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

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CATATAN GEOLOGI (Geological Notes)

Active faulting in Kundasang - Gunung Kinabalu area, Sabah

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The adamellite - granodiorite Kinabalu pluton currently peaks at 4095 m. The rock is medium to coarse-grained and possesses flow structure. Ages calculated for the plutonic massif ranged between 1.3 and 12 Ma (K - Ar dates on biotite; Jacobson 1970). Ten fission-track ages using apatite and zircon average 8.5 Ma (Swauger et al. 2000). On the assumption that the pluton was emplaced at depth between 4 km and 10 km, its current position suggests uplift averaging between 0.95 and 1.65 mm/year, respectively. Crustal uplift at this rate marks tectonically mobile crust. Earthquakes of moderate strength and of Richter magnitudes 5 to 5.5 (Geological Survey of Malaysia archives) are consistent with tectonic mobility. The latter is also expressed in the topography where slopes predominate over plains and by the presence of valley terraces stacked up to several hundred metres over valley floors.



Figure 1. Locality of study area.

The triangular faceted ridge-spurs are estimated to reach as high as 50 metres above their base. One of the fault scarps have more trapezoidal faceted scarps. In front of these scarps and closer to the Liwagu river, hummocky topography was produced by earth creep. The nearby settlement of Kundasang including the trunk road Kota Kinabalu - Ranau has been experiencing large-scale mass movements that comprise slumping, creep and hill-side slides. These phenomena are being investigated by Ibrahim Komoo and others of Lestari.

On aerial photos, the Mensaban lineament turns out to belong to a more than 10-km wide set of WNW - ESE lineaments, undoubtedly a regional fault zone across the central part of Sabah. The area containing the faceted ridge-spurs of Figure 2 has the Late Pleistocene Pinausuk deposit as blanket. The lineament has been active after the deposit was laid down. Active mass movements are most probably facilitated by the fault zone. The morphologically youthful

The SE foot hill area of Gunung Kinabalu is cut by a strongly expressed lineament that can be traced over a distance exceeding 12 kilometres (Fig. 1). On the geological map and section of Jacobson's, this WNW - ESE lineament is indicated as a steep normal fault downthrowing to the south. The fault is interpreted to continue under a surficial blanket of Late Pleistocene Pinausuk/ Pinosok tilloids and mudflows (described by Jacobson, and Sahibin Abdul Rahim et al. 2003). A lineament on aerial photographs, however, still hint at its presence. The lineament follows part of the Mensaban river and will be referred too by that name.

In the field to the north of Kundasang, the Mensaban lineament is seen to comprise several WNW - ESE fault lines and fault-line scarps (Fig. 2). Up to 4 parallel fault lines can be seen.

appearance of the scarps also suggests continuing fault activity, possibly recurring in historical times. Closer examination of the fault zone is needed to determine the actual type of movement. The morphology indicates a significant normal fault component and the aerial photos do not show obvious lateral displacements. Could this normal faulting be related to a still rising Kinabalu pluton?

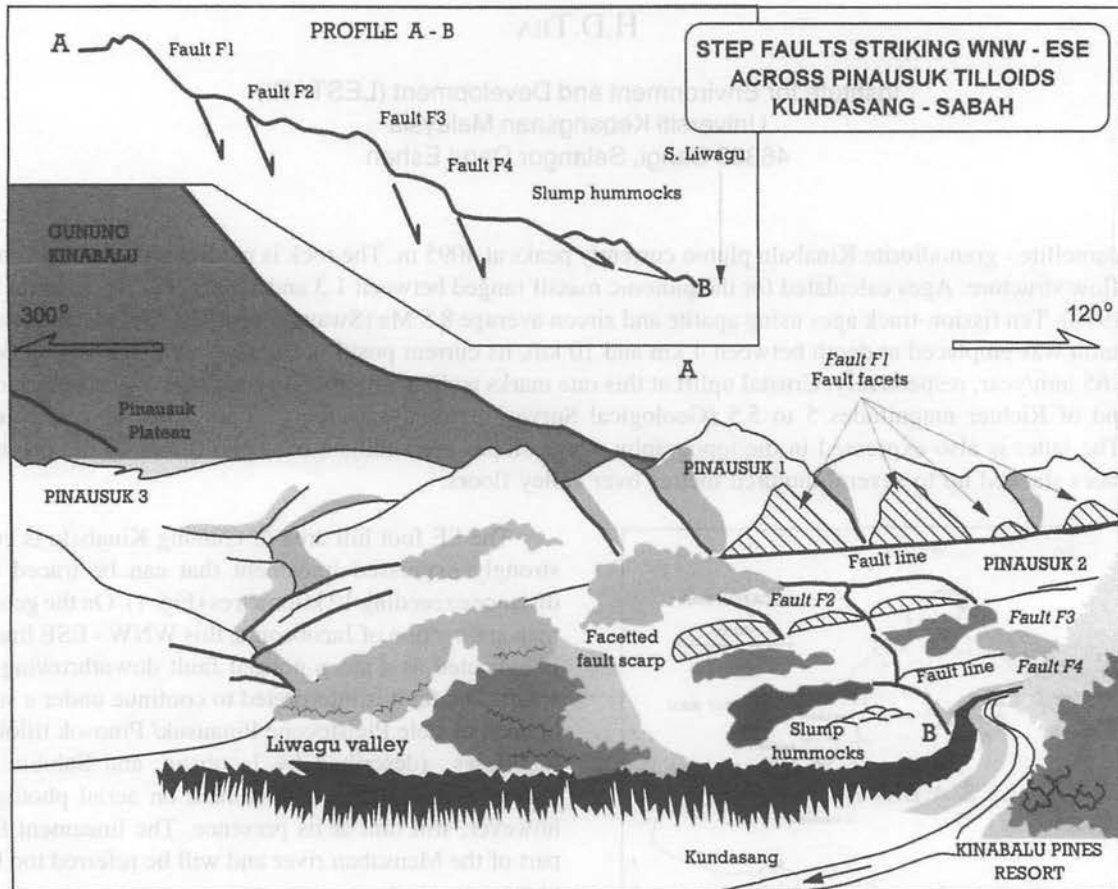


Figure 2. WNW - ESE striking step faults of the Mensaban lineament. The largest triangular scarp is about 50 m high. The Pinausuk tilloid blanket is affected by faulting. A - B is the section across the Mensaban fault set.

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CATATAN GEOLOGI (Geological Notes)

Some physical and mechanical properties of porphyritic hypersthene microdiorite from the Tawau area, Sabah, East Malaysia

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Abstract: Laboratory tests show porphyritic hypersthene microdiorite from the Tawau area to have average dry, and saturated, unit weights of 25.73 and 25.75 kN/m³, and average dry, and saturated, densities of 2,623 and 2,626 kg/m³, respectively. The rock material has an average effective porosity of 1.74 %; its mineral grains having a specific gravity of 2.67. Ultrasonic pulse velocities of compression waves through the rock material yield a mean value of 6,046 m/sec. Unconfined compression tests on block samples show the rock material to have an average uniaxial compressive strength of 244.9 MPa or 35,601 lb/in²; this value being related to the point load strength index [$Is_{(50)}$] by a multiplication factor of 18.

INTRODUCTION

Standard geological descriptions and classification fulfill an important role in the appraisal of rock material for engineering purposes, though such qualitative data often needs to be confirmed and augmented by quantitative data which allow a more precise description. Several laboratory testing procedures have therefore, been formalized to determine the quantitative data which includes both physical and mechanical properties (Lama and Vutukuri, 1978; ISRM, 1979).

In the Tawau area of Sabah, East Malaysia is found a wide variety of calc-alkaline intrusive igneous rocks that range in composition from ultrabasic to acidic. These small to medium sized intrusions, are of plutonic to hypabyssal habit and have been subdivided into two fairly well defined groups; an older, pre-orogenic group consisting predominantly of ultrabasic and basic rocks with some granites, and a younger, post-orogenic group ranging in composition from diorite to leucogranite and intruded during volcanic activity after the main Miocene orogenic movements (Kirk, 1962). Although the petrography, petrology and geochemistry of these igneous rocks have been discussed by several workers, including Kirk (1962) and Liaw (1979), their physical and mechanical properties have as yet not been investigated, apart from Raj (1993). In this paper, are presented some physical and mechanical properties of one of these igneous rocks; a porphyritic hypersthene microdiorite outcropping near Tawau.

SAMPLING SITE - GEOLOGICAL SETTING

In the Semporna Peninsula, post-orogenic volcanism during the Pliocene and Quaternary was accompanied by the injection of a varied assemblage of intrusive igneous rocks into older, folded formations and volcanic rocks. Most of these intrusions form small steep-sided stocks and thick dykes; sills and other concordant intrusions being rare, probably owing to the relative ease of injection of magma along innumerable faults in the severely disturbed formations. The intrusions are of an intermediate to acidic composition and predominantly consist of diorite, andesite, dacite and granite (Kirk, 1962).

In the Tawau area, hypersthene diorite forms the bedrock of a line of prominent steep conical hills, Mount Gemok, Middle Hill and Kukusan Hill; these hills rising abruptly above the surrounding, flat to undulating, low-lying Quaternary deposits. A number of quarries are found at these hills for the bedrock serves as an important source of aggregates in Sabah (Fig. 1).

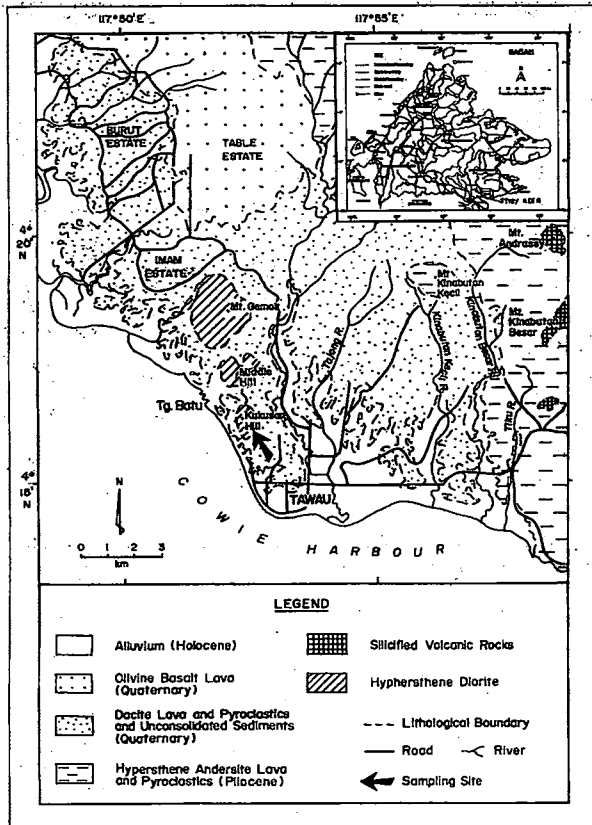


Figure 1. Geological sketch map of the Tawau area, Sabah (After Kirk, 1962)

In hand specimens, the rock material shows an indistinct porphyritic texture with several small, light to dark grey and black phenocrysts set in a light grey, fine grained matrix. The phenocrysts, of square to rectangular shapes, are mostly between $1 \times 2 \text{ mm}^2$ and $2 \times 3 \text{ mm}^2$ in size, whilst the matrix comprises grains of less than 1 mm size. A few dark grey, oblate xenoliths of some 2 cm diameter are also sometimes seen in the rock material.

In thin sections, the rock material shows a hypidiomorphic-granular texture with phenocrysts of plagioclase, hornblende, hypersthene and augite set in a fine grained matrix of mainly plagioclase with some hornblende and pyroxene as well as abundant iron oxide grains and minor, accessory orthoclase and quartz. On the basis of textural features and mineral composition (as determined from the counting of 1,000 points in each of 2 thin-sections), the rock material is best classified as a Porphyritic Hypersthene Microdiorite (Raj, 1993; Liaw, 1979). Kirk (1962), however, considered the rock material to be a hypersthene diorite and noted that it was medium to fine grained and not markedly porphyritic.

Plagioclase phenocrysts are the predominant ones and together with the matrix plagioclases constitute some 77.2 % of the rock material. They are mainly of an oligoclase composition and commonly show concentric zoning as well as polysynthetic twinning. Hornblende constitutes some 9.9% of the rock material and occurs both in the matrix and as phenocrysts, though it is invariably altered to mainly iron oxides and chlorite. Hypersthene constitutes some 2.9% of the rock material and occurs both in the matrix and as phenocrysts, while augite constitutes some 1.7% and mainly occurs

METHOD OF STUDY

A large, fresh diorite block of some 0.1 m^3 was collected at a quarry at Kukusan Hill and sawn into smaller tetrahedral shaped blocks of various sizes. The sides of these blocks were then finely ground before their individual, visible textural and structural features were described. Densities, unit weights and porosities of these small blocks were then determined according to the saturation and buoyancy technique of ISRM (1979), whilst specific gravity determinations were made of crushed samples of four of the blocks.

The blocks were oven-dried at 105°C overnight before the ultrasonic pulse velocities of compression waves through them were measured with an OYO Corporation New Sonic Viewer (Model 5217A). A few of the blocks with approximately square cross-sections but variable height to breadth ratios were also tested in an ELE 1100 kN Compression Machine to determine uniaxial compressive strengths; a loading rate of 25 MPa per minute being employed.

PETROGRAPHY OF INVESTIGATED ROCK MATERIAL

as phenocrysts. Iron oxide grains (opaques) constitute some 3.2% of the rock material and are mainly magnetite with cubic shapes. Quartz and orthoclase are only found as interstitial grains and constitute some 2.5%, and 2.6%, of the rock material respectively.

RESULTS AND DISCUSSION

Table 1 shows the porphyritic hypersthene microdiorite to have unit weights ranging from 25.670 to 25.855 kN/m³, with average dry, and saturated, values of 25.73, and 25.75, kN/m³, respectively. Density values also show a fairly narrow range from 2,618 to 2,636 kg/m³, with average dry, and saturated, values of 2,623, and 2,626, kg/m³, respectively. The crushed rock material has an average specific gravity of 2.67 whilst the average effective porosity of the rock material is 1.74%.

In view of the low effective porosity, the porphyritic hypersthene microdiorite can be expected to have a high compressive strength, as the presence of pores in the fabric of a rock material decreases its' strength and increases its deformability (Lama and Vutukuri, 1978). The inter-locking texture of the rock material is also expected to give it a high strength as the strength characteristics of crystalline rocks are mainly governed by their textures, which refers to the relative amounts, grain sizes and shapes of constituent grains, as well as the manner in which they interlock (Merriam *et al*, 1970).

Sample No.	Dry Unit Weight (kN/m ³)	Saturated Unit Weight (kN/m ³)	Dry Density (kg/m ³)	Saturated Density (kg/m ³)	Effective Porosity (%)	P Wave Velocity (m/sec)
SD 1a	25.729	25.885	2,624	2,619	1.738	6,066
SD 2c	25.730	25.763	2,624	2,627	1.732	5,838
SD 2d	25.710	25.742	2,622	2,625	1.809	6,216
SD 4	25.689	25.705	2,620	2,621	1.890	6,125
SD 5	25.711	25.742	2,622	2,625	1.804	6,150
SD 7a	25.670	25.764	2,618	2,627	1.961	6,273
SD 8c	25.731	25.744	2,624	2,625	1.731	5,849
SD 9c	25.728	25.766	2,624	2,627	1.739	5,971
SD 10a	25.648	25.855	2,636	2,636	1.283	5,928
Average	25.727	25.752	2,623	2,626	1.743	6,045

Table 1. Physical properties of the Porphyritic Hypersthene Microdiorite

Sample No.	Dry Unit Weight (kN/m ³)	Length/Breadth Ratio	Uniaxial Comp. Strength (MPa)	Uniaxial Comp. Strength (lb/in ²)	Type of Failure
SD 8c	25.731	1.8	234	33,855	Cataclastic. 2 sets shear.
SD 9b	25.728	2.0	286	38,480	Cataclastic. 2 sets shear
SD 9c	25.728	1.9	233	34,016	Cataclastic. 2 sets shear
Average			244	35,450	

Table 2. Results of Unconfined Compression Tests on Blocks of Porphyritic Hypersthene Microdiorite

Unconfined compression tests on block samples of the porphyritic hypersthene microdiorite thus yield an average uniaxial compressive strength of 244.9 Mpa (Table 2). In terms of standard rock classifications as that of ISRM (1985), the rock material would be classified as being one of very high strength. Similar strengths have been reported by other workers as Wuerker (1956) who quoted a uniaxial compressive strength of 274.4 Mpa for a hornblende diorite, and Merriam *et al* (1970) who quoted a value of 29,400 psi (202 MPa) for a diorite.

Point load tests carried out on air, and oven, dried as well as water saturated blocks of the porphyritic hypersthene microdiorite all yield a point load strength index [$I_{s(50)}$] of 13.6 MPa (Raj, 1993). The uniaxial compressive strength is thus related to the point load strength index by a multiplication factor of 18; a value that corresponds well with other reported multiplication factors (ISRM, 1985).

Results of the ultrasonic pulse velocities are also reflective of the low effective porosity and inter-locking nature of the rock material, with a mean compression wave velocity of 6,045 m/sec. Shear wave velocities were also determined, though they are not discussed as they were much lower than expected with a mean value of 1,754 m/sec.

CONCLUSION

It is concluded that the porphyritic hypersthene microdiorite is a very high strength rock material with an uniaxial compressive strength of 244.9 MPa; a value that is related to the point load strength index [$Is_{(50)}$] by a multiplication factor of 18. The rock material also shows average dry, and saturated, unit weights of 25.73, and 25.75, kN/m³, and average dry, and saturated, densities of 2,623, and 2,626, kg/m³, respectively. The rock material also shows a mean effective porosity of 1.74 %; its' solid mineral grains having a specific gravity of 2.67.

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PERTEMUAN PERSATUAN (Meetings of the Society)

**Annual Geological Conference 2004
Putra Palace, Kangar, Perlis
4-6 June 2004**

Laporan

The 18th Annual Geological Conference 2004 was successfully held from 4 to 6 June 2004 at Putra Palace, Kangar, Perlis. The conference had to begin with the presentation of the first two technical papers first as the VIP doing the opening could not make it at 9 am as scheduled. Upon his arrival the opening ceremony began with a welcoming address by the Organising Chairman En. Jamaludin Othman and an address by the President of the Geological Society of Malaysia, Associate Professor Dr. Lee Chai Peng. It was officially opened by the representative of the Menteri Besar Perlis, En. Azam Rashid who is the State Exco Member for Land and Forestry in Perlis.

A total of 139 participants from the institutions of higher learning, government departments and private sector were registered for the conference. Fifty-five papers covering a broad range of geological topics were presented orally and as posters during the two days of the conference. Technical Session I was on Environmental Geology, Session II on Engineering Geology & Hydrology, Session III on Petrology & Geochemistry, Session IV on Sedimentology, Stratigraphy & Paleontology and Session V on Structural Geology & Geoscience Tools & Techniques. Two poster sessions were also held to enable the presenters to brief the participants on their posters. Twenty-four of those papers presented were published in the special conference issue, Bulletin 48 of the Society. The rest of the papers would be published subsequently subject to review and editing as the time was too short to deal with all the papers offered for presentation. A sumptuous B-B-Q was sponsored by the Perlis State Government on Friday evening after Technical Sessions I and II and Poster Session A was held. The rest of the technical sessions and Poster Session B was held on Sunday.

The mid-conference field trip lead by En. Bazran Mat Taib this year must have been the best attended as we had over 50 participants joining us. It started with a visit to the famous Gua Kelam near Kaki Bukit to examine the Setul Limestone and speleothems in the cave. We proceeded to a durian feast at a *dusun* per kindness of GSM member Hj. Mokhtar Ghani before allowing for some time for shopping and lunch at Padang Besar. We then went on to look at some very interesting sink-holes developed over the karst south of Bukit Chuping near Mata Ayer and ended the trip with a fossil hunting spree lead by En. Meor Hakif Hassan at an earth quarry at Kampong Binjal, Utan Aji. It rained on and off throughout the day and we miraculously had enough dry breaks at each stop and rain while travelling between them.

The conference was successfully concluded at the closing ceremony late on Sunday afternoon where both the Organising Chairman and the President of the Society thanked all who had worked so hard to contribute to the success of the conference.

Reported by Lee Chai Peng

Special Thanks

Generous contributions for the Annual Geological Conference 2004 was received:

**Kerajaan Negeri Perlis Indera Kayangan
Chua Teong Teong Chai & Sons Quarry Sdn. Bhd
CIMACO Quarry Sdn. Bhd
Pens Industries
Specific Resources Sdn. Bhd**

Laporan Kerjalapangan - 5 Jun 2004

The decision was made, this year, to hold the field trip in the middle of the Annual Conference, as, in the past, field trips held before or after the conference did not attract very many participants. In addition, the organizing committee chose stops that were “family-friendly”, since many family members were in attendance during the conference. The result was one of the largest number of participants ever, with over 50 geologists and family members taking part.

The caravan left the Putra Palace at 8 am sharp on Saturday morning. Aside from the University of Malaya van and two 4x4's provided by the Minerals and Geosciences Department, there were several private vehicles in the convoy. Bazran Mat Taib from the Minerals and Geosciences Department led the trip.

The first stop was Gua Kelam, near the village of Kaki Bukit. Gua Kelam was the site of alluvial tin mining operations in the 19th and early 20th centuries. The ore placers were found in deep depressions in the limestone caves of the area, and were worked by hand. The cave and the surrounding area has been designated a tourist destination by the Perlis state government, which has lighted a portion of the cave and built a 350 meter, elevated wooden walkway through its prepared length.

After Gua Kelam, we visited the *dusun* belonging to the family of Mokhtar Ghani, who had graciously invited the field trip participants to share and enjoy kampung-grown durian in the ambience of a *dusun*. Mokhtar's family had also prepared *pulut* and *santan*, to be enjoyed with the durian. This was an opportunity for our foreign visitors to see, in person, fruiting durian trees for perhaps the first time. We wish to thank Mokhtar and his family for their generosity, and the trip participants all enjoyed themselves.

The next stop, for lunch and shopping, was the bazaar town of Padang Besar, on the border with Thailand. This stop was included in the itinerary for the benefit of the families who had come along on the trip. Padang Besar is famous for goods brought over from Thailand, mainly clothes, footwear and food.

After lunch, we visited the area south of Bukit Chuping, near Mata Ayer, where, on the evening of 14.10.2000, several large, deep sinkholes appeared, causing damage to several buildings and the surrounding grounds. The area is highly karsted, and many incipient sinkholes were in evidence in the rugby field next to the now-abandoned barracks. The original sinkholes have grown very large and have caused additional damage to the buildings.

The last stop was in the outskirts of Kangar, at Kampung Binjal, Utan Aji. Here, fossiliferous shales of the Late Devonian to Early Carboniferous Jentik Formation were being quarried. Fossils were abundant and easy to find, which was especially exciting for the children who had come along on the trip. The most common fossils were bivalves (*Posidonomya* sp.) and brachiopods, but there were also crinoids, and of the most interest to all, trilobites to be found. Unfortunately, a light drizzle had started, so we only spent 45 minutes at this site. Field notes for the fossils found at the location were prepared by Meor Hakif Hassan, from Universiti Malaya.

The trip ended back at the hotel around 6pm.

Annual Geological Conference 2004
Putra Palace, Kangar, Perlis
4-6 June 2004

**Ucapan Alu-aluan oleh En. Jamaludin Othman,
 Pengerusi Jawatankuasa Penganjur
 Persidangan Tahunan Geologi 2004**

Assalamualaikum wbt

Tuan Pengerusi Majlis,

Yang Berhormat, En. Azam Rashid, EXCO Tanah dan Perhutanan Negeri Perlis, Wakil YAB Dato Seri Shahidan Bin Kasim, Menteri Besar Perlis

Yang Berusaha, Dr. Lee Chai Peng, Presiden Persatuan Geologi Malaysia

Yang Berusaha, Tn. Hj. Yunus Abd. Razak, Timbalan Ketua Pengarah (Korporat & Ekonomi Mineral) Jabatan Mineral dan Geosains Malaysia merangkap Naib Presiden Persatuan Geologi Malaysia

Tuan-tuan & Puan-Puan Sekalian,

Terlebih dahulu saya mengucapkan selamat datang kepada semua yang hadir pada pagi ini di Persidangan Geologi Tahunan Ke-18 yang julungkalinya diadakan di Negeri Perlis Indera Kayangan. Saya juga mengambil kesempatan ini untuk merakamkan ucapan ribuan terima kasih kepada YB En. Azam Rashid, EXCO Tanah & Perhutanan Negeri Perlis, yang mewakili YAB Dato Seri Shahidan Kasim, Menteri Besar Perlis, kerana sudi hadir bersama-sama kita pada pagi ini bagi merasmikan persidangan ini. Tidak lupa juga saya menyampaikan ucapan ribuan terima kasih saya kepada Kerajaan Negeri Perlis yang telah sudi menaja makan malam kita pada malam ini.

Tuan-Tuan dan Puan-Puan,

Pada persidangan kali ini, sejumlah 55 kertas kerja telah diterima. Dari jumlah ini 28 kertas kerja akan dibentangkan secara lisan dan 27 lagi dalam bentuk poster. Pembentangan lisan akan dijalankan dalam 5 sesi teknikal manakala pembentangan secara poster akan dibuat dalam 2 sesi.

Mungkin terdapat sedikit kelainan dalam persidangan tahun ini jika dibandingkan dengan tahun-tahun yang lepas kerana ianya *tidak* mempunyai tema khusus. Perkara ini sebenarnya disengajakan dengan tujuan untuk menggalakkan lebih banyak kertas kerja dikemukakan tanpa menjurus kepada sesuatu tema tertentu. Mungkin bilangan kertas kerja akan menjadi terhad sekiranya pembentang-pembentang kertas kerja terikat kepada tema yang telah ditetapkan. Mungkin juga sukar bagi para pembentang kertas kerja untuk mencari tajuk yang bersesuaian dengan tema persidangan. Keadaan ini mungkin menyebabkan pembentang kertas kerja merasa tawar hati untuk menulis kertas kerja kerana tidak mempunyai tajuk yang bersesuaian dengan tema.

Jika diperhatikan tajuk-tajuk kertas kerja yang akan dibentangkan, ianya merangkumi pelbagai aspek geologi termasuk alam sekitar, geologi kejuruteraan, hidrogeologi, paleontologi, geokimia dan juga petrologi. Semuanya ini bertujuan menambah ilmu para peserta persidangan yang sememangnya mempunyai pengkhususan yang berlainan.

Saya juga amat berharap persidangan ini digunakan sebagai satu forum untuk kita sama-sama berbincang dan bertukar-tukar fikiran dalam rangka menambahkan ilmu pengetahuan. Dalam persidangan seumpama ini, kita juga mampu menyelesaikan

pelbagai masalah berhubung geologi yang mungkin selama ini sukar diatasi. Penemuan-penemuan baru hasil daripada penyelidikan yang telah dibuat dapat membantu dalam memahami dengan lebih mendalam geologi negara kita. Oleh kerana itu saya menyeru kepada semua peserta agar menfaatkan sebaik mungkin persidangan ini bagi tujuan menambah ilmu.

Pada tahun ini juga, Jawatankuasa Penganjur merancang mengadakan *mid-conference fieldtrip*. Saya menyeru kepada semua peserta supaya mengambil peluang ini untuk bersama-sama mengikuti *fieldtrip* yang sudah pastinya memberikan pengalaman yang tidak mungkin dapat dilupakan ! Secara tradisinya, *fieldtrip* seumpama ini diadakan samada sebelum atau sesudah persidangan. Dari pengalaman yang lepas, didapati ianya kurang mendapat sambutan. Oleh kerana itu Jawatankuasa Penganjur mengubah strategi mengadakan *mid-conference fieldtrip* dengan harapan ianya mendapat sambutan yang menggalakkan dari semua para peserta.

Tuan-Tuan dan Puan-Puan,

Dalam menganjurkan persidangan seumpama ini, peruntukan selalunya menjadi isu. Dalam hal ini, saya mengambil kesempatan ini untuk merakamkan ribuan terima kasih saya kepada beberapa pihak yang telah sudi menghulurkan sumbangan, termasuk Kerajaan Negeri Perlis, bagi menjayakan persidangan ini. Saya juga mengucapkan terima kasih kepada semua penyumbang kertas kerja, penyemak (*reviewer*) dan kesemua mereka yang telah terlibat samada secara langsung atau tidak dengan penganjuran persidangan ini.

Akhirkata, sekali lagi saya merakamkan penghargaan saya kepada YB En. Azam Rashid, EXCO Tanah & Perhutanan Perlis, yang sudi hadir pada pagi ini untuk merasmikan persidangan ini. Semoga persidangan ini mencapai objektifnya !

Sekian. Terima kasih.

Annual Geological Conference 2004
Putra Palace, Kangar, Perlis
4-6 June 2004

Ucapan Presiden Persatuan Geologi Malaysia
Prof. Madya Dr. Lee Chai Peng

Yang Berusaha Saudara Pengerusi Majlis,

Yang Berhormat En. Azam Rashid, Exco Tanah & Perhutanan, Negeri Perlis sebagai wakil Menteri Besar,

Yang Berbahagia Tuan Hj. Yunus Abd. Razak, Timbalan Ketua Pengarah, Jabatan Mineral dan Geosains Malaysia,

Yang berusaha En. Jamaludin Othman, Pengarah Jabatan Mineral dan Geosains Keadah, Perlis dan P.Pinang selaku Pengerusi Jawatankuasa Penganjur Persidangan, Tuan-tuan dan puan-puan para hadirin yang dihormati sekalian.

Selamat pagi dan salam sejahtera. Terlebih dahulu saya ingin memberi sesyukuran kepada Tuhan Pencipta Alam Semesta yang begitu indah itu kerana memberi berkatNya kepada kita semua supaya dapat berkumpul di sini untuk perasmian Persidangan Tahunan Geologi 2004.

Saya mengucapkan ribuan terima kasih kepada Yang Berhormat, En. Azam Rashid, wakil Menteri Besar Perlis kerana sudi meluangkan masa daripada tugas-tugas beliau untuk datang merasmikan persidangan ini. Saya bagi pihak Persatuan Geologi Malaysia mengucapkan Selamat Datang kepada tuan-tuan dan puan-puan yang dihormati sekalian ke persidangan tahunan ini.

Persidangan Tahunan Geologi 2004 ini merupakan persidangan ke-18 yang dianjurkan oleh Persatuan Geologi Malaysia dari permulaan samapai ke sekarang. Persidangan ini sangat unik sebab ia membantu mengenap tujuan tak rasmi Persatuan Geologi untuk mengadakan persidangan tahunan di semua negeri di Malaysia. Lapanbelas tahun yang lalu kami tidak boleh mengadakan persidangan di Perlis sebab tiada hotel sebesar macam ini sebagai venue persidangan.

Saya merasa sangat gembira agak terdapat mengadakan persidangan tahunan ini di negeri Perlis dari sudut pandangan sendiri sebab banyak kajian geologi saya sebagai seorang paleontologis dan sedimentologis dilakukan keatas fosil dan batuan Paleozoik yang banyak terdedah di kawasan Perlis. Saya masih ingat kali pertama lebih daripada 20 tahun yang lalu saya dibawa oleh mentor dan penyelia MSc saya, Prof. Peter Stauffer, ke Perlis untuk kerjaluar penyelidikan. Kami melawat Gua Kelam selepas mendapat kebenaran khas dari pihak polis di Kangar. Perasaan saya bila keluar di Wang Kelian selepas menembus bukit batukapur melalui Gua Kelam dari Kaki Bukit adalah penuh dengan kemesraan macam masuk ke tempat semulajadi yang tak pernah disentuh oleh orang luar seperti dalam filem Shangri-la. Hajat saya pada saat yang gembira itu ialah memperkongsikan keindahan alam semulajadi yang bersejarah itu dengan ahli keluarga dan rakan-rakan saya.

Negeri Perlis telah membangun dengan pesat dalam 20 tahun kemudian. Sekarang semua orang boleh melawat Gua Kelam dan tempat-tempat pelancongan lain di negeri yang indah ini dengan senangnya atas usaha kuat oleh kerajaan negeri untuk membangunkan dan memajukan kemudahan-kemudahan infrastruktur untuk pelancong luar dan dalam negeri.

Saya telah kembali berberapa kali ke negeri Perlis bersendirian atau bersama pakar-pakar geologi luar negeri selepas lawatan pertama itu dan mendapat bahawa pembukaan tanah untuk pembangunan dan pembinaan infrastruktur misalnya jalan ke Wang Kelian, telah mendedahkan banyak lagi jujukan batuan Paleozoik yang berfosil. Pengkuarian tanah di

Guar Jentik telah mendedahkan fosil skifokrinoid yang unik dan juga kuari tanah di Kg. Binjal dan Bkt. Raja, Utan Aji telah mendedahkan batu lumpur yang sangat kaya dengan fosil Paleozoik yang senang dikutip. Anda boleh melawat ke beberapa kawasan yang menarik ini jika menyertai lawatan lapangan tengah persidangan pada hari esok

Seperti dalam persidangan tahunan yang lepas, sambutan kali ini juga sangat menggalakan dengan 55 kertas dalam semua bidang geologi utama yang akan dibentangkan secara lisan atau poster pada dua hari persidangan ini.

Saya ingin mengambil kesempatan ini untuk merakamkan penghargaan dan mengucapkan jutaan terima kasih bagi pihak Persatuan Geologi Malaysia kepada semua pihak atas sokongan dan bantuan yang dihulurkan untuk menjayakan persidangan ini, terutamanya kepada:-

Y.A.B. Mentri Besar Perlis dan Kerajaan Negeri Perlis,
En. Jamaludin Osman dan Jawatankuasa Penganjur Persidangan,
Ahli-ahli Jawatankuasa Kecil Penyunting yang membantu mengeluarkan Buletin khas untuk persidangan dalam masa yang suntuk,
Penderma-penderma Chua Teong Chai & Sons Quarry, CIMACO Quarry dan Pens Industries,
Pembentang-pembentang kertas dan pengerusi-pengerusi sesi,
Pn. Anna Lee bersama semua yang membantu menjayakan persidangan ini,
dan akhir sekali semua peserta persidangan ini.

Sokongan yang diberi oleh anda semua kepada saya sebagai Presiden baru Persatuan Geologi Malaysia sangat dihargai. Akhir sekali, saya memohon ma'af jika terdapat apa-apa kekurangan semasa persidangan ini.

Sekian. Terima kasih.

**Annual Geological Conference 2004
Putra Palace, Kangar, Perlis
4-6 June 2004**

**Ucapan YAB Dato' Seri Shahidan bin Kassim, Menteri Besar Perlis Indera Kayangan
Sempena Majlis Perasmian Persidangan Tahunan Geologi 2004 yang dibaca oleh YB
En. Azam Rashid, EXCO Tanah & Perhutanan Perlis**

Yang Mulia Tuan Pengerusi Majlis,

Yang Berbahagia Dr. Lee Chai Peng, Presiden Persatuan Geologi Malaysia,

Yang Berusaha Tn. Hj. Yunus Abd. Razak, Timbalan Ketua Pengarah Jabatan Mineral dan Geosains Malaysia,

*Yang Berbahagia Tuan Haji Jamaludin Othman, Pengarah Jabatan Mineral dan Geosains Negeri Kedah/Perlis/P.Pinang,
selaku Pengerusi J/kuasa Penganjur Persidangan, Ahli-Ahli Yang Berhormat,(jika ada)*

Dato'-Dato', Tuan-tuan dan puan-puan serta hadirin yang dihormati sekalian.

Terlebih dahulu saya ingin mengucapkan terima kasih di atas undangan yang diberi kepada saya untuk hadir dan seterusnya merasmikan Persidangan Tahunan Geologi Tahun 2004 pada hari ini. Saya dimaklumkan bahawa Persidangan Tahunan kali ini adalah yang ke 18 dan inilah pertama kalinya Persidangan ini diadakan di negeri Perlis. Terima kasih yang tidak terhingga saya ucapkan kerana memilih negeri Perlis untuk persidangan pada kali ini. Saya bagi pihak kerajaan Negeri Perlis dan seluruh rakyat mengalu-alukan kedatangan tuan-tuan dan puan-puan sekalian. Apatah lagi tahun ini merupakan Tahun Melawat Negeri Perlis. Berbagai program diatur sepanjang tempoh itu dan saya berharap tuan-tuan dan puan-puan berkesempatan untuk turut merasai kehangatan dan kehebatan Negeri Perlis.

Pada pagi yang bertuah ini Saya berasa sungguh gembira kerana dapat bersama tuan-tuan dan puan-puan, yang merupakan antara kumpulan profesional penting dalam pembangunan dan kemakmuran negara. Saya difahamkan bahawa para peserta terdiri daripada Ahli Geologi dari Universiti-Universiti Tempatan, Jabatan-Jabatan Kerajaan, Badan-Badan Berkanun dan Sektor Swasta di Malaysia. Sebagai Ahli Geologi, tuan-tuan dan puan-puan terlibat secara langsung di dalam mencarigali sumber asli seperti bahan batuan, bijih, arang batu, air tanah dan minyak serta turut membantu di dalam pembinaan infrastruktur seperti jalanraya, lebuhraya, terowong, empangan, bangunan dan sebagainya.

Saya juga difahamkan, negeri Perlis ini tidak kurang pentingnya dari segi geologi dan sumber buminya walaupun saiznya agak kecil. Batu kapur Setul yang membentuk banjaran sempadan Negeri Perlis-Thailand (Nakawan Range) merupakan antara batuan yang tua di utara Semenanjung, berusia (Ordovisi-Silur, lebih daripada 400 juta tahun lampau). Saya difahamkan bahawa terdapat banyak lokasi-lokasi fosil yang menjadi tumpuan para pengkaji dari dalam dan luar Negara. Di antaranya ialah Gunung Hutan Haji, Bukit Temiang, Bukit Wang Pisang, Bukit Mata Ayer, Guar Jentik, Guar Geteri dan banyak lagi. Bahkan Negeri Perlis telah digunakan dalam penamaan fosil trilobit yang ditemui di Gunung Hutan Haji iaitu *Cyrtosymbole (Waribole) perlisense* oleh Kobayashi dan Hamada dari Jepun. Saya percaya tuan-tuan dan puan-puan lebih maklum tentang hal ini.

Tidak dapat dinafikan, pembangunan dan ekonomi negeri Perlis turut mendapat manfaat yang besar dari sumber-sumber bahan bumi. Dari segi perlombongan bijih timah, negeri Perlis tidak kurang hebatnya suatu masa dulu. Bahkan aktiviti perlombongan di Kai Bukit agak unik kerana ianya merupakan kawasan perlombongan di dalam gua yang terbesar di dunia. Selain daripada bijih timah, beberapa bijih lain juga pernah dilaporkan ditemui seperti emas di Wang Kelian, 'barite' di Bukit Ramera dan arang batu di Bukit Arang. Usaha mencarigali bijih-bijih tersebut pernah dilakukan sebelum ini tetapi mendapati longgokannya tidak ekonomik untuk diusahakan.

Kewujudan batu kapur yang bermutu juga turut menyumbang kepada ekonomi negeri melalui industri bahan binaan, simen dan serbuk kapur. Dalam tahun 2003, industri berasaskan batu kapur di Perlis menggunakan kira-kira 3.8 juta tan batu kapur bernilai kira-kira RM20 juta. Kebanyakannya adalah untuk bahan binaan dan industri simen.

Saya percaya, bahan-bahan bumi yang diusahakan di negeri Perlis ini adalah hasil penerokaan dan kajian tuan-tuan yang berada di dewan ini. Dan saya berharap, tuan-tuan dan puan-puan akan terus mempergiatkan usaha mengkaji dan menerokai sumber bumi di Perlis ini khususnya, dan sekaligus membantu kami mewujudkan suasana pembangunan yang mampan serta mengurangkan kerosakan kualiti alam sekitar. Sehubungan dengan itu, Enakmen Mineral Negeri Perlis telah pun diluluskan bagi menerajui usaha ini.

Tuan-tuan dan Puan-puan;

Suatu ketika dahulu Ahli Geologi lazimnya dikaitkan dengan aktiviti-aktiviti penerokaan dan perlombongan sumber bahan bumi seperti bijih, emas dan petroleum. Kemudian, sejajar dengan pembangunan pesat infrastruktur negara, Ahli Geologi turut memainkan peranan penting dalam kerja-kerja kejuruteraan, berganding bahu dengan jurutera, untuk membina rangkaian lebuh raya-lebuh raya, bangunan-bangunan pencakar langit, empangan-empangan hidroelektrik, lapangan terbang, sehinggalah kepada pembukaan kawasan-kawasan perumahan di lereng-lereng bukit.

Pembangunan yang sebegini memang diperlukan dan memberikan sumbangan yang besar kepada negara dalam mengorak langkah mencapai Wawasan 2020. Dalam masa yang sama ianya juga ada meninggalkan beberapa impak negatif. Di antaranya ialah kemerosotan kualiti alam sekitar dan meningkatnya kejadian-kejadian bencana cetus-manusia ('man-induced hazard'). Umpamanya, masalah banjir lumpur, banjir kilat, kejadian tanah runtuh dan sebagainya. Kesemua kesan atau impak negatif ini tentunya mempunyai kaitan langsung dengan sekitaran fizikal, khususnya proses-proses alam yang bertindak di permukaan bumi.

Tuan-tuan dan Puan-puan;

Negeri Perlis juga turut terdedah kepada bencana geologi ('geohazard') terutamanya berkaitan dengan lubang benam ('sinkhole') dan batu runtuh ('rockfall') kerana sebahagian besar dari negeri Perlis didasari oleh batu kapur. Pada 14 Oktober 2000, kami dikejutkan dengan kejadian lubang benam di Kem Oran, Chuping. Inilah kali pertama ianya berlaku dalam sejarah negeri Perlis tetapi dari segi saiznya merupakan yang terbesar pernah berlaku di Malaysia. Saya percaya tuan-tuan dan puan-puan telah sedia maklum tentang perkara ini. Bahkan ada diantara tuan-tuan dan puan-puan di dalam majlis ini yang turut terlibat dalam usaha mengkaji bencana yang terjadi.

Saya yakin, tentu banyak sumbangan yang boleh dijalankan oleh pakar-pakar geologi untuk memantapkan pembangunan dan kemajuan Negara seterusnya mengekalkan kemakmuran Negara Malaysia yang tercinta ini. Tuan-tuan dan puan-puan sebagai pakar tentang kejadian bumi dan proses-proses yang berlaku di permukaannya, tentu dapat memainkan peranan yang lebih aktif dalam menasihati kerajaan dan pihak swasta tentang cara-cara dan kaedah-kaedah yang paling sesuai membangunkan negara tanpa menjejaskan kualiti alam sekitar dan keselamatan nyawa serta harta benda.

Dengan meningkatnya kesedaran tentang penjagaan kualiti alam sekitar dan penggunaan sumber yang optimum, saya yakin skop peranan tuan-tuan dan puan-puan kini menjadi lebih luas dan penting. Input daripada tuan-tuan sangat diperlukan dalam membantu menangani masalah-masalah seperti yang disebutkan tadi. Oleh itu saya ingin menyeru agar Ahli Geologi tempatan perlu lebih sensitif terhadap keperluan pelanggan dan teknologi baru untuk memastikan sokongan yang berterusan kepada pengembangan aktiviti industri dan pembangunan negara.

Tuan-tuan dan Puan-puan;

Dalam keghairahan membangunkan negara, seharusnya kita tidak lupa akan kepentingan menjaga dan memelihara unsur-unsur geologi semulajadi yang penting dan menarik kerana ini adalah sebahagian daripada khazanah negara. Saya dimaklumkan bahawa kini terdapat satu lagi sub-bidang geologi yang baru berkembang di Malaysia, iaitu Geopelancungan ('Geotourism'). Usaha-usaha sedang giat dilakukan untuk mengenalpasti kawasan-kawasan yang mempunyai nilai saintifik yang tinggi dan menarik agar dipelihara sebagai Taman Warisan Geologi untuk dijadikan tarikan pelancong dan

monumen semulajadi kebanggaan Negara. Dalam hal ini, negeri Perlis telah mengorak langkah dengan mewartakan **Taman Negeri Perlis** ('Perlis State Park'), meliputi keluasan 5,075 hektar yang mengandungi khazanah geologi, ekologi dan sejarah yang sangat bernilai. Taman Negeri Perlis merupakan yang pertama di Semenanjung yang terletak di sempadan dan bergabung dengan 'Thaleban National Park', Thailand. Buat masa ini Taman Negeri Perlis ditadbirkan oleh Jabatan Perhutanan Negeri Perlis dan dibangunkan mengikut pelan yang disediakan oleh 'World Wildlife Fund' (WWF) Malaysia dengan bantuan kewangan daripada 'Danish International Development Assistance' (DANIDA).

Saya difahamkan juga, ahli-ahli geologi professional tempatan telahpun menubuhkan **Institut Geologi Malaysia** dan telah mencadangkan kepada kerajaan untuk mewujudkan "**Akta Ahli Geologi**" sebagaimana yang diamalkan oleh pertubuhan-pertubuhan geosains di negara-negara maju. Saya berharap usaha tuan-tuan ini akan segera terlaksana. Ini kerana sebagai sebuah badan professional, amat penting bagi ahli-ahlinya menjaga reputasi profesionalisma masing-masing, supaya hanya geologis yang benar-benar berkeelayakan melibatkan diri dalam menangani masalah dan kerja-kerja yang membabitkan sekitaran fizikal bumi dan kandungannya.

Akhir kata, sekali lagi saya mengucapkan berbilang terima kasih di atas jemputan dan penghormatan yang diberikan kepada saya untuk bersama-sama tuan-tuan dan puan-puan pada pagi ini.

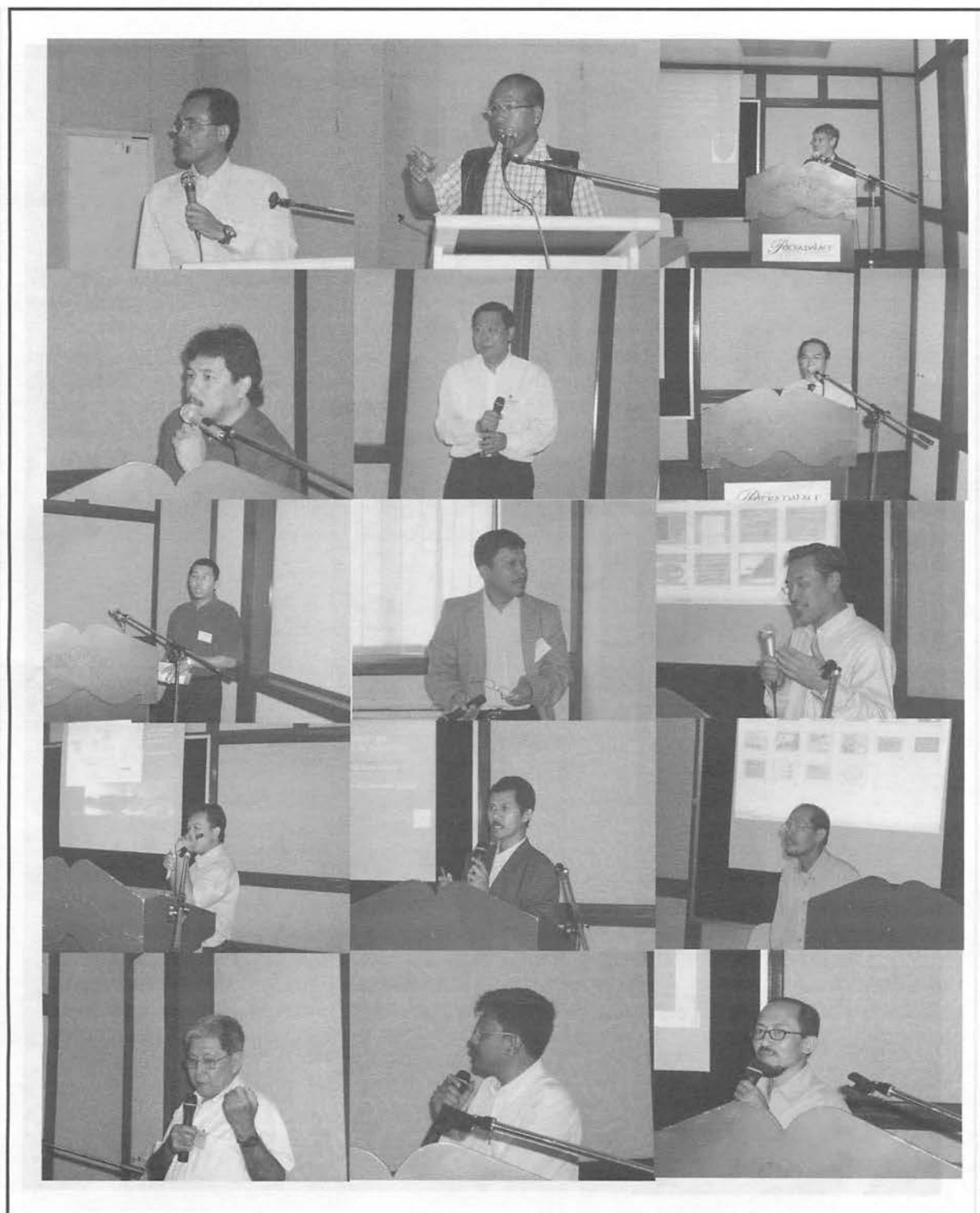
Dengan lafaz *bismillah*..... saya dengan ini mengisytiharkan **Persidangan Tahunan Geologi 2004**, dibuka dengan rasminya.

Terima kasih dan Selamat Bersidang.

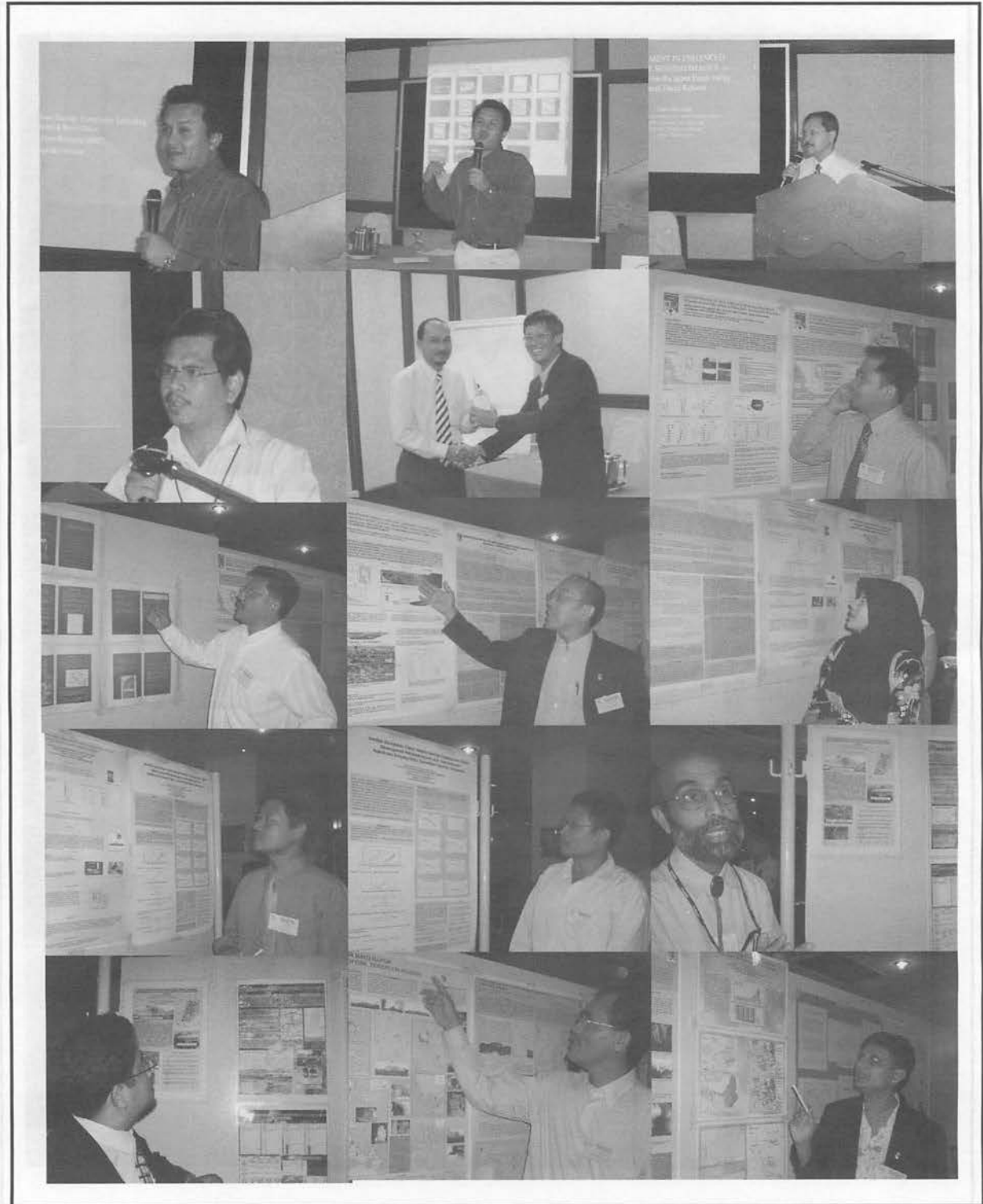
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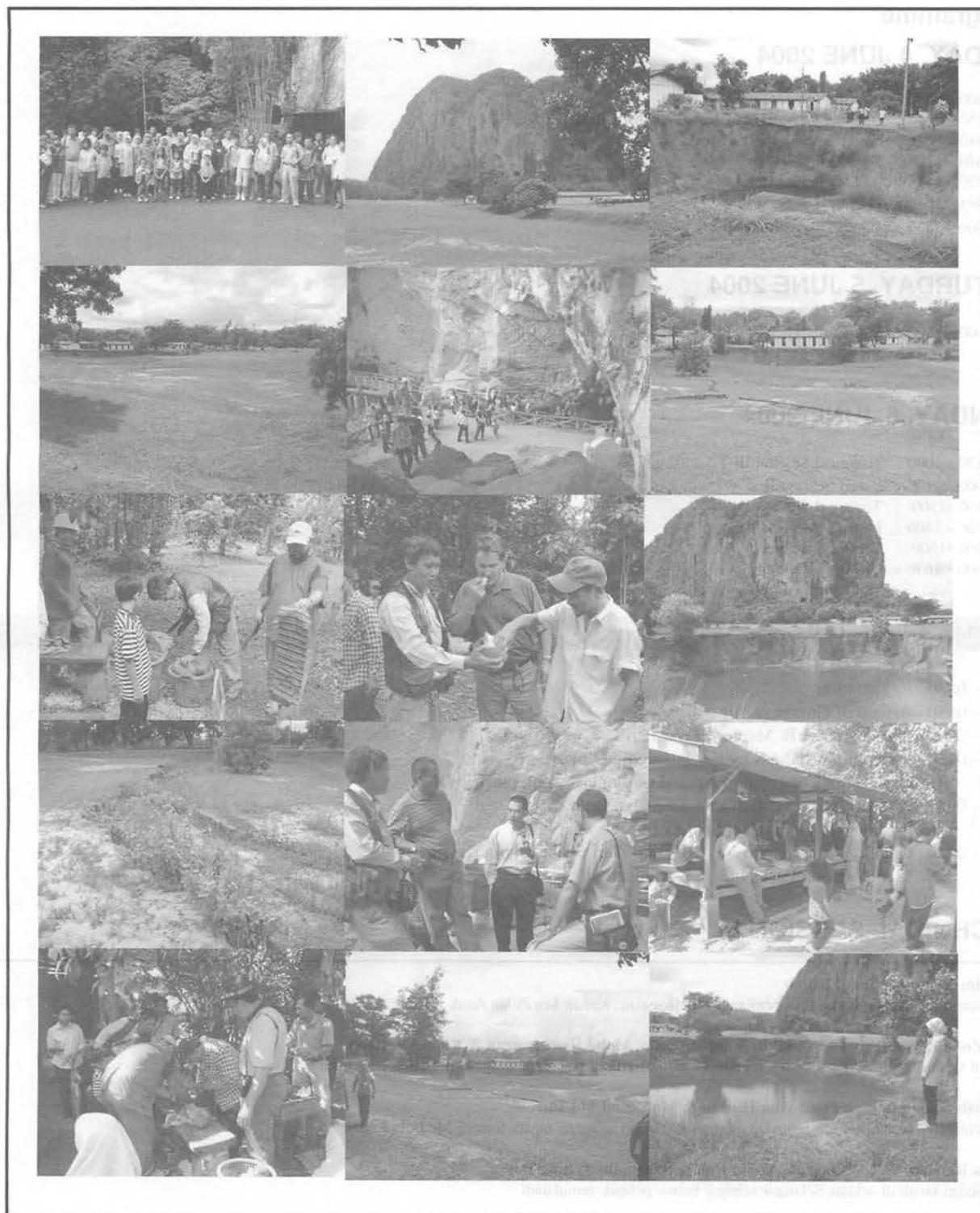
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Annual Geological Conference 2004
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Programme

FRIDAY, 4 JUNE 2004

- 0800 - 0830 : Registration
- 0830 - 0940 : Opening Ceremony by Y.A.B. Menteri Besar Perlis
- 0940 - 1040 : Poster Session I / Tea Break
- 1040 - 1220 : Technical Session I
- 1220 - 1445 : Lunch / Prayer Break
- 1445 - 1645 : Technical Session II
- 2000 - 2130 : Dinner

SATURDAY, 5 JUNE 2004

- 0800 - 1700 : Mid-Conference Fieldtrip – Gua Kelam and Kg. Chuping

SUNDAY, 6 JUNE 2004

- 0820 - 1000 : Technical Session III
- 1000 - 1100 : Poster Session II
- 1100 - 1300 : Technical Session IV
- 1300 - 1400 : Lunch / Prayer Break
- 1400 - 1600 : Technical Session V
- 1600 - 1630 : Closing Ceremony

Friday, 4 June 2004

- 0800 - 0830 Registration
- 0830 - 0850 Arrival of Guests
- 0850 - 0900 Arrival of Y.A.B. Menteri Besar Perlis
- 0900 - 0910 Welcoming Address by En. Jamaludin Othman,
Organising Chairman of Annual Geological Conference 2004
- 0910 - 0920 Address by Prof. Madya Dr. Lee Chai Peng,
President of Geological Society of Malaysia
- 0920 - 0940 Opening Ceremony by Y.A.B. Dato' Seri Shahidan bin Kassim
Menteri Besar Perlis Indera Kayangan

TECHNICAL SESSION I

Ibrahim Komoo & Tanot Unjah

Pencirian landskap geologi untuk penilaian kepelbagaian: Kajian kes Pulau Anak Datai

Wan Zuhairi Wan Yaacob, Abdul Rahim Samsudin, Mohd Ramziemran & Chan Yik Loon

Natural sorption capability of heavy metals: Granitic residual soil from Broga and marine clay from Sg. Besar Selangor

Habibah Hj Jamil, Wan Fuad Wan Hassan & Mohamad Md Tan

Pengaruh jenis batuan sekitar terhadap taburan Pb dalam sedimen muara Sungai Merbok, Kedah

Nurita Ridwan, W.Z.W. Yaacob, Abdul Rahim Samsudin & B.K. Tan

Kesesuaian tanah di sekitar Selangor sebagai bahan pelapik semulajadi

Mohd Yasir, Ibrahim Komoo & Sarah Aziz

Pemetaan guna tanah untuk menilai impak gelinciran tanah terhadap komuniti Kundasang

Friday, 4 June 2004

TECHNICAL SESSION II

J. K. Raj

Failures at slope cuts in elastic sedimentary bedrock in Malaysia (presented by Mustaffa Kamal Shuib)

Tajul Anuar Jamaluddin

Reactivated ancient slides at the Sungai Kelalong dam site, Bintulu, Sarawak, East Malaysia

Ahmad Tajuddin Hj. Ibrahim & Che Noorliza Lat

Detecting subsurface voids using the microgravity method – A case study from Kuala Lipis, Pahang

Tan Boon Kong & Eng Boon Keong

Physico-chemical properties of serpentinite soils in the Kuala Pilah area, Negeri Sembilan

Ismail Yusoff, Ismail C. Mohamad, Azman Abd. Ghani & Tajul Anuar Jamaluddin

Groundwater modelling of Nenas, Pekan, Pahang

Kamal Roslan Mohamed, Che Aziz Ali, Mohd Shafeea Leman & Ibrahim Abdullah

Sedimentologi dan analisis fasies batuan Paleozoik Akhir di kawasan Panching, Pahang

Che Aziz Ali, Mohd Shafeea Leman & Kamal Roslan Mohamed

Fasies karbonat dan diagenesis di dalam Batu Kapur Bukit Biwah dan Bukit Taat, Kenyir, Ulu Terengganu.

Sunday, 6 June 2004

TECHNICAL SESSION III

Azman A. Ghani, V. Ramesh, B.T. Yong & T.T. Khoo

Geochemistry and petrology of syenite, monzonite and gabbro from the western part of Benom Complex of Peninsular Malaysia

Wan Fuad Wan Hassan & Heru Sigit Purwanto

Radiometric age of Kampung Awah andesite

Mohd Azamie W. A. Ghani, Azman A. Ghani & Ismail Yusoff

Occurrence, field relations and petrography of metamorphic rocks and adjacent rocks from Pos Selim Highway, central Main Range of Perak-Pahang: Preliminary observations

B.T. Yong, Azman A. Ghani, T.T. Khoo & Shafari Muda

Benom Complex: Evidence of magmatic origin

Abdelmoniem Ahmed Masoud, Teh Guan Hoe & Azman A. Ghani

Biotite geochemistry of the western belt granitoids of Peninsular Malaysia (presented by Azman A Ghani)

TECHNICAL SESSION IV

Basir Jasin & Zaiton Harun

Discovery of some Early Carboniferous radiolarians from north Perak and their significance

Meor Hakif Hassan & Lee Chai Peng

The depositional environment of the Mid-Palaeozoic red beds at Hutan Aji, Perlis and its bearing on global eustatic sea level change

Sugeng S Surjono, Mohd. Shafeea Leman, Che Aziz Ali & Kamal Roslan Mohamed

A review on Palaeozoic lithostratigraphy of east Johor, Malaysia

Ibrahim Abdullah

On the presence of the pre-Carboniferous meta-sediments in the Eastern Belts: A structural view

Sunday, 6 June 2004

TECHNICAL SESSION V

H.D. Tjia

Periglacial involutions, large folded recumbent folds and tectonic overprints at Putrajaya

Mustaffa Kamal Shuib

Synsedimentary deformation of the Kapas Conglomerate, Pulau Kapas, Terengganu

Jatmika Setiawan & Ibrahim Abdullah

Superimposed Folding in the Triassic Semantan Formation, Temerloh, Pahang

Lakam anak Mejus, Mohd Tadza Abdul Rahman, Rahman Yaccup, Roslanzairi Mostapa, Kamarudin Samudjing, Nazrul Hizam Yusoff & Rifaie Murtadza

Pemetaan keadaan air bawah tanah di tapak pelupusan sampah dengan menggunakan kaedah 2-D pengimejan keberintangan geoelektrik

Juhari Mat Akhir

Lineaments in enhanced remote sensing images: An example from the Upper Perak Valley, Perak Darul Ridwan

POSTER SESSION A FRIDAY, 4 JUNE 2004 (0940 - 1040)

1. **Mustaffa Kamal Shuib & Tajul Anuar Jamaluddin**
A hazard assessment and slope stabilization of a granite cut slope in a hillside development off Jalan Kuari, Cheras, Selangor
2. **Ismail Yusoff, Abd. Hadi Abd. Rahman, Ahmad Farid Abu Bakar & Mohd. Azamie Abd. Ghani**
Baseflow study of Sungai Chuau and Sungai Bisa, Putrajaya Wetland
3. **Abd Rasid Jaapar & Siti Hafidzah Sheikh Ismail**
Detection and treatment of cavities in Kuala Lumpur limestone at Ampang Jaya District, Selangor
4. **Wan Zuhairi Wan Yaacob & Vincent Ngoo Teck Swee**
Penjerapan Logam Berat Pb, Cu, Ni dan Zn oleh beberapa komponen penting tanah di sekitar Negeri Selangor.
5. **Wan Zuhairi Wan Yaacob, Abdul Rahim Samsudin & Suzana Ismail**
Beberapa faktor penting yang mempengaruhi kadar penjerapan logam berat oleh tanah basalt di sekitar Kuantan, Pahang
6. **Wan Zuhairi, Wan Yaacob, Abdul Rahim Samsudin, Bahaa El-Din El-Wali, Suharsono & Umar Hamzah**
Resistivity survey and soil chemistry of unsecured landfill sites in Bukit Kemuning, Shah Alam, Selangor
7. **Abdul Ghani Rafek & Norsyafina Roslan**
Pencirian mekanik batuan syis amfibol, Putrajaya, Wilayah Persekutuan
8. **Suharsono, Abdul Rahim Samsudin & Abdul Ghani Rafek**
Pengiraan nilai Penanda Mutu Batuan (RQD) menggunakan kaedah analisis spektral gelombang permukaan
9. **Haswanto & Abd. Ghani Md. Rafek**
Analisis kestabilan cerun buatan bentuk gelongsoran satah dipengaruhi ketakselajaran dan gempabumi: Kajian kes Tanjung Enim, Sumatera Selatan, Indonesia
10. **J.J. Pereira & T.F. Ng**
Construction aggregates for urban development: Consumption, sterilisation and the environment
11. **Hamzah Zakaria, Kamal Roslan Mohamed & Che Aziz Ali**
Pemetaan gua batu kapur di Gunung Senyum, Temerloh, Pahang
12. **Wong Meng Li, Kamal Roslan Mohamed & Che Aziz Ali**
Pemetaan gua batu kapur di Gunung Jebak Puyuh, Temerloh, Pahang

13. **Brena Sue Jonathan, Jason Lew Koon Yong & Che Aziz Ali**
Sedimentologi dan diagenesis batu kapur Gunung Senyum, Jengka, Pahang
14. **Abdul Rahim Samsudin, Wan Zuhairi Wan Yaacob, Abdul Ghani Rafek & Bahaa-eldin Elwali A.Rahim**
Concentration of heavy metals beneath the Ampar Tenang municipal open-tipping site, Selangor, Malaysia

POSTER SESSION B

Sunday, 6 June 2004 (1000 - 1100)

1. **Basir Jasin, Zaiton Harun & Uyop Said**
Some Devonian radiolarians from chert blocks in the Bentong-Raub Suture Zone, Pahang
2. **Azman A. Ghani & Mohd Farid Abu Bakar**
Geology and granite petrology of the Besar Island, Johor
3. **Azman A. Ghani**
Geochemistry of volcanic and granitic rocks from the western part of the Endau Rompin area, Johor
4. **Azman A. Ghani**
Chemical characteristics of some granitic bodies from Terengganu, Peninsular Malaysia.
5. **Cheng Kwong Kiong & Teh Guan Hoe**
Characterisation of amang minerals from the Klian Intan area, Upper Perak
6. **Umar Hamzah, Abdul Rahim Samsudin, Mohd. Shahid Ayub, Lai Kian Voon, Rahman Yaacub & Lakam Mejus**
Pengeimejan lempung samudera dengan survei geoelektrik dan seismos: Kajian kes di Banting, Selangor
7. **Mohd Shafeea Leman, Norhaslinda Ramli, Shaaffudin Mohamed & Charles Molujin**
The discovery of Late Permian (early Changshingian) brachiopods from Penjum, Pahang Darul Makmur
8. **Siti Norhajar Hassan & Basir Jasin**
Kajian awal radiolaria berusia Trias dari Formasi Semanggol di Bukit Lada, Kedah
9. **Ibrahim Abdullah, Jatmika Setiawan & S.M. Awalnur**
Sistem sesar dalam Basalt Segamat: Kajian kes di Kuari Yam Fong
10. **Mokhtar Ghani**
Geology in the Quran
11. **Harminzar Mansor, Ibrahim Abdullah, Azirul Liana Abdullah, Jatmika Setiawan & Mohd Syukri Wahid**
Struktur dan Canggaaan Batuan Lapisan Mersing di Teluk Bangka, Mersing, Johor
12. **Baba Musta & Khairul Anuar Kassim**
Engineering properties of on lime stabilised clayey soil from the Crocker Formation

Annual Geological Conference 2004
Putra Palace, Kangar, Perlis
4-6 June 2004

Abstracts of Papers

**Pencirian landskap geologi untuk penilaian kepelbagaian:
 Kajian kes Pulau Anak Datai**

IBRAHIM KOMOO & TANOT UNJAH
 Institut Alam Sekitar dan Pembangunan (LESTARI)
 Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor Darul Ehsan

Pencirian landskap geologi untuk penilaian kepelbagaian memerlukan pendekatan pemetaan yang bersistem mengenai setiap rupabumi, unit-unit rupabumi dan fitur geologi dan geomorfologi. Kajian kes ini dijalankan bertujuan untuk mengenalpasti dan mencari setiap komponen rupabumi dan fitur geologi dan geomorfologi bagi membolehkan rupabumi Pulau Anak Datai dinilai berasaskan kepelbagaian geologi dan nilai warisannya.

**Natural sorption capability of heavy metals: Granitic residual soil from Broga and
 marine clay from Sg. Besar Selangor**

WAN ZUHAIRI WAN YAACOB, ABDUL RAHIM SAMSUDIN, MOHD RAMZIEMRAN &
 CHAN YIK LOON
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 Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor Darul Ehsan

The study aims to investigate sorption capability of heavy metals (HMs), i.e. lead (Pb), copper (Cu), nickel (Ni) and zinc (Zn) by two soil types; granite residual soils from Broga (BRG) and marine clay soils from Sg. Besar (SBMC). All samples were subjected to physico-chemical properties and batch equilibrium tests (BET). The physico-chemical test results show that SBMC soils have high pH, high clay content, high CEC and SSA values and montmorillonite. In contrast, BRG soils have low pH, low clay content, low CEC and SSA values and contain mainly kaolinite and illite. Sorption tests (BET) show that SBMC soils have higher sorption for HMs compared to BRG soils. The sorption capability of these soils is greatly controlled by their physico-chemical properties.

**Pengaruh jenis batuan sekitar terhadap taburan Pb
 dalam sedimen muara Sungai Merbok, Kedah**

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 Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor Darul Ehsan

Plumbum dalam sedimen muara terbahagi kepada dua fraksi utama iaitu Pb baki atau litogenik (*residual*) dan Pb bukan baki (*non-residual*). Pengaruh jenis batuan terhadap kepekatan Pb bukan baki dalam sedimen muara penting bagi mengenalpasti sama ada kepekatan Pb bukan baki dalam sedimen muara berpunca secara tabii ataupun disumbangkan oleh kegiatan manusia. Kajian ini bertujuan untuk mengenalpasti pengaruh jenis batuan sekitar iaitu granit-pegmatit, syis,

syal dan bijih besi terhadap kepekatan Pb baki dan bukan baki dalam sedimen muara Sungai Merbok. Sebanyak 80 sampel sedimen berkedalaman 5-50 cm di sepanjang Sungai Merbok dan Sungai Petani telah diambil. Kandungan Pb pukal dalam batuan granit-pegmatit, syis, syal dan bijih besi masing-masing sebanyak 91 ppm, 6.3 ppm, 59 ppm dan di bawah had pengesanan. Sebahagian besar daripada Pb baki dan bukan baki dalam sedimen muara dipengaruhi oleh batuan syal Formasi Mahang. Pengaruh batuan granit-pegmatit terhadap Pb baki di kesan dalam sedimen muara di selatan Gunung Jerai. Walau bagaimanapun, kesannya terhadap Pb bukan baki tidak begitu ketara. Batuan syis dan bijih besi mempunyai kepekatan Pb yang rendah dan tidak menunjukkan pengaruh yang besar terhadap kepekatan Pb dalam sedimen muara Sungai Merbok. Secara kesimpulan, pengaruh jenis batuan didapati lebih jelas dalam fraksi Pb baki atau litogenik berbanding dengan Pb bukan baki.

Kesesuaian tanah di sekitar Selangor sebagai bahan pelapik semulajadi

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Dalam kajian ini, sifat fizik dan sifat kimia tanah digunakan bagi mengenalpasti kesesuaian tanah untuk dijadikan bahan pelapik semulajadi dengan mengambil enam jenis tanah berdekatan dengan tapak pelupusan sisa pepejal di sekitar Selangor. Hasil kajian menunjukkan tanah lempung lautan dari kawasan Sg. Besar di Kuala Selangor (SBMC) dan tanah metasedimen dari kawasan Kg. Hang Tuah di Batang Berjuntai (HMS) mempunyai potensi yang paling baik untuk dijadikan bahan pelapik semulajadi berbanding tanah kuarzit terluluhawa dari Ayer Hitam, Puchong (PMS), tanah aluvium sungai dari Sg. Sedu, Hulu Langat (SRA), tanah aluvium sungai dari Ampar Tenang, Sepang (ARA) dan metasedimen dari Sg. Kembong, Hulu Langat (KMS). Kesesuaian tanah tersebut boleh disusun seperti berikut: SBMC > HMS > PMS > SRA > ARA > KMS.

Pemetaan guna tanah untuk menilai impak gelinciran tanah terhadap komuniti Kundasang

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Kundasang merupakan sebahagian daripada daerah Ranau terletak di kaki Gunung Kinabali, berketinggian 1200-1800m d.p.l., dan mempunyai iklim seakan sederhana. Disebabkan iklim dan kedudukannya yang menarik, pekan ini mempunyai dua tarikan pembangunan: (a) pertanian, khususnya tanaman sayur-sayuran untuk bekalan negeri Sabah; dan (b) pelancongan, mereka yang menginginkan suasana udara sejuk dan rekreasi pendakian Gunung Kinabalu. Perubahan corak gunatanah di kawasan ini berlaku dengan pesatnya sejak 20 tahun terakhir ini. Selain daripada pembangunan yang pesat, terdapat lima sistem gelinciran tanah yang mampu menimbulkan ancaman geobencana terhadap komuniti tempatan, sumber hidupan mereka dan pembangunan kawasan pertempatan.

Failures at slope cuts in clastic sedimentary bedrock in Malaysia

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Interbedded sandstones, siltstones and shales are the dominant clastic sedimentary rocks of Malaysia and are exposed at slope cuts where an upper Zone I (residual soil) of completely weathered bedrock modified by pedological processes is seen. Zone I is up to 6 m thick and overlies the *in situ*, slightly to completely weathered bedrock of Zone II that

preserves the minerals, textures and structures of the original strata; the degree of preservation increasing with depth. Low cuts and the top benches of high cuts in undulating to hilly and mountainous terrain expose Zone I and have experienced small earth falls and shallow slips during periods of continuous daily rainfall. Where the cuts intersect unconfined groundwater tables, slumps and compound slides are observed. In hilly to mountainous terrain, the lower benches of high cuts (>10 m high) expose Zone II and have experienced small to large, block and slab slides as well as wedge failures, during periods of continuous daily rainfall. At some very steep benches exposing indurated (hard) bedrock, toppling failures and rock falls have sometimes occurred during rainfall. Design of slope cuts in clastic sedimentary bedrock in Malaysia thus needs to take into consideration their geometry, topographic setting, exposed lithologies and structural discontinuity planes as well as weathering and rainfall patterns.

Reactivated ancient slides at the Sungai Kelalong dam site, Bintulu, Sarawak, East Malaysia

TAJUL ANUAR JAMALUDDIN

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The Sungai Kelalong Dam site is founded in the interbedded mudstone-sandstone of the Miocene age Nyalau Formation. The formation has been mildly deformed resulting in very broad, open syncline-anticlinal folds plunging in the E-NE direction. The rock mass is dissected by at least 4 sets of discontinuities, mainly the bedding planes, joints and faults. The occurrence of a massive landslide on the spillway slope and part of the neighbouring core trench wall is largely attributed to the intersection of a low angle, listric normal fault and the subvertical, E-W striking fault zone. The former is interpreted as a sliding plane of an ancient slide, which probably took place during the Pliocene uplifting in a condition of wet soft sedimentary deformation, to allow for the formation of a well-developed normal listric faults system. Reactivation of the ancient slide caused by extensive earthworks activities for the dam construction resulted in a massive landslide to the spillway slope. This case study gives clear examples of the importance of geological inspection during the construction stage to check and detect any structural defects not identified in previous site investigation works.

Detecting subsurface voids using the microgravity method – A case study from Kuala Lipis, Pahang

AHMAD TAJUDDIN HJ. IBRAHIM & CHE NOORLIZA LAT

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The gravity method is one of the more popular geophysical methods to detect subsurface voids. The voids, whether they are filled with air or water, will give anomalous gravity lows above their localities. The gravity pattern is also related to subsurface topography of the bedrock. A borehole drilled earlier indicated a possibility of a cavity. This study was conducted to see if the suspected cavity could also be detected by gravity method. Based on the borehole information, the lithology of the area comprises sandy clayey silt with limestone bedrock. A total of 42 observations were made in four profiles bearing east-west and north-south along the bunds (*batas*) of a paddy field. The survey area measured 50 m by 40 m. Readings were made at 5 m spacing, using a LaCoste-Romberg Model D gravimeter. This instrument was chosen because of its capability for detecting minute changes in the earth gravity field caused by local anomaly. The results indicate the possibility of cavities at four locations at depths varying from 3.77 to 6.50 m. The depth to the center of each anomalous body was calculated using the half-width method. The depth of the cavity interpreted from the borehole turned out to be shallower when the field gravity data is inverted using that method. The cavities were probably filled with wet sediments of densities between 1.85 to 2.05 g/cm³.

Physico-chemical properties of serpentinite soils in the Kuala Pilah area, Negeri Sembilan

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Residual soils of serpentinite in the Kuala Pilah area, Negeri Sembilan, have been analysed for their physico-chemical properties. Results indicate that the serpentinite soils are characterised by their predominantly clayey nature, high plasticities, generally low compacted densities, slightly acidic pore fluids, and non-dispersive nature.

Groundwater modelling of Nenasi, Pekan, Pahang

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One of the most valuable and practical tools the groundwater manager can use is the computer model. Any professional working in the field of hydrogeology should adapt to and use groundwater models to be truly efficient. The conceptual model of the groundwater system in Nenasi, Pekan Pahang was proposed and translated into a numerical model. Groundwater flow model, MODFLOW was used to simulate the steady state hydrogeological conditions for the area. Good agreement was obtained between the simulated and observed groundwater levels. The calibrated model was used to study the environmental impacts on groundwater caused by over abstraction in Nenasi. The present model boundary conditions and modelling results suggested that over abstraction would lower down the groundwater level, dry up the shallow aquifer and induce saltwater intrusion.

Sedimentologi dan analisis fasies batuan Paleozoik Akhir di kawasan Panching, Pahang

KAMAL ROSLAN MOHAMED, CHE AZIZ ALI, MOHD SHAFEEA LEMAN &
IBRAHIM ABDULLAH

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Kawasan Panching di Pahang terdiri daripada batuan sedimen klastik dan juga batuan karbonat, dan telah dipetakan sebagai sebahagian daripada Kumpulan Kuantan. Kumpulan Kuantan di sini telah dibahagikan kepada tiga formasi iaitu Formasi Charu yang paling tua, diikuti oleh Formasi Batu Kapur Panching, dan Formasi Sagor yang paling muda. Daripada data lapangan dan analisis fasies terhadap batuan daripada ketiga-tiga formasi ini, lapisan fasies telah dikenalpasti dan satu korelasi jujukan sedimen serta sejarah pengendapan telah ditafsirkan. Kajian ini menunjukkan bahawa kesemua fasies yang ditemui telah dihasilkan oleh proses-proses pengendapan di sekitaran laut cetek. Jujukan batuan yang terdapat di kawasan Panching terbentuk pada masa Karbon Awal di sekitaran laut cetek, tidak jauh daripada sistem delta atau muara sungai. Lautan cetek ini dapat dibahagikan kepada beberapa sub-sekitaran seperti pulau penghalang, pesisir, alur muara, lepas pantai serta sekitaran karbonat, dan ditafsirkan bahawa pengendapan sedimen dalam kesemua sub-sekitaran ini berlaku serentak.

Fasies karbonat dan diagenesis di dalam batu kapur Bukit Biwah dan Bukit Taat, Kenyir, Ulu Terengganu

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Batu kapur Bukit Biwah dan Bukit Taat yang terletak di Tasik Kenyir, Terengganu mewakili unit batu kapur yang terbentuk di zaman Perm Tengah. Komposisi batu kapur ini terdiri daripada batu lumpur, batu wak dan batu padat dengan sedikit batu butir. Butiran utama terdiri daripada kerangka organisma laut cetek (alga, foraminifera, bryozoa, fusulinid, brakiopod, bivalvia, gastropod dan karang). Sebahagian lagi butiran dibentuk oleh bahan-bahan peloid. Batuan ini telah melalui beberapa tahap proses diagenesis yang melibatkan penyimenan semasa sedimen berada di dasar laut dan juga penyimenan yang telah berlaku selepas batuan tertimbus dalam. Di samping itu pendolomitan juga sangat lazim namun ianya tidak membentuk isipadu yang besar di dalam batuan. Kehadiran stilolit minor dan beramplitud rendah dan lipit pelarutan menunjukkan bahawa batuan tersebut tidak mengalami tekanan dan tegasan yang kuat.

Geochemistry and petrology of syenite, monzonite and gabbro from the western part of Benom Complex of Peninsular Malaysia

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The Benom Igneous Complex situated in the central part of this belt forms a pear shaped batholith consisting of a variety of igneous rocks ranging in composition from granitic to syenitic to monzonitic and gabbroic. The syenitic, monzonitic and gabbroic rocks are found mainly in the western part of the batholith. The range of SiO₂ for each of the gabbro, syenite and monzonite are 46.5 to 49.1%, 52.9 to 56.9% and 56.6 to 64.7% respectively; with high alkali content and shoshonitic with I type characteristics. They have very high LIL elements, i.e. Ba and Sr are nearly 1000 times rock/mantle. The high Ba and Sr values may result from the penetration of the lower lithosphere by a small volume of mantle material that is enriched in those elements.

Radiometric age of Kampung Awah andesite

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The age of andesite from Kampung Awah in particular and the Peninsular Malaysia in general, is reported as Upper Permian. A sample from Kampung Awah andesite was sent for K-Ar radiometric dating. The result obtained is 269±46 Ma or Middle Permian age. The result indicates that contrary to earlier belief, the andesite of Kampung Awah was extruded earlier, viz. in Middle Permian and that limestone was subsequently deposited on the cooled andesite much later, in the Upper Permian period. An older age for the andesite is also supported by field and petrological evidences.

Occurrence, field relation and petrography of metamorphic rocks and adjacent rocks from Pos Selim highway, central Main Range of Perak-Pahang: Preliminary observations

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The Pos Selim Highway consists of two main lithological units i.e. metamorphic rocks and various range of granites. The area lies in the central part of the Western Belt granite near the Perak-Pahang border. The main objective is to study the occurrences of new outcrops of regional metamorphic rocks that are known as greenschist facies by their occurrence, field relations and petrography. The metamorphic body forms an irregular elongate form ranging from 1 to 4 km in width and extending southwards, oblique to the axis of the Peninsula. There are varied constituent of minerals in the schist, which are dominated by quartz, mica (muscovite and biotite) and ilmenite with several assemblages of garnet, sillimanite and chloritoid. Graphitic schist is formed in the sheared zone and gives different structural appearances compared to regional beddings that strike northwest-southeast and dip northeast for quartz mica schist.

Benom Complex: Evidence of magmatic origin

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The study area is underlain predominantly by syenite, monzonite and gabbro. The area lies on the western flank of Benom batholith. Field mapping has proven the intrusive nature of the suite of rocks into the surrounding country rocks. The country rocks were contact metamorphosed into various hornfels of hornblende hornfels facies. The occurrence of a crystal settling layer within the suite of rocks is particularly convincing of an igneous origin. Moreover, the occurrence of accidental xenoliths in these igneous rocks, which correspond to the aureole rocks, indicate that the xenoliths were incorporated during magma intrusion. The presence of different types of cognate xenoliths ranging from pyroxinite to gabbroic and syenitic in composition, is also widespread in the study area. The occurrence of planar flow structure in the syenite and monzonite defined by megacrystic K-feldspar, is evident of magmatic flow. Petrographic studies reveal that igneous foliation in the suite of rocks is made up of euhedral to subhedral plagioclase and K-feldspar crystals.

Biotite geochemistry of the western belt granitoids of Peninsular Malaysia

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This study involves the petrological and geochemical characterization of biotite from 25 granitoids of the western belt of Peninsular Malaysia and 3 from South Johor. The Main Range granite representing the western belt plutons is a coarse to very coarse grained porphyritic biotite-muscovite granite that usually contains altered biotite with pleochroic colours from pale brown to slight darker brown to a dark rich brown or reddish brown colour and have inclusions of zircon, monazite, ilmenite, fluorite, xenotime, apatite, rutile, iron oxide and other opaque minerals. In contrast, the South Johor granite is medium to coarse grained porphyritic hornblende-biotite granite with biotite of light grey-green and brown to dark muddy brown pleochroic colours and inclusions of zircon, apatite, rutile, iron oxide and other opaque minerals. Data from electronprobe microanalyses of biotites of the granitoids were plotted in discrimination diagrams to highlight their distribution patterns. The biotites from the Penang, Kuala Lumpur, Negeri Sembilan and Pahang granites are mainly plotted in the peraluminous field and the biotites from the Perak granites are mainly plotted in the alkaline field. The biotites from the Selangor, Kedah and South Johor granites are mainly plotted in the calc-alkaline

field. The average SiO₂, TiO₂, MgO, K₂O, Al₂O₃, MnO and FeO contents of biotites are about 35 wt%, 3 wt%, 5 wt%, 8 wt%, 16 wt%, 0.5 wt% and 27 wt%, respectively. The study revealed the distinctive biotite distribution patterns of the four granitoids namely, Teluk Bahang (Penang), Papan (Perak), Batu Tiga (Selangor) and Hume Quarry Kulai (Johor) which have lower than average SiO₂, TiO₂ and K₂O contents in their biotites and higher MgO, Al₂O₃, MnO and FeO contents. Such trends are probably related to the nature of the magma they have crystallised; tectonic setting or whether they are S-type or I-type granites. The study demonstrates that the composition of igneous biotites of the western belt of Peninsular Malaysia clearly reflect the nature of their host magmas.

Discovery of some Early Carboniferous radiolarians from North Perak and their significance

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Twenty radiolarians taxa were identified from a chert sample collected from an outcrop of an Upper Paleozoic rocks in North Perak. This is a new discovery of radiolarians in the area. The radiolarian assemblage represents the *Albaillella deflandrei* Assemblage Zone that indicates an age of Tournaisian, Early Carboniferous. Tournaisian radiolarians were found in many localities in Peninsular Malaysia and worldwide. Development of radiolarians during Tournaisian was a worldwide event and is known as a hypersiliceous period. The radiolarian assemblage occupied paleobiogeographic province in the Paleo-Tethys ocean.

The depositional environment of the Mid-Palaeozoic red beds at Hutan Aji, Perlis and its bearing on global eustatic sea level change

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Late Devonian – Early Carboniferous red coloured mudstones and sandstones are widely distributed in northwest Peninsular Malaysia. A relatively complete and well preserved sequence is exposed at Bumita Quarry, Hutan Aji, Perlis, and is described herein. The facies associations observed are indicative of a marine prodelta-delta front depositional environment for the Mid-Palaeozoic red beds. A thin (9m) black mudstone facies in the middle of the Bumita Quarry sequence may represent the Latest Devonian Hangenberg Anoxic Event. The occurrence of a Mid-Palaeozoic orogeny is refuted. The major regression just after the global Hangenberg Event transgressive episode is proposed as the cause of the major, pre-Carboniferous paraconformity observed in mid-Palaeozoic successions of the Sibumasu/Shan-Thai Terrane.

A review on Palaeozoic lithostratigraphy of east Johor, Malaysia

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A revision on the Palaeozoic lithostratigraphy of east Johor has been made. The Palaeozoic of east Johor comprises the Mersing Formation, Murau Conglomerate Formation, Dohol Formation, Jasin Volcanic, Pengerang Volcanic and Linggiu Formation. The pre-Permian Mersing Formation, the oldest known rock unit is entirely made up of metamorphosed

sedimentary rock of shallow marine origin. Unconformably overlying this unit is the Murau Conglomerate Formation developed in a small continental faulted basin. The siliciclastic Dohol Formation containing late Early to early Middle Permian Sumalayang limestone and Sedili volcanic is also unconformably overlying the Mersing Formation, as are the other volcanic units of Pengerang Tuff and Jasin Volcanic. The three volcanic units are thought to be contemporaneous and closely related with the Early to Middle Permian Dohol Formation and the overlying Late Permian Linggiu Formation. The absence of volcanic clasts in the Murau Conglomerate Formation indicate that the later is a pre-volcanic, hence pre-late Early Permian formation. The shallow marine Linggiu Formation and associated volcanic rocks is the youngest Palaeozoic formation in east Johor.

On the presence of pre-Carboniferous metasediments in the Eastern Belt: A structural view

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The geological map of Peninsular Malaysia shows that the oldest rock formation in the Eastern Belt is Carboniferous in age, consisting of mainly clastic sedimentary rocks. The rocks have been subjected to low grade regional metamorphism to become metaquartzite and phyllite and are generally known as metasediments. The metasediments are unconformably overlain by the Jurassic-Cretaceous continental deposits. Recent findings of plant fossils from the continental deposits in Bukit Keluang area, Terengganu indicate Late Permian age. The area was intruded by Permo-Carboniferous mafic to intermediate igneous rocks, followed by the Late Permian-Early Triassic biotite granite, the Late Triassic granite and finally by the Jurassic-Cretaceous dolerite dykes. Most of the interpreted Carboniferous metasediments show at least two episodes of folding trending north-northwest or south-southeast and north-south directions. However, in certain areas, these rocks indicate more complex structures with two generations of folding with the earliest trending east-northeast, followed by north-northwest trending folds. From a structural point of view, it is suggested that the more complicated metasediments with three generation of folds are of older (pre-Carboniferous) age. The earliest ENE trending folds were probably developed during the mid-Devonian orogeny that was interpreted based on structural studies in other areas.

Periglacial involutions, large folded recumbent folds and tectonic overprints at Putrajaya

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The development of Putrajaya and Cyberjaya brought to light many new outcrops of black pelite, buff to reddish brown psammite and subordinate bands of light-coloured tuffaceous or loessic material. Most of the outcrops are in advanced weathered states. The nature of the fresh rock was identified in drill cores acquired for foundation designs. These rocks are geochemically similar to the Upper Palaeozoic Kenny Hill Formation, although the dominant dark colour is rarely found among the Kenny Hill strata in the type area of Kuala Lumpur. At Salak Tinggi, Kenny Hill-like strata is marked by an *Agathiceras* sp. fossil (Early Permian) and also contains a pebbly horizon of interpreted glacial origin. The Putrajaya-Cyberjaya rock assemblage is therefore interpreted as being of Gondwanan origin. At "Cyberjaya Hill", bands of light-coloured tuff(?) or loess(?) were irregularly deformed into crinkles of varied wave lengths and shapes that contrast with the more systematically folded larger structures. The disharmonic character of the crinkles suggests these to represent periglacial involute structures. The larger folds are tectonic and developed as recumbent structures that became refolded into open warps. These two tectonic fold sets are coaxial about a north-southerly trend. Indications of tectonic transport of the recumbent folds include to the west, southeast and east.

Synsedimentary deformation of the Kapas Conglomerate, Pulau Kapas, Terengganu

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Late Paleozoic continental conglomerates are widely distributed in the Eastern Belt of Peninsular Malaysia. In Terengganu, it primarily occurs in Pulau Kapas as a wedge shaped basin, thought to be formed within a strike slip fault system. A structural and sedimentological study of the Kapas Conglomerate provides insight into its sedimentary tectonic history. The initial tectonic activity in the basin can be traced to movement along two major splaying strike-slip faults, the dextral NS Kapas Fault Zone and a sinistral NNW fault, which enclose the Kapas Conglomerate. When these faults were concurrently active, a region of compression and uplift developed where they converged. Correspondingly, extension and subsidence occurred where they diverged. This setting produced a major source area, which supplied relatively constant detritus to the adjacent fault-wedge basin. In the Late Palaeozoic, a braided alluvial fan developed in the region, as represented by the Kapas Conglomerate. The fan evolved in a semi-arid climate, and flows were generally from the west. The development of the fan is coeval with synsedimentary volcanism. The overall trend of the sedimentary sequence is the result of the strike slip faulting along the active margin of the subsiding basin. Active faulting activities continued during the deposition leading to synsedimentary deformation of the conglomerate. A NS dextral strike slip fault system at the western margin of the Kapas Conglomerate provides clear evidence for this tectonic phase. The influence of this tectonic phase is recorded in the coarsening upward cycles of the sedimentation. Due to ongoing synsedimentary strike slip deformation, the sediments show sets of small-scale conjugate normal faults creating a pattern of horst and graben structures, internally progressive tilting of the strata and an internal angular unconformity. This Late Palaeozoic dextral transpressive deformation, and rapid uplift followed deposition of continental sediment coeval with volcanism, in a tectonically active strike slip basin is a major orogenic event which can be considered as part of a large scale deformation in the Eastern Belt that may have accommodated the oblique convergence of the two tectonic blocks of Peninsular Malaysia.

Superimposed folding in the Triassic Semantan Formation, Temerloh, Pahang

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The rocks of the Semantan Formation which are well exposed in the Temerloh-Mentakab area, Pahang were folded with the axis plunging towards N145°E- N155°E. Generally they can be classified as inclined to overturned folds with one of the limbs gently dipping. The first generation slaty cleavage (S1) can be clearly seen in slightly weathered rocks. Reverse-right slip faults (RRSF) developed almost parallel to S1 followed by another set of RRSF that cut the S1 are interpreted as a back-thrust. Field observations indicate that the gently dipping limbs are refolded, to form second generation open and asymmetrical folds (f2) with the axis plunging towards N130°E- N135°E and second generation cleavages (S2) that intercept the S1. Left-normal slip faults are considered as the third generation faults and oriented almost parallel to S2. The last deformation resulted in the formation of normal-left slip fault and is considered as a result of reactivation of the RRSF that were formed almost at the same time with the formation of the first generation folds. The refolding and formation of two generations of cleavage in the rocks of the Semantan Formation show that the structural style in this rock formation differs from that of the Jurassic-Cretaceous Tembeling Group. Therefore, the widely reported Triassic orogenic compression in Malaysia Peninsular that has been disputed should be reconsidered and accepted.

Pemetaan keadaan air bawah tanah di tapak pelupusan sampah dengan menggunakan kaedah 2-D pengimejan keberintangan geoelektrik

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Kaedah pengimejan keberintangan geoelektrik boleh digunakan untuk memetakan struktur geologi subpermukaan bumi berdasarkan perubahan keberintangan bahan di sepanjang garis survei yang dilakukan. Tanah mempunyai keberintangan yang berbeza bergantung kepada sifat kimia dan fiziknya. Sifat kimia dan fizik tanah sentiasa berubah dan ini mempengaruhi nilai keberintangannya. Keberintangan bahan subpermukaan bumi juga banyak bergantung kepada kandungan air dan darjah kemampatannya. Kajian telah dilakukan dengan menggunakan ABEM Terrameter SAS 4000 dan sistem pemilihan elektrod ES464. Sepuluh garisan survei telah dilakukan untuk memetakan perubahan nilai keberintangan air bawah tanah dan kesan pencemaran air tanah di tapak pelupusan sampah. Daripada kajian didapati nilai keberintangan air tanah yang tercemar secara relatifnya lebih rendah ($<10\text{Wm}$) berbanding dengan air tanah yang tidak tercemar atau air tanah segar.

Lineaments in enhanced remote sensing images: An example from the Upper Perak Valley, Perak Darul Ridwan

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Linear structural features (lineaments) mapped from remotely sensed images are often used as indicators of fractures in near-surface rocks. Previous lineament mapping and interpretations of Malaysia have used aerial photographs and relatively unenhanced satellite images. Images covering the Upper part of Perak River Basin have been produced from LANDSAT MSS data using several digital image processing techniques, particularly filtering, intended to enhance the visibility of lineaments. The contrast stretched of MSS band 7 was found to be the best in displaying lineaments for the area, hence, was further processed by using directional filters. The four directionally filtered images, which contain lineaments in EW, NS, NE-SW and NW-SE direction, were used for lineament mapping. All lineaments longer than 1 km were traced and mapped at scale 1: 250,000; their orientations were determined and lengths measured, and further analyzed by preparing rose diagrams for analysis, interpretation and comparison with published maps. Fracture analysis of the mapped lineaments was carried out together with its relation with rock types and mineral deposits in the study area. A good correlation, both in terms of direction and location, do exist between image lineaments and previously mapped faults. In addition, new prominent lineaments which are probably newly identified faults were delineated and recorded along with new circular features, thus, updating the structural geologic map of the area as well as to facilitate the planning of mineral exploration and identification of new mineral deposits.

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Abstracts of Posters

Hazard assessment and slope stabilization of a granite cut slope in a hillside development off Jalan Kuari Cheras, Selangor

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One example of a hillside residential development that is of concern to the authorities is a rock slope off Jalan Kuari in Cheras. The rock slope was identified as being potentially unstable. The stability of this particular slope was critical because it was located immediately across the backlane behind a row of newly completed terrace houses. A study was undertaken to analyze the stability of the rock slope and to recommend suitable protection and/or stabilization measures, to ensure long term stability of the rock slopes and safety of existing properties and human activities in the newly developed residential area. From this study, it is concluded that the rock slope behind the newly completed terrace houses is generally stable. Although all the joint planes are potential slip surfaces, no signs of major instability were found except for some localized small-scale unstable elements. Suitable protection measures and monitoring and maintenance programme are suggested to ensure long term stability of the cut-slope. In any hillside development, the stability of the cut slope should be maintained to prevent undesirable landslides hazards. This study illustrates the concern of the authorities on the stability of cut slopes on hillside development for roads and housings. With adequate cut slope design and implementation of stabilization and protective measures, including regular maintenance and monitoring, the need for costly rehabilitation and remediation measures can be avoided, which would become necessary should the slope failures occur.

Baseflow study of Sungai Chuau and Sungai Bisa, Putrajaya Wetland

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The groundwater component in the form of baseflow in Sg. Chuau and Sg. Bisa sub-catchment within Putrajaya wetlands during the low flow period was studied. Field investigations show that the alluvium deposits along Sg. Chuau is composed of more sand and gravel, thus increasing its hydraulic conductivity and groundwater discharge. Sg. Chuau could be classified as a baseflow river and the groundwater component maintains its flow during any dry period. The existence of this condition would guarantee stream flow and maintenance of the wetland ecosystem in the upper part of Putrajaya wetlands during long dry periods. Sg. Bisa, on the other hand is not a baseflow river and could easily dry up.

Detection and treatment of cavities in Kuala Lumpur limestone at Ampang Jaya District, Selangor

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Kuala Lumpur limestone in the Klang Valley generally show two geomorphologic expressions, one above the ground and the other buried beneath alluvium. The buried limestone shows highly irregular karst topography. These features have caused a variety of geotechnical problems in both the design and construction stage of substructures or foundations. This paper presents a case study on the detection and treatment of cavities in limestone at the new government hospital project in the district of Ampang Jaya, Selangor Darul Ehsan. A combination of microgravity survey and rock probing drilling to scrutinise potential geohazards related to the occurrence of cavities were utilised successfully. This exercise shows that cavity treatment using consolidation grouting method has been successfully implemented. It also shows that cooperation, understanding and teamwork from various parties are essential in solving problems in a cost effective manner.

Penjerapan logam berat Pb, Cu, Ni dan Zn oleh beberapa komponen penting tanah di sekitar Negeri Selangor

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Logam berat iaitu plumbum, kuprum, nikel dan zink kerap dijumpai dalam tanah yang tercemar. Empat jenis sampel tanah dari Selangor telah diambil untuk mewakili beberapa komponen aktif tanah; iaitu bahan liat dari tanah metasedimen di ambil dari Air Hitam, bahan berkapur dari batu kapur Batu Caves, bahan organik dari Syis Bergrafit Ampar Pechah, dan kongresi besi dari Bandar Baru Bangi mewakili bahan amorfus oksida/hidroksida. Ujian Keseimbangan Batch (Batch Equilibrium Test) digunakan untuk mendapatkan data penjerapan logam berat untuk setiap komponen bahan yang dikaji. Hasil menunjukkan yang kadar penjerapan logam berat boleh disusun seperti berikut: bahan berkapur > bahan amorphous > bahan bergrafit > bahan liat. Afiniti terhadap penjerapan logam berat adalah mengikut susunan berikut; Pb>Cu>Ni>Zn.

Beberapa faktor penting yang mempengaruhi kadar penjerapan logam berat oleh tanah basalt di sekitar Kuantan, Pahang

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Kajian keupayaan penjerapan logam berat plumbum, kuprum dan nikel oleh tanah basalt di Kuantan, Pahang dilakukan dengan menggunakan kaedah *Batch Equilibrium Test* (BET) dengan mempertimbangkan faktor perubahan konsentrasi, perubahan masa, perubahan kedalaman, perubahan nilai pH, dan kesan penamabahan kandungan komponen tanah iaitu bahan berkapur, bahan organik dan bahan amorfus. Hasil kajian menunjukkan penjerapan logam berat bertambah dengan pertambahan masa dan konstan selepas 6 jam pengoncangan dilakukan. Tanah yang diambil pada kedalaman yang dekat dengan permukaan bumi didapati berupaya menjerap logam berat lebih tinggi berbanding tanah yang diambil pada kedalaman yang lebih dalam. Keupayaan penjerapan logam berat oleh tanah pada pH tinggi (beralkali) adalah lebih tinggi daripada tanah pH rendah (berasid). Penambahan Komponen kapur (karbonat) lebih banyak mempengaruhi kadar penjerapan logam berat berbanding dengan bahan organik dan bahan amorfus.

Resistivity survey and soil chemistry of unsecured landfill sites in Bukit Kemuning, Shah Alam, Selangor

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The study was undertaken to highlight the suitability of the resistivity survey as a tool to investigate the migration of leachate into groundwater. The results indicate that the resistivity image corresponds very well with field data from the excavated part of this landfill. The results of soil analysis reveal that the soil below the landfill site is highly contaminated with heavy metals that originate from local industrial waste. The concentration of heavy metals increase slightly with depth and become constant after a depth of 50 cm.

Pencirian mekanik batuan syis amfibol, Putrajaya, Wilayah Persekutuan

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Penemuan batuan syis amfibol di Putrajaya mendorong pengkaji menjalankan kajian mekanik batuan ke atas batuan tersebut kerana kurang data sedemikian bagi litologi ini. Kawasan kajian adalah di Presint 8, Putrajaya, pada garis lintang 02°56'N dan garis bujur 101°40'E. Tiga litologi utama ditemui di kawasan kajian, terdiri daripada syis amfibol jenis syis tremolit, syis grafit dan mikrogranit dalam bentuk korok. Penentuan nilai indeks beban titik, nilai pantulan tukul Schmidt, kekuatan regangan, dan kekuatan mampatan sepaksi membolehkan batuan syis tremolit dikelaskan sebagai batuan berkekuatan sangat kuat. Nilai pantulan tukul Schmidt bagi batuan segar adalah berjulat antara 50 sehingga 64 dengan nilai purata 58. Nilai purata indeks beban titik dan kekuatan regangan masing-masing ialah 14.05 MPa dan 22.23 MPa bagi kes kegagalan bahan, manakala kes kegagalan yang dipengaruhi satah ketakselajaran mencatatkan penyusutan nilai dalam lingkungan 50% bagi kedua-dua ujian. Untuk ujian mampatan sepaksi, kegagalan yang dipengaruhi ketakselajaran masih menghasilkan nilai kekuatan sangat tinggi dengan nilai purata 127.51 MPa.

Pengiraan nilai penanda mutu batuan (RQD) menggunakan kaedah analisis spektral gelombang permukaan

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Penanda mutu batuan (RQD) seringkali digunakan sebagai ukuran mutu jasad batuan. Indeks RQD ini dikira berdasarkan peratus jumlah teras gerudi yang diperolehi semasa penggerudian. Nilai RQD mempunyai hubungan secara empirikal dengan jarak retakan dan darjah luluhawa pada jasad batuan. Skema pengelasan jasad batuan yang berdasarkan kepada hubungan diantara nilai RQD dan kualiti jasad batuan telah dikenalkan oleh Deere (1968). Singh dan Goel (1999) telah membuat pengiraan nilai RQD menggunakan halaju gelombang mampatan (V_p) yang diukur di lapangan dan halaju V_p sampel teras gerudi batuan yang diperolehi melalui ujian ultrasonik di makmal. Kertas kerja ini membincangkan teknik baharu bagi pengiraan nilai RQD menggunakan kaedah analisis spektral gelombang permukaan (SASW) yang pada masa ini telah digunakan dan dikembangkan untuk menentukan kekukuhan daripada tanah dan jasad batuan serta jalan raya dan konkrit. Dalam teknik baharu ini, halaju gelombang ricih (V_s) yang diukur melalui kaedah SASW beserta halaju V_s yang

diperolehi daripada ujian ultrasonik sampel teras batuan di makmal digunakan bagi mengira nilai RQD melalui persamaan,

$$RQD (\%) = 100^{(1-\delta)}, \text{ dimana } \delta = \left[\frac{(V_{sp} - V_{sb})^2}{(V_{sp} + V_{sb})^2} \right]^2 \text{ dan } V_{sb} \text{ serta } V_{sp} \text{ adalah halaju gelombang ricih yang diukur dengan}$$

kaedah SASW serta ujian ultrasonik. Kaedah baharu ini telah diuji kebolehgunaannya di tiga tapak kajian iaitu Bandar Tasik Selatan, Kepong dan Bandar Sri Damansara dan hasil yang diperolehi bersesuaian (tidak melebihi 10%) dengan nilai RQD yang diperolehi daripada data lubang gerudi.

Analisis kestabilan cerun buatan bentuk gelongsoran satah dipengaruhi ketakselajaran dan gempabumi: Kajian kes Tanjung Enim, Sumatera Selatan Indonesia

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Kegagalan cerun batuan terjadi disebabkan oleh berbagai faktor seperti ketakselajaran (kekar) dan gempabumi. Kegagalan cerun batuan terjadi dalam berbagai bentuk, seperti gelongsor bentuk satah, lingkaran, jatuhnya terbalik dan baji. Semua bentuk kegagalan cerun batuan terbentuk di cerun lebuhraya dan lombong dedaah. Pada jasad batuan terdapat banyak ketakselajaran (kekar) yang mempengaruhi kegagalan cerun bersama dengan gempabumi di kawasan lombong. Pada tulisan ini satu pengembangan dan analisis cerun batuan menggunakan model keruntuhan satah pada lapisan penutup dengan dipengaruhi oleh faktor kekar dan gempabumi.

Construction aggregates for urban development: Consumption, sterilisation and the environment

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The relationship between economic growth, urban expansion, aggregate consumption and its resultant implications with respect to the environment is depicted well in the Langat Basin, which is situated south of the Klang Valley, in the states of Selangor and Negeri Sembilan. Extensive development within the Basin has created demand for construction aggregates and brought to fore environmental problems associated with quarrying. Uncoordinated planning of land development has contributed to aggregate resource sterilization, and if left unchecked may threaten future environmental well-being of the Basin. Policy instruments using mineral landbanks for construction aggregates and buffer zones for quarry operations is an option that can be considered to address these problems.

Pemetaan gua batu kapur di Gunung Senyum, Temerloh, Pahang

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Gunung Senyum merupakan bukit batu kapur yang terdiri daripada batu kapur berusia Perm-Trias. Jujukan Batu Kapur Gunung Senyum terdiri daripada batu kapur tebal hingga masif dan bewarna kelabu hingga cerah. Sebanyak 12 buah gua telah dipetakan dengan terperinci untuk mengenalpasti jenis dan kedudukan fitur-fitur yang ada. Antara gua-gua tersebut ialah Gua Kolam Tujuh, Gua Terang Bulan, Gua Taman Dua, Gua Makam Tok Long dan Gua Taman Impian. Beberapa fitur landskap yang menarik telah dikenalpasti dan boleh dimajukan untuk tarikan pelancongan. Antaranya stalagmit berbentuk buah konifer yang mungkin mempunyai persamaan dengan *Palm Trunc stalagmite* yang jarang terdapat di gua-gua batu kapur di Malaysia. Stalagmit unik ini dan dolina-dolina yang berasosiasi dengannya dicadangkan sebagai monumen geologi Negeri Pahang. Keadaan landskap, gua dan jalan-jalan rintisan sekeliling perbukitan dan ke Gunung Jebak Puyuh berpotensi untuk aktiviti riadah, sukan tahan lasak dan treking rimba.

Pemetaan gua batu kapur di Gunung Jebak Puyuh, Temerloh, Pahang

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Landskap Gunung Jebak Puyuh dicirikan oleh keunikan geologi seperti kehadiran gua, dolina dan speleotem. Gua-gua Gunung Jebak Puyuh mudah dikunjungi dan mempunyai kepelbagaian landskap yang menarik. Di dalam gua-gua terdapat fitur-fitur geomorfologi yang mempunyai nilai estetik, rekreasi dan saintifik tinggi seperti speleotem yang terhasil melalui proses pelarutan, pegenapan dan penghabluran semula batu kapur. Kehadiran landskap semula jadi yang menarik seperti gua berbentuk terowong, stalakmit, stalaktit, kolam dan dolina runtunan merupakan khazanah yang sangat bernilai dan perlu dipelihara. Dalam konteks ini, Gunung Jebak Puyuh untuk mempunyai potensi untuk dibangunkan sebagai kawasan pelancongan.

Sedimentologi dan diagenesis batu kapur Gunung Senyum, Jengka, Pahang

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Gunung Senyum terletak lebih kurang 40 kilometer ke Utara Bandar Temerloh, di dalam Hutan Simpan Jengka Negeri Pahang. Batu Kapur Gunung Senyum secara umumnya bersifat masif. Perlapisan batu kapur dijumpai di bahagian Utara gunung dengan jurus tenggara-barat laut dan kemiringan 30° hingga 40° ke arah barat-barat daya. Litologi di sekeliling gunung terdiri daripada peralapisan syal, batu lumpur dan batu pasir bertuf. Berdasarkan pengelasan Dunham (1962), batu kapur ini dikelaskan kepada tiga kumpulan iaitu batu wak, batu padat, batu butir, batu kapur berpasir dan batu kapur berdolomit. Mengikut pengelasan Folk (1959, 1962), batu kapur di sini dapat dibahagikan kepada 11 mikrofases iaitu biomikrit, intramikrit, pelmikrit, biomiksparit, intramiksparit, pelmiksparit, biosparit, oosparit, intrasparit, pelsparit dan biopelsparit. Batu kapur yang dikaji telah mengalami proses diagenesis yang terdiri daripada penyimenan, neomorfisme, pemampatan, pengstilolitan, penghabluran semula dan pendolomitan. Fosil yang dapat dikenali terdiri daripada *Malayspirina fontainei* dan *Endothyra cf. kuepperi*. Himpunan fosil ini memberikan usia Awal Trias Akhir. Fases-fases Batu Kapur Gunung Senyum ditafsirkan terbentuk di sekitaran marin cetek iaitu pelantar karbonat. Hasil kajian geokimia mendapati batu kapur di Gunung Senyum adalah batu kapur yang mempunyai ketulenan sederhana. Bahan pencemar yang hadir terdiri daripada unsur SiO₂ dan MgO. Ini menunjukkan Batu Kapur Gunung Senyum tidak sesuai digunakan sebagai sumber bahan untuk industri batu kapur tetapi sifatnya yang masif membolehkan ia digunakan sebagai batu dimensi dalam sektor pembinaan.

Concentration of heavy metals beneath the Ampar Tenang municipal open-tipping site, Selangor, Malaysia

ABDUL RAHIM SAMSUDIN, WAN ZUHAIRI WAN YAACOB, ABDUL GHANI RAFEK &
BAHAA-ELDIN ELWALI A. RAHIM

School of Environmental Science and Natural Resources, Faculty of Science and Technology
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Heavy metals namely Cu, Cr, Ni, Zn, Pb and Co in soil horizons beneath the Ampar Tenang municipal open-tipping site have been extensively investigated through examination of twenty-one representative triplicate soil samples that were collected from nine auger-boreholes. Soils sampled from the body of the disposal site revealed considerably higher concentration levels of most of the elements analyzed compared to other samples. Moreover, Cr, Zn and Pb show higher levels of concentration among all examined metals. It was found that in most cases, the heavy metal concentration was generally high at the surface and downwards to a depth of 60 cm, then decreased relatively with increasing depth. It is shown that in addition to vertical infiltration of leachate from the solid waste, the hydrological regime of groundwater also has strong impact on contaminant distribution in soils below the site.

Some Devonian radiolarians from chert blocks in the Bentong-Raub Suture Zone, Pahang

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Ten radiolarian taxa were identified from chert blocks of the Bentong-Raub Suture Zone, exposed at a new road cut along the Bentong-Raub road. The assemblage is composed of *Trilonche minax* (Hinde), *Trilonche davidi* (Hinde), *Trilonche vetusta* Hinde, *Trilonche cf. echinata* (Hinde), *Trilonche cf. parapalimbola* Wang, *Trilonche tretactinia* (Foreman), *Trilonche sp.*, *Stigmosphaerostylus herculea* (Foreman), *Stigmosphaerostylus sp.*, and *Helioentactinia sp.* This assemblage represents an age of Famennian, Late Devonian.

Geology and granite petrology of the Besar Island, Johore

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²Minerals and Geoscience Department Malaysia, P.O. Box 560, 93658 Kuching, Sarawak

The Besar Island, located about 13 km off the east coast of Johore is one of the nearest islands off the coast of Johore. The island consists of metasediments, granite and intruded mafic dykes. The granitic rocks in the Besar Island is homogeneous, medium to coarse grained and mostly equigranular. Geochemical data of the granitic rocks show that the rock has a very high SiO₂ content more than 76%. The geochemical data suggest that the granite magma originated from anatexis of a homogenous source rock composition (or minimum melt).

Geochemistry of volcanic and granitic rocks from the western part of the Endau Rompin area, Johore

AZMAN A. GHANI

Department of Geology, University Malaya, 50603 Kuala Lumpur

Stratigraphically, the rocks of the western part of the Endau Rompin area can be divided into four main units: Jasin

Volcanics, granite, Tebak Formation and Quaternary alluvium. The Jasin Volcanics are the oldest rocks, and are suspected to be Permian to Late Triassic in age. They are composed mainly of bedded rhyolite, pyroclastics and tuff. The granite is part of the Eastern Belt granite, and is of the I-type characterized by high Na_2O content and the presence of hornblende. The volcanic rocks in the study area are similar to the volcanic rocks from eastern Johore. Geochemical evidence suggests that the granite and volcanic magma is different.

Chemical characteristics of some granitic bodies from Terengganu, Peninsular Malaysia

AZMAN ABDUL GHANI

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The study involves some granitic rocks of the eastern granitic belt in Terengganu consisting of four granitic bodies. They are the Maras Jong pluton, Jerong batholith, Perhentian granite pluton and Kapal batholith. The range of SiO_2 in each granitic body is: Maras Jong (65.67 - 6.34 wt%), Jerong (66.7 - 76.9 wt%), Perhentian (70.9 - 75.4 wt%) and Kapal (63.03 - 76 wt%). All the granites are high K calcalkaline. They also have high total alkali content ($\text{Na}_2\text{O} + \text{K}_2\text{O} = 5.9$ to 9.8 wt%) and are mildly metaluminous to peraluminous (ACNK values: Maras Jong = 1.01 - 1.27 ; Jerong = 0.98 - 1.05 ; Perhentian = 0.92 - 1.03 and Kapal = 0.89 - 1.07). LIL elements and TiO_2 vs Zr plots of all the granites indicate that K-feldspar, biotite, plagioclase, zircon, biotite, hornblende and sphene play an important role in determining the variation during fractionation process. The geochemistry of the granites shows that each granitic body has a specific character and probably is made up of individual batches of melt.

Characterisation of amang minerals from the Klian Intan area, Upper Perak

CHENG KWONG KIONG & TEH GUAN HOE

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Samples of amang were collected from Rahman Hydraulic Tin Mine, Klian Intan, Upper Perak, and its adjacent areas, for both physical and chemical characterisation. Results show that the amang from the Klian Intan area contain mainly arsenopyrite, pyrite, cassiterite, wolframite, rutile, zircon, and iron oxides. The main iron oxide present is hematite, which shows botryoidal texture and zoning. Goethite and gangue minerals replaced some of the hematite grains. Some of the arsenopyrite grains were replaced by covellite and scorodite, while the pyrite is mainly associated with quartz and wolframite. There are still valuable amounts of cassiterite in the amang from the Klian Intan area. Some of the cassiterite grains show exsolutions of tapiolite. Some are associated with sphalerite, pyrite, and wolframite. EPMA study has identified several new minerals, which have not been recorded yet in the Klian Intan amang. These include wittichenite (Cu_3BiS_3), bournonite (PbCuSbS_3), boulangerite ($\text{Pb}_5\text{Sb}_4\text{S}_{11}$), and possibly tsugaruite ($\text{Pb}_4\text{As}_2\text{S}_7$) and trippkeite (CuAs_2O_4).

Pengimejan lempung samudera dengan survei geoelektrik dan seismos: Kajian kes di Banting, Selangor

UMAR HAMZAH, ABDUL RAHIM SAMSUDIN, MOHD SHAHID AYUB, LAI KIAN VOON,

RAHMAN YAACUP & LAKAM MEJUS

Pusat Pengajian Sains Sekitaran dan Sumber Alam, Fakulti Sains dan Teknologi
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Satu kajian geofizik telah dilakukan di sekitar Dengkil-Morib untuk mengkaji struktur aluvium Holosen Formasi Gula dan Beruas. Formasi Beruas dibentuk oleh bahan gambut dan gambut berlempung serta lodak dan pasir manakala

Formasi Gula adalah terdiri daripada lempung, lodak, pasir dan kelikir. Kedua-dua Formasi tersebut terendap di atas batuan syal Formasi Bukit Kenny yang berusia Karbon. Survei geofizik yang dilakukan ialah tomografi geoelektrik 2D dan survei seismos pantulan. Pengukuran rintangan elektrik dilakukan dengan alat ABEM Terrameter SAS 1000/4000. Imej keberintangan 2D di setiap garis survei diperolehi dengan teknik pemprosesan model kesongsangan dan dibandingkan dengan maklumat lubang gerudi. Imej keberintangan kesemua garis survei menunjukkan pola yang hampir sama iaitu berbentuk peralihan dan peralihan berkekanta berjulat keberintangan di antara 0.1 hingga 50 Wm. Lapisan teratas berjulat keberintangan 0.1 hingga 5 Wm ditafsirkan sebagai lempung dengan ketebalan sehingga 45 m. Lapisan kedua di bawahnya berkeberintangan 5 hingga 20 Wm yang dirujuk sebagai pasir kasar dan kelikir pada kedalaman 45 hingga 70 m berdasarkan lubang gerudi. Julat keberintangan lapisan terbawah bernilai 20-50 Wm yang dikorelasikan sebagai batuan metasedimen yang terletak di kedalaman bawah daripada 70 m. Satu survei seismos pantulan sepanjang 1.7 km yang dilakukan menggunakan teknik pemprofilan titik kedalaman sepunya menunjukkan dengan jelas peralihan lempung yang terletak di atas batu dasar metasedimen.

The discovery of Late Permian (early Changshingian) brachiopods from Penjom, Pahang Darul Makmur

MOHD SHAFEEA LEMAN¹, NORHASLIDA RAMLI¹, SHARAFFUDIN MOHAMED² &
CHARLES MOLUJIN²

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Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor Darul Ehsan

² Specific Resources Sdn Bhd., PO Box 49, 27207 Kuala Lipis, Pahang Darul Makmur

A brachiopod fauna has been recently discovered in dark grey calcareous shale at Penjom, near Kuala Lipis, Pahang. The fauna consists of *Peltichia kwangtungensis* (Zhan), ?*Peltichia* sp., *Semibrachythyryna rhombiformis* Shen & He, *Semibrachythyryna* sp., ?*Spiriferellina* sp., ?*Anchorhynchia* sp., ?*Acosarina* sp., *Derbyia* sp. and unidentified meekellid, rhynchonellid and productid. The brachiopod faunal assemblage suggests a Late Permian (early Changhsingian) age to the calcareous shale bed and the associated limestone in the block below the Penjom thrust. The brachiopod genus *Peltichia* Jin & Liao is reported for the first time in Malaysia.

Kajian awal radiolaria berusia Trias dari Formasi Semanggol di Bukit Lada, Kedah

SITI NORHAJAR HASSAN & BASIR JASIN

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Enam belas spesies radiolaria telah dikenalpasti dari lokaliti baru di Bukit Lada, Kedah. Himpunan radiolaria yang ditemui terdiri daripada *Busuanga* sp., *Cryptosphenidium* spp., *Cryptosphenidium verrucosum*, *Eptingium manfredi*, *Eptingium manfredi robustum*, *Parasepsagon asymmetricus praetetracanthus*, *Parasepsagon variabilis*, *Planispinocyrtes* sp., *Pseudostylosphaera compacta*, *Pseudostylosphaera longispinosa*, *Pseudostylosphaera japonica*, *Pseudostylosphaera magnispinosa*, *Pseudostylosphaera helicata*, *Pseudostylosphaera coccostyla* dan *Triassocampe deweveri*. Kehadiran Zon himpunan *Triassocampe deweveri* dan Zon himpunan *Eptingium manfredi robustum* telah memberikan usia rijang di Bukit Lada sebagai Trias (Anisian hingga Ladinian).

Sistem sesar dalam Basalt Segamat: Kajian kes di Kuari Yam Fong

IBRAHIM ABDULLAH, JATMIKA SETIAWAN & S. M. AWALNUR

Pusat Pengajian Sains Sekitaran dan Sumber Alam, Fakulti Sains dan Teknologi
Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor Darul Ehsan

Basalt Segamat diletuskan semasa Tersier Awal, ketika keadaan tektonik Semenanjung Malaysia dikatakan telah berada dalam keadaan setabil. Kajian lapangan di Kuari Yam Fong, Kampung Jabi, Segamat menunjukkan batuan, disamping telah mengalami peretakan dan pembentukan telerang kalsit, basalt di sini juga mengalami sesaran mendatar dan sesaran sungkup. Berdasarkan kepada perkaitan antara struktur yang terdapat di sini, ditafsirkan basalt Segamat telah mengalami dua kali mampatan, yang awal daripada arah timur-timurlaut (TTL) diikuti oleh mampatan dari arah timur-tenggara (TTG). Telerang kalsit juga didapati tersibar dengan agak meluas dalam jalur-jalur tertentu berarah utara timur laut dan timur-timurlaut. Sesar mendatar konjugat gererasi awal yang terhasil daripada mampatan daripada arah TTL dipotong dan dianjakkan oleh sistem sesar mendatar konjugat yang terhasil daripada mampatan dari TTG. Selain berkaitan dengan pembentukan sesar mendatar, sistem tegasan yang awal juga bertanggung jawab dalam pembentukan telerang kalsit. Sistem tegasan ke dua bertanggung jawab dalam pembentukan satu lagi set sesar mendatar konjugat dan sesar songsang. Hasil kajian ini juga menunjukkan bahawa sistem tegasan dalam keadaan mampatan masih beroperasi di Semenanjung Malaysia selepas zaman Tersier awal yang dikatakan telah berada dalam keadaan stabil.

Geology in the Quran

MOKHTAR GHANI

Department of Geology, University of Malaya, 50603 Kuala Lumpur

Geologists are encouraged to seriously study the Holy Books of all religions, on the content related to geology. Many verses in the Quran, related to geology are examined, interpreted and inferences made. To simplify the understanding of the subject matter, the original texts in Arabic are not included, instead translations in English and Bahasa Malaysia from reputable sources are used. It is conclusive that many facts on geology are given in the Quran. It is recommended that more geological research in general, should be done and new knowledge found should be carefully and correctly applied for the benefits of mankind.

Struktur dan canggaan batuan Lapisan Mersing di Teluk Bangka, Mersing, Johor

**HARMINZAR MANSOR, IBRAHIM ABDULLAH, AZIRUL LIANA ABDULLAH,
JATMIKA SETIAWAN & MOHD SYUKRI WAHID**

Pusat Pengajian Sains Sekitaran dan Sumber Alam, Fakulti Sains dan Teknologi,
Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor Darul Ehsan

Kawasan kajian tertumpu di sepanjang pantai bahagian barat Teluk Bangka, Mersing. Litologi yang dicerap terdiri daripada metakuarzit, filit dan selang lapis metakuarzit – filit yang dikenali sebagai Lapisan Mersing berusia Karbon-Perm. Pemetaan geologi terperinci telah dilakukan di kawasan ini menggunakan kaedah grid bagi menghasilkan peta litologi dan struktur. Struktur geologi yang dijumpai di kawasan ini ialah lipatan, sesar, kekar, telerang dan ira. Terdapat empat arah lipatan di kawasan ini. Sesar mendatar kanan (dekstral) dan kiri (sinistral) banyak dicerap. Sesar mendatar kiri di kawasan ini wujud dalam dua arah, iaitu timur-tenggara dan tenggara manakala sesar mendatar kanan berarah hampir utara-selatan hingga timurlaut. Di kawasan ini terdapat dua jenis ira iaitu ira sabak dan ira retakan. Secara keseluruhannya, kawasan ini ditafsirkan telah mengalami empat fasa canggaan. Canggaan fasa pertama (D1) dihasilkan oleh mampatan berarah timur-timurlaut, membentuk lipatan ketat yang mempunyai paksi menunjam ke utara-baratlaut. Fasa kedua (D2) pula dengan mampatan berarah timur-barat, menerbitkan struktur lipatan yang terlipat semula dengan paksi menunjam ke utara. Selain itu, canggaan ini juga membentuk sesar mendatar konjugat kanan dan kiri masing-masing berjurus $U55^{\circ}T$ dan $U112^{\circ}T$ berserta telerang. Canggaan fasa ketiga (D3) dengan mampatan berarah timur-

tenggara, membentuk lipatan terbuka dengan paksi menunjam kearah utara-timurlaut, sesar mendatar kiri berarah U140°T dan telerang. Canggaaan keempat (D4) pula dengan mampatan berarah utara-timurlaut menerbitkan lipatan terbuka yang paksinya menunjam hampir timur (barat), sesar mendatar kanan berarah hampir utara-selatan berserta telerang.

Engineering properties of on lime stabilised clayey soil from the Crocker Formation

BABA MUSTA¹ & KHAIRUL ANUAR KASSIM²

¹School of Science and Technology, UMS 88999 Kota Kinabalu, Sabah, Malaysia

²Faculty of Civil Engineering, UTM 81310 Skudai, Johor, Malaysia

This paper presents a study on lime stabilisation of clayey soil from weathered Crocker Formation. In this study 2%, 4%, 6%, and 8% of lime were added into the soil. The result of compaction test show a decrease in dry density and an increase in the optimum moisture content (OMC) with increasing lime content. This is due to the adsorption of water by the soil and development of cementitious mineral. With addition of 2% lime the dry density decreased by about 5% and further additions of 4%, 6% and 8% lime caused the dry density to decrease by 1-3%. The unconfined compression test shows that the compressive strength increases rapidly after 14 days of being cured with lime ranging from 2% to 8%. Samples with 6% and 8% lime however show that the most significant increase in strength is after 45 days and 100 days of curing. The increase of strength is due the development of cementitious mineral and formation of bridge like structures as observed by scanning electron microscope.

Ceramah Teknik (Technical Talk)**ASSESSING RAPID GEOLOGICAL CHANGE USING THE GEOINDICATOR APPROACH****PROFESSOR ANTONY R. BERGER**

Institute for Environment and Development (LESTARI)
Co-Director, IUGS Geoinicator Initiative, Victoria BC, Canada

This technical talk was organised by the Institute of Geology Malaysia and Geological Society of Malaysia with support from the Institute for Environment and Development (LESTARI) of Universiti Kebangsaan Malaysia and the Geology Department of Universiti Malaya on 28 June 2004, at 5.00 pm at the Geology Department, University Malaya

Summary: The geoinicator concept developed recently by the International Union of Geological Sciences is proving to be a useful tool in assessing the condition of ecosystems, whether in protected areas, around mining sites, or in State-of-the-Environment reporting (www.geoinicator.org). Geoindicators are geological parameters that can change significantly on the time scale of a century or less. Examples include karst and frozen ground activity, relative sea level and shoreline position, landslides and avalanches, dune movement, groundwater and soil quality, and stream channel morphology. In this lecture, examples were drawn from a wide range of environmental settings of geoindicators, showing how they can be tracked and why this is important to environmental management.



BERITA-BERITA PERSATUAN (News of the Society)

Keahlian (Membership)

The following applications for membership were approved:

Full Members

1. Ian Longley
Woodside, GPO Box D188
Perth, W Australia 6840
2. Fatkur Rahman Zakaria
SMHB Sdn. Bhd, 38, Jln 1/76D,
Desa Pandan, 55100 Kuala Lumpur
3. Donald Sim Chee Yew
Sarawak Shell Bhd
98100 Lutong, Sarawak

Student Member

1. Tang Zhen Wen
Universiti Malaysia Sabah
90, Lorong 9, Taman Damai
34700 Simpang, Perak

Associate Member

1. Arnold Doray,
Block 160, Bt. Batok Street 11,
13-58, Singapore 650160

Pertukaran Alamat (Change of Address)

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

1. Chieng Yih Yaw
P.O.Box 560
96108 Sarikei, Sarawak
2. Dr. Sci. Shigeki Hada
Faculty of Literature
Kobe Women's University
Suma-ku, Kobe, 654-8585 JAPAN
e-mail: hada@suma.kobe-wu.ac.jp
3. Goh Seng Hong
26, Jalan SS24/24
Taman Megah
47301 Petaling Jaya, Selangor

Current Addresses Wanted

The Geological Society of Malaysia is seeking the address of the following members. Anyone knowing the new address, please inform the Society.

1. Serge Froment
2. Mohd Reza Lasman
3. Volker C. Vahrenkamp
4. Meh Jabeen Zainuddin
5. E.R. Telatovich
6. Wong See Ching
7. Ramdanshah Bacho
8. Wan Noorull Hana Ahmad Ghazali
9. Ong Wei Ching
10. Sunny A.A. Singh
11. Colin H. Ford
12. Wong Poh Poh
13. Hazura Hashim

Pertambahan Baharu Perpustakaan (New Library Additions)

The Society has received the following publications:

1. Mineralogica Polonica, vol 33, nos. 1-2, 2002.
2. Berliner paläobiologische abhandlungen, band 2-4, 2003.
3. Earth Science Frontiers, vol. 10, nos. 3-4, 2003.
4. Journal of Shijiazhuang, University of Economics, vol. 26, nos. 4-6, 2003.
5. Geoscience, vol. 17, nos. 3-4, 2003; vol. 18, nos 1, 2004.
6. Acta Geoscientia Sinica, vol. 24, nos. 5-6, 2003; vol. 28, no.1, 2004.
7. AAPG Bulletin, vol. 88, no. 5-6, 2004.
8. Geological Bulletin of Turkey, vol. 45, no. 2, 2002; vol. 46, no. 1, 2003.
9. AAPG Explorer, May & June, 2004.
10. SOPAC News, no.1, 2004.
11. Institute of Geoscience. The University of Tsukuba, Annual Report, no. 29, 2003.
12. Acta Microplalaeontologica Sinica, vol. 20, nos, 3-4, 2003; vol. 21, no. 1, 2004.
13. Acta Palaeontologica Sinica, vol. 42, no. 4, 2003; vol. 43, no.1, 2004.
14. Palaeontological Abstracts, vol. 18, no. 4, 2003; vol. 19, no. 1, 2004.
15. Science Reports of the Institute of Geoscience, University of Tsukuba, vol. 25, 2004.
16. Monthly Statistics on Mining Industry in malaysia, Dec. 2003; Jan 2004.
17. Geological Survey of Japan Bulletin, vol. 54, nos.9-12, 2003
18. Geosciences Journal, vol. 8, no. 1, 2004.

BERITA-BERITA LAIN (Other News)

OBITUARY



PROFESSOR NEVILLE S. HAILE MA, D.PHIL, D.SC. (OXON)

5 June 1928 – 20 June 2004

Neville was born in Bognor Regis, the second child of Richard Haile, a well-known photographer and Amelia Haile who ran a gift-shop. From an early age he was interested in geology and struck up an early friendship with the curator of the Bognor Regis Museum. Together they collected fossils from the London Clay that is exposed at low-tide on Bognor Beach. Neville ignored his headmaster's advice to join the Palestinian Police Force, and would have gone straight to University at the age of 16, but was told by Oxford to go away for a year and learn Latin.

Neville graduated in geology at Oxford University in 1948, with the top 1st Class Degree. He then joined the Overseas Geological Service in 1949, having chosen Asia as he had always been intrigued by the Chinese newspaper that wrapped his mother's imported Chinese crafts.

Over the next 15 years he was engaged in surveying previously unmapped areas of Sarawak and Sabah, investigating mineral deposits and also published a field guide to Bornean snakes. His outstanding contributions to our geological knowledge of Borneo began in 1954 with the publication of his Memoir 1 on the Strap and Sadong Valleys, followed in 1957 by his Memoir 7 on the Lupar and Saribas Valleys, and in 1962 Memoir 13 on the Suai-Baram area of Sarawak. These three memoirs were published by the *Geological Survey Department, British Territories in Borneo*. In 1965 he published Memoir 16 of the *Geological Survey, Borneo Region, Malaysia*, on the Dent Peninsula of Sabah. These memoirs, and their geological maps, continue to be our primary source of information on these regions, all now unfortunately out-of-print.

The inaugural professor Charles Pichamuthu had retired in 1961, and his successor T.H.F. Klompé died in office after only a short tenure of the chair. Neville was appointed the third professor of geology in 1964 (University of Malaya, Kuala Lumpur). He spent the next 14 years as Head of Department, during which time it flourished into a well established academic institution. Neville was thrust into administration almost from the beginning. He became Dean of Science and made good use of the office to plan and approve a new geology building that continues to this day to be the pride of the campus. Neville collaborated closely with the director of the Geological Survey in Kuching, and there followed a very fruitful period of research by university staff on many fundamental aspects of Sabah geology. He carried out research and published on the tectonics of

Southeast Asia and engaged in fieldwork in Malaysia, Thailand and Indonesia. His rapport with staff of GRDC in Bandung led to his active participation on research cruises to Natuna, Tambelan and the islands of the Banda Sea. He set up the first laboratory for the study of palaeomagnetism in the department and carried out and published the first results on Southeast Asian rocks.

Upon retirement from the University of Malaya, Neville was a consultant for the United Nations from 1980 to 1982 attached to the C.C.O.P. office in Bangkok. This was followed by attachment to Robertson Research in North Wales from 1982 to 1991 as senior consultant involved in worldwide petroleum assessments. Whilst there, and in collaboration with Russian colleagues, he produced a Palaeogeographic Atlas of the Shelf Regions of Eurasia for the Mesozoic and Cenozoic.

He then returned to Kuala Lumpur from 1991–1992 as advisor to the Petronas Research Laboratory in Ulu Klang, before moving to Oxford, where he was a visiting professor in geology at Oxford Brookes University from 1994 to 1999.

Final retirement was not a period of relaxation, for Neville continued to be involved in many activities: he was Chairman of the Oxford Branch of the Royal Commonwealth Society; he gave occasional lectures to the “University of the Third Age”; was actively involved in the RIGS conservation group (Regionally Important Geological and Geomorphological Sites); was a member of the local mineral and lapidary club; was a member of HOGG (History of Geology Group of the Geological Society of London), specialising in Victorian Geologists, especially William Buckland.

Neville was a talented amateur actor, taking on major roles in many plays in the Town Hall and British Council in Kuala Lumpur. He also gave very entertaining performances in the Malaysian TV comedy series ‘Jangan Ketawa’.

He was the driving force in the founding of the Geological Society of Malaysia and was its first president. Later he was appointed an honorary member of the society. He was a fellow of the Geological Society of London, member of the Geologists Association, fellow of the Gemmological Association, and member of the Petroleum Exploration Society of Great Britain.

He died suddenly in Oxford on Sunday 20th June and is survived by his wife Maureen, their son James and two grand-children.

C.S. Hutchison

Up Coming Events in Malaysia

2004, July 27-28

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