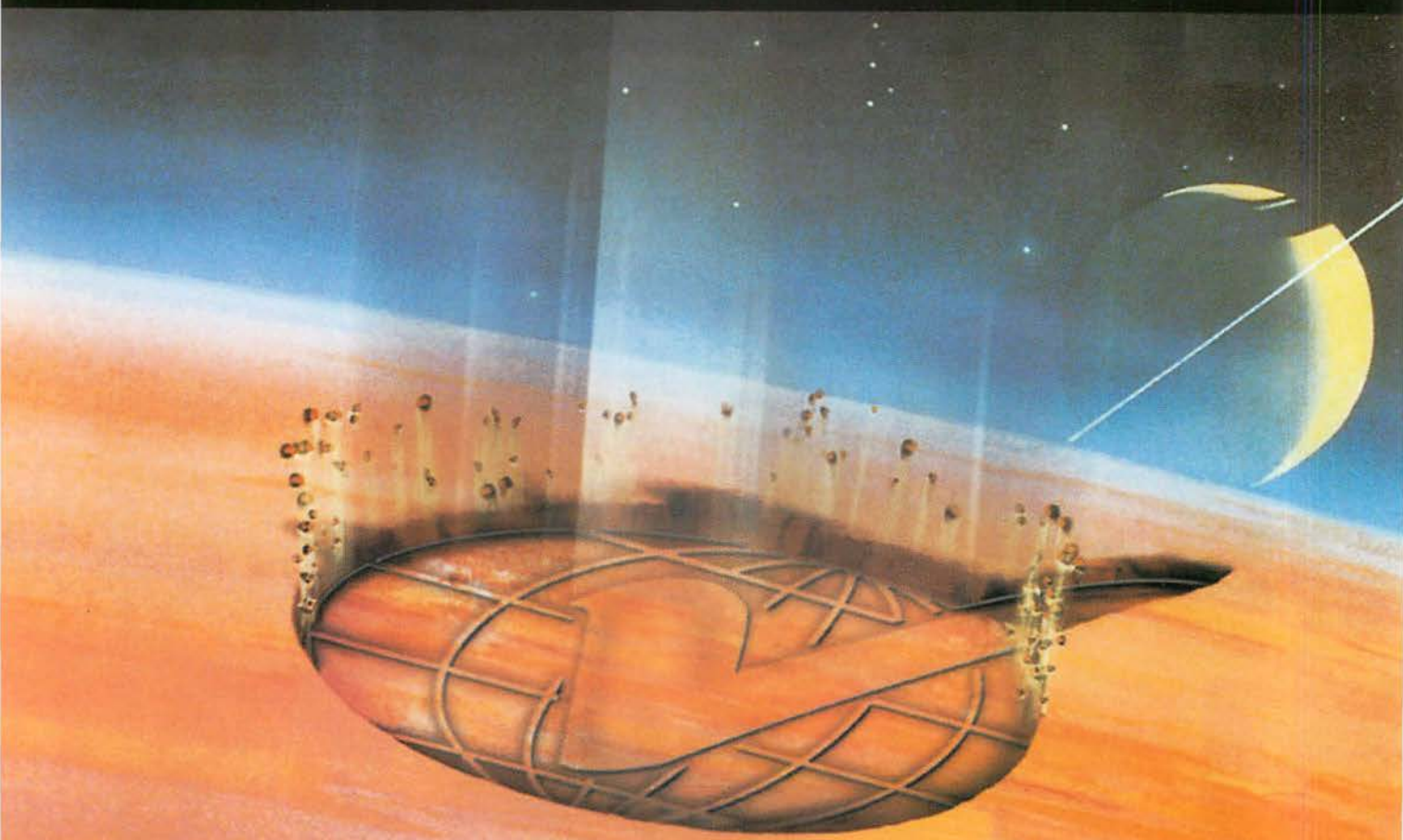

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Penggunaan kaedah pengimejan keberintangan geoelektik dan isotop sekitaran dalam kajian air resapan di empangan Durian Tunggal, Melaka

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Kajian menggunakan kaedah pengimejan keberintangan geoelektrik dan nuklear (isotop stabil) dilakukan untuk mengenalpasti punca terbitnya air resapan di kaki sayap sebelah kiri empangan Durian Tunggal, Melaka sehingga menyebabkan wujudnya tompokan air di kaki empangan berkenaan. Kaedah nuklear digunakan untuk mengesan punca air resapan dengan menganalisis kandungan isotop stabil oksigen-18 dan deuterium (H-2) dalam sampel air yang dipungut di kawasan kajian. Sementara itu, maklumat mengenai lokasi dan taburan air resapan diperolehi daripada kajian pengimejan keberintangan geoelektrik yang digambarkan dalam bentuk profil 2-D. Hasil kajian menunjukkan kehadiran air resapan di kaki empangan dikaitkan dengan berlakunya kebocoran paip air yang di tanam di kaki empangan melalui 'Bounded Storage'dan sebaliknya ke di Sg. Melaka.

Geophysical mapping of saltwater intrusion in the Kerpan coastal area, Kedah

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The salinity of the ground water in the coastal alluvial aquifer between Kerpan-Air Hitam and Sanglang area in Kedah was investigated using both vertical geoelectrical sounding (VES) and 2-D geoelectrical resistivity imaging techniques. The resistivity measurements were made using ABEM SAS 300C and SAS4000 terrameters. A total of 61 VES stations were established over an area of approximately 100 km^2 of Quaternary alluvium. The 2-D imaging was used to study the lateral and vertical changes in resistivity of the alluvial sediments. Salinity of the ground water was interpreted based on the apparent resistivity values. Ground water with resistivity values less than 5 ohm-m is considered as saline and those of greater than 100 ohm-m is fresh water. The resistivity values ranging from 5 to 100ohm-m is for brackish water. The VES and imaging results show that the ground water has resistivities ranging from 0.53 to 670.5 ohm-m. The results of spatial distributions of apparent resistivity indicate that the ground water is mainly brackish with the salt-water affected aquifer confined to the coastal part of the study area. Vertical variations of the resistivity values plotted along profiles perpendicular to the coastal line, indicate that the saltwater has significantly affected the ground water at depth and far away from the coastal area.

Prospecting for iron ore in the Bedong area, Kedah using geophysical techniques

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Geophysical studies were conducted in the Sungai Tok Pawang locality in Bedong, Kedah on sites which had been mined for iron ore as well as areas adjacent to them. Reconnaissance magnetic profiling over three old mining sites did not locate any anomalies significant enough to warrant further investigation. However, ground magnetic, gravity and electrical imaging surveys carried out along a network of traverses in an unmined area, adjacent to some old mining pools, detected a previously unknown probable iron ore deposit. Integrated mathematical modelling of the magnetic and gravity data shows a sizeable ore body with physical characteristics similar to previously mined deposits in the area. Follow-up detailed geophysical surveys and drilling are needed to further delineate this new iron ore body.

Penggunaan seismos biasan dalam pencirian tanah tambakan di tapak projek pembinaan Kamsis H UKM, Bangi

KHAIRUL ANUAR MOHD. NAYAN, MOHD. RAIHAN TAHA
& SRI ATMAJA PJNN ROSYIDI

Jabatan Kejuruteraan Awam dan Struktur
Fakulti Kejuruteraan, Universiti Kebangsaan Malaysia
43600 Bangi, Selangor, Malaysia

Kajian ini dijalankan dengan menggunakan kaedah seismos biasan dalam mencirikan dua lapisan subpermukaan yang mempunyai ketumpatan yang berlainan di tapak pembinaan Kamsis H, Universiti Kebangsaan Malaysia, Bangi, Selangor. Survei seismos biasan dijalankan di dua lokasi di tapak dan data yang diperolehi dianalisis mengikut Kaedah Masa Silang. Hasil analisis menunjukkan perbandingan yang baik dengan data aras ukur, aras tambakan dan juga data penanaman cerucuk di tapak.

Effect of lime on permeability and microstructure of soil

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Unstabilised and stabilised clayey sand soil with 6% of lime were cured in 190 mm and 100 mm diameter of cylindrical plexy-glass mould for 4 weeks to study the effect of lime on permeability and microstructure of the soil. The permeability of soils were measured for every 1 pore volume (PV)

solution by falling the head method during the leaching test. The leaching test was conducted until 7 PV solutions. Scanning Electron Microscopic (SEM) was used to study the microstructures of both soils before and after leaching tests. The initial permeability of stabilized soil is typically lower compared to the unstabilised soil after curing for 4 weeks. The permeability of unstabilised soil samples was 7.02×10^{-9} m/s and the stabilised soil was 2.40×10^{-9} m/s. The unstabilised samples show the immediate decrease of permeability to 1.85×10^{-9} m/s with leaching 2 PV leaching solutions, whereas the stabilized samples show the immediate decrease of permeability to 1.86×10^{-10} m/s after 1 PV leaching solution. Further increase in PV values almost maintained the permeability of stabilized and unstabilised soils with average values of 1.42×10^{-10} m/s and 2.33×10^{-9} m/s respectively. The phenomenon of decrease of permeability is due to the clogging of fine particles in pore space and formation of cementitious minerals. The scanning electron micrographs showed the structure of layered kaolinite, angular shape of quartz and high pore space in the unstabilised soil. After leaching at 7 PV solutions, the unstabilised soil at the top layer indicated packed microstructure and good reorientation of clay particles. Whereas, the structures at the bottom layer showed a more packed structure, flocculated and with low pore space. The scanning electron micrographs showed the formation of cementitious mineral in stabilized soil. After leaching with 7 PV solutions, the dissolution of cementitious minerals occurred and formed new channel. However, the dense cementitious minerals at the bottom layer were flocculated, link with one another and clogged up the fine particles in pore spaces. The test result indicates that addition of lime could modify the microstructure and reduce the permeability of the soil.

Middle Miocene planktonic foraminifera and their implications in the geology of Sabah

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Planktonic foraminifera flourished during Middle Miocene. They were recorded from the Ayer, Kuamut, Garinono mélanges, the Libong Tuffite, Tungku Formation, Tabanak Conglomerate, and Setap Shale Formation. Three assemblages of planktonic foraminifera were identified from the Libong Tuffite, the Garinono mélange, and the Setap Shale Formation. The assemblages indicate an age ranging from the early Middle Miocene *Globigerinoides sicanus-Globigerinatella insueta* Zone (N 8) to the middle Middle Miocene *Globorotalia fohsi fohsi* Zone (N12). The occurrence of the planktonic foraminifera suggests that a transgressive event caused the influx of the nutrient-rich water mass into the area. This event was probably related to the rifting of the Sulu Sea and the development of the eastern Sabah deep marine environment where the mélanges were deposited. The occurrence of tuff and tuffite indicates volcanic activity in the region. The age of the volcanic tuff is middle Middle Miocene as dated by planktonic foraminifera.

Early Permian sequence from Sungai Itau quarry, Langkawi: its age, depositional environment and palaeoclimatic implication

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A sequence of thickly bedded sandstone, massive mudstone, silty shale and massive sandstone exposed at a quarry in Kampung Sungai Itau, Langkawi is described herein. In the lower part, sandstone with calcareous horizons is rhythmically interbedded massive black pebbly mudstone or diamictite indicates sea level fluctuation influenced by glaciation and deglaciation of the Gondwana supercontinent. The deposition took place in the outer shelf. The silty shale yields an Early Permian (late Asselian-Sakmarian) brachiopod assemblage of strong Gondwanan affinity. The massive sandstone on the top part of the section represents a storm deposit.

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

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The transitional sequence from the Setul Limestone to the Kubang Pasu Formation is well exposed at Guar Sanai, Kampung Guar Jentik, Beseri District, northwest Perlis, Malaysia. The rocks of the study area are divided into three major units: Upper Setul Limestone, Jentik Formation, and Kubang Pasu Formation.

The Upper Setul Limestone exposed in Guar Sanai contains *Scyphocrinites*, which gives it a late Silurian age.

The name Jentik Formation is proposed for the roughly 300 m thick sequence between the Setul Limestone and Kubang Pasu Formation. The Jentik Formation can be further divided into six informal units: (a) Unit 1; (b) Unit 2; (c) Unit 3; (d) Unit 4; (e) Unit 5; (f) Unit 6. Unit 1 consists mainly of black shales containing a Dacryoconarid-*Monograptus-Plagiolaria* faunal assemblage, which gives an early Devonian age. Unit 2 consists of light coloured, unfossiliferous sandstones and shales. Unit 3 is mainly thick red mudstone, interbedded with sandstone, sometimes showing graded bedding. A brachiopod-*Diacoryphe-Posidonomya* faunal assemblage gives it a late Devonian age. Unit 4 consists of well bedded, dark limestone, containing straight coned nautiloid fossils. Unit 5 is composed mainly of black mudstone interbedded with cherts, with slump structures. The base of the unit contains a brachiopod–gastropod fossil assemblage. Unit 6 consists mainly of thick beds of brownish red mudstone, interbedded with sandstone. The red mudstones contain a *Macrobole–*

crinoid fossil assemblage, which is earliest Carboniferous in age. The Kubang Pasu Formation is suspected to be unconformably overlying the Jentik Formation.

The epicontinental sea that covered present day northwest Peninsular Malaysia during the Palaeozoic was probably density stratified. Transition from shelf carbonate, to black shale and redbed deposition could be due to shifting of the boundary between the oxygen minimum layer and the deeper oxic layer of the sea, triggered by sea level changes.

Palynomorph assemblage from Keratong, Pahang: its age and emergence of angiospermlike pollen

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The identified palynomorph assemblage from a rock sequence which is exposed at Felda Keratong 8, southeastern part of Pahang, resembles the *Paradoxa* Assemblage and it is suggested that its age is late Lower Cretaceous (Barremian-Albian). The occurrence of monosulcate pollen of *Clavatipollenites hughesii* indicates that the emergence of angiosperms has taken place during the deposition of the sediments in this area.

Annual Geological Conference 2002

Renaissance Hotel
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26–27 May 2002

** Abstracts of Posters **

Climate change and chalk aquifer groundwater resources in West Norfolk, UK

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Assessment of the significance of climate change on water resources presents a considerable challenge. This study investigated the impacts of climate change on the Chalk aquifer of West Norfolk using a combination of a groundwater model (MODFLOW) and a climate change model (Hadley Centre's climate change experiment, HadCM2). Two future climate change scenarios were selected from the HadCM2 model: (i) a Medium-high (MH) emissions scenario and (ii) a Medium-low (ML) emissions scenario of greenhouse gases. Two future periods were considered: 2020-35 and 2050-65. Climate-change impacts were evaluated by incorporating the monthly estimated recharge inputs within the transient flow model and comparing the relative changes of groundwater levels and river baseflow volumes over monthly and annual timescales. Two opposite trends are predicted from the modelling of climate change scenarios for the two future periods considered (2020s and 2050s). The 2050ML scenario predicts an annual decrease in recharge of up to 13 mm, a monthly decrease in groundwater levels of up to 70 cm and a monthly decrease of up to 11% in the baseflow volume of the River Nar while the 2020ML scenario predicts an annual increase in recharge of up to 8 mm, a monthly increase in groundwater level of up to 50 cm and a monthly increase of up to 7% in the baseflow volume of the River Nar.

Landskap geologi Kompleks Migmatit Stong Kelantan

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Landskap geologi Kompleks Stong dikelaskan sebagai landskap pergunungan muda. Landskap geologi ini dicirikan oleh keunikan geologi seperti kehadiran batuan magmatit pelbagai jenis,

struktur sisipan (*enclave*) dan kepelbagaian telerang serta keistimewaan landskap seperti pembentukan puncak tor dan siri air terjun dan jeram yang mempunyai nilai estetik, rekreasi dan saintifik tinggi. Pembentukan landskap ini dikaitkan dengan aktiviti magma secara dinamoterma yang luarbiasa membentuk batuan magmatik dan keindahan bentuk landskap yang diukir oleh proses eksogen. Beberapa geotapak yang bernilai warisan tinggi dari segi estetik, rekreasi dan saintifik dalam landskap ini telah dikenalpasti.

Kajian geokimia batuan igneus di sepanjang Jalan Kulai-Simpang Layang-Layang, Kulai, Johor Darul Takzim

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Kajian geokimia telah dijalankan ke atas batuan igneus yang terdapat di sepanjang Jalan Kulai hingga ke Simpang Layang-Layang, Johor. Ia meliputi kawasan seluas 76.38 km^2 yang merangkumi kawasan Ayer Bemban, Ayer Manis dan Bukit Batu. Kajian ini bertujuan untuk menentukan proses pembentukan dan asalan magma sama ada berasal daripada granit mandala timur atau granit mandala barat. Batuan igneus yang terdapat di kawasan kajian boleh dibahagikan kepada lima jenis iaitu granit merah jambu, granit kelabu cerah dan granit berfenokris feldspar alkali serta dua korok berkomposisi dasit dan basalt. Hasil analisis geokimia menunjukkan bahawa batuan yang terdapat di kawasan kajian adalah batuan jenis siri kalk-alkali. Secara keseluruhannya, batuan di kawasan kajian merupakan granit jenis I, kecuali batuan granit merah jambu yang menunjukkan cirian granit jenis S disebabkan berlaku pencemaran oleh batuan keliling semasa pembentukannya. Batuan granit kelabu cerah dan granit merah jambu merupakan batuan peralumina manakala granit berfenokris feldspar alkali, korok dasit dan basalt adalah batuan metalumina. Kesimpulan yang diperolehi menunjukkan batuan igneus di sepanjang jalan Kulai ke simpang Layang-Layang merupakan granit jenis I dan berada di dalam mandala tengah Semenanjung Malaysia.

Geokimia batuan granit di sepanjang jalan dari Kangkar Pulai ke Pekan Nenas, Pontian, Johor Darul Takzim

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Objektif kajian geokimia bagi batuan granit di beberapa buah kuari di sepanjang jalan daripada Kangkar Pulai ke Pekan Nenas ialah untuk menentukan kandungan unsur-unsur kimia dan sejarah penghabluran bagi batuan granit di kawasan kajian. Data bagi analisis geokimia dipersembahkan dalam bentuk gambarajah TAS, gambarajah Harker dan gambarajah A/CNK. Daripada tren analisis data yang diperolehi, batuan granit di kawasan kajian didapati terdiri daripada batuan peralumina dalam siri kalk-alkali tinggi K dan berjenis granit S. Keseluruhan

batuan menunjukkan pembezaan semasa proses penghabluran. Melalui kajian ini, dapatlah disimpulkan bahawa batuan granit di kawasan kajian menghablur daripada magma yang berasal daripada batuan sedimen atau protolith.

Description of some important textures and paired host-enclave geochemistry of mafic microgranular enclaves (MME) in the Eastern Belt granite, Peninsular Malaysia: preliminary observations

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This paper describes some of the important petrographic characteristics of the mafic microgranular enclaves from the Eastern Belt granite of Peninsular Malaysia as well as their chemical relationship. The enclaves are invariably darker coloured and finer grained than the enclosing granitic rocks. They usually have sharp contact with the granitic host. Occurrence of the acicular apatite in the enclave indicates that the crystals are quenched, probably formed when a globule of relatively mafic (enclave) magma comes into contact with cooler granitic magma (granitic host). Occurrence of the quartz-hornblende ocellar reflected hybridism of the two magmas. The variable geochemical trends in the enclave and their host rocks is probably related to the variable degrees of diffusive exchange between the enclave and their host rock magmas during slow cooling

Magmatic epidote: probable absence and implication to the geobarometry of the granitic rocks from Peninsular Malaysia

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Occurrence and implications of magmatic epidote in granitic rocks is reviewed. The presence of magmatic epidote in granodiorites, tonalites and trondhjemites is commonly used as evidence of magma crystallisation at pressure in the region of 6 to 8 kbar. The epidote is easily identified as they are usually euhedral, overgrowth on euhedral allanite, associated with magmatic flow, included in primary muscovite and have fine scale oscillatory zoning. The concept of magmatic epidote and its pressure is apply to granitic rocks from Peninsular Malaysia. Work on the barometry of Malaysian granitoid based on the aluminium content of amphiboles indicate that the highest crystallisation pressure of the granites is 4.98 kbar, which is below the crystallisation pressure of magmatic epidote. This may suggest that the Peninsular Malaysia granitic magmas may not have crystallised the epidote at low pressure.

Geochemistry of mafic dykes from Perhentian and Redang islands: an example of petrogenesis of the younger (dolerite) dykes from the Eastern Belt of Peninsular Malaysia

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Mesozoic mafic dykes in the Perhentian islands and their surrounding area can be divided into two types, based on their field occurrence, i.e. the older and younger dykes. The older dykes are synplutonic to their felsic host and the younger dykes post date their felsic host. The younger dykes, which are more abundant, are mainly doleritic in composition and are similar to those found throughout the Eastern Belt of Peninsular Malaysia. They are made up of plagioclase, clinopyroxene, amphibole, iron ore and chlorite. The silica content of the dykes is between 47.17 to 53.7% and can be classify as basalt, trachybasalt and basaltic trachyandesite. Geochemical study shows that the younger dykes formed in a continental within plate tectonic setting.

Geochemical characteristics of the granitic rocks from Boundary Range Batholith, Peninsular Malaysia

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Geochemical characteristics of Boundary Range granite are similar to those of the Eastern Belt Granite and not to those of the Western Belt Granite. Although, the majority of the rocks from the Boundary Range granite have SiO_2 contents (> 65% SiO_2) similar to those of Western Belt granite, other elements such as P_2O_5, Na_2O, Ba and Sr are very different. The Boundary Range granite can be classified as 'I' type granite as the granite has high Na_2O content, abundance of mafic microgranular enclave, contain sphene and hornblende and increasing ACNK values with SiO_2. Simple modeling of the granite using log-log Ba vs Sr plot suggest that plagioclase, K-feldspar and biotite are important crystallisation phases in the magmatic evolution.

Petrology of dioritic rocks from the Pemanggil Island, Johore

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The three types of dioritic rocks occurring in the Pemanggil Island are pyroxene hornblende diorite, porphyritic pyroxene hornblende diorite and microdiorite. The rock intruded into the volcanic rock probably of Permian age. Geochemical data shows that the SiO_2 content increases from pyroxene hornblende diorite to porphyritic pyroxene hornblende diorite to microdiorite. LIL log-log plot suggests that crystal fractionation plays an important role in the magmatic evolution of the Pemanggil dioritic magmas and plagioclase, hornblende and biotite are the major precipitating phases.

Estimating limestone dissolution rates in the Kinta and Lenggong valleys using the micro erosion meter: a preliminary study

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Limestone dissolution rates have been measured using micro erosion meter in the area of Kinta and Lenggong valleys. Limestone samples in the form of tablets are used with the micro erosion meter which measures the lowering of the tablets' surface after being exposed in certain environments of erosion. The samples are left in three different conditions in the field: in running streams, in stagnant pond water and exposed to the subaerial condition.

Thirty one (31) samples were left to be dissolved and due to the time constraint, the last measurements were taken after 5 to 14 months in the field. The results obtained showed that the rates for each tablet are highly variable with the range of about 1.830 to 0.005 mm/yr. More reliable results are considered representative of dissolution rates in/under running water and stagnant water environment, with values of 0.369 and 0.244 mm/yr, respectively. Depositions are also common on some sample surfaces, believed to be due to the airborne dust and material from quarrying activities in the study area. Growth of mosses on the samples left in the subaerial condition is also common. For these samples, the erosion rate could not be obtained.

Mata air panas Sungai Mering, Lojing, Gua Musang, Kelantan

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Tapak mata air panas Lojing mempunyai potensi untuk menarik ramai pelancong ke kawasan tersebut. Mata air panas ini terletak di dalam kawasan Granit Banjaran Besar, dan berkait rapat dengan retakan atau zon sesar yang berarah 220°. Di sekitar kawasan Lojing ditemui enam tapak mata air panas, dan tiga daripadanya terletak di sepanjang Sungai Mering. Kajian ini bertujuan untuk menilai potensinya untuk dibangunkan sebagai kawasan pelancongan.

Petrografi dan cirian mekanikal bahan aggregat di Kuari IJM, Labu, Negeri Sembilan

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Kawasan kajian terletak di Kuari (IJM), Labu, Negeri Sembilan. Berdasarkan kajian petrografi yang dilakukan didapati mineral utama yang membentuk batuan di kuari ini ialah kuarza, feldspar di samping mineral biotit serta klorit. Kandungan mineral kuarza melimpah iaitu melebihi 39%, feldspar kira-kira 25% manakala biotit dan klorit masing-masing menunjukkan nilai sekitar 5% dan 2%. Batuan granit di kuari ini boleh dikelaskan kepada empat jenis kumpulan iaitu granit berbutir halus, granit biotit berporfiri berbutir kasar, granit biotit berbutir sederhana dan granit zon sesar. Berdasarkan hasil ujian mekanikal, sumber bahan aggregat daripada kuari ini mempunyai kekuatan yang tinggi.

Stratigrafi seismos Lembangan Penyu, Laut Cina Selatan

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Satu pendekatan stratigrafi seismos telah dilakukan keatas enapan sedimen disekitar lembangan Penyu yang terdapat dibahagian lepas pantai Pahang dilaut Cina Selatan. Pengcaman yang dilakukan keatas enapan lembangan berpelantar tersebut termasuklah jujukan seismos, fasies seismos dan sekitaran pengenapan. Lembangan Penyu pada amnya berada pada sekitaran

benua pada zaman Tersier Awal. Sejak Miosen Awal hingga Tengah, sekitaran lembangan pada amnya berubah kepada pantai manakala sekitaran lautan adalah dominan pada zaman Pliosen. Majoriti bahan telah dienapkan pada sekitaran benua dan pantai. Cuma sedikit sahaja dibahagian termuda adalah merupakan bahan enapan lautan. Dari kajian fasies seismos, telah ditemui sebanyak 8 pemantul utama yang membahagikan 8 jujukan seismos. Fasies seismos yang mewakili enapan cerun dan dasar lembangan dicamkan sebagai enapan kipas dan komplek kemaraan serta enapan beting pasir garis pantai yang dicirikan oleh kehadiran lapik mara bawah yang dominan. Fasies ini ditafsirkan mewakili saluran sistem surut. Enapan saluran sistem transgresi yang menindih saluran surut dicamkan dengan permukaan transgresi, satah kebanjiran maksimum dan juga retrogred iaitu kemaraan songsang pada arah benua. Manakala saluran sistem pasang dikenali dengan meneliti lapik bawah yang menindih saluran transgresi serta lapik kemaraan. Kajian fasies seismos dan fitur-fitur enapan pula boleh dikaitkan dengan sekitaran pengendapan. Diantara fitur yang dikenal pasti termasuklah palung sungai kuno dan delta kemaraan menyerong yang berada dalam fasies kacau. Sekitaran enapan yang ditafsirkan ialah pantai yang berhampiran dengan muara sungai. Sekitaran lautan tenang yang terdiri dari enapan kaya lempung ditunjukkan oleh fasies seismos beramplitud rendah dan kurang pantulan. Penurunan paras laut maksimum yang dicirikan oleh hakisan diwakili oleh fasies seismos pangkasan erosi, satah hakisan selaras dan lembah tertoreh. Fitur delta kemaraan sigmoid juga telah ditemui di bahagian atas permukaan erosi yang boleh ditafsirkan sebagai mewakili sekitaran air cetek bertenaga rendah.

A sedimentological study at Bukit Belah, Batu Pahat, Johor

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A sedimentological study was carried out at Bukit Belah, Batu Pahat, Johor which was interpreted by previous workers as part of the Bukit Payong Formation. The study area consists of three main sedimentary facies, namely conglomerate facies, sandstone facies and siltstone facies. In general, the sandstone is thickly-bedded and relatively more dominant than the conglomerates. At some localities, the sandstone is interbedded with siltstone and mudstone. Based on petrographic study, the Bukit Belah sandstone can be classified as lithic arenites, quartz arenites, arkose wacke and quartzose wacke sandstone. Several sedimentary structures were identified in the study area such as parallel lamination, cross lamination and graded bedding. The rock sequence shows a fining upward sequence and together with the presence of some sedimentary structures, it is interpreted that the sediments were deposited in a braided river system.

Plant fossils from Bukit Belah, Batu Pahat, Johor

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The discovery of fairly well-preserved plant fossils from a rock sequence exposed at Bukit Belah, Batu Pahat, Johor can be utilised in interpreting the age of the rocks. The revised age proposed in this paper is Late Jurassic to Early Cretaceous. The identified plant fossils include *Gleichenoides* sp. and *Ptilophyllum* cf. *pterophylloides* Yokohama.

Sedimentary sequence in the subsurface of the Pekan coastal plain, Pahang

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The Pekan coastal plain in which the Pahang river delta is located is made up of a thick sequence of unconsolidated sedimentary sequence of an unnamed formation. Drilling programmes carried out in the area show that the unconsolidated sequence was deposited during two major periods of sedimentation that took place in two different setting. The lower sequence which has been interpreted to have been deposited during the Pleistocene period consists of entirely continental sediment. The continental sequence can be devided into several packages according to their depositional trends and the boundary of each package is marked by an apparent depositional break. The sea-level rise during the early Holocene period have resulted in deposition of a series of marine/ marine-influenced sediments at the top of the sequence.

Geological modelling for site characterization using sufficient and insufficient subsurface exploration data: lesson learned from case histories

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Where good quality data have been obtained from careful supervision of subsurface exploration program, it is essential that the exact geological conditions be carefully analyzed. Without this it is impossible to check the design assumptions or to apply the results to a similar situation elsewhere.

This paper presents the use of geological modelling for civil engineering projects. The modelling is useful for any layman involved in engineering to understand the geological conditions, thus hinder all the surprises during the construction stage. It also useful for understanding geological and

deposition process for prediction of the history of the ground. However, modelling must be made precisely. Insufficient data must not be treated as sufficient.

Survei graviti di Ulu Melaka, Pulau Langkawi, Kedah

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Satu struktur cincin yang dipercayai merupakan kesan hentaman meteorik telah dikesan di bahagian barat daya Pulau Langkawi melalui kajian imej satelit. Kajian lanjut keatas linemen berdasarkan gambarfoto udara juga menunjukkan kehadiran fitur yang berbentuk membulat. Sampel batuan yang diambil daripada kawasan tersebut menunjukkan kehadiran butiran kuarza yang telah mengalami kejutan akibat daripada impak yang kuat dipercayai oleh hentaman meteorik. Struktur cincin tersebut berada dalam batuan metasedimen yang terdiri daripada syis dan kuatzit. Cincin tersebut dan juga kawasan disekitar telah ditutupi oleh endapan lempung aluvium. Survei graviti telah dijalankan di sepanjang beberapa rentasan memotong struktur membulat tersebut dalam rangka untuk menyiasat morfologi subpermukaan disekitar cincin yang dipercayai dibentuk oleh hentaman meteorik. Pengukuran graviti dilakukan disebanyak 100 stesen menggunakan alat La Coste Romberg pada sela 200-500 meter diantara stesen-stesen. Anomali graviti baki di sepanjang garis rentasan ditafsir untuk memperolehi model geologi subpermukaan 2-D kawah meteorik. Rentasan pada arah timur-barat struktur cincin menunjukkan struktur subpermukaan yang menyerupai lembangan dengan kedalaman aluvium di pusat pengendapan setebal 104 meter dan garispusat disekitar 2.0 kilometer. Satu lagi lembangan telah dijumpai pada jarak 0.5 kilometer disebelah barat lembangan tersebut pada rentasan yang sama. Lembangan kedua ini mempunyai kedalaman maksimum 47 meter dan garispusat sepanjang 2.5 kilometer. Lembangan ini telah dipenuhi dengan aluvium Kuaterner. Rentasan lain yang dibuat pada arah timur laut-barat daya struktur cincin juga menunjukkan kehadiran struktur lembangan dengan kedalaman aluvium maksimum disekitar 107 meter dan garispusat 1.8 kilometer. Struktur-struktur lembangan ini adalah bukti tambahan untuk menguatkan lagi bahawa kawasan kajian ini telah mengalami hentaman meteorik.

Teknik-teknik geoelektrik dalam Pemetaan air masin di Kuala Selangor

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Kaedah duga-dalam menegak dan pengimejan geoelektrik telah digunakan untuk memetakan taburan kemasinan air tanah yang terdapat di sekitar kawasan pantai di Kuala Selangor. Kajian ini adalah susulan daripada beberapa penggerudian pemantauan air bawah tanah yang terdapat dalam akuifer aluvium di beberapa lokaliti terpilih oleh Jabatan Mineral dan Geosains. Analisis geokimia keatas air tanah tersebut menunjukkan perbezaan darjah kemasinan bergantung kepada

kedudukan perigi pemantauan. Kawasan yang lebih hampir dengan pantai dan juga sungai mempunyai darjah kemasinan yang tinggi berbanding dengan kawasan yang agak jauh daripada pantai dan sungai. Kemasinan ini dipercayai berasal daripada samada intrusi air laut atau infiltrasi air sungai berhampiran ketika berlaku perubahan pasang-surut. Ketebalan akuifer adalah 20 hingga 30 meter dan terdiri daripada pasir dan kelikir bercampur dengan kekanta lempung. Akuifer ini berada di atas batu dasar metasedimen dan juga granit. Lapisan lempung kuning setebal 15m dan mengandungi kekanta pasir dan lodak didapati menutup akuifer ini di bahagian atas. Kajian geoelektrik telah dilakukan di sekitar kawasan pemantauan untuk memetakan taburan kemasinan air bawah tanah secara keseluruhan. Dua teknik survei iaitu duga-dalam menegak dengan susunatur Schlumberger dan pengimejan sisi-menegak telah diguna pakai untuk mencapai tujuan tersebut. Bagi teknik duga-dalam menegak, jarak elektrod arus maksimum yang di gunakan ialah 300 meter. Survei pengimejan elektrik pula menggunakan sistem susunatur eketrod Wenner. Hanya empat elektrod digunakan dalam survei duga-dalam manakala 50 elektrod yang disambungkan dengan kabel multiteras telah digunakan dalam survei pengimejan. Alat ABEM SAS 300C digunakan untuk mengukur keupayaan elektrik dan kotak suis digunakan untuk memilih kedudukan elektrod arus dan keupayaan. Panjang rebakan maksimum bagi survei pengimejan ialah 200 meter. Data analisis kimia yang dilakukan keatas sampel air bawah tanah akan digunakan sebagai data tambahan dalam pentafsiran. Sejumlah 45 stesen duga-dalam elektrik telah dilakukan di sepanjang tiga jalan raya utama yang merentasi kawasan kajian dan pada arah menegak dengan garis pantai. Jarak diantara setiap stesen ialah di antara 1-2 kilometer dan jumlah panjang garis survei ialah 60 kilometer. Hasil survei duga-dalam elektrik menunjukkan air bawah tanah di kawasan kajian boleh dibahagikan kepada air tawar, masin dan payau dan sempadan diantara air payau dan masin terletak di sekitar 4-8 kilometer daripada garis pantai. Keputusan ini sesuai dengan zon pemetaan klorida yang diperolehi melalui analisis air tanah. Sempadan air tawar – air payau dan air payau – air masin dapat dilihat dengan jelas melalui survei pengimejan elektrik di beberapa lokaliti yang telah ditentukan dengan bantuan survei duga-dalam dan analisis klorida.

Compressibility and Young's modulus of a filled joint under uniaxial compression

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Weathering not only imposes a weakening effect but often widens critical and discrete geological discontinuities that induce further inhomogeneity into the weathered rock mass. Filled joint is one of the example of these geological discontinuities which has been frequently associated with numerous constructional problems. This paper discusses a laboratory investigation on the compressibility of a filled joint model under uniaxial loading. Laboratory test data was used to estimate the modulus of the infill and joint block. Using a *composite homogeneous model*, the modulus of the model filled joint was estimated. The resultant modulus is found to be lower than the modulus of joint block alone.

Penggunaan teknik gelombang permukaan (SASW) dalam kajian geologi kejuruteraan

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Teknik gelombang permukaan adalah teknik seismos tanpa musnah yang digunakan untuk menentukan sifat-sifat dinamik sub-permukaan pada tahap terikan yang rendah. Ujian lapangan boleh dilakukan samada di permukaan tanah atau turapan. Dengan penghasilan dan pengukuran gelombang permukaan di lapangan, lengkung serakan, iaitu plot halaju gelombang permukaan melawan panjang gelombang akan dihasilkan. Lengkung serakan ini seterusnya akan menjalani analisis songsangan bagi mendapatkan profil kekukuhan sebenar tapak berkenaan. Teknik ini berpotensi untuk digunakan dalam sektor kejuruteraan geologi. Hasil ujian gelombang permukaan yang dilakukan ke atas dua jenis tapak yang berlainan, iaitu teres potongan dan tambakan termampat adalah dibentangkan. Hasil ujian SASW dibandingkan dengan kaedah-kaedah ujian piawai seperti SPT dan meter-tekanan.

Taburan ketakselanjaran dalam profil luluhawa batuan metasedimen - Kajian kes cerun potongan CH11540 - CH11700 Lebuhraya Baru Pantai, Kuala Lumpur

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Cerun Potongan di CH11540 –CH11700 Lebuhraya Baru Pantai, Kuala Lumpur, terdiri daripada batuan metasedimen Formasi Kenny Hill, yang berusia Perm-Karbon. Formasi ini terdiri daripada selang lapis metabatu pasir, metabatu lumpur dan syal yang telah termetamorf menjadi seakan-akan filit. Cerun potongan setinggi 23m ini mendedahkan batuan terluluhawa sederhana (gred III) hingga sepenuhnya (gred V) dan tanah baki (gred VI).

Survei ketakselanjaran telah dilakukan pada setiap cerun teres dengan kaedah garis pengimbasan yang direntangkan pada permukaan cerun. Setiap satah ketakselanjaran yang memintasi garis imbasan ini direkodkan orientasinya (jurus dan kemiringan). Data-data ketakselanjaran tersebut diasingkan mengikut gred luluhawa batuan dan diplotkan ke dalam unjuran stereografi hemisfera bawah untuk menilai taburan ruangnya di dalam profil luluhawa.

Hasil kajian jelas menunjukkan bahawa orientasi ketakselanjaran relikta yang terawet di dalam "tanih kejuruteraan" (batuan gred IV - V), didapati hampir sama dengan orientasi ketakselanjaran yang terdapat di dalam "batuan dasar" (gred III). Ini membuktikan bahawa pemetaan struktur ketakselanjaran relikta secara terperinci dan teliti boleh memberikan gambaran sebenar orientasi ketakselanjaran pada batuan dasar, dengan syarat zon "tanah kejuruteraan" dan "batuan dasar" tersebut berada di dalam domain struktur yang sama.

Detection of seismic phases from a major earthquake on a local seismogram

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A study was undertaken to investigate how a local seismogram records a major earthquake. The earthquake chosen was the one that shook Afghanistan's Hindu Kush region on the 3rd of March, 2002 at 12:08:22.9 UTC. This major magnitude 7.4, intermediate depth, tremor killed about 150 people. This intriguing earthquake was preceded by another earthquake of magnitude 6.2 at 12:08:12.3 and followed by several large aftershocks in the same day. The data used is from the NEIC website and the FRIM station. Several phases were successfully identified from the local seismogram, including multiples and depth phases.

Struktur dan sejarah canggaan batuan di Pulau Kapas, Terengganu

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Batuan metasedimen bergred rendah berusia Karbon di Pulau Kapas telah mengalami canggaan yang menghasilkan lipatan ketat menunjam ke arah selatan-tenggara (STG) atau utara-baratlaut (UBL). Pada zon tertentu terdapat lipatan ketat yang terbalik disempadani oleh sesar songsang atau sungkup. Sungkupan ke arah barat-baratdaya adalah yang dominan, manakala ke timur-timurlaut ditafsirkan secagai sungkup-belakang. Canggaan seterusnya menghasilkan sesaran mendatar dekstral berarah hampir utara-selatan yang turut melibatkan konglomerat yang ditafsirkan berusia Perm. Sistem tegasan dengan mampatan arah timur-timurlaut sekali lagi dialami oleh kawasan ini, menerbitkan sesaran mendatar dekstral dan sinistral yang diakhiri dengan rejahan daik dolerit. Sistem tegasan dengan mampatan dari arah tenggara-baratlaut mengakhiri canggaan kawasan ini yang menrbitkan sesaran hampir utara-selatan dengan gerakan sinistral. Sistem tegasan ini juga telah mengaktifkan semula sesar utara-selatan yang sudah sedia wujud dengan gerakan sinistral.

A meaningful correlation between shallow seismic refraction data to borehole data in site investigation work

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In site investigation work the subsurface characteristic is mainly determined from boreholes data such as the bore log, standard penetration test and other suitable test. Surface geophysical survey including seismic refraction has been routinely used to compliment the borehole data. In many small scale site investigation boreholes are made mainly using the wash boring method and are normally very shallow. The standard penetration test value N = 50 is used to end the borehole and it occurs normally within the weathered zone or above the bedrock surface. The seismic work determines the depth and characteristic of the bedrock as well as the strata above the bedrock. The seismic refraction data is compared to the boring data and often used to extrapolate the subsurface condition between the boreholes. Correlation of seismic refraction data to wash boring data is often difficult because the wash boring bore log description is mainly grain sized based and not lithological based. Comparison to both the bore log and the standard penetration test values allows a better correlation. In addition, at the shallower level the Mackintosh probe test value and the water table has been used. The two sites studied show that comparison of the seismic refraction data to an integrated data gives a more meaningful and useful correlation.

The effect of major faults and folds in hard rock groundwater potential mapping: an example from Langat Basin, Selangor

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Together with other factors, geological factors such as lithology, bedding, fractures (lineaments), faults and folds play a very significant role in the movement and accumulation of groundwater in hard rock terrain. However, in most cases of groundwater potential mapping, only the role of lithology and lineaments are considered together with other non-geological factors. This paper will demonstrate the effect of faults and folds in groundwater potential mapping by using remote sensing and the geographic information system integration method. By incorporating faults and folds in the study, zones of groundwater potential become more focussed and well defined as compared to the result when only lithology and lineaments are considered. It is hoped that the derived ground water potential zonation map will be useful for further work in groundwater exploration of a selected area.

EPMA characterisation and geochemistry of cassiterites from the Kuala Lumpur area

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The Kuala Lumpur area used to be a major tin producing area in the last century. The purpose of this study is to characterise the cassiterite in the Kuala Lumpur area using the EPMA and petrological microscope. This study involves primary and alluvial cassiterite from past and present mines in the Kuala Lumpur area, namely, the Ulu Klang, Kampung Pandan, Setapak, Pudu Ulu and Puchong areas.

EPMA study show that the cassiterites in the Kuala Lumpur area have, on the average, Sn contents of 68.0526 to 75.3848 wt%. The average Sn content for cassiterite from the Ulu Klang area is 73.5696–74.9022 wt%, the Kampung Pandan area is 71.6597–74.1387 wt%, the Setapak area is 68.0526–69.2089 wt%, the Pudu Ulu area is 73.5723–74.3704 wt% and the Puchong area is 73.0738–75.3848 wt%.

Cassiterites from Kampong Pandan show strong reddish pleochroism. EPMA analysis show that the reddish areas are higher in Sn, Fe, Ti and Nb.

The cassiterites in the Kuala Lumpur area are also characterised by inclusions of native bismuth and bismuth-containing minerals, namely, rooseveltite ($BiAsO_4$) and bismuthinite (Bi_2S_3) in the Ulu Klang area. Wodginite [$(Ta, Nb, Sn, Mn, Fe)_{16}O_{32}$] and native bismuth inclusions were found in cassiterites from Kampong Pandan while cassiterites from Puchong showed inclusions of andalusite (Al_2SiO_5).

EPMA study of heavy minerals in the Annah Rais-Bayur area, Sarawak

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The EPMA technique is applied in the geochemical exploration for heavy minerals in stream sediments in the Annah Rais-Bayur area in Sarawak. The rivers sampled include Sg. Semadang, Sg. Tebia, Sg. Abang O, Sg. Nibong and Sg. Temurang.

Among the five rivers draining the area, it was found that ilmenite and rutile were present in all the rivers sampled with higher concentrations in Sg. Semadang and Sg. Tebia. Zircon and monazite were also found in all the rivers but with higher concentrations in Sg. Abang O and Sg. Tebia. Cassiterite was found in Sg. Nibong and Sg. Tebia while cinnabar was found in Sg. Temurang. More importantly, gold was also found in Sg. Nibong, Sg. Tebia and Sg. Abang O.

The Annah Rais-Bayur area has good potential for economic mineral resources in particular Au, Sn, Ti and Hg. More intensive geochemical exploration is recommended to delineate the source areas of the minerals of economic potential.

Palynological study on a rock sequence at Bandar Tenggara, Johor

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The identified palynomorph assemblage from a rock sequence exposed at Bandar Tenggara, Johor is interpreted to be Tertiary in age. It resembles the *Verrucatosporites usmensis* zone which is characterised by the presence of *Verrucatosporites usmensis*, *Spinizonocolpites baculatus*, *Alnipollenites* and *Psilatricolporites operculatus* of Late Eocene age. By the presence of fresh water algae *Pediastrum* sp., together with *Striatricolpites catatumbus*, *Stenochlaena* sp., *Laevigatosporites* sp. and *Deltoidospora*s sp. which were derived from freshwater swamp plant community, it shows that, the sediments were deposited in a freshwater swamp environment.

BERITA-BERITA PERSATUAN
News of the Society

KEAHLIAN (Membership)

The following applications for membership were approved:

Full Members

1. Peter Anak Garang
Syarikat Billawati, No. 870, Lot 1304, Chester Park, Jalan Kangkok, Batu Kawa, 93250 Kuching.

2. Che Maznah Mat Isa
Universiti Teknologi Mara (UiTM), Shah Alam, Selangor.

PETUKARAN ALAMAT (Change of Address)

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

1. Lim Peng Siong
Geo-Enviro Technology, 19-3, Block D, Inanam Business Centre, Mile 6, Jalan Tuaran, 88450 Kota Kinabalu.

2. Goh Seng Hong
113, Jalan SS2/18, 47300 Petaling Jaya, Selangor.

CURRENT ADDRESSES WANTED

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

1. Mr. U.W.A. Sirisena
   Jabatan Mineral & Geosains, P.O. Box 560, 93712 Kuching, Sarawak.
2. Ir. Wan Anuar Hj. Wan Ibrahim
   1398, Jalan Mawar 24, Taman Permint Jaya, Chendering, 21080 Kuala Terengganu, Terengganu.
3. En. Hamdan Hassan
   404, Block C4, Section 10, Wangsa Maju, Setapak, 53300 Kuala Lumpur.
4. Dr. Idris Mohamed
   Roxar Sdn. Bhd., Suite 2109, Plaza Pengkalan, Jalan Tiong, 51100 Kuala Lumpur.

PERTAMBAHAN BAHARU PERPUSTAKAAN (New Library Additions)

The Society has received the following publications:

1. Monthly statistics on Mining Industry in Malaysia, Jul–Dec 2001 & Jan-Feb 2002.
2. Tin International, vol. 75, nos. 2, 3 & 4, 2002.
3. Acta Palaeontologica Sinica, vol. 40, no. 4 (2001) & vol. 41, no. 1 (2002).
4. Palaeontological abstracts, vol. 16, nos. 2 & 3.
5. Acta Micropalaeontologica Sinica, vol. 18, no. 4 (2001).
6. Episodes, vol. 25, no. 1, 2002.
7. Nature & Human Activities, no. 6, 2001.
8. Museum of Nature & Human Activities, Hyogo, vol. 12 (2001).
9. Oklahoma Geology Notes, vol. 61, nos. 3 & 4, 2001.
10. Institute of Geoscience, The Univ. of Tsukuba, no. 27 (2001).
11. AAPG Explorer, May 2002.
12. Geosciences Journal, vol. 6, no. 1, 2002.
13. AAPG Bulletin, vol. 86, nos. 4 & 5, 2002.
14. Geological Bulletin of Turkey, vol. 44, no. 2, 2001.
15. USGS Prof. Paper: 2000: nos. 1625-B(CD); 2001: nos. 1620, 1649, 1416-F, 1640, 1645.
16. USGS Circular: 2001: nos. 1217, 1218; 2002: no. 1221.

BERITA-BERITA LAIN
Other News

14th SEAPEX EXPLORATION CONFERENCE SINGAPORE

9–13 April 2003

SEAPEX EXPLORATION CONFERENCE 2003 (INCLUDING FARMOUT FORUM)

Singapore-based South East Asia Petroleum Exploration Society (SEAPEX) announced today that the next biannual SEAPEX EXPLORATION CONFERENCE will be held from Wednesday 9th April to Friday 11th April 2003.

After the success of the 2001 Conference, the 14th SEAPEX Exploration Conference (SEC) will focus on the upstream/new ventures activities and opportunities in the Asia Pacific region. Timing is aimed at a period of anticipated expansion after the annual budgets for such activities have been approved. The conference will end at noon on Friday 11th to allow for the Singapore Scout Check Meeting to be held in the afternoon.

The traditional SEAPEX Golf Tournament will be held on Tuesday 8th April at Ria Bintan, Indonesia.

The venue is the same as for the last conference, the Orchard Hotel in Singapore, a location well known to SEAPEX members and Scout Check meeting participants. SEAPEX has reserved a larger floor area for 2003. During the 3-day programme, the morning sessions will feature keynote speakers and industry experts giving high-level technical talks on a wide variety of topics of interest to the whole region.

Farmout Forum presentations will be included in the programme of the first two afternoons.

As in 2001, the SEAPEX Exploration Conference 2003 promises to be the premier SE Asia exploration event in the region.

For further details please refer to the

SEAPEX webpage: www.seapex.org
email: "seapex@seapex.org"
or fax +65 6236 4534
or contact Jon Savage
The Technical Programme Director
e-mail: "jon.savage@pgs.com"

Quotable Quotes

"In matters of conscience, the law of majority has no place."

Gandhi

*****

"Nothing is politically right which is morally wrong."

Thomas Jefferson

*****

"What is a tunnel?? A tunnel is a long hole where at one end stands a GEOLOGIST, and at the other, a LAWYER!!"

Professor Leopold Muller
(generally regarded as the Father of Rock Mechanics), during his keynote address at the 4th International Congress of the International Association for Engineering Geology, 10–15 Dec. 1982, New Delhi, India.

*****

Boon Kong

KALENDAR (CALENDAR)

2002

July 6–10

FIRST INTERNATIONAL PALAEONTOLOGICAL CONGRESS, Sydney, Australia. (Contact: Jophn A. Talent, MUCEP, Earth and Palaeontological Sciences, Macquarie University, NSW 2109, Australia. Fax: 61 2 9850 6053; E-mail: IPC2002@mq.ed.au; Website: www.es.mq.edu.au/mucep)

July 7–12

16TH INTERNATIONAL SEDIMENTOLOGICAL CONGRESS, Auckland Park, Gauteng, South Africa. (Contact: Bruce Cairncross, Department of Geology, Rand Africans University, P.O. Box 524, Auckland Park, 2006, South Africa. Tel: +27 11 489 23 13; Fax: +27 11 489 23 09; E-mail: bc@na.rau.ac.za; Website: http://general.rau.ac.za/geology/announcement.htm)

July 9–12

GEOLOGY OF THE DEVONIAN SYSTEM, Syktyvkar, Russia. (Contact: Website: http://sds.uta.edu/ras-update/russian-academy-of-sciences.htm)

July 21–25

9TH INTERNATIONAL PLATINUM SYMPOSIUM, Billings, Montana, USA. Sponsored by IGCP 427/SEG/SGA. (Contact: Website: http://www.platinumsymposium.org/)

July 22–26

THIRD INTERNATIONAL CONFERENCE ON WATER RESOURCES AND ENVIRONMENT RESEARCH (ICWRER), Water quantity & quality aspects in modeling and management of ecosystems, Dresden, Germany. (Contact: Conference Secretariat ICWRER 2002, Institute of Hydrology and Meteorology, Dresden University of Technology, Wuerzburger Str. 46, 01187 Dresden, Germany. Tel: + 49-351-463 3931; Fax: + 49-351-463 7162; E-mail: icwrer2002@mailbox.tu-dresden.de; Website: www.tu-dresden.de/fghhihm/hydrologie.html)

July 22–26

11TH QUADRENNIAL IAGOD SYMPOSIUM AND GEOCONGRESS 2002, Windhoek, Namibia. (Contact: Website: http:www.geoconference2002.com/)

August 11–15

4TH INTERNATIONAL CONGRESS ON ENVIRONMENTAL GEOTECHNICS, Rio de Janeiro, Brazil. (Contact: Tel: +55 21 290-1730; Fax: +55 21 280-9545; E-mail: 4iceg@pec.coppe.ufrj.br; Website: www.4iceg.ufrj.br)

August 25–30

GONDWANA 11: CORRELATIONS AND CONNECTIONS, Gateway Antarctica, University of Canterbury, Christchurch, New Zealand. (Contact: Tel: +64-3-364 2136; Fax: +64-3-364 2197; E-mail: s.hawtin@anta.canterbury.ac.nz or gateway@anta.canterbury.ac.nz; Website: www.anta.canterbury.ac.nz)

September 1–5

17TH WORLD PETROLEUM CONGRESS, Rio de Janeiro, Brazil. (Contact: Brasoc — Brazillian Organizing Committee, Tel: +55 21 2282 2002; Fax: +55 21 2282 2005; E-mail: brasoc@wpc2002.com; Website: www.wpc2002.com)

September 1–6

MINERALOGY FOR THE NEW MILLENNIUM, Edinburgh, Scotland. (Contact: E-mail: info@minersoc.org; Website: www.minersoc.org/IMA2002)

September 12–22

6TH INTERNATIONAL SYMPOSIUM ON THE JURASSIC SYSTEM, Palermo, Sicily, Italy. (Contact: Dr. Luca Martire, Fax: 39 011 541755; E-mail: martire@dst.unito.it)

September 15–19

INTERNATIONAL CONFERENCE ON URANIUM MINING AND HYDROGEOLOGY, Freiberg, Germany. (Contact: E-mail: umh@geo.tu-freiberg.de; Website: www.geo.tu-freiberg.de/umh)

September 16–20

INTERNATIONAL ASSOCIATION OF ENGINEERING GEOLOGY AND THE ENVIRONMENT (IAEG), "Engineering Geology for Developing Countries" (9th International Congress), Durban, South Africa. (Contact: South African Institute for Engineering and Environmental Geologists, P.O. Box 2812, Pretoria, 0001, South Africa. E-mail: saieg@hotmail.com; Website: home.geoscience.org.za/saieg/2002.htm)

September 22–27

SOCIETY OF EXPLORATION GEOPHYSICISTS (72nd Annual Meeting and International Exposition), Las Vegas, Nevada, USA. (Contact: SEG Business Office, Tel: +1-918 497 5500; Fax: +1-918 497 5557; Website: seg.org/)

September 24–28

URANIUM DEPOSITS: FROM THEIR GENESIS OF THEIR ENVIRONMENT IMPACTS, Prague, Czech. (Contact: Bohdan Kribek, Czech Geological Survey, 152000 Prague 5. Tel: 422 51085 518; Fax: 422 5817 390; E-mail: kribeck@cgu.cz)

October 15–19

INTERNATIONAL WORKSHOP ON INTEGRATED WATER RESOURCE MANAGEMENT. Organised by the US Bureau of Reclamation, Denver, Colorado, U.S.A. (Contact: International Affairs Team, D-1520, US Bureau of Reclamation, P.O. Box 25007, Denver, CO 80225, U.S.A. Tel: +1 303 445 2127; Fax: +1 303 445 6322; E-mail: lprincipe@do.usbr.gov; Website: http://www.usbr.gov/)

October 21–25

INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS, "Groundwater and Human Development" (32nd International Congress), Mar del Plata, Argentina. (Contact: Dr. Emilia Bocanegra, Centro de Geología de Costas y del Cuaternario, Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Mar del Plata, Casilla de Correo 722, 7600 Mar del Plata, Argentina; Tel: +54 223 475 4060; Fax: +54 223 475 3150; E-mail: ebocaneg@mdp.edu.ar)

October 27–30

GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Denver, Colorado, USA. (Contact: Meeting 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: www.geosociety.org/meetings/index.htm)

November 20–23

ROLE OF NATURAL RESOURCES AND ENVIRONMENT FOR SUSTAINABLE DEVELOPMENT IN SOUTH AND SOUTHEAST ASIA, Dhaka, Bangladesh. (Contact: Ms. Afia Akhtar, Convenor, NESDA & Vice President, AGID, Director, Geological Survey of Bangladesh, 153 Pioneer Road, Segunbagicha, Dhaka 1000, Bangladesh. Tel: 880-2-418545 (O), 9337559, 9350412 (H); E-mail: afia@agni.com or mnhasan@agni.com; or Mr. Nehal Uddin, Member Secretary, NESDA, Deputy Director, Geological Survey of Bangladesh, 153 Pioneer Road, Segunbagicha, Dhaka 1000, Bangladesh. Tel: 880-2-9348318; E-mail: nehalu@bttb.net.bd)

2003

SIXTH INTERNATIONAL SYMPOSIUM ON ENVIRONMENTAL GEOCHEMISTRY, Edinburgh, Scotland. (Contact: John Farmer, Dept. of Chemistry, The University of Edinburgh, Joseph Black Building, Kings Buildings, West Mains Road, Edinburgh EHP 3JJ Scotland. Tel: 0131-650-1000; Fax: 0131-650-4757; E-mail: J.G.farmer@ed.ac.uk)

March 27–30

NATIONAL EARTH SCIENCE TEACHERS ASSOCIATION (Annual Meeting), Philadelphia, Pennsylvania, USA. (Contact: NESTA, 2000 Florida Ave., N.W., Washington, D.C. 20009, USA. Tel: +1-202 462 6910; Fax: +1-202 328 0566; E-mail: fireton@kosmos.agu.org)

May

INTERNATIONAL SYMPOSIUM ON KARST AND HARD ROCK FORMATIONS, Esfahan, Iron. (Contact: Dr. A. Afrasiabian, National Karst Study and Research Center, P.O. Box 15875-3584, Tehran, Iran. Tel: +98 21 7520474; Fax: +98 21 7533186)

June 15–17

7TH ICOBTE — INTERNATIONAL CONFERENCE ON BIOGEOCHEMISTRY OF TRACE ELEMENTS, Uppsala, Sweden. (Contact: George R. Gobran. Fax: 46 (18) 67 34 30; E-mail: George.Gobran@eom.slu.se or ICOBTE7@slu.se; Website: http://www.eom.slu.se)

June 16–18

5TH INTERNATIONAL CONFERENCE ON THE ANALYSIS OF GEOLOGICAL AND ENVIRONMENTAL MATERIALS, Rovaniemi, Finland. (Contact: Website: http://www.gsf.fi/geoanalysis2003)

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)

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 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/)

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)

2004

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)

August

32ND INTERNATIONAL GEOLOGICAL CONGRESS, Florence, Italy. Congress theme: *"The Renaissance of Geology: From the Mediterranean area toward a global Geological Renaissance-Geology, Natural Hazards, and Cultural Heritage"*. (Contact: E-mail: 32igc@32igc.org; Website: http://www.32igc.org/)

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)

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PROCEEDINGS

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Earth Science in Support of Growing Southeast Asian Economies

August 17 – 19, 1998
Kuala Lumpur, Malaysia

GEOLOGICAL SOCIETY OF MALAYSIA

GEOSEA '98 Kuala Lumpur

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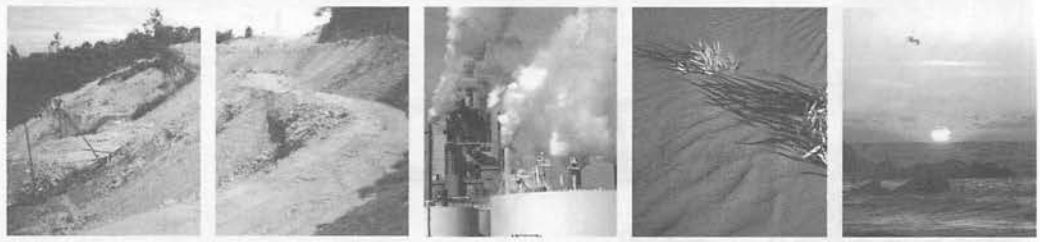

ANNUAL GEOLOGICAL CONFERENCE 2001

Pan Pacific Resort, Pangkor Island, Perak Darul Ridzuan
2 – 3 June 2001

Editors: G.H. Teh, Mohd. Shafeea Leman & T.F. Ng

Collaborators:
Minerals and Geoscience Department Malaysia
Universiti Kebangsaan Malaysia
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GEOLOGICAL SOCIETY OF MALAYSIA

ANNUAL GEOLOGICAL CONFERENCE 2002

Renaissance Hotel,
Kota Bharu, Kelantan
26 – 27 May 2002

Editors: G.H. Teh, Ismail Yusoff, Azman Abdul Ghani & T.F. Ng

Collaborators:
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Universiti Kebangsaan Malaysia
University of Malaya
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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.

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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 41 (Dec 1997). 165 p. Papers from Petroleum Geology Conference 1996 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 (Jun 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.

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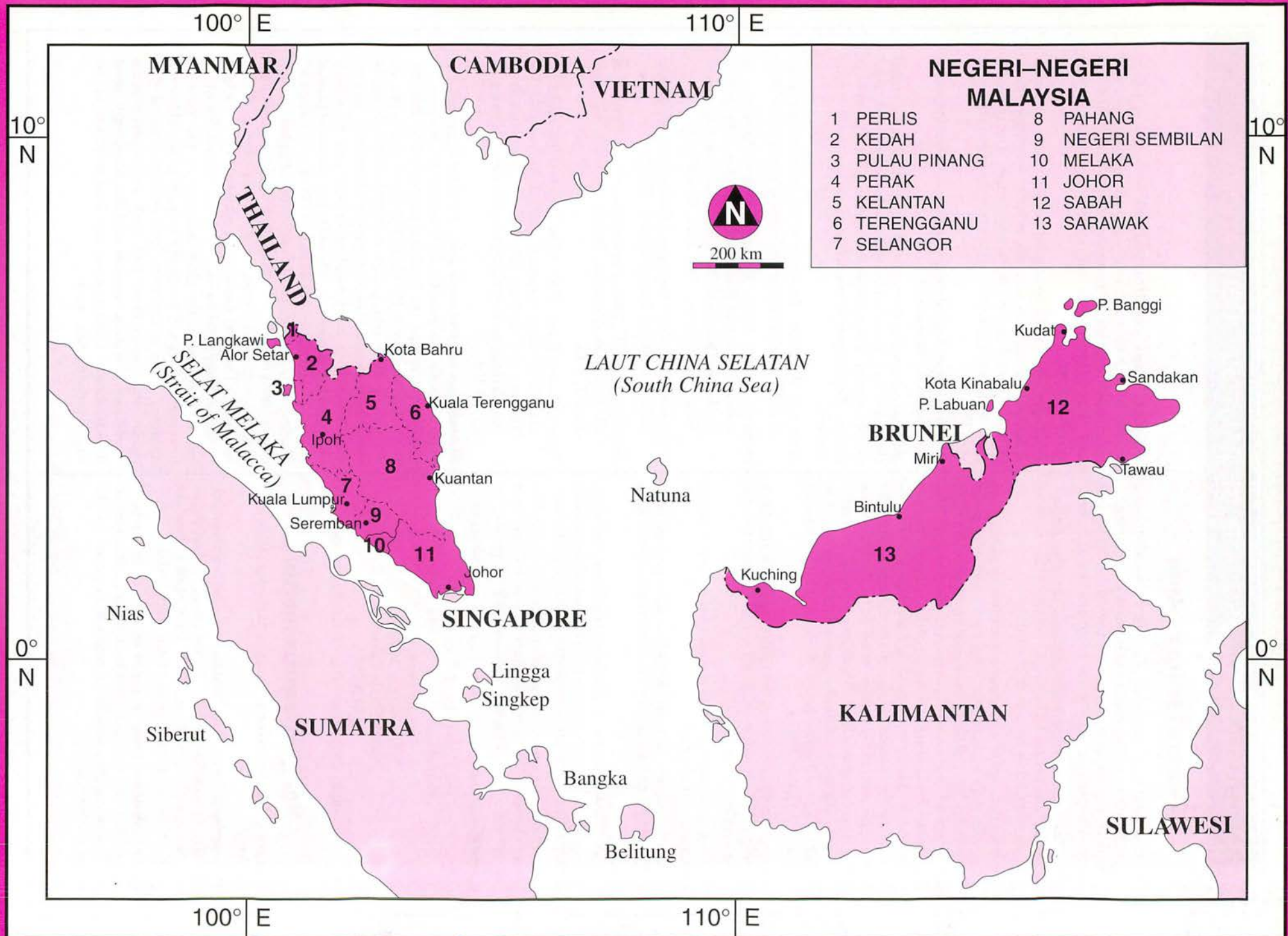
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