### CATATAN GEOLOGI (Geological Notes)

Azman A. Ghani: Occurrence, subdivision and petrochemistry of mafic dykes from the Perhentian islands 73

### PERTEMUAN PERSATUAN (Meetings of the Society)

Malam Jurutera II 81

Lee Chai Peng: Geology of the three gorges on the Changjiang (Yangtze) River — a CD presentation 83

Report on the AAPG Student Chapter and GSM Talk — Career Opportunities and Career Challenges in the Oil Industry 84

Annual General Conference 2001 — Laporan (Report) 86

Ucapan Alu-aluan oleh Prof. Madya Dr. Mohd Shafeea Leman, Pengerusi Jawatankuasa Penganjur Persidangan Tahunan Geologi 2001 87

Ucapan Prof. Madya Dr. Abdul Ghani Rafek, Presiden Persatuan Geologi Malaysia sempena Majlis Perasmian Persidangan Tahunan Geologi 2001 89

Opening Address by Y.A.B. Dato' Seri Di Raja Mohd Tajol Rosli Tan Sri Ghazali, Menteri Besar Perak D.R. 91

Programme 96

Poster Presentation 104

Abstracts of Papers 106

Abstracts of Posters 129

### BERITA-BERITA PERSATUAN (News of the Society)

Keahlian (Membership) 141

Pertukaran Alamat (Change of Address) 142

Current Addresses Wanted 142

Pertambahan Baru Perpustakaan (New Library Additions) 142

### BERITA-BERITA LAIN (Other News)

Kalendar (Calendar) 150
About the Society

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

The Society has a membership of about 600 earth scientists interested in Malaysia and other Southeast Asian regions. The membership is worldwide in distribution.
Occurrence, subdivision and petrochemistry of mafic dykes from the Perhentian islands

AZMAN ABDUL GHANI
Department of Geology
University of Malaya
50603, Kuala Lumpur

Abstract: Mesozoic mafic dykes in the Perhentian islands and their surrounding area can be divided into two based on their field occurrence, i.e. the older and younger dykes. The older dykes are synplutonic to their felsic host and the younger dykes postdate their felsic host. Synplutonic features shown by the older dykes are recrystallisation of the dyke with the production of amphibolite or hornfelsic texture, back veining into the dyke and dismemberment of the dyke into trains of amoeboid enclaves. All these features suggest that hot mafic dyke magma intruded into the mobile semi solid felsic magma. The younger dykes, which are more abundant, are mainly doleritic in composition and are similar to those found throughout the Eastern Belt. They are made up of plagioclase, clinopyroxene, amphibole, iron ore and chlorite. Geochemical study shows that the dykes formed in a continental within plate tectonic setting.

INTRODUCTION

One of the Mesozoic igneous events in the Eastern Belt of Peninsular Malaysia is the intrusion of mafic magmatism as dykes. These dykes are without doubt the most neglected aspect of the igneous province in Peninsular Malaysia. The dykes, intruding both intermediate to felsic igneous rocks and older layered rocks, are widespread, not only in the mainland but also in several islands off the East Coast of Peninsular Malaysia (Haile et al., 1983; Azman, 1992, 2000a, b; Azman et al., 1998). Despite being abundant in many parts of the area, they have to date received little consideration in regional models. A complete field and geochemical based study, which comprises data for the dykes in this region, does not, as yet, exist. Such a study is an important step to fully constrain the wholly mantle derived magma composition which were available throughout the second half of the Mesozoic time.

This paper will present data of an ongoing research on the mafic dykes from the Perhentian islands, Terengganu (Fig. 1). The dykes extensively intruded both metasediments and
igneous rocks of the islands (Fig. 1). This paper will describe the field occurrence, subdivision and provide a preliminary geochemical data of the dykes in this area. The dykes will be divided into two namely older and younger dykes. The older dykes occur synplutonically with their host rock whereas the latter postdates the host rock. Studies show that the younger ones are more abundant and are found intruding the Eastern Belt igneous and sedimentary rocks.

GENERAL GEOLOGY

The Perhentian islands are situated at the northern part of the Eastern Belt of Peninsular Malaysia and west of the Tertiary Malay Basin. The Perhentian islands consist of several islands, the biggest of which are Perhentian Kecil and Perhentian Besar (Fig. 1). The area is underlain by metasedimentary rocks and intruded by a series of igneous rocks ranging from granitic to syenitic compositions. They are considered as part of Eastern Belt magmatism of Peninsular Malaysia (Cobbing and Mallick, 1987). The metasedimentary rocks are represented by slate, quartzite, pelitic hornfels and calc-silicate hornfels (Azman, 1992; Azman and Khoo, 1998).

The Perhentian area is underlain by two main types of igneous phases namely the Perhentian Kecil syenite and the Perhentian granite, which intruded the metasediments. The Perhentian Kecil syenite forms a circular outcrop at the central part of Perhentian Kecil Island. Although from the map, it appears to intrude the surrounding granite body, field evidence shows that the Perhentian granite is relatively younger than the Perhentian Kecil syenite (Azman and Khoo, 1998). The pluton consists of a variety of igneous rocks ranging in composition from syenitic to monzonitic and even gabbroic. In terms of percentage, the syenitic rock total almost 90% of the pluton.

Figure 1. Geological map of the Perhentian islands and their surrounding area.
Epidote nodules and veins (thickness from 2 to 5 cm) can be seen throughout the pluton. The Perhentian granite has been divided into 2 varieties by Cobbing and Mallick (1987) namely hornblende-bearing and hornblende-free granite. The main body of Perhentian granite consists of medium to coarse grained biotite granite (hornblende-free granite) exposed along the coast of Perhentian Besar island, northern and southern parts of Perhentian island and the whole of Rawa island (Fig. 1). Microgranite and granite porphyry are found at the contact with Perhentian Kecil syenite. Occasionally the microgranite contains pegmatite patches characterized by large plates of muscovite, biotite and K-feldspar. Field, petrography and chemical evidence suggest that the Perhentian Kecil syenite and Perhentian granite are not co-magmatic (Azman and Khoo, 1998; Azman, 2001, in press).

FIELD OCCURRENCE OF THE MAFIC DYKES

The best dykes’ exposure can be found along the coastal area. In general the dykes can be divided into two groups based on the relative age to the host rock. They are the older and the younger dykes. The older dykes are coeval to their felsic host and younger dykes postdate their felsic host. The latter is more abundant and found in all six Perhentian islands.

The older dykes occur in the eastern part of the Perhentian Kecil island and only found intruding into the Perhentian Kecil syenite. Their width varies from a few cm to 20 cm and length up to several meters and are marked by necking and disrupting or pinching and swelling along their length (Fig. 2). Other synplutonic features shown by the dykes are recrystallisation of the dyke with the production of amphibolite or hornfelsic texture, back veining into the dyke and dismemberment of the dyke into trains of amoeboid enclaves (Azman, 1998). Inclusion of the host material in the dykes suggest that the quenched dykes carapace were sometimes breached by host vein material which broke up into globules on penetrating the more fluid interior of the dykes. All these features suggest that hot mafic dyke magma intruded into mobile semi solid felsic magma.

The younger dykes are green to dark green in colour with average thickness ranging from 10 cm to 3 meters. A total of 23 younger dykes were found to intrude all the three main rock types in the study area. The thicker dykes commonly show chilled margins and a regular inward increase of grain size. Angular to sub angular inclusions of granitic host up to 0.5 m across are occasionally found in the dykes. In the Perhentian Besar Island, at Pasir Tiga Ruang, three dykes converge to form a dyke. The dykes are sometimes intruded by yellowish green epidote veins with average thickness of 15 cm. Amygdales filled with calcite, zeolite, quartz and analcite are sometimes found in the dykes.

PETROLOGY

Older dykes

The dykes consist of plagioclase, biotite, hornblende, clinopyroxene and quartz. In thin section, the dykes show an amphibolitic texture (suggesting their basic origin) or sometimes hornfelsic texture. Detailed inspection of sawn slabs of the sample from Tanjung Batu Sireh show that the dyke is banded. It consists of alternating greyish non-biotite and reddish grey biotite-bearing bands. A syenitic back-vein up to 1 cm in thickness can be seen cutting the dykes. The vein is made up of subhedral to anhedral K-feldspar set in relatively finer grained hornblende, biotite, opaque phase and sphe. The grain size of the vein is up to 2.5 mm, compared to the dykes, usually less than 0.3 mm. Flow texture produced by alignment of hornblende and sphe is well developed in the vein (Fig. 3). Evidence of plastic deformation shown by sphe crystals may suggest that the veining occurred in a semi-solid condition (Fig. 4). These imply that the syenitic magma has already crystallised when it came into contact with the dyke magma. The flow alignment is commonly parallel to the vein margin. The dyke minerals also show strong flow alignment. Interestingly, the alignment of the minerals in the dykes curve following the crenulate outline of the vein (c.f. Vernon, 1991).
Figure 2. Photograph of the synplutonic dyke found in Tanjung Batu Peti showing irregular shape and pinching along its length. Location: Eastern part of the Perhentian Kecil island.

Figure 3. Photomicrograph of flow texture around K-feldspar inclusion.

Figure 4. Photomicrograph of deformed sphene in syenitic vein.
Younger dykes

The dyke rocks are made up of plagioclase, clinopyroxene, amphibole, iron ore and chlorite. In general the texture is either intergranular or subophitic. The rocks are often chloritised to varying degrees and in the most extreme case contain up to about 60% modal chlorite. Pale green fibrous uralite may be present within chlorite. MacDonald (1967) suggested that both chlorite and uralite are late magmatic phases. Plagioclase crystals occur as small subhedral to euhedral laths, which do not show any preferred orientation. The crystals sometimes show twinning but rarely zoning. Clinopyroxene, mainly augite, generally subhedral to anhedral, occurs as interstitial grains between plagioclase laths forming a typical doleritic texture. Lamprobolite (basaltic hornblende) if present, is usually less than 5%. This mineral is characterised by its brown colour. Common pleochroism is X = light yellow; Y = brown and Z = dark red brown. In some samples, euhedral to anhedral iron ore can constitute up to 10%. MacDonald (1967) showed that ilmenite is the main iron ore type in the quartz dolerite from the Eastern Belt. In rare cases, some interstitial calcite may occur.

DISCUSSION

Textural constraints on the age of the older dykes

The phenomenon of disruption of a mafic dyke within a felsic host is ubiquitous. It has been discussed in some detail by many authors (e.g. Roddick and Armstrong, 1959; Moore and Hopson, 1961; Kumar, 1988; Pitcher, 1991). Most of the descriptions can be matched to the examples described in this paper. The field features shown by the older dykes suggests that the dyke intrusion is coeval to its host. Lobate to crenulate contact and necking of the dykes suggest that the dyke magma was injected into the mobile semi solid syenitic magma. This is evident from the flow texture developed in both dykes and back vein. Plastic deformation shown by some of the minerals in the syenitic vein (e.g. sphene) suggest that the early crystallised mineral was dragged by the magmatic flow. Occurrence of syenitic inclusions in the dykes suggests that the quenched dykes carapace were sometimes breached by syenitic vein material which broke up into globules on penetrating the more fluid interior of the dykes (Bussell, 1991). Occurrence of fine grained or pegmatitic borders of syenitic composition suggests contraction of dyke magma after cooling. This gave rise to syenitic liquid filling the marginal area of the dyke. The amphibolitic or hornfelsic texture of the dykes suggest that they have undergone metamorphism. The texture may have been the result of metasomatism caused by differences in the concentration gradient of certain elements between the dyke and the host interface.

Tectonic setting of the younger dykes

This section will discuss some of the tectonic aspects of the younger dykes based on the geochemical data. Geochemical data discussed in this section are taken from Azman et al. (1998). Numerous studies have shown that immobile element compositions of basaltic rocks can be used to determine chemical affinities and tectonic setting, even after alteration (Pearce and Cann, 1973; Winchester and Floyd, 1976; Meschede, 1986). Many of the diagrams use high field strength elements such as Ti, Zr, Y and Nb which are thought to be relatively immobile in aqueous fluids unless there are high activities of F-. On a plot of Zr/Y and Ti/Y (Fig. 5), the majority of the samples plot in the within plate basalt field. On a plot Ti/100-Zr-Yx3 ternary diagram (Fig. 6), most of the samples plot mainly on the within plate basalt-island arc tholeiite line. The tholeiitic nature of the dykes magma is also supported by the petrographic and geochemical studies, for example the normative plot which established that the dykes range in composition from olivine tholeiite to quartz tholeiite (Azman et al., 1998). This is also true for the dykes from Terengganu mainland (Azman et al., in prep).

Hence, the chemical data indicate that the dolerites are formed in a continental within plate tectonic setting. The magmatic affinities and tectonic setting of the presently studied dykes is similar to the dolerites in the Kuantan area (central Eastern Belt) which also range in composition from olivine tholeiite to quartz
tholeiite and bear affinities to the tholeiites of continental setting (Chakraborty, unpublished work, in Sita Ram et al., 1980). Regionally, the tectonic setting of the dykes is similar to the Upper Paleozoic volcanic rocks from Chiang Mai belt, northern Thailand (Barr et al., 1990) and Upper Cenozoic basaltic rocks of Thailand, Kampuchea and Vietnam (Barr and James, 1990).

REFERENCES


Figure 5. Zr/Y vs Ti/Y plot of the mafic dykes from the Perhentian islands.

Figure 6. Ternary plot of Ti/100-Zr-Yx3. Fields from Pearce and Cann (1973).


---

Manuscript received 15 April 2001
Design of embankments in soft clays
TAN YEAN CHIN

Design of marine structures: geotechnical & environmental aspects
LEE ENG CHOY

Slopes in hill-site development
YEE YEW WENG

Laporan (Report)

Three “young” engineers presented talks to members of GSM at this event.

1. Ir. Tan Yean Chin (Gue & Partners)
   Design of embankments in soft clays

2. Ir. Lee Eng Choy (dpi Konsult)
   Design of marine structures: geotechnical & environmental aspects

3. Ir. Yee Yew Weng (Arup Perunding)
   Slopes in hill-site development

Ir. Tan Y.C. gave a comprehensive discussion on the design of embankments on soft clays, including types and modes of failures, case histories, analysis, etc. The Muar trial embankment was also used as illustration.

Ir. Lee E.C. presented various geotechnical and environmental considerations in the design of marine structures such as wharfs, ports, etc. Corrosion of concrete structures due to the high chloride environment was highlighted. The interesting phenomenon of “breathing” structures and “suffocating” structures was introduced, much to the amusement of the audience.
Ir. Yee Y.W. discussed in great detail the application of caissons in foundation and slope stabilization works in Malaysia, with examples from the Genting Highlands. Construction method, analysis, advantages, cost comparisons, etc. were presented, and amply supported by case histories and field data.

All presentations were followed by lively discussions and questions from the floor.

About 20 people were present.

Tan Boon Kong
Chairman
Working Group on Engineering Geology & Hydrogeology
Geology of the three gorges on the Changjiang (Yangtze) River — a CD presentation

LEE CHAI PENG

Laporan (Report)

Dr. Lee Chai Peng, who was recently in China, gave an audio-visual presentation of the geology of the famous three gorges of the Yangtze River, on a CD he obtained on the trip, on Monday 18 June 2001 at 5.30 pm at the Geology Department, University of Malaya.

It turned out to be a very informative presentation.
Report on the AAPG Student Chapter and GSM Talk
June 24, 2001

Career Opportunities and Career Challenges in the Oil Industry

The talk was organised as a monthly activity of the AAPG Student Chapter in collaboration with the GSM. Mr. Ouzani Bachir was the Chairman.

Speakers

1. Mr. Peter Lloyd
   Business Development Manager, Asia-Pacific Network of Excellence in Training (NexT)
2. Mr. Zahris Abu
   Recruiting Manager
   Malaysia, Brunei & Philippines
   Schlumberger Oil Services
3. Dr. Mazlan Madon
   Petronas Research and Scientific Services (PRSS)
4. Mr. Leslie Hayward
   accompanied by Mr. Denis Tan
   Recruitment Manager
   Shell People Services

Program

• At 9.30 am more than 40 students were present at the Geology Hall to hear Career Opportunities and Career Challenges in the Oil Industry from the leaders of the oil industry (National Oil Company, Oil Company, Services Company and Training Company).
• Mr. Peter Lloyd was the first speaker and addressed the importance of being a member of an association of geologists such as GSM or AAPG to get updates on the ongoing research and achievements as well as the demand and new directions of the oil industry.
• The Chairman then invited Mr. Zahris Abu to present his speech that was focused on career opportunities in Schlumberger. He also defined the qualities that the companies are expecting from the new comers to the oil industry, as well as the challenges they could face.
• Dr. Mazlan then gave an idea about the PRSS activities and career opportunities available especially with worldwide expansion of Petronas.
• Mr Leslie Hayward was the last speaker. He introduced Shell activities in Malaysia and worldwide. Mr. Hayward showed the different opportunities available in Shell and explained the new human resources strategy adopted by Shell.
• At around 12.30 pm the Chairman Ouzani invited Dr. Azhar, Head of Geology Department, to close the session and present tokens of appreciation to the speakers.
• All those present were then invited for tea at the 1st Year Lab.

Ouzani Bachir
President of the AAPG Student Chapter
Career Opportunities and Career Challenges in the Oil Industry


Mohd Shafeea Leman

Ucapan Alu-aluan oleh Prof. Madya Dr. Mohd Shafeea Leman, Pengerusi Jawatankuasa Penganjur Persidangan Tahunan Geologi 2001

Assalamualaikum Warahmatullahi Wabarakatuh dan Salam sejahtera,


Y.A.B. Dato’ Seri Di Raja Mohd Tajol Rosli Tan Sri Ghazali, Menteri Besar Perak Darul Redzuan, yang berusaha Dr. Abdul Ghani Rajek, Presiden Persatuan Geologi Malaysia,

Tuan-Tuan dan Puan-Puan serta hadirin yang dihormati sekalian.

Pada kesempatan ini, izinkan saya mengucapkan ribuan terima kasih kepada Malaysia Mining Corporation Bhd. yang merupakan penaja utama dalam menjayakan Persidangan Tahunan Geologi 2001 ini. Terima kasih juga diucapkan kepada Specific Resources Sdn Bhd dan Projek Lebuhraya Utara Selatan Berhad (PLUS) sumbangan dan sokongan mereka. Terima kasih juga ditujukan kepada Jabatan Mineral dan Geosains, Universiti Malaya, Universiti Kebangsaan Malaysia, Universiti Sains Malaysia dan Institut Geologi Malaysia kerana sudi bekerjasama dalam menjayakan persidangan ini.

Para hadirin yang saya hormati sekalian, seperti tahu ini, prosiding kertas kerja telah diterbitkan dan akan diedarkan kepada para peserta semasa pendaftaran. Di sini saya mengucapkan ribuan terima kasih kepada semua penyumbang, pentasyih sepakar dan ahli jawatankuasa kecil penyunting yang telah bertungkus lumus untuk

memastikan prosiding tersebut diterbitkan untuk diedarkan kepada semua peserta seperti yang dijanjikan. Saya juga amat terhutang budi kepada semua ahli Jawatankuasa Penganjur, yang walaupun sibuk dengan tugas resmi masing-masing, masih sanggup meluangkan masa untuk membantu menjayakan persidangan ini. Semoga usaha gigih kalian akan terbalas dengan tercapainya objektif dan matlamat persidangan selama dua hari ini.


Sekian, terima kasih.
Assalamualaikum dan salam sejahtera,


negara, bertepatan dengan tema persidangan "Enhancing the Contribution of Geoscientists in the Development of Malaysia" atau "Mempertingkatkan Sumbangan Geosaintis dalam Pembangunan Malaysia". Pembatasan sesi teknikal kepada satu sesi, diharapkan dapat menghasilkan suasana persidangan yang lebih selesa dan memberikan peluang kepada para peserta mengikuti kesemua sesi tanpa perlu membuat pilihan. Pemberian masa yang lebih lama untuk sesi poster pula, diharapkan dapat memberi lebih peluang kepada para peserta meneliti poster-poster yang disediakan.


Tuan-Tuan dan Puan-Puan,


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

Sekian, terima kasih.
Opening Address by Y.A.B. Dato’ Seri Di Raja Mohd Tajol Rosli Tan Sri Ghazali, Menteri Besar Perak Darul Ridzuan


Yang Dihormati Tuan Pengerusi Majlis,
Yang Berusaha Dr. Abdul Ghani Rafek, Presiden Persatuan Geologi Malaysia,
Yang Berusaha Dr. Mohd Shafeea Leman, Pengerusi Jawatankuasa Penganjur Persidangan,
Tuan-Tuan dan Puan-Puan hadirin yang dihormati sekalian

Assalamualaikum dan Salam Sejahtera.


Saya difahamkan Persidangan Tahunan Geologi kali ini adalah yang ke-15 diadakan dan kali kedua ialah di Negeri Perak. Saya percaya suasana Pulau Pangkor dengan alam sekitar yang indah, nyaman dan tenteram akan membantu Tuan-Tuan dan Puan-Puan melahirkan ide-ide lebih berkesan, untuk meningkatkan kefahaman akademik dan profesional geosaintis, dan selanjutnya untuk meningkatkan sumbangan geosaintis dari pelbagai disiplin dalam pembangunan negara.

Kehadiran Tuan-Tuan dan Puan-Puan di sini, jelas menunjukkan betapa pentingnya persidangan ini bukan saja kepada Persatuan Geologi Malaysia malah kepada negara. Tidak boleh dinakfkan bahawa Tuan-Tuan dan Puan-Puan merupakan aset penting kepada negara. Penglibatan Tuan-Tuan dan Puan-Puan secara langsung di dalam penjelajahan dan pembangunan sumber tabii seperti petroleum, gas, air tanah, mineral logam, mineral industri dan sebagainya telah banyak menyumbang kepada kekayaan negara. Memandangkan kebanyakan sumber tabii tidak dapat diperbaharui, maka sebahagian daripada tanggungjawab Tuan-Tuan dan
Puan-Puan adalah untuk memastikan penggunaan sumber tersebut dilakukan secara mampun supaya dapat dimanfaatkan oleh generasi kini dan generasi kita yang akan datang.

Sumbangan Tuan-Tuan dan Puan-Puan amat kritikal bagi mengelakukan kejadian bencana seperti tanah runtuh, amblesan, hakisan, banjir dan banjir kilat serta bagi menentukan kesesuaian tapak dalam projek pembangunan. Sumbangan tersebut penting bagi memastikan kesejahteraan masyarakat terjamin dalam mencapai pembangunan yang mampun ketika negara bergerak pantas menuju ke era negara maju. Di samping itu, Tuan-Tuan dan Puan-Puan juga memainkan peranan penting dalam pemuliharaan alam sekitar bagi menjamin pembangunan mampun terlaksana.

Bagi Negeri Perak Darul Redzuan, pembangunan negeri ini memang berkait rapat dengan eksploitasi sumber tabib bumii yang telahpun mula diusahakan lebih se abad yang lalu. Saya pasti, terlalu banyk pengalaman pahit-manis dan suka-duka yang telah dialami oleh geosaintis pelbagai generasi, dalam usaha mereka memakmurkan Negeri Bijih Timah ini. Jika dahulu bijih timah menjadi sumber kekayaan Negeri Perak, kini mineral industri seperti batu kapur, pasir silika dan lempung telah memainkan peranan yang sangat penting dalam menjana pertumbuhan ekonomi negeri ini.

Saya difahamkan, geopelancongengan, dengan berkonsepkan pengeksploitasi tanpa musnah sumber bumi dan landskap mempunyai potensi yang cerah sebagai penyumbang kepada pembangunan ekonomi Negeri Perak Darul Redzuan.

Tuan-Tuan dan Puan-Puan,


Saya mengambil kesempatan mengucapkan tahniah atas segala kejayaan yang telah dicapai oleh geosaintis sehingga kini. Tahniah juga ucapkan kepada Persatuan Geologi Malaysia atas kejayaan penganjuran persidangan ini. Dengan itu, saya menyeru supaya Tuan-Tuan dan Puan-Puan menggunakan peluang bersidang di Pulau Pangkor untuk melahirkan ide-ide lebih berinas bagi menghadapi cabaran pada abad yang ke 21 dalam membantu usaha pencapaian pembangunan mampun di Malaysia.

Buat mengakhiri ucapan, saya sekali lagi mengucapkan ribuan terima kasih kepada pihak penganjuran kerana sudi menjemput saya merasmikan majlis ini.


Sekian. Selamat Bersidang.
Annual Geological Conference 2001
Annual Geological Conference 2001
Programme — Opening Ceremony

FRIDAY (1 June 2001)

19.50 : Arrival of Participants and Guests


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


20.40 : Dinner (Sponsored by the State Government of Perak Darul Ridzuan)

Official Dress — Batik
Scientific Programme

SATURDAY (2 June 2001)

Forum on
Enhancing The Contribution of
Geoscientists in the Development of Malaysia

The forum is jointly organised by the Geological Society of Malaysia (GSM) and the Institute of Geology Malaysia (IGM) with the aim of:

- Evaluating the current status of geoscience education to optimise graduate capability,
- Identifying mechanisms to strengthen R&D in higher learning institutions, public and private sectors
- Identifying strategies to increase the contribution of geoscience in the development of Malaysia
- Identifying mechanisms of disseminating information regarding the contribution of geoscience to non-geoscientists.

The resolutions from this meeting will be documented and utilised by the GSM and IGM in drawing up their programmes in the future.

08.30 – 08.40  Welcoming Address
Chairman, Dr. Abd. Ghani Rafek,
President, Geological Society of Malaysia

08.40 – 08.50  The New Roles of Geoscientists in the Petroleum Industries
Mr. Abdul Samad Nordin, Petronas Carigali

08.50 – 09.00  The New Roles of Geoscientists in the Mining Industries
Mr. Shamsul Baharin Saim, Malaysia Mining Corporation Berhad

09.00 – 09.10  The New Roles of Geoscientists in Engineering Geology
Mr. Ng Chak Ngoon, Subsurface Engineering Sdn Bhd

09.10 – 09.20  The New Roles of Geoscientists in Institutions of Higher Learning
Dr. Wan Fuad Wan Hassan, Universiti Kebangsaan Malaysia

09.20 – 09.30  The Role of the New Department of Mineral and Geosciences
Haji Ab Halim Hamzah, Department of Mineral and Geosciences

09.30 – 09.40  The Role of IGM towards Recognition for the Geoscience Profession
Mr. Chu Ling Hing, Department of Mineral and Geosciences

09.40 – 10.00  Discussion

1000 – 1100  Tea Break & Poster Session A
Scientific Programme

SATURDAY (2 June 2001)

TECHNICAL SESSION I

MINERAL & ENERGY RESOURCES

1100 – 1130 :  KEYNOTE I — Chu Ling Hing & Azimah Ali
               The Industrial Mineral-based Industry of Malaysia: Current Status and Prospects

1130 – 1150 :  Wan Fuad Wan Hassan & Heru Sigit Purwanto
               Perubahan Batuan Dinding berkaitan dengan Pemineralan Emas di Penjom Gold Mine, Pahang, Malaysia

1150 – 1210 :  Sonny Lim Teng Chye, Sharafuddin Mohamad, Mona Sulaiman, G.H. Teh & Jasmi Hafiz Abdul Aziz
               Geology, Structure, Mineralization and Geochemistry of the Penjom Gold Deposit, Penjom, Pahang

1210 – 1230 :  G.H. Teh, Mahat Sibon & Mohd Sazani Saarani
               Characterization, Geochemistry and Possible Usage of the Limestone Hills in the Kinta Valley, Perak

1230 – 1250 :  Othman Ali Mahmud, H.D. Tjia & Mohd Idrus Ismail
               Interpretation of Newly Acquired Aerogravity Data Enhances the Prospectivity of the Tinjar Province Onshore Sarawak

1250 – 1310 :  Wan Hasiah Abdullah
               A Petrographic Comparison of Oil-Generating Coals from the Tropics and Non Oil-Generating Coals from the Arctic

1310 – 1420 :  Lunch & Prayer Break
Scientific Programme

SATURDAY (2 June 2001)

TECHNICAL SESSION II

STRUCTURAL GEOLOGY & TECTONICS
SEDIMENTOLOGY & STRATIGRAPHY

1420 – 1440 : H.D. Tjia
Wrench Tectonics in Sundaland

1440 – 1500 : Ibrahim Abdullah
Gaya Struktur Kawasan Cendering - Rhu Rendang, Marang, Terengganu: Satu Cadangan
Kehadiran Batuan Pra-Karbon di Jalur Timur Semenanjung

1500 – 1520 : Basir Jasin & Zaiton Haron
Some Triassic Radiolarians from the Kodiang Limestone, Northwest Peninsular Malaysia

1520 – 1540 : Lee Chai Peng
Occurrences of Scyphocrinites Loboliths in the Upper Silurian Upper Setul Limestone of Pulau
Langgun, Langkawi, Kedah and Guar Sanai, Berseri, Perlis

1540 – 1600 : Che Aziz Ali
Evolusi Delta Sungai Pahang: Bukti-bukti Permukaan dan Bawah Tanah

1600 – 1620 : Tea Break
Scientific Programme

SATURDAY (2 June 2001)

TECHNICAL SESSION III

PETROLOGY & GEOCHEMISTRY
MINERAL & ENERGY RESOURCES

1620 – 1640 : Azman Abd Ghani
Some Problems with the Classification of the ‘S’ Type Granite with Particular References to the Western Belt Granite of Peninsular Malaysia

1640 – 1700 : Mohd Rozi Umar & Hamzah Mohamad
Penamaan Semula Kompleks Ston kepada Unit Stratigrafi Suit Ston berdasarkan Cerapan Lapangan

1700 – 1720 : Azimah Russin & Mohamad Md Tan
Batu Kapur Formasi Chuping dan Batu Kapur Monsal Dale: Petrogrefi dan Geokimia Dua Sumber Karbonat bagi Simen Portland

1720 – 1740 : Zakaria Hussin
Plumbogumit dan mineral-mineral lain yang ditemui berasosiasi dengan emas di Lubuk Mandi, Marang, Terengganu, Malaysia
Scientific Programme

SUNDAY (3 June 2001)

TECHNICAL SESSION IV

GEO SCIENCE TOOLS & TECHNIQUES

0830 – 0900 : KEYNOTE II — Nik Nasruddin Mahmood, Loh Kok Fook, Jimat Bolhassan & Jasmi Ab. Talib
Remote Sensing and Geosciences: Current Status and Future Challenges

0900 – 0920 : Mohd Azmi Ismail, Khairul Anuar Mohd Nayan, Abdul Rahim Samsudin & Abdul Ghani Rafek
Spectral-analysis of Surface-waves Method: An Initial Assessment and Its Potential Use in Geology

0920 – 0940 : Bashillah Baharuddin, Abdul Rahim Samsudin, Abdul Ghani Rafek & Mohd Tadza Abdul Rahman
Kaedah Keberintangan Elektrik dalam Pemetaan Intrusi Air Masin di Kerpan, Kedah

0940 – 1000 : Umar Hamzah, Abdul Rahim Samsudin, Rahman Yaacup, Abdul Ghani Rafek, Mohd Hafizal Mad Zahir & Lakam Mejus
Teknik Geofizik dalam Kajian Tanah Runtuh di Kawasan Bau, Sarawak

1000 – 1100 : Tea Break & Poster Session B
Annual Geological Conference 2001
Pan Pacific Resort, Pangkor Island
Perak Darul Ridzuan
2–3 June 2001

Scientific Programme

SUNDAY (3 June 2001)

TECHNICAL SESSION V

GEOSCIENCE TOOLS & TECHNIQUES
ENGINEERING GEOLOGY & HYDROGEOLOGY

1100 – 1120 : Samsudin Hj Taib, Khairun Niza Baharaldin & Azman A. Ghani
Source of the Batu Pahat Magnetic Anomaly

1120 – 1140 : Ismail C. Mohammad, Abdul Rahim Samsudin & Abdul Ghani Rafek
Penggunaan Bersama Data Geofizik dan Geologi dalam Kajian Akuifer Aluvium Pantai, Kawasan
Pekan-Rompin, Pahang

1140 – 1200 : Tan Boon Kong & Azwari Huslan Mohd
Physico-chemical Properties of Carbonaceous Shale Soils in the Yong Peng area, Johor

1200 – 1220 : Abdul Ghani Rafek, Abdul Rahim Samsudin, Rahman Yaacup, Umar Hamzah & Khairul
Anuar Mohd Nayan
Pencirian Geofizik dan Geologi Kejuruteraan Profil Lulusawa Syis Kuarza-Mika di km 67,
Lebuhraya Timur-Barat, Malaysia

1220 – 1240 : Chow Weng Sum
Minor and Trace Metals in Slurry Slime in Mined-out Ponds in the Kinta Valley, Perak

1240 – 1300 : Tajul Anuar Jamaluddin & Ahmad Nizam Hassan
Engineering Geology of Slopes for the Preparation of EIA Reports — A Case Study from the
Proposed Site for a National Secondary School at Ringlet, Pahang Darul Makmur

1300 – 1440 : Lunch / Prayer Break

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

Scientific Programme

SUNDAY (3 June 2001)

TECHNICAL SESSION VI

ENGINEERING GEOLOGY & HYDROGEOLOGY
ENVIRONMENTAL GEOLOGY & CONSERVATION GEOLOGY

1420 – 1440 : Baba Musta, Khairul Anuar Kassim & Mohd Razman Salim
Mineralogical Development in a Lime Treated Clayey Sand Soil

1440 – 1500 : J. Shamshuddin
The Charge Properties of Highly Weathered Tropical Soils

1500 – 1520 : Ros Fatihah, Peter Smart & Yeap Ee Beng
Preliminary Uranium Series Dates on Speleothem in the Kinta Valley and its Significance in the Karst Landscape Evolution

1520 – 1540 : Askury Abd Kadir, Mohd Yusof Abdullah & Kamal Roslan Mohamed
Pendekatan Geologi dalam Penafsiran Sejarah Kesultanan Terengganu

1540 – 1600 : Tanot Unjah, Ibrahim Komoo & Hamzah Mohamad
Inventori Sumber Warisan Geologi dan Landskap Negeri Kelantan

1600 – 1620 : CLOSING CEREMONY

1620 – 1640 : Tea Break
Poster Presentation

POSTER SESSION A

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

1. Heru Sigit Purwanto, Ibrahim Abdullah & Wan Fuad Wan Hassan
   Influence of Paleostresses in Controlling the Gold Mineralization in Lubuk Mandi Area, Peninsular Malaysia

2. Lim Chee Kheong
   Structural Style of Cyber Jaya and Putra Jaya, Selangor

3. Uyop Said & Syahrul Sallehudin
   A Palynological Study on an Early Cretaceous Rock Sequence at Bukit Belah, Batu Pahat, Johor

4. Basir Jasin & Zaiton Harun
   Some Radiolarians from the Bedded Chert of the Kubang Pasu Formation

5. Mohd Shafiee Leman & M. Sone
   Conglomerate from Setia Jasa near Temerloh, Pahang, Malaysia: Its Stratigraphic Position and Depositional Environment

   Geology of the Semenyih Granite

7. Abdul Rahim Samsudin & Ngo Chen Ni
   In situ Measurement of Geoelectrical Resistivity in Relation to Weathering Profile of a Sedimentary Rock Mass at Lubuk Paku, Pahang: A Case Study

8. Umar Hamzah
   Penganggaran Sekitaran Sedimen di Delta Pahang dengan Teknik Seismos Pantulan

9. Khairul Anam Musa, Juhari Mat Akhir & Ibrahim Abdullah

10. R. Soeria-Atmadja, Y. Sunarya, Sutanto & Hendaryono
    Epithermal Gold-Copper Mineralization, Late Neogene Calc-Alkaline to Potassic Calc-Alkaline Magmatism and Crustal Extension in the Sunda-Banda Arc
Annual Geological Conference 2001
Pan Pacific Resort, Pangkor Island
Perak Darul Ridzuan
2–3 June 2001

Poster Presentation

POSTER SESSION B

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

1. Azman A. Ghani
Petrogenesis of Perhentian Granite and Perhentian Kecil Syenite from the Perhentian Island, Northeastern Peninsular Malaysia: Evolution of Two Contrasting Magmas

Occurrence, Field Relations and Petrochemistry of Mafic Dykes from the Kenyir Area, Central Trengganu: Preliminary Observation

3. Randanshah Bacho & Mohd Rozi Umor
Geokimia Tonalit Berangkat dan Leukogranit Kenerong Sebagai Petunjuk Kepada Pembentukan dan Asalan Magma Kompleks Stong, Kelantan

4. Suraya Tlut & Mohd Rozi Umor
Asalan Zenolith di dalam Pluton Granit Noring, Kompleks Stong, Kelantan

5. Nur Huda Jamin & Mohd Rozi Umor
Kompleks Stong: Kajian Geokimia ke atas Batuan Granit Noring dan Leukogranit Kenerong di Kampung Renyok, Jeli, Kelantan

6. Sahibin Abd Rahim, Mohamad Md Tan & Azimah Hussin
Komposisi Unsur Surih dan Major dalam Tanihatas di Sekitar Bukit Batu Kapur Bukit Jernih, Kangar, Perlis

7. Tajul Anuar Jamaluddin & Ahmad Nizam Hassan
A Geomorphological Approach in predicting environmental impacts of proposed development in hilly terrain

Perubahan Zon Pinggir Pantai dan Implikasinya di Kuala Selangor, Malaysia

9. Rohayu Che Omar, Ibrahim Komoo & Halimaton Saadiah Hashim
Pembandaran Mampan: Penggunaan Pendekatan Geosains dalam Proses Perancangan Guna Tanah di Malaysia

10. Mohd For Mohd Amin
An Approach to Joint Roughness Measurement in Rocks: A Comparative Study

The industrial mineral-based industries in Malaysia — current status and prospect

CHU LING HENG AND AZIMAH ALI

Minerals and Geoscience Department Malaysia
20th Floor, Tabung Haji Building
Jalan Tun Razak, P.O. Box 11110
50736 Kuala Lumpur

The industrial mineral-based industry in Malaysia can be broadly grouped into three categories, viz, rock-based, clay-based and sand-based. During 1999, from a total amount of RM17.0 billion worth of mineral-based products manufactured, RM7.3 billion originated from the industrial mineral sector, while the remaining RM2.8 billion came from tin smelting and RM6.9 billion from the basic iron and steel industries. The clay-based industry is well developed, producing a wide range of products to cater for the construction, domestic and industrial consumers both locally as well as abroad. The clay-based products include activated clay, advanced ceramic, ceramic decorativeware, ceramic former, ceramic tiles, clay brick, clay pipe, refractory bricks, roof tile, rough pottery, sanitaryware and tableware. In 1999, the total output from these manufacturers was estimated at RM1.4 billion. The sand-based manufacturers include those producing filter sand, glass, silicon and sodium silicate. In 1999, a total of 42 manufacturers were involved in this sector. The total output from these manufacturers was estimated at RM2.3 billion. The glass industry, as part of the sand-based industry, is fairly well-developed with highly automated manufacturing processes. It produced a wide variety of products including container glass, domestic glassware, optical lenses, sheet glass, glass funnels and panels for cathode ray tubes, etc. However, most of the higher end silica products, such as optical and ophthalmic glasses use imported blanks. The rock-based manufacturers produced a variety of products from essentially granite and limestone. In 1999, the total output from these manufacturers was estimated to be around RM3.6 billion. Dimension stone is mainly produced from locally obtained granite and limestone. Cement, lime, limestone powder and terrazzo constitute value-added products produced from limestone. Whilst demand for traditional
rock tiles has dwindled owing to stiff competition from ceramic tiles, the limestone powder industry is at present, expanding rapidly with the production of coated ground calcium carbonate (GCC) as well as precipitated calcium carbonate (PCC). They offer stiff competition to the kaolin producers for use as fillers. The issues pertaining to these sectors include their pertinent linkage to the construction growth, promotion of the Investments Act 1986, value-adding capabilities, export market and globalisation/open market. With globalisation, free-trade, open-market system and AFTA coming into force soon, Malaysia’s industrial mineral based-industries will face stiff competition from our neighbouring countries where cheap labour and low fuel costs are readily available. High productivity, advanced technology, quality of products and the search for new markets will to a certain extent determine the success of our industries in the globalised market.

Perubahan batuan dinding berkaitan dengan permineralan emas di Penjom Gold Mine, Pahang, Malaysia

WAN FUAD WAN HASSAN DAN HERU SIGIT PURWANTO
Program Geologi, Fakulti Sains dan Teknologi
Universiti Kebangsaan Malaysia
43600 Bangi, Selangor

Penjom in Kuala Lipis, Pahang, is an active mining area. The bedrock of the area consists of volcanoclastic rocks (tuff and lithic tuff) and sedimentary rocks (sandstone, siltstone and limestone), being part of the Permian Gua Musang formation. The volcanics and sedimentary sequences are later being intruded by microgranite, rhyodacite and quartz veins. The main mineralization in the area is gold, associated with pyrite, chalcopyrite, galena, arsenopyrite and sphalerite which is generally found in the alteration zones. Wall rock alteration in Penjom is due to the interaction of hydrothermal activity, igneous intrusions, quartz veins and fault zones. Three dominant types of alteration recognized are silicification, argillic alteration and chloritisation, marked by a prolific development of secondary minerals over the primary minerals. Silicification is marked by the development of secondary quartz, generally around the intrusions, quartz veins and fault zones. Argillic alteration is marked by the development of clay minerals such as montmorillonite and illite and limonite generally around the intrusions and fault zones outside the silicified zone. Chloritic alteration is marked by the presence of chlorite, epidote and carbonate, developed generally in the outer-most zone outside the silification and argillic zones.
Geology, structure, mineralisation and geochemistry of the Penjom gold deposit, Penjom, Pahang

SONNY LIM TENG CHYE¹, SHARAFUDDIN MOHAMED¹, MONA SULAIMAN¹, G.H. TEH² AND JASMI HAFIZ ABDUL AZIZ²

¹Specific Resources Sdn. Bhd.
P.O. Box 49, 27207 Kuala Lipis, Pahang
²Geology Department, University of Malaya
50603 Kuala Lumpur

The Penjom Gold Mine lies within Permian rocks dominated by tuffs and sediments of the Padang Tengku Formation striking E-W with a 30° dip south, close to eastern boundary with the Triassic. A series of early intruded felsite sills have helped unravel the complex structural history of the mine.

The thrusting and assymetric folding of the Penjom Thrust cut by a series of N-S faults together with intense graphite alteration have controlled gold mineralisation. The favourable gold depositional sites are diverse and comprise dilational, chemical contrast and competency contrast sites. The diverse styles of mineralisation give rise to diverse widths, grades and orientations of individual ore zones.

The gold mineralising episode, which is associated with and overprints an earlier deposition of pyrite and arsenopyrite, was accompanied by quartz, carbonate and minor amounts of galena and sphalerite. EPMA analyses of the gold show slight variations in fineness from the three main centres of mineralisation, namely, Kalampong East/Hill Six, Jalis and Manik. EPMA study also revealed a gold-bearing graphite-ankerite-quartz intrusive rock.

Characterisation, geochemistry and possible usage of the limestone hills in the Kinta Valley area, Perak

G.H. TEH, MAHAT SIBON AND MOHD SAZANI SAARANI

Department of Geology
University of Malaya
50603 Kuala Lumpur

The primary purpose of the characterisation of the limestone hills in the Kinta Valley is to determine their physical and geochemical characteristics with the aim of ascertaining their most appropriate economic or industrial usage. The limestone (or more appropriately termed marble) has very varied usage depending on their chemical and physical characteristics.

The limestone hills in the Kinta Valley extend from Gunung Temelang near Tg. Rambutan in the north to Gunung Gajah, near Kuala Dipang to the south, a distance of about 30 km. The marble outcrops in the Kinta Valley, in fact, form 3 groups of limestone hills trending more-or-less north-south.

The main physical characteristics that were considered for each hill included colour, presence of fractures, joints or veins, texture or pattern, grain size, resistance to weathering, contamination and foreign material (such as chert nodules, quartz, etc.).
For their geochemical characteristics, the limestones were analysed for their CaCO$_3$, MgCO$_3$, SiO$_2$, Fe$_2$O$_3$ and Al$_2$O$_3$ contents. A thorough petrographic study was also carried out to determine whether they are calcitic or dolomitic and to detect the presence of other minerals which could jeopardise their quality and usage. Other than their CaCO$_3$ and MgCO$_3$ contents, the contents of Al$_2$O$_3$, SiO$_2$ and Fe$_2$O$_3$ are generally very low in the limestone samples; Al$_2$O$_3$ usually less than 0.25%, SiO$_2$ less than 0.55% and Fe$_2$O$_3$ less than 0.3%.

Geochemical analyses show that each limestone hill in the Kinta Valley has, generally, a distinctive, more-or-less homogeneous chemical composition throughout, except for Gunung Tempurung and Gunung Lanno. Hills with unusually high CaCO$_3$ content include Gunung Sepah (average 99.0%), Gunung Terendum (average 96.46%), Gunung Panjang (average 95.6%), Gunung Sentang (average 98.75%), Gunung Tasek (average 98.20%), Gunung Lang (average 97.35%), Gunung Mabella (average 98.3%), Gunung Rapat (average 96.8%), Gunung Karang Besar (average 97.8%), Gunung Merawan (average 97.1%), Gunung Toh Sembilan (average 95.5%), Gunung Pua (average 97.8%), Gunung Sin (average 97.9%) and Gunung Pipit (average 96.8%). Those with unusually high MgCO$_3$ content include Gunung Ayer Hangat (average 43.32%), Gunung Layang-layang (average 53.90%), Gunung Ginting (average 41.47%), Gunung Tambun (average 40.30%), Gunung Bercham (average 39.50%) and Gunung Temelang (average 38.80%), Gunung Kero (average 40.7%), Gunung Kandu (average 40.8%) and Gunung Mesah (average 40.3%).

Based on their physical and chemical characteristics, the limestone resources in the Kinta Valley area that can be utilised as raw material for decoration like dimension stones, terrazzo or marble chips include Gunung Rapat, Gunung Lanno, Gunung Mabella, Gunung Sin, Gunung Tempurung and Gunung Terendum. In industries that require high calcium contents like cement, agricultural fertilisers, ammonia powder, animal feed, calcium carbide, the ideal hills are Gunung Datuk, Gunung Panjang, Gunung Rapat, Gunung Lanno, Gunung Karang Besar, Gunung Merawan, Gunung Toh Sembilan, Gunung Pua, Gunung Sin, Gunung Pipit, Gunung Sepah and Gunung Tempurung (south). In industries that require high MgCO$_3$ contents like magnesium fertilisers, glass, Gunung Air Hangat, Gunung Layang-layang, Gunung Kero, Gunung Kandu, Gunung Mesah, Gunung Tempurung (north) should be considered. For use as aggregate and concrete most of the hills can be exploited except Gunung Karang Besar, Gunung Kero, Gunung Kandu, Gunung Mesah. Finally for conservation in terms of religion, tourism and preserving the environment, Gunung Cheroh, Gunung Lang, Gunung Panjang, Gunung Datok, Gunung Rapat, Gunung Tempurung and Gunung Terendum are potential candidates.
Interpretation of newly acquired aerogravity data enhances the prospectivity of the Tinjar Province, onshore Sarawak

OTHMAN ALI MAHMUD¹, H.D. TJIA² AND MOHD IDRUS ISMAIL¹

¹PRAD-PMU, PETRONAS
28th Floor Menara 1, Petronas Twin Towers P.O. Box 12444
50778 Kuala Lumpur

²PETRONAS Research & Scientific Services Sdn. Bhd.
Lots 3288 & 3289, Jalan Ayer Itam Kawasan Institusi, Bandar Baru Bangi
43000 Bangi

The first commercial field in Sarawak, the Miri field was discovered in the onshore part in 1910. After this discovery further exploration work on the onshore area was hampered by lack of significant or commercial discovery despite extensive drilling. These exploration activities were concentrated in the north-eastern and south-western parts of Sarawak. In the north-central part of the Sarawak onshore (designated as the Tinjar Province) only a few wells were drilled with some oil and gas shows. For a total of 12 wells drilled in the area covering almost 25,000 km², the Tinjar Province is considered underexplored. One major reason that the area was excluded from the early days of exploration is that it was assumed to possess a shallow basement as result of active uplifting and erosion during Oligocene-Miocene time. Lack of sediment thickness and shallow burial were also considered as negative factors for hydrocarbon expulsion and migration. However, this claim on shallow basement was not supported by any seismic or good gravity and magnetic data. In late 1996 a PMU/PRSS team began a study of the hydrocarbon potential of the Tinjar Province. Based on fieldwork, interpretation and review of SAR (Synthetic Aperture Radar) images and the existing geological data, the study concluded that the area has potential for hydrocarbon entrapment, which warrants further investigation. As a continuation from the study, a gravity survey was undertaken to further explore the area and to determine depth to the basement. In 1998 a total of 4653-line km of new aerogravity and magnetic data were acquired over the Tinjar Province. The data were later merged and processed with the previously acquired data in the adjacent areas (to the east a total 3,080 km of gravity and magnetic data acquired by OPIC in 1990, and to the west a total of 3,224 km of gravity data acquired by Idemitsu in 1991). Combined, this information provides a good coverage of gravity data over the Sarawak onshore area. Marine gravity results over the Balingian province were also integrated to provide an analogue to the onshore data interpretation. The study showed fairly good sediment thickness of up to 5,000 m in the Tinjar Province and the surrounding area. The gravity data detected and defined a series of highs and lows trends, major faults and other elements of the basement that can create structural and stratigraphic traps in the overlying Oligocene-mid Miocene clastics. The location, areal extent and sources of density contrasts causing residual gravity anomalies were also identified. A series of structural highs and gentle folds associated with thrusted basements are excellent targets for hydrocarbon accumulations. In general, the gravity data acquired recently provide a guide in delineating areas for future exploration activity in the north-central part of the Sarawak onshore.
Schlumberger's New Fullbore Formation MicroImager Doubles Your Coverage With Core-Like Clarity

The FMI* fullbore electrical imaging tool makes evaluation of complex reservoirs simpler and quicker than ever before. Its 192 microelectrical sensors give you twice the coverage of previous tools and improved spatial resolution, to 0.2 inches.

The fullbore images enable direct structural analysis and characterization of sedimentary bodies even in extremely complex sequences. The fine detail provided by FMI images allows determination of paleocurrents and rock anisotropy, including the recognition of permeability barriers and paths. And determination of net-to-gross ratio in thin bed sand/shale sequences is automatic.

Understanding the internal structure of the rock can confirm hypotheses regarding its geological evolution and can provide valuable clues to geologists and engineers regarding local porosity and permeability changes. This is possible with the enhanced textural analysis from the new high-resolution sensors, as well as detailed evaluation of fracture networks and other secondary porosity.

Ask to see an example of the new FMI log. You'll be looking at the clearest, most complete picture of the rock available today.

Schlumberger (Malaysia) Sdn Bhd., 7th & 8th Floor, Rohas Perkasa No. 8, Jalan Perak, 50450 Kuala Lumpur.
Tel: (03) 2667788. Fax: (03) 2667800.

* Mark of Schlumberger—the FMI tool is a MAXIS 500® tool.
The Schlumberger Ultrasonic Borehole Imager Detects Openhole Problems and Fractures, Even in Oil-Base Muds.

Accurate, high-resolution, acoustic measurements by the UBI* Ultrasonic Borehole Imager let you examine an openhole for stability problems, deformation and fractures when nonconductive, oil-base muds prevent resistivity measurements. On the same trip, the UBI rotating transducer can check for corrosion and mechanical wear of the internal surface of the casing as the tool is pulled out of the hole.

No other borehole measurement gives you the thin-bed resolution you get with the UBI tool. The images, cross-section plots and pseudo-3D "spiral" plots generated from UBI measurements also reveal keyseats, breakouts, shear sliding and shale alteration to help you avoid the added drilling costs that result from stuck pipe and lost time or equipment. In addition, you get horizontal stress information for mechanical properties evaluations to predict breakouts and perforation stability in unconsolidated sands.

Talk to your Schlumberger representative about detecting openhole problems and fractures acoustically, even in oil-base muds. What UBI images show you could save you time, expense or possibly your well.
Geoservices,
the Leader in Mud Logging Services
in Asia-Pacific

Advanced Logging System - NT

Pore Pressure Engineering
Real-Time Reservoir Evaluation
Early Kick Detection
Wellsite Geological Services
Drilling Optimisation
Intranet Data Distribution & Access

Geoeast (M) Sdn Bhd.
Suite 702A, 7th Floor
See Hoy Chan Plaza
Jalan Raja Chulan
50200 Kuala Lumpur
MALAYSIA
Telephone : 603-20266641/2/3
Facsimile : 603-20266640
e-mail : Malaysia.ki@geosrv.com

Geoservices
People, Knowledge & Technology
A petrographic comparison of oil-generating coals from the tropics and non oil-generating coals from the arctic

WAN HASIAH ABDULLAH

Department of Geology
University of Malaya
50603 Kuala Lumpur

This paper discusses the findings of a comparative study of microscopically recognisable oil-generative features observed in coals from two presently extreme climatic conditions: the arctic and the tropics. The samples investigated are from Spitsbergen, Svalbard and from Sarawak, Borneo. Both sets of coals are of Tertiary age and both were deposited in a lower coastal plain setting. The Palaeocene-Eocene coals of Spitsbergen were deposited in temperate to subarctic conditions while the Miocene coals of Sarawak were deposited in subtropical to tropical conditions. Features associated with oil-generation from the Sarawak coals include a widespread occurrence of exsudatinite veins and oil globules/haze. Hydrocarbon generation is often observed to be associated with the occurrence of a high abundance of framboidal pyrite. Coals from Spitsbergen, on the other hand, lack the oil generative features described above. Although the occurrence of oil-smears can be observed, they are not extensive and exsudatinite is rarely observed. To date, no significant oil accumulations of terrestrial origin have been discovered on or around the island of Spitsbergen. In contrast, offshore Sarawak is a prolific oil and gas producing province. Considering that the terrestrially-derived oils of the Balingian Province are sourced from stratigraphic equivalent sequences to the onshore coal-bearing sequences investigated here, it is clear that microscopical features are good indicators for the recognition of oil-prone coals.

Wrench tectonics in Sundaland — subsurface and offshore evidence

H.D. TJIA

PETRONAS Research & Scientific Services Sdn Bhd
Lots 3288 & 3289 Off Jalan Ayer Itam
Bangi Institutional Area, 43000 Kajang

Wrenching is widespread in Sundaland. Convincing evidence from onshore mapping is now combined with lesser known information from the subsurface and from the offshore. Maximum principal stress ($S_H$) directions were determined from wrench patterns, well-bore breakouts, and first-motion of major earthquakes occurring in the last century. Most of Sundaland is currently subjected to north-south $S_H$. Towards its margins the stress trajectories deviate from the meridian, probably as result of interference with $S_H$ of the convergence of adjoining megaplates and the southeast extrusion of Indosinia. From at least the late Oligocene onward Sundaland has been the focus of converging plates and subplates. Fracture zones that are suitably orientated with respect to the convergence direction in various parts of the region responded by wrenching. Until approximately the onset of Mid-Miocene most wrenching was transtensional forming pullapart depressions and modifying the structuration of the large depocentres: the backarc basins of Sumatra-Java, the aulacogens Malay-Penyu-West Natuna,

and the forearc/marginal basins Soikang-Sarawak-NW Sabah-East Kalimantan. Cessation of spreading in the Philippine Sea and Caroline basins by Mid-Miocene changed the wrenching into transpressional structures that was accompanied by slip-sense reversals and substantial structural inversion.

Gaya struktur kawasan Cendering-Rhu Rendang, Marang Terengganu: satu cadangan kehadiran batuan Pra-Karbon di Jalur Timur Semenanjung

IBRAHIM ABDULLAH

Program Geologi
Universiti Kebangsaan Malaysia
43600 Bangi, Selangor

The structure of the Cendering-Rhu Rendang area is dominated by a major anticline, plunging towards approximately N 170°E. At several localities, the folds were modified by reverse and thrust faults to produce asymmetrical and overturned minor folds. Other than that, slump folds and crenulation folds with axes trending almost north-northwest are also found. Based on the fold axis similarities of the major and crenulation folds, it is believed that the rocks in this area have suffered coaxial superimposed folding. The ENE fault displaced the axis of the major anticline which is known as Panji Anticline dextrally. The structure style at Bukit Cendering and Kampung Rhu Rendang has a regional trend different from the rest of the area. Further more the structure at these two sub-area are more complicated. These differences is interpreted to be due to the rock on the eastern side of the area is older (pre-Carboniferous) and separated from the western side by a westwards thrusting fault.

Some Triassic Radiolarians from the Kodiang Limestone, northwest Peninsular Malaysia

BASIR JASIN AND ZAITON HARUN

Program Geologi
Universiti Kebangsaan Malaysia
43600 bangi, Selangor

The clastic and radiolarian chert sequence at the base of Bukit Kechil, is the only clastic interval in the Kodiang Limestone. The chert yielded eleven taxa of radiolarians i.e. Entactinosphaera chiakensis, Entactinosphaera sp., Entactinia nikorni, Thaisphaera minuta, Cenosphaera andoi, Cenosphaera sp., Pantanellium ? virgeum, Pantanellium sp., Acanthosphaera sp A, Acanthosphaera sp B, and Acanthosphaera sp C. This assemblage is indicative of late Spathian age, Early Triassic. The sequence was deposited in a deeper environment compared to the limestone. The Kodiang Limestone was deposited on an unstable shelf environment.
Occurrences of *Scyphocrinites* loboliths in the Upper Silurian Upper Setul limestone of Pulau Langgun, Langkawi, Kedah and Guar Sanai, Berseri, Perlis

LEE CHAI PENG
Department of Geology
University of Malaya
50603 Kuala Lumpur, Malaysia

*Scyphocrinites* loboliths, the bulbous floats attached to the roots of a Late Silurian to Early Devonian crinoid, have been found within the Upper Silurian Upper Setul limestone along the beach north of Telok Memplam, Pulau Langgun, Langkawi, Kedah and in limestone blocks from an earth quarry at Guar Sanai, near Guar Jentik, Berseri, Perlis. The loboliths belong to the plated type characterized by having plated chamber walls, fewness of internal chambers and the presence of chamber openings near the axil of the primary root.

Evolusi Delta Sungai Pahang: bukti-bukti permukaan dan bawah tanah

CHE AZIZ ALI
Program Geologi, Fakulti Sains dan Teknologi
Universiti Kebangsaan Malaysia
43600 Bangi Selangor

The Pahang River Delta represents a young delta system developing under tropical climatic regime. The delta is believed to have started during the early Holocene time when the sea was at its highest level. The protodelta began at about 40 km inland in a cone-shaped embayment. The delta has prograded out and changed shape and location several times following the fluctuation of sea-level(?). This changes have produced at least four delta lobes as recognized from aerial photographs and topographic maps. Evidence from subsurface shows that the delta was initially dominated by clay which has been deposited in restricted environments such as lagoon and mangrove swamp. Thick sand bodies are found at the very top part of the sequence forming the present day beach ridges on the surface.
Some problems with the classification of the ‘S’ type granite with particular reference to the Western Belt granite of Peninsular Malaysia

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

The Peninsular Malaysian granites have been grouped into two granite provinces namely Western and Eastern Belt granites. The Western Belt has been considered as constituting an exclusively ‘S’ type granite. The ‘S’ type features in the granites are, (a) high initial $^{87}\text{Sr}/^{86}\text{Sr}$ isotope ratio > 0.710, (b) low Na$_2$O content, < 3.2% Na$_2$O in rocks with ~ 5% K$_2$O, (c) narrow range of felsic rock (SiO$_2$: 65.95 to 77.4%), (d) high K$_2$O/Na$_2$O ratio, 1.4–2.8 (‘S’ type: 0.9–3.2), (e) usually ilmenite bearing and (f) contain pelitic or quartzose metasedimentary xenoliths. However, detailed study of published and unpublished field and geochemical reports reveal that the Western Belt granite shows mixed ‘I’ and ‘S’ type features and thus the batholiths cannot be designated as exclusively ‘S’ type. The ‘I’ type features are (a) Al-rich minerals such as sillimanite and cordierite are absent, (b) occurrence of primary wedge sphene and pale green amphibole especially in the northern part of the batholith, (c) occurrence of pinkish K-feldspar crystals (usually as phenocrysts), (d) occurrence of mafic, hornblende bearing enclaves, (e) increasing ACNK values with SiO$_2$, (f) showing a similar trend to the ‘I’ type granite in P$_2$O$_5$ vs Rb and A-B plots. Implication of this study indicates that the Western Belt granite is not solely derived from metasediments. The study favours a mixed origin of crustal material such as metapelites, greywackes and metaigneous rocks.

Penamaan semula Kompleks Stong secara stratigrafi kepada unit Suit Stong berdasarkan cerapan lapangan

MOHD ROZI UMOR DAN HAMZAH MOHAMAD
Program Geologi, Pusat Pengajian Sains Sekitaran dan Sumber Alam
Fakulti Sains dan Teknologi, Universiti Kebangsaan Malaysia
43600 Bangi, Selangor D.E.

The reassignment of Stong Complex to Stong Suite proposed here is based on field observations on the setting and relationship of various rock types. Based on the Malaysian Stratigraphic Guide, the Stong Complex is more suitable to be ranked as a suite. The proposed Stong Suite can be divided into three lithodemic units, namely the Noring Granite, Kenerong Leucogranite and Berangkat Tonalite. All this lithodemic units are mappable in the field. Each unit has its own set of rock grouped together in the same intrusive body, probably being emplaced at almost the same time.
Batu kapur Formasi Chuping dan batu kapur Monsal Dale: petrografi dan geokimia unsur major dua sumber karbonat bagi simen Portland

AZIMAH HUSSIN DAN MOHAMMAD Md TAN
Program Geologi, Fakulti Sains dan Teknologi
Universiti Kebangsaan Malaysia
43600 Bangi, Selangor

Chuping Formation limestone and Monsal Dale limestone are two carbonate resources for the manufacture of Portland cement. The petrography of both rocks is differentiated by their lithofacies. The Chuping Formation limestone at CIMA Quarry consists of three facies of biomicrite, biopelmicrite and biosparite. Whereas biomicrite and biomicsparite are two identified facies of Monsal Dale limestone. The geochemistry of these two commercial resources are controlled primarily by the carbonate components.

Plumbogumit dan mineral-mineral lain ditemui berasosiasi dengan emas di Lubuk Mandi, Marang, Terengganu, Malaysia

ZAKARIA HUSSAIN
Jabatan Mineral dan Geosains Malaysia
Ipoh, Perak

Plumbogumit merupakan mineral yang baru ditemui di lombong emas Lubuk Mandi, Terengganu, Malaysia. Ia didapati berasosiasi dengan emas. Emas ada yang wujud bebas (free gold) dan ada yang berasosiasi dengan mineral lain seperti arsenopirit, pirit, galena, sfalerit, kalkopirit dan besi oksid.


Emas ada antaranya bebas mengisi rekahan dan rongga dalam telerang kuarza. Emas juga ada yang berasosiasi dengan mineral lain dengan mengisi rekahan dan ruang dalam mineral seperti arsenopirit, pirit, besi oksid dan galena.
Remote sensing and geoscience: current status and future challenges

N.N. MAHMOOD, K.F. LOH, J. BOLHASSAN AND A.T. JASMI
Malaysian Centre for Remote Sensing (MACRES)
No. 13, Jalan Tun Ismail
50480 Kuala Lumpur

The integrated use of remote sensing and related technologies is commonly applied to multi-disciplinary analysis in Malaysia. Many models and processing techniques have been developed for this purpose. MACRES, the focal point for providing as well as using remote sensing and related technologies to cover a wide spectrum of applications in the country, has developed among others the National Resources and Environmental Management System (NAREM) for interactive integrated spatial data analysis and modeling. NAREM is a dedicated system for the input, validation, management and analysis of integrated spatial data. Several integrated natural resources and environmental application packages have been developed under NAREM which will be put into operational use in the near future. This paper highlights the application of geo-science packages developed under NAREM which include groundwater potential zoning, soil erosion risk assessment and landslide hazard zonation. The paper also touches on the future directions in the use of remote sensing data for geo-hazard and geobotanical studies in line with the availability of new generation satellite data at present and in the near future.

Spectral-Analysis-of-Surface-Waves method: an initial assessment and its potential use in geology

MOHD AZMI ISMAIL, KHAIROUL ANUAR MOHD NAYAN, ABDUL RAHIM SAMSUDIN AND ABDUL GHANI RAFEK
Geology Programme, School of Environmental and Natural Resource Sciences
Faculty of Science and Technology
Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor D.E.

The Spectral-Analysis-of-Surface-Waves (SASW) method for profiling the subsurface non-destructively is discussed. The method assumes that the subsurface structures consist of a stack of horizontally homogeneous layers. Transient impact source on the ground surface is used to generate Rayleigh wave of different frequencies into the medium. From analysis of phase information for each frequency, the velocity of the waves is determined between two receivers. Initial results of the SASW measurements on flexible and rigid pavement systems are presented.
Kaedah keberintangan geoelektrik dalam pemetaan intrusi air masin di Kerpan, Kedah

BASHILLAH BAHARUDDIN\textsuperscript{1}, ABDUL RAHIM SAMSUDIN\textsuperscript{2}, ABDUL GHANI RAFEK\textsuperscript{2} dan MOHD TADZA ABDUL RAHMAN\textsuperscript{1}

\textsuperscript{1}Institut Penyelidikan Teknologi Nuklear Malaysia, Bangi 43000 Kajang, Selangor, Malaysia
\textsuperscript{2}Pusat Pengajian Sains Sekitaran & Sumber Alam, Fakulti Sains dan Teknologi Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor

Lately, groundwater contamination has become a public concern. It comes from many activities such as industrial, domestic and agriculture. Seawater intrusion is not a new issue, and has only now started to draw attention from lots of parties since it is also a contributor to groundwater contamination. Therefore a study about seawater intrusion is carried out and the selected area is Kerpan, Kedah. The objectives were to map seawater intrusion and to find the best techniques for contamination investigation. This information is useful particularly in agriculture because any contamination caused by chlorine (seawater) intrusion can affect crops production. For the Kerpan Project, two electric resistivity survey instruments, the Terrameter SAS 4000 and SAS 300C were used. SAS 4000 provides two-dimensional resistivity profiles. These profiles have the capability to assess a comprehensive geological interpretation by examine subsurface electric characteristics such as resistivity, permittivity and chargeability. SAS 300C on the other hand provided sounding data (vertical structure - 1-D profiles only) which can also be used to determine subsurface layering. Resistivity values for seawater is less than 10 ohm.m whilst freshwater around 10–100 ohm.m. Result from the sounding technique showed that seawater exists in the study area.

Teknik geofizik dalam kajian tanah runtuh di kawasan Bau, Sarawak

UMAR HAMZAH, ABDUL RAHIM SAMSUDIN, RAHAMAN YACCUP, ABDUL GHANI RAFEK, MOHD HAFIZAL MAD ZAHIR DAN LAKAM MEJUS

Program Geologi, Pusat pengajian Sains Sekitaran & Sumber Alam Fakulti Sains & Teknologi 43600 UKM Bangi, Selangor D.E.

Limestone terrain or karst is susceptible to surface collapse or subsidence which could cause damage to property and loss of life. Surface depressions in the limestone terrain which is always covered by alluvium may be caused by solution in the limestone. Dissolution of the limestone always take place along discontinuities or cracks and cavities which are filled up by rain water or subsurface solution. Therefore it is necessary to investigate the possibility of collapse before any project in limestone areas is carried out. This paper presents a few surface geophysical techniques to detect subsurface cavities and cracks in collapsed limestone in the Bau area, Sarawak. These techniques include seismic refraction, seismic reflection and geoelectrical imaging. ABEM Terraloc MK3 seismograph together with 100 Hz frequency detectors are used.
for the seismic work. Sound wave energy is produced by impinging a 5 kg sledgehammer on a squared steel plate placed on the tarmac road. A total of 24 detectors which are linearly arranged with the source are used to receive signals returning to the surface. These signals are then processed to produce profiles of distance versus depth and 2-D seismic sections. Velocity values calculated are used for rocks and structural interpretations. On the other hand, ABEM AC Terrameter is the instrument used in the geoelectrical survey together with a total of 50 steel rods representing electrodes for injecting currents into the ground and measuring the potential difference between them. Final 2-D pseudosection shows the resistivity distribution laterally and vertically. This variation is used for interpreting the earth material and the type of water content in it. In this study, the three techniques were tried in order to detect any possible cavity or cracks underneath a peripheral shaped cracks on the tarmac road. These techniques have more or less been able to detect the presence of a sinkhole with faults surrounding it underneath the cracks. Depth and width of the cavity is about 7–10 m.

Source of the Batu Pahat magnetic anomaly

SAMSUDIN BIN HJ TAIB, KHAIRUN NIZA BAHARALDIN
AND AZMAN ABDUL GHANI

Department of Geology
University of Malaya
50603 Kuala Lumpur

An almost circular magnetic anomaly north of Batu Pahat town is made up of a pair of magnetic high and magnetic low. It is a typical magnetic anomaly at this magnetic latitude with magnetization in the earths field direction where the magnetic high is situated to the north and the magnetic low to its south. The magnetic anomaly has been generally associated to the Batu Pahat granite which outcrops east, west and south of the town. However, the location of the anomaly only at the northern tip of the granite mass suggest that it is not the source. The geological study indicates that gabbro is present within this magnetic anomaly area. Modelling of the anomaly indicates that two source bodies produce the anomaly. The first is situated where the gabbro is located and the second body is located slightly to the north. This location was formally a bauxite mine. The first has its top at about 50 to 100 meters depth while the second body has its base at less than 100 meters. The deeper body is presumably associated with the gabbro while the second body is probably of sedimentary origin. The Batu Pahat residual magnetic anomaly map suggest that the short wavelength anomalies present are associated with shallow fracture system having orientation similar to that of the existing faults trend in the granite.
Penggunaan bersama data geofizik dan geologi dalam kajian akuifer aluvium pantai, kawasan Pekan-Rompin, Pahang

ISMAIL C. MOHAMAD¹, ABD. RAHIM SAMSUDIN² DAN ABD. GHANI MD. RAFIK²

¹Jabatan Mineral dan Geosains Malaysia
Tingkat 20, Bangunan Tabung Haji, Jalan Tun Razak, Peti Surat 11110
50736 Kuala Lumpur

²Program Geologi, Universiti Kebangsaan Malaysia
43600 Bangi, Selangor

A significant lowering of the groundwater level was identified at Pekan District due to large amounts of groundwater being pumped out from the coastal alluvial aquifer of the area. An increasing trend of salinisation of fresh water was also observed in the production wells of Nenasi Waterworks. Geophysical surveys were planned as part of the studies to gain basic hydrogeological information of the area besides identifying the problem. Reconnaissance geophysical survey was conducted using the transient electromagnetic technique to determine the brackish/salt water boundary. The result of the survey which was correlated together with geological data such as well log information, water level and groundwater chemistry data, have provided valuable hydrogeological information of the area and successfully identified the basal extent of the brackish/salt water boundary for further studies.

Physico-chemical properties of carbonaceous shale soils in the Yong Peng area, Johor

TAN BOON KONG AND AZWARI HUSLAN MOHD

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

Residual soils of carbonaceous shale in the Yong Peng area have been analysed for their physico-chemical properties. Results indicate that the carbonaceous shale soils are characterised by their predominantly silty nature, low plasticities, generally low compacted densities, highly acidic pore fluids (low pH's), and intermediate dispersivity behaviour. These results indicate similarities in soil properties to graphitic schist soils found in the Melaka and Rawang areas.
Pencirian geofizik dan geologi kejuruteraan profil luluhawa syis kuarza-mika di km 67, Lebuhraya Timur-Barat, Malaysia

ABDUL GHANI RAFEK¹, ABDUL RAHIM SAMSUDIN¹, RAHMAN YACCUP¹, UMAR HAMZAH¹ dan KHAIRUL ANUAR MOHD NAYAN²

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

²Jabatan Kejuruteraan Awam dan Struktur, Fakulti Kejuruteraan
Universiti Kebangsaan Malaysia
43600 Bangi, Selangor D.E.

Mapping of the weathering profile and determination of weathering grade were correlated with a refraction seismic survey and geoelectrical resistivity imaging of a quartz mica schist rock slope at km 67, east-west highway, northern Peninsular Malaysia, to obtain the true P-wave velocities ($V_p$) and specific geoelectrical resistivities for each weathering grade. Fresh and slightly weathered rock (grade I and II) is characterised by high $V_p$ values ranging from 2,300 m/s to 5,300 m/s. The intensity and extent of discontinuities influence the $V_p$ values, where lower $V_p$ values are obtained for highly fractured zones. Grade III has $V_p$ values between 1,200 m/s to 2,300 m/s with $V_p$ values between 250 m/s to 1,200 m/s for grade VI, V and IV. The range of specific geoelectrical resistivities is <2,525 ohm.m for grade VI and V, 2,526 ohm.m to 5,025 ohm.m for grade IV, 5,026 ohm.m to 7,025 ohm.m for grade III dan more than 7,025 ohm.m for grade II and I.

Minor and trace metals in slurry slime in mined-out ponds in the Kinta Valley, Perak

CHOW WENG SUM

Minerals and Geoscience Department Malaysia
20th Floor, Tabung Haji Building, Jalan Tun Razak
P.O.Box 11110, 50736 Kuala Lumpur

The Kinta Valley was renowned as the largest tin field in the world and up to 1989, there were 70,158 hectares of land under mining leases. Thereafter, the tin mining industry took a down-turn due to falling tin metal prices and what is left of the industry is now mined-out land with abundant abandoned ponds. Stretching from Pengkalan near Ipoh to Kampar in the south over a distance of 42 km, there is a total of 1,194 mined-out ponds. About 66.7% of these ponds have slurry slime at the pond bottoms, with thickness varying from 0.1 m to 7.0 m. Many of these abandoned ponds are used for the rearing of fish and ducks, or are cultivated with lotus plants. Slime is occasionally admixed with tailing sand for agricultural purposes. As such, should the slime be contaminated with heavy metals the food chain will be affected. Slime from eight ponds in the Kinta Valley was tested for minor and trace metals. Most of the slime contained higher concentrations of uranium and other trace heavy metals such as Sn, Hg, Sb,
Bi and Cd as compared to the norm in the earth’s crust or stream sediments. Amongst the eight test ponds, slime from Pond B81 contained relatively higher concentrations of minor, radioactive and trace metals. Slime from Pond B81 should not be utilised as fill material as the concentration of as is above the trigger concentration and threshold value. It should also not to be used for the planting of crops as the level of zinc is high.

Engineering geology of slopes for the preparation of EIA reports — a case study from the proposed site for a national secondary school at Ringlet, Pahang Darul Makmur

TAJUL ANUAR JAMALUDDIN¹ AND AHMAD NIZAM HASSAN²

¹Geology Department
University of Malaya
50603 Kuala Lumpur

²Cadence Technical Services, Lot 4694A
Batu 8½, Jalan Sungai Tua
68100 Batu Caves, Selangor D.E.

The site for the proposed National Secondary School at Ringlet, Cameron Highland is situated in a rugged hilly terrain underlain by granite and schist. The proposed school buildings is sited in a V-shaped valley because of the difficulty in getting flat or low-lying ground in the tropical highland areas such as Ringlet. Thus, existing slopes have to be cut to create room for the school building. The engineering geological study for slopes presented in this paper forms part of the geological input required for the preparation of an environmental impact assessment (EIA) report prior to approval by the local authority. To assess the stability of the existing and future cut slopes, structural geological mapping has been carried out by collecting data of relict structures in the intensely weathered and restricted outcrops. The study area has been arbitrarily divided into 3 structural domains, i.e Domain A, B and C. In the kinematic slope stability analysis, it is assumed that slopes in each structural domain contain similar structural style and orientation. Results of the analysis indicates that most of the slopes in the study area have variable potential to undergo wedge and/or planar failures. This is evident in the field by some occurrences of wedge/planar failures, although they are of relatively small-scale. The risk of slope failures can be reduced if the proposed slopes are cut in the orientations and gradients recommended in this study.
Mineralogical development in a lime treated clayey sand soil

BABA MUSTA¹, KHAIRUL ANUAR KASSIM¹ AND MOHD. RAZMAN SALIM²

¹Department of Geotechnic, Faculty of Civil Engineering
UTM 81310 Skudai
Johor, Malaysia

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

Three samples of lime treated clayey sand soils and a control sample were cured for one month at room temperature before being analysed using X-Ray Fluorescence (XRF), X-Ray Diffraction (XRD) and scanning electron microscopy (SEM). The XRF data shows high abundances of SiO₂ (73.57%–80.45%), Al₂O₃ (10.77%–11.09%), L.O.I (4.38%–7.38%), Fe₂O₃ (2.32%–2.88%), K₂O (0.88%–1.03%) and CaO (0.03%–4.20%), whereas the other major elements are lower than 1.00%. The treated samples with 2% and 6% of lime show an increasing concentration of CaO about 1.41% and 4.20% respectively. The X-ray diffractograms and scanning electron micrographs detected the appearance of quartz and kaolinite in the control soil as well as in the treated soil samples. The development of new cementitious minerals in treated soil appear in low intensities in the X-ray diffractograms, due to their low crystalization. Scanning electron micrographs also show the development of new cementitious minerals, and modification of the surface micromorphology of the treated soil due to increasing concentration of lime.

The charge properties of highly weathered tropical soils

J. SHAMSHUDDIN

Department of Land Management
Faculty of Agriculture, Universiti Putra Malaysia
43400 Serdang, Selangor

Phyllosilicates are the major minerals of soils. These minerals change to oxides or hydroxides on weathering in tropical environments. Charges are developed in the phyllosilicates via isomorphic substitution of Si by Al; these termed negative permanent charges. In highly weathered tropical soils, oxides or hydroxides are predominant. The minerals become positively charged when the soil pH is lowered. In such soils, negative charges develop when soil pH increases. Hence, it would be possible to change charges in soils by agronomic manipulation. In soils dominated by oxides, positive charges in the B-horizon can be higher than negative charges.
Preliminary uranium series dates on speleothem in the Kinta Valley and its significance in the karst landscape evolution

ROSE FATIHAT, PETER SMART\textsuperscript{2} AND YEAP EE BENG\textsuperscript{1}

\textsuperscript{1}Department of Geology
University of Malaya
50603 Kuala Lumpur

\textsuperscript{2}Department of Geographical Sciences
University of Bristol

Uranium series dating technique has been used in dating cave materials and give estimation of up to 500 ka. The $^{230}$Th/$^{234}$U method has been proven to be the most versatile and useful of all the uranium series methods and has been applied to a wide range of materials including speleothems in which the optimal range being around 350 ka using the alpha spectrometer and 500 ka for mass spectrometer. This technique has been used in dating speleothem samples from Kinta Valley caves. The preliminary ages obtained show some indications that it can be correlated to the rate of denudation in this area. These ages when combined with the rate of denudation and studies of slope processes will help in better understanding the evolution of karst landscape.

Pendekatan geologi dalam penafsiran sejarah Kesultanan Terengganu

ASKURY ABD. KADIR\textsuperscript{1}, MOHD YUSOF ABDULLAH\textsuperscript{2}

DAN KAMAL ROSLAN MOHAMED \textsuperscript{3}

\textsuperscript{1}Jabatan Mineral dan Geosains Terengganu
Kuala Terengganu

\textsuperscript{2}Lembaga Muzium Terengganu
Kuala Terengganu

\textsuperscript{3}Program Geologi, Universiti Kebangsaan Malaysia
43600 Bangi

The discovery of the use of Bukit Biwah limestone and light grey granite as gravestone at the Royal graveyard located at Bukit Keledang provides a new insight into the history of the Sultanate of Terengganu. The assemblages of gastropod, foraminifera, coral and algae in the construction material similar to the Bukit Biwah limestone suggests that Kuala Berang was the administration centre for rulers in the past. This discovery will help archaeologists in their exploration for artifacts along Sungai Terengganu to strengthen the current ideas on the history of the Terengganu Sultanate. Thus, Bukit Keledang can be developed as an interesting geosite with a strategic location to attract visitors.
Inventori sumber warisan geologi dan landskap Negeri Kelantan

TANOT UNJAH\textsuperscript{1}, IBRAHIM KOMOO\textsuperscript{1} DAN HAMZAH MOHAMAD\textsuperscript{2}

\textsuperscript{1}Institut Alam Sekitar dan Pembangunan (LESTARI) UKM Universiti Kebangsaan Malaysia 43600 Bangi, Selangor D.E.

\textsuperscript{2}Pusat Pengajian Sains Sekitaran dan Sumber Alam, Fakulti Sains & Teknologi Universiti Kebangsaan Malaysia 43600 Bangi, Selangor D.E.

The inventory of geological heritage resources in Kelantan has been conducted and the identified resources were classified into geological and landscape diversity categories. Geological diversity consists of variety in rock, construction material and minerals. Meanwhile, landscape diversity is classified into mountain, hill, plain and coastal landscapes.
Influence of paleostresses in controlling the gold mineralization in Lubok Mandi area, Peninsular Malaysia

HERU SIGIT PURWANTO, IBRAHIM ABDULLAH, WAN FUAD WAN HASSAN AND JUHARI MAT AKHIR

Fakulti Sains dan Teknologi
Universiti Kebangsaan Malaysia
43600 Bangi, Selangor

The geology of Lubok Mandi area, Terengganu is very interesting especially its geological structures which control the overall geology of the area. A detailed geological study was conducted at part of the PCCL Sdn Bhd Gold Mine that show very good rock exposures. The underlying bedrock is dominated by metasedimentary (slate and phyllite) and volcanic rocks (tuff, tuff lapilli and lithic tuff), calcareous sandstone which in some places are carbonaceous. This rock formation of Middle Carboniferous to Permian in age, is cut by dacite intrusion and quartz veins. The major geological structural trends in the Lubok Mandi area are aligned in WNW-ESE and NNW-SSE directions. These structural trends were intercepted by several fault zones which could be classified as either thrust right lateral slip fault and sheared or right lateral slip fault zones. The directions of N(300°–320°)E or WNW-ESE show thrust right lateral slip faults and most of the high angle faults in the directions N(345°–355°)E or NNW-SSE show right lateral slip, while those in N(045°–060°)E or NE-SW directions indicate right lateral slip faults. The mineralization in the quartz veins and wall rocks was also related to the intensive alteration by silicification, argillization and propilitization (chloritization) dominantly around the right lateral fault zones (NNW-SSE). The stress history or paleostresses in the area, which were operating at the time or after the formation of the fault planes, determined the movement or slip that took place on the fault planes. At the same time the paleostresses also governed the orientation of the gold-quartz veins which are related to the gold mineralizations of the area. Paleostresses determination or reconstruction is done by using all the available slip data of the meso structures observed on the fault planes. The paleostress history is constructed based on the cross-cutting relationship and the displacement of the fault zones. Generally, the gold
mineralization in the quartz veins is related to and follow the NNW-SSE fault and shear zones. Among the common minerals observed are chalcopyrite, arsenopyrite, sphalerite, goethite and pyrite. Based on the fault slip data of the meso-structures (fault planes, pitch and pitch directions), the direction of paleostress was obtained. The first paleostress that was acting from NNE-SSW ($\sigma_1 = 10^\circ-11^\circ$, N183°-198°E) controlled the formation of WNW-ESE thrust fault zones and quartz veins, while the second was NE-SW ($\sigma_1 = 04^\circ-16^\circ$, N194°-203°E) controlled the NNW-SSE right lateral fault zones and quartz veins. The third paleostress was acting from ENE-WSW ($\sigma_1 = 18^\circ-21^\circ$, N 232°-236°E) and is related to the NE-SW right lateral fault zones. The WNW-ESE and NNW-SSE quartz veins are related to the compressional paleostresses. The NNW-SSE quartz veins related to the right lateral slip fault zones are high-grade gold mineralization, especially those in the form of quartz breccia.

**Structural style of Cyberjaya and Putrajaya, Selangor**

**LIM CHEE KHEONG**

T & T Konsult Sdn Bhd
55-3 Jalan SS 23/15, Taman SEA
47400 Petaling Jaya selangor

Rock cores from Putrajaya consists of various materials including calc-silicate hornfels, granite, carbonaceous schist and quartz-mica schist. Sheared materials were common and difficult to trace. In order to appreciate the geology of this area, especially the structural geology, outcrops in the adjacent areas were assessed. The Cyberjaya and Putrajaya areas have experienced several phases of deformation.

**A palynological study on an Early Cretaceous rock sequence at Bukit Belah, Batu Pahat, Johor**

**UYOP SAID AND SYahrul SAlEHUDIN**

Geology Programme
School of Environmental and Natural Resource Sciences
Faculty of Science and Technology
Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor D.E.

The palynomorph assemblage from a rock sequence exposed at Bukit Belah, Batu Pahat, Johor is interpreted to be of Early Cretaceous age. The assemblage is characterised by the presence of some significant species such as Cicatricosisporites australiensis, C. ludbrooki and Reticulatisporites pudens, and it closely resembles the Speciosus Assemblage which was reported from lower Cretaceous strata (Valanginian-Aptian). Based on its similarity in having some common species with that of the older assemblage, therefore, the present palynomorph assemblage is suggested to be correlated with the lower part of the Speciosus Assemblage (Valanginian?-Hauterivian).
Some Radiolarians from the bedded chert of the Kubang Pasu Formation

BASIR JASIN AND ZAITON HARUN

Program Geologi
Universiti Kebangsaan Malaysia
43600 Bangi, Selangor

An assemblage of radiolarians were discovered from a chert sequence exposed at Bukit Binjal, Kedah. Eight taxa were recognized; *Entactinia variospina* (Won), *Entactinia? inaequoporosa* Won, *Callela hexatinia* Won, *Callela cf. parvispinosa* Won, *Treanosphaera hebes* Won, *Cubaxonium? octaedrospongiosum* Won, *Duplexia? foremanae* (Ormiston & Lane) and *Duplexia parviperforata* Won. This assemblage indicates an age of late Tournaisian, Early Carboniferous. The chert was deposited on the outer continental shelf of a passive margin during the period of high siliceous productivity.

Conglomerate from Setia Jasa near Temerloh, Pahang, Peninsular Malaysia: its stratigraphic position and depositional environment

MOHD SHAFFEA LEMAN¹ AND MASATOSHI SONE²,*

¹Geology Programme, School of Environmental Science and Natural Resources, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia
²Institute for Environment and Development (LESTARI) Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia
*Present address: Asia Centre, University of New England, Armidale, NSW 2351 Australia

A thick sequence of conglomerate, tuffaceous sandstone and shale/mudstone largely exposed at the Setia Jasa area is described. The matrix-supported conglomerate of very well rounded clasts conformably overlies pebbly mudstone and shows a gradual change in matrix grain size from clay to sand. An Anisian (early Middle Triassic) age is indicated for a whole sequence by the presence of an ammonoid *Paraceratites* sp. found in a lower shale bed. Sedimentological features suggest that the conglomerate and underlying sandstone/shale sequences were possibly deposited in a relatively deep marine environment, and probably belong to the Semantan Formation.
Geology of the Semenyih Granite

MUHAMMAD BARZANI GASIM¹, WAN NOR AZMIN SULAIMAN², MOHD. ISMAIL YAZIZ², ABD. RAHIM SAMSUDIN¹ AND WAN ZUHAIRI WAN YAacob¹

¹School of Environmental and Natural Resource Sciences
Faculty Science and Technology, Universiti Kebangsaan Malaysia
43600 Bangi, Selangor

²Department of Environmental Science
Faculty Science and Environmental Study
Univerisiti Putra Malaysia

The Semenyih Granite is located in Mukim Semenyih, Hulu Langat. It was tectonically emplaced during the Late Mesozoic period. This granite intrudes Jelebu Schist in the northeast and Kajang Formation in the southwest. The mineral composition of the Semenyih Granite consists of 60–70% potash feldspar; 15–20% quartz; 5–15% plagioclase (oligoclase); 5–10% mica and 5% accessory minerals. The Semenyih Granite is divided into the Semenyih and Beroga Granites. Beroga Granite has medium to coarse grain texture and dark grey in color while Semenyih Granite has fine to medium grain texture and pale grey to light brown in color. The second texture formation due to tectonic events such as rotation of the crystal lattice, slip and rearrangement at grain boundaries, micro fractures and faults and fluid-filled micro fracture was observed under microstructure study. The microscopic evidence of deformation is compared with the macroscopic phenomenon of the Semenyih Granite. The northeastern area rock is characterized by cataclasites, strike–slip faults and highly fracture zones. It may be due to deformation after cooling or due to latest emplacement of this granite body, but the impact was lesser in the southwestern area. Field observations that the Semenyih Granite is highly weathered and severely eroded with landslides and rock falls occurrence locally, especially from Semenyih town to Sg. Lui road.

In situ measurement of geoelectrical resistivity in relation to weathering profile of a sedimentary rock mass at Lubuk Paku, Pahang: a case study

ABDUL RAHIM SAMSUDIN AND NGO, C.N.

School of Environment and Natural Resources Sciences
Faculty of Sciences and Technology
Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor D.E.

2-D geoelectrical resistivity imaging using the Wenner configuration was conducted to investigate the weathering profile of a sedimentary rock cut slope at Lubuk Paku, Pahang. The rock which belongs to the Tembeling Formation was cut into three terraces and it consists of, from bottom to top, thick layers of basal conglomerate, massive pebbly sandstone and highly weathered shale. The resistivity imaging results show that the rock cut slope can be characterised into several zones of low, moderately low, moderately high and high resistivities. The low resistivity zone which has resistivity values ranging from 150 to 500 Wm is associated with the residual soil with high water content. It is classified as grade VI according to the IAEG (1981)
weathering index with an average layer thickness of about 1.8 m. A moderately low resistivity zone with weathering index of grade V shows resistivity values ranging from 650 to 800 Wm. This layer appears to have low water content and its thickness varies from 1.1 to 1.7 m. Weathered rock material of grade IV shows resistivity values ranging from 800 to 1,200 Wm. A zone of moderately high resistivity is represented by the weathered rock mass of grade III. The resistivity value for this particular zone is relatively high and ranges from 1,232 to 2,000 Wm. This zone is dominated by a slightly weathered layer of pebbly sandstone. A slightly weathered rock of grade II represents the high resistivity zone with values ranging from 2,000 to 3,000 Wm. This zone is correlated well with the massive and solid rocks of basal conglomerate and pebbly sandstone. The results of the present study illustrate empirically that the geoelectrical resistivity values decrease as the weathering grades of the rock material increase. The presence of discontinuities and fractures in the rock mass appears to have lowered the overall resistivity of the rock mass. This empirical correlation could be used to map zones of different grades of weathered sedimentary rock mass and to study other subsurface geological structures related to slope cuts.

Penganggaran sekitaran sedimen di delta Pahang dengan teknik seismos pantulan

UMAR HAMZAH

Program Geologi
Pusat Pengajian Sains Sekitaran and Sumber Alam
Fakulti Sains & Teknologi, Universiti Kebangsaan Malaysia
43600 Bangi, Selangor D.E.

Up to 180 m thickness of Quaternary deposits overlying granitic bedrock have been delineated by geophysical seismic reflection survey. Emulex 150 and electric detonators were used to produce the source of energy. A total of 24 units of 100 Hz frequency detectors were linearly arranged with the explosive source to receive the waves reflected from each subsurface geological boundary of different acoustic impedance. The received signals were recorded by ABEM Terraloc MK III seismograph. These data were then processed to produce seismic sections used in the interpretation. The seismic sections are correlated with the boreholes for geological interpretations. Based on borehole logs, the deposits are subdivided into a younger 30 m thickness of Holocene greenish marine clay overlying the older 70–80 metres thickness of Pleistocene stream sediments. Since no seismic information is obtained from depth shallower than 30 m, interpretation for this part is totally based on borehole log. The Pleistocene deposits at depth greater than 30 m are represented by chaotic seismic facies in the Temai Hilir and Kuala Pahang seismic sections. These features are interpreted as numerous cut and stacked channels of low and high sinuosity representing braided alluvial system together with flat flood plain deposits.
Remote sensing and geographic information system (GIS) approach in groundwater potential zone mapping in hardrock terrain: a case study of the Langat Basin, Selangor

KHAIRUL ANAM MUSA¹, JUHARI MAT AKHIR² AND IBRAHIM ABDULLAH²

¹Malaysian Centre for Remote Sensing (MACRES)
No. 13, Jalan Tun Ismail
50480 Kuala Lumpur, Malaysia

²School of Environmental and Natural Resource Sciences
Faculty of Science and Technology, Universiti Kebangsaan Malaysia
43600 Bangi, Selangor

The advantages of remote sensing images in projecting ground surface features of a wide area and the ability of the geographic information system (GIS) to integrate several layers of data of certain area are used in producing the groundwater potential map of the Langat Basin. By using the GIS technique, all groundwater related data in hardrock terrain, consisting of lineaments and land use information depicted from remote sensing images are integrated with other auxiliary data such as topographic elevation, topographic gradient, annual rainfall, soil type, drainage density and lithology of the area. As a result, a derived map which demarcate the study area into very high, high, moderate, low or very low groundwater potential zones is produced. The map indicates that hardrock terrain that was previously mapped as low to very low potential actually possess moderate to high groundwater potential. Since the derived groundwater potential zone map is very useful, and can be produced quickly, it is suggested that this method be applied in the early stages of groundwater exploration to locate target areas in hardrock terrain, before further detailed investigation.

Epithermal gold-copper mineralization, late Neogene calc-alkaline to potassic calc-alkaline magmatism and crustal extension in the Sunda-Banda arc

R. SOERIA-ATMADJA¹, Y.SUNARYA², SUTANTO³ AND HENDARYONO³

¹Jurusan Teknik Geologi, Institut Teknologi Bandung
Jalan Ganesa 10 Bandung 40132, Indonesia

²PT ANEKA TAMANG, Jalan Letjen T.B Simatupang/Lingkar Selatan
Tanjung Barat, Jakarta 12530, Indonesia

³Jurusan Teknik Geologi, Universitas Pembangunan Nasional (UPN)
Condong Catur, Yogyakarta, Indonesia

The majority of gold-copper mineralization along the Sunda-Banda arc belongs to low-sulfidation epithermal type. Studies by previous authors suggest that mineralization environment changes from low-sulfidation epithermal in the western segment of the arc, minor porphyry and high-sulfidation epithermal to submarine stratiform deposit in the eastern region. It seems that the nature of geologic setting and magmatic evolution exert a profound influence on the
mineralization environment. Most epithermal mineralization are hosted by stratovolcanoes and are associated with old caldera complexes controlled by strike-slip faults and graben subsidence. The present available K-Ar ages of mineralization suggest that the process is related to primarily Late Neogene volcanic eruption of fine silicic pyroclastics of calc-alkaline to potassic calc-alkaline affinity.

Petrogenesis of Perhentian granite and Perhentian Kecil syenite from the Perhentian Island, northeastern Peninsular Malaysia: evolution of two contrasting magmas

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

The Perhentian complex consists of two plutons, the younger Perhentian granite and the older Perhentian Kecil syenite. They form a reversely zoned complex where the syenitic rock is rimmed by the granitic rock. The former ranges in composition from syenite to monzonite to gabbroic rocks whereas syenogranite dominates the latter pluton. The syenitic rocks are characterized by an extended composition of lower SiO$_2$ (46 to 66%) compared to the Perhentian granite (> 70.9% SiO$_2$) and have significantly high Al$_2$O$_3$, TiO$_2$, Fe$_{tot}$, MnO, MgO, CaO, P$_2$O$_5$, Sr, Ba and V compared to the granitic rocks. Petrology and geochemical datas indicate that both rocks are individual melt probably derived from a different sources. It is suggested that the syenitic magmas formed by hydrous melting of lower crust probably as a result of underplating by, or intrusion of mantle derived basaltic magma. The strong enrichment of large ion lithophile elements (Sr and Ba) is probably related to transfer of enriched (hydrous?) fluids from the mantle into the lower crust, and possibly initiated melting to form the syenites. In contrast to the Perhentian Kecil syenite, the Perhentian granite has no mafic association. The felsic nature of the Perhentian granite suggests that it may be derived from an SiO$_2$ rich source or may represent a minimum melt, the first melt produced from a solid containing plagioclase-K-feldspar-quartz.

Occurrence, field relations and petrochemistry of mafic dykes from the Kenyir area, central Terengganu: preliminary observation

AZMAN A. GHANI, A TAJUDDIN IBRAHIM, MOHZANI MOHAMAD, WAN ZAKARIA WAN IBRAHIM, REKMAN A. RASHID, WAN SALMI WAN HARUN, MOHAMAD ALI HASAN, ISMAIL YUSOFF, AFANDI MUDA, KAMARUL HADI ROSELEE, AMAN SHAH OTHMAN AND ANUAR ISMAIL

Department of Geology
University of Malaya
50603 Kuala Lumpur

The Kenyir lake is located in the western side of the Terengganu state, about 17 km from Kuala Berang, the nearest township. This paper will focus on the mafic dykes that occur at the eastern part of the Kenyir lake area. Intrusion of the mafic dykes in the study area are apparently controlled by a pre-existing NE-E trending fracture. The trend is similar to the regional mafic dykes trend in the Eastern Belt. The silica content of the dykes are between 48.8 to 58.8% and can be classified as basalt-basaltic andesite and basaltic trachyandesite on a TAS diagram. The chemical data indicate that the dykes are tholeiitic, and formed in a continental within plate tectonic setting.

Geokimia Tonalit Berangkat dan Leukogranit Kenerong sebagai petunjuk kepada pembentukan dan asalan magma Kompleks Stong, Kelantan

RAMDANSHAH BACHO DAN MOHD ROZI UMOR

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

Two main components of the Stong Complex in the order of decreasing age are Berangkat Tonalite and Kenerong Leucogranite. The concentration of 10 major elements and 9 trace elements of 14 representative samples from these two components were analyzed using X-Ray Fluorescence (XRF). The purpose of this study is to identify their genesis and the origin of the magma, whether it is from the Main Range Granite Batholith or from the Eastern Belt Granite. Analysis of major elements were carried out using Harker, AFM and A/CNK diagrams, while trace elements were divided into two groups, the LIL elements (large ion lithopile elements) and the trace transition metal. The Harker diagrams show both positive and negative correlation. The negative correlation shows that the Al₂O₃, Fe₂O₃, MnO, TiO₂, MgO, P₂O₅ and CaO decrease in concentration with increasing SiO₂. The positive correlation indicates that the Na₂O and K₂O increase in concentration with increasing SiO₂. These suggest that the Berangkat Tonalite and Kenerong Leucogranite originated from the same magma that had undergone differentiation. The trend of magma differentiation from Berangkat Tonalite to Kenerong Leucogranite is indicated from major and trace element analysis. Both Berangkat Tonalite and Kenerong Leucogranite are more felsic in nature containing high alumina (peraluminous) and the magma
is of calc-alkaline series. The Stong Complex is from I-type granites suggesting that they are part of the Eastern Belt Granite.

---

Asalan zenolit di dalam pluton Granit Noring, Kompleks Stong, Kelantan

SURAYA TULOT DAN MOHD. ROZI UMOR

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

The Stong Complex in the study area is represented by granitic rocks exposed along the TNB road heading towards Sg. Terang pumping station and Lata Lubuk Gajah. These granite rocks are known as Noring Granite. Field observation shows that there are five rock types in the area. They are porphyritic granite, microgranite, phyllite, tuffaceous sandstone and xenolith of sedimentary origin. Xenoliths are widespread within the Noring Granite. Petrographic study shows close similarity between the xenoliths and the metasediments. Therefore, it is important to know the origin of xenoliths in the Noring granite. Three approaches were used in this study that is by using field observations, petrographic study and geochemical relationship. Petrographic study shows that the granite consists of quartz, alkali feldspar, plagioclase and biotite. Results from data plotted on the AFM diagram suggest that the xenoliths within the Noring Granite originated from the Gua Musang Formation.

---

Komplek Stong: kajian geokimia ke atas batuan Granit Noring dan Leukogranit Kenerong di Kampung Renyok, Jeli, Kelantan

NUR HUDA MOHD JAMIN DAN MOHD ROZI UMOR

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

Geochemistry of the Stong Complex at Kampung Renyok, Jeli, Kelantan, has been studied to determine the chemical behaviour, correlation and crystallisation history of Noring Granite and Kenerong Leucogranite. The Stong Complex consists of three rock units namely the Berangkat Tonalite, the Noring Granite and the Kenerong Leucogranite. However, this study concentrated on the Noring Granite and the Kenerong Leucogranite. The geochemical data were interpreted using the Harker diagram, ACNK diagram and AFM diagram. The results suggest that the Noring Granite and Kenerong Leucogranite are high K calc-alkaline rock and peraluminous with I-type granitic rock. The differentiation trend is from the Noring Granite to Kenerong Leucogranite, suggesting that the Noring Granite crystallised before the Kenerong Leucogranite. Analysis on trace elements shows substitution of major elements by trace elements. Based on the above, it is interpreted that both granites crystallised from the same crustal magma through several series of differentiation. The original magma was regarded as basic in nature and had undergone differentiation before evolving into felsic magma.

Komposisi unsur surih dan major di dalam tanihatas di sekitar kawasan bukit batu kapur Bukit Jernih, Kangar, Perlis

SAHIBIN ABD. RAHIM, MOHAMAD MD. TAN dan AZIMAH HUSSIN

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

Composition of minor and major elements in soils (topsoil and profile) in the vicinity of limestone hills at Bukit Jernih, Kangar, Perlis was determined. Minor elements that were determined included As, Ba, Ce, Co, Cr, Cu, Ni, Pb, Rb, Sr, V, Zn and Zr. In decreasing order, the minor elements concentration are Zr, Ba, Cr, V, Ce, Zn, Ni and Pb with their respective composition of 774 \( \mu g \cdot g^{-1} \), 396 \( \mu g \cdot g^{-1} \), 325 \( \mu g \cdot g^{-1} \), 233 \( \mu g \cdot g^{-1} \), 213 \( \mu g \cdot g^{-1} \), 152 \( \mu g \cdot g^{-1} \), 110 \( \mu g \cdot g^{-1} \) and 100 \( \mu g \cdot g^{-1} \). Concentration of the other minor elements in soil was less than 100 \( \mu g \cdot g^{-1} \). Composition of minor elements in soil profile was decreasing with depth, however the amount of change was not significant. Composition of major elements in soils that was studied included SiO\(_2\), Al\(_2\)O\(_3\), Fe\(_2\)O\(_3\), TiO\(_2\), CaO, MgO, MnO, Na\(_2\)O, P\(_2\)O\(_5\), and K\(_2\)O. Silica constitutes the highest concentration in limestone soil. This is followed by Al\(_2\)O\(_3\), Fe\(_2\)O\(_3\), CaO, MgO, MnO, Na\(_2\)O, P\(_2\)O\(_5\), and K\(_2\)O in decreasing order. The formation of Al\(_2\)O\(_3\) in soil is three to four times greater than the formation of Fe\(_2\)O\(_3\). In the soil profile, minor elements were found to accumulate at around 20–60 cm depth.

A geomorphological approach in predicting environmental impacts of proposed development in hilly terrain

TAJUL ANUAR JAMALUDDIN\(^1\) AND AHMAD NIZAM HASSAN\(^2\)

\(^1\)Geology Department
University of Malaya
50603 Kuala Lumpur

\(^2\)Cadence Technical Services, Lot 4694A, Batu 8½
Jalan Sungai Tua
68100 Batu Caves, Selangor D.E.

Classification of slopes and the associated risk by means of slope angle alone is often not adequate to give appraisal on possible risk and environmental impacts. This is mainly because the geomorphic processes that take place differ with locations. This paper presents an example of geological studies with emphasis on geomorphology for an EIA report, which has been conducted recently at the proposed site of Ringlet National Secondary School, Cameron Highland, Pahang Darul Makmur. The study area is a sub-catchment within the larger catchment area of Sungai Bertam. The geology of the area consists of granitic and schist bedrock, which is locally unconformably overlain by alluvial/colluvial deposits notably in the valley floor. Natural slopes in the study area were divided into 9 geomorphic units based on the predominant geomorphic and pedogenic processes. Each geomorphic unit mapped has distinctive geomorphic processes and problems. In this way, prediction of the associated environmental impacts and
planning for mitigation and abatement measure can be executed more effectively. Amongst the significant environmental impacts predicted due to the development activities in this area include landslide, erosion and associated problems, disaggregation, compaction and pollution, notably during the site clearing and construction phase. However, with well-planned mitigation measures, such as slope stabilisations, minimising slope cuttings, provision of vegetative covers and siltation traps, the impacts can be greatly reduced and minimised.

Perubahan zon pinggir pantai dan implikasinya di Kuala Selangor, Malaysia

ZAITUL ZAHIRA GHAZALI¹, JOY JACQUELINE PEREIRA¹ DAN JUHARI MAT AKHIR²

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

²Program Geologi, Pusat Pengajian Sains Sekitaran dan Sumber Alam
Fakulti Sains dan Teknologi
Universiti Kebangsaan Malaysia
43600 Bangi, Selangor

Abiotic changes and physical processes occurring in the coastal zone have deteriorated the natural environment within Kuala Selangor district. Shoreline movement towards the continent contributed to soil loss thus affecting agricultural land. Physical processes, especially erosion and deposition, coupled with changing activity associated with human land-use, have affected infrastructures and destroyed the mangrove ecosystem in Kuala Selangor. Integrated coastal zone management, efficient legislation implementation and the improvement of public awareness are needed to solve the problem. Furthermore, complete information system support and continuous coastal zone monitoring are important to safeguard the coastal zone sustainability in Kuala Selangor.

Pembandaran mampan: penggunaan pendekatan geosains dalam proses perancangan guna tanah di Malaysia

ROHAYU CHE OMAR¹, IBRAHIM KOMOO¹ DAN HALIMATON SAADIAH HASHIM²

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

²Jabatan Perancangan Bandar dan Desa Selangor

Sustainable urbanization can be accomplished by developing the geoscience concept in landuse planning. Geoscience concepts have been developed based on environmentally sensitive areas for Selangor. This concept comprises three principal components and their associations i.e. (a) natural heritage value (geodiversity); nature site/geosite and man-induced site; (b) life support system (natural resource): water resources, minerals/rocks/aggregates and; (c) geohazard risk: slope failure, site stabilization, erosion, siltation, flood, man-induced instability, industrial
and natural pollution. The principal components and their associated environment is extrapolated using the information matrix approach, which is usually used in the evaluation of rational planning. The results are compared with the principal components and their associations from the Wales and England as well as ideal estimated values. The analysis will list an approach, which can be used for integrating geoscience information in more holistic planning processes and assisting in the formulation of an instrument for landuse development.

An approach to joint roughness measurement in rock — a comparative study

MOHD FOR MOHD AMIN, TEO KING BENG, MUSHAIRRY MUSTAFFAR, HO CHIN KUN AND LOH TAR HER

Fakulti Kejuruteraan Awam
UTM Skudai

Surface texture dictates the degree of roughness of a joint surface. Surface roughness on the other hand, has a significant effect on joint strength particularly, the frictional component of shear strength and surface contact during shear. Joint roughness is therefore, an important aspect to be considered when dealing with joint shear strength. The present approach in obtaining the surface texture of a joint is through the use of profilier. However, the measurement process is laborious and time consuming.

This paper highlights a study on the suitability of close-range digital photogrammetry, as an alternative method for measuring surface texture. Specifically, this paper presents the usage of area-based image matching approach. Initial findings give promising indications on the suitability of this method. Apart from being semi-automated, it also exhibit positive characteristics, in terms reliability and practicality.

Influence of discontinuity sets on slope failures at Pos Selim Highway, Malaysia

AZIMAN MADUN AND HUSAINI OMAR

Mountainous Terrain Development Research Center, Faculty of Engineering Universiti Putra Malaysia
43600 UPM Serdang, Selangor

The types of discontinuity of studied slopes are joints and foliations. The discontinuity sets in all the locations have maximum pole intensity of more than 8%. Several sets of discontinuities are recorded at each location. The stereographic plot of the discontinuities set revealed that most of the rock slopes have the potential to fail in the mode of wedge, planar and toppling, as well as the combination of more than one mode of failure. Potential wedge failure is found at seven locations, potential planar failure at five locations and potential toppling at four locations.

The following applications for membership were approved:

**Full Members**

1. Mohd Azmi Ismail  
MINT, Bangi, Selangor.
2. Ismail C. Mohamad  
Jabatan Mineral & Geosains Malaysia,  
Ipoh, Perak.
3. Thangaraju Rajasekaran  
124 Jalan Tun Sambanthan, Brickfields,  
50470 Kuala Lumpur.
4. Zainal Abidin Hasan  
MACRES, No. 13, Jalan Tun Ismail, 50480  
Kuala Lumpur.

**Student Members**

1. John Mark A/L Anthoan @ Anthuvan  
Jabatan Geologi, Universiti Malaya, 50603  
Kuala Lumpur.
2. Ummi Farah Mohd Rosli  
Jabatan Geologi, Universiti Malaya, 50603  
Kuala Lumpur.
3. Mohd Hafizul Kamaruddin  
Jabatan Geologi, Universiti Malaya, 50603  
Kuala Lumpur.
4. Chai Shin Ni  
Jabatan Geologi, Universiti Malaya, 50603  
Kuala Lumpur.
5. Christly Tony AK Naih  
Jabatan Geologi, Universiti Malaya, 50603  
Kuala Lumpur.
6. Patrick Gou  
Jabatan Geologi, Universiti Malaya, 50603  
Kuala Lumpur.
7. Tiong Chiong Ngu  
Program Geologi, Universiti Kebangsaan  
Malaysia, 43600 Bangi.
PETUKARAN ALAMAT (Change of Address)

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

1. Adi Suprapto
   PSL-UNPAK (Pusat Studi Lingkungan Universitas Pakuan), Environmental Research Centre, Pakuan University, Bogor, Jl. Pakuan Raya, Bogor 16110, Indonesia.

2. James Bujang S.
   Lot 957, Jalan Terusan Utama, Pujut 4, 98000 Miri, Sarawak.

3. C. Dickinson
   The International School of Penang (Uplands0, Kelawei Road, Pulau Tikus, 10250 Penang, Malaysia.

4. Abdul Hadi bin Abdul Rahman
   Jab. Mineral & Geosains Terengganu, Tkt. 2 Kompleks Taman Selera Tanjung, Peti Surat 50, 20906 Kuala Terengganu, Terengganu.

5. Aziman Bin Madun
   No. 12, Lorong TMJ 7, Taman Maran Jaya, 26500 Maran, Pahang.

6. David Bowling

CURRENT ADDRESSES WANTED

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

1. Charlie Lee
   Sarawak Shell Bhd., EPS-WS1, 98100 Lutong, Sarawak.

PERTAMBAHAN BAHARU PERPUSTAKAAN
(New Library Additions)

The Society has received the following publications:

1. Oklahoma Geology notes, vol. 60, nos. 3 & 4, 2000
4. System and boundary conceptualization in ground-water flow simulation, 2000
5. AAPG Bull. vol. 85, no. 5, 2001
Cheques, Money Orders, Postal Orders or Bank Drafts must accompany local orders. Please add 80 sen for postage. For foreign orders, please send your purchase order. We will invoice you in your own currency. Orders should be addressed to:

PRICE: RM50.00

The Hon. Assistant Secretary
GEOLOGICAL SOCIETY OF MALAYSIA
c/o Dept. of Geology, University of Malaya
50603 Kuala Lumpur, MALAYSIA
**ADVERTISING SPACE ORDER FORM**

**WARTA GEOLOGI**

<table>
<thead>
<tr>
<th>Format: 20 cm x 28 cm</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Black &amp; White</td>
<td>Colour</td>
</tr>
<tr>
<td>Inside full page per issue</td>
<td>RM300</td>
</tr>
<tr>
<td>Inside half page per issue</td>
<td>RM200</td>
</tr>
<tr>
<td>Inside full page for 6 issues</td>
<td>RM1,500</td>
</tr>
<tr>
<td>Inside half page for 6 issues</td>
<td>RM1,000</td>
</tr>
</tbody>
</table>

**BULLETIN**

<table>
<thead>
<tr>
<th>Format: 20 cm x 28 cm</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Black &amp; White</td>
<td>Colour</td>
</tr>
<tr>
<td>Inside full page per issue</td>
<td>RM1,000</td>
</tr>
<tr>
<td>Inside half page per issue</td>
<td>RM500</td>
</tr>
<tr>
<td>Inside full page for 6 issues</td>
<td>—</td>
</tr>
<tr>
<td>Inside half page for 6 issues</td>
<td>—</td>
</tr>
</tbody>
</table>

Artwork and positive films or slides (for colour or black & white) should be supplied by the advertiser.

Please send the completed form below together with remittance payable to “Geological Society of Malaysia” to

The Editor,  
Geological Society of Malaysia  
c/o Dept. of Geology,  
University of Malaya,  
50603 Kuala Lumpur, Malaysia.

For further information, please ring 603-7957 7036 or fax 603-7956 3900 or e-mail to geologi@po.jaring.my.

---

The Editor,  
Geological Society of Malaysia  
c/o Dept. of Geology,  
University of Malaya,  
50603 Kuala Lumpur.

We would like to take up advertising space in **WARTA GEOLOGI**/**BULLETIN** in the form (please tick as appropriate):

**WARTA GEOLOGI**

<table>
<thead>
<tr>
<th>Inside full page</th>
<th>one issue</th>
<th>one issue</th>
<th>one issue</th>
<th>one issue</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>six issues</td>
<td>six issue</td>
<td>issues</td>
<td>issues</td>
</tr>
</tbody>
</table>

**BULLETIN**

<table>
<thead>
<tr>
<th>Inside half page</th>
<th>one issue</th>
<th>one issue</th>
<th>one issue</th>
<th>one issue</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>six issues</td>
<td>six issue</td>
<td>issues</td>
<td>issues</td>
</tr>
</tbody>
</table>

Artwork/Positive film/slide* enclosed [ ] not enclosed [ ]

Company ........................................................................................................

Address ........................................................................................................

Enclosed cheque/money order/bank draft* for RM ..................................................

Person to be contacted ................ Tel: ..................................................

Designation ................ Fax: ..................................................

* Please delete as appropriate.

Signature ........................................................................................................
PROCEEDINGS
AAPG-GSM
International Conference 1994
Southeast Asian Basins: Oil and Gas for the 21st Century
August 21-24, 1994
Kuala Lumpur, Malaysia
Published by:
Geological Society of Malaysia
Editor: G.H. Teh

Bulletin of the
GEOLOGICAL SOCIETY OF MALAYSIA
July 1995 SPECIAL PUBLICATION No. 37

Cheques, Money Orders, Postal Orders or Bank Drafts must accompany local orders. Please add 80 sen for postage. For foreign orders, please send your purchase order. We will invoice you in your own currency. Orders should be addressed to:

PRICE: RM50.00
Common Rocks of Malaysia

A full colour poster illustrating 28 common rocks of Malaysia. With concise description of the features and characteristics of each rock type including common textures of igneous, sedimentary and metamorphic rocks.

Laminated

Size: 94 cm x 66 cm (42" x 26"

Price:
- Student members: RM7.00 (one copy per member, subsequent copies RM10.00 each)
- Members: RM8.00 (one copy per member, subsequent copies RM10.00 each)
- Non-members: RM10.00 per copy
ORDER FORM

GEOLOGICAL SOCIETY OF MALAYSIA
PUBLICATION

Date: ..........................

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

Dear Sir,

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

<table>
<thead>
<tr>
<th>Item</th>
<th>No. of Copies</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sub–Total
Total

Signature:

*Delete where applicable

Please mail to: ..........................................................
(Please print)
BERITA-BERITALAIN
Other News

KALENDAR (CALENDAR)

July 3-8
CLIMATE AND BIOTA OF THE EARLY PALEOGENE, Plowell, Wyoming, USA.
(Contact: Scott Wing, Dept. of Paleobiology, Smithsonian Inst., Washington, DC 20560, USA.
Tel: (202) 3578 2649; E-mail: wing-scott@nmnh.si.edu)

July 17-20
(Contact: Overseas Exhibition Services Ltd., 11 Manchester Square, London W1M 5AB, Angleterre. Tel: +44 (0) 207 862 2000; Fax: +44 (0) 207 862 2078; E-mail: pmckean@montnet.com)

July 29 - August 2
BIOGEOCHEMISTRY OF TRACE ELEMENTS (6th International Conference, University of Guelph, Guelph, Ontario, Canada.
(Contact: ICOTBE Secretariat, Department of Land Resource Science, University of Guelph, Guelph, Ontario, Canada N1G 2W1. Tel: +1-519 829 4120 ext. 2531; Fax: +1-519 823 1587; E-mail: icotbe@lrs.uoguelph.ca; Website: icotbe.crle.uoguelph.ca)

July 29 - August 4
12TH INTERNATIONAL CLAY CONFERENCE, Bahía Blanca, Argentina.
(Contact: Fernanda Cravero, Secretary-General 12 ICC, Departamento de Geología, Universidad del Sur, 8000 Bahía Blanca, Argentina. Tel: +54 291 459 51 01 ext. 30 41; Fax: +54 291 459 51 48; E-mail: 12icc@criba.edu.ar; Website: http://www.12ICC.criba.edu.ar)

July 30 - August
(Contact: Secretariat, EngGeoCity-2001, UralTISIZ 79, Bazhov str., Ekaterinburg, Russia 620075. Tel: +7 3432 559772; Fax: +7 3432 550043; E-mail: UralTIS@etel.ru)

August 6-10
7TH INTERNATIONAL CONFERENCE ON FLUVIAL SEDIMENTOLOGY, University of Nebraska-Lincoln, USA.
(Contact: Mike Blum, Department of Geosciences, 214 Bessey Hall, University of Nebraska-Lincoln, Lincoln, NE 68588-0340, USA. Tel: +1 402 472 78 72; Fax: +1 402 472 49 17; E-mail: mblum@unl.edu; Website: http://www.unl.edu/geology/icsf.html)

August 6-10
AGGREGATE 2001 — ENVIRONMENT AND ECONOMY, Helsinki, Finland.
(Contact: Tampere University of Technology, Lab. of Engineering Geology, P.O. Box 600, FIN-33101 Tampere, Finland. Fax: +358 365 2884; E-mail: kuulavai@cc.tut.fi or pekka.ihalainen@luvy.fi)

August 10-13
(Contact: Dr. Tong Jinnan, Faculty of Earth Science, China University of Geosciences, Wuhan 430074, China. Tel: +86-27-87482031; Fax: +86-27-8780 1763; E-mail: jntong@public.wh.hb.cn)

August 20-24
PALEOFORAMS 2001 (International Conference on Paleozoic Benthic Foraminifera), Middle East Technical University, Ankara,
Turkey. (Contact: Demir Altiner, Department of Geological Engineering, Middle East Technical University (ODTU), 06531 Ankara, Turkey. Tel: +90-312-2102680, +90-312-4275195; Fax: +90-312-2101263; E-mail: <altiner@tubitak.gov.tr><demir@metu.edu.tr>)

August 23–28
INTERNATIONAL CONFERENCE ON GEOMORPHOLOGY (5th), Tokyo, Japan. (Contact: Prof. K. Kashiwaya, Dept. of Earth Sciences, Kanazawa University, Kanazawa, 920-1192 Japan. E-mail: kashi@kenroku.kanazawa-u.ac.jp)

August 24–27
1ST INTERNATIONAL CONFERENCE ON SUSTAINABLE DEVELOPMENT IN KARST REGIONS, Beijing, China. (Contact: Prof. Yuan Daoxian, E-mail: dxyuang@osmanthus.gxnu.edu.cn)

August 27–29
SOCIETY FOR GEOLOGY APPLIED TO MINERAL DEPOSITS “Mineral Deposits at the Beginning of the 21st Century” (6th Biennial Meeting), Kraków, Poland. (Contact: 6th Biennial SGA Meeting, Dr. Wojciech Mayer, University of Mining and Metallurgy, Faculty of Geology, Geophysics & Environmental Protection, av. Mickiewicza 30; 30-059 Kraków, Poland. Tel: +48-12 617 2385; Fax: +48-12 633 2936; E-mail: wmayer@geol.agh.edu.pl; Website: http://galaxy.ucl.agh.edu.pl/~sga)

September 3–5
21ST IAS MEETING OF SEDIMENTOLOGY, Davos, Switzerland. (Contact: Haruko Hartmann, IAS-2001, Institute of Geology, ETH-Zentrum, 8092 Zurich, Switzerland. Fax: +41 1 632 1080; E-mail: info@ias-2001.ethz.ch; Website: http://www.ias-2001.ethz.ch)

September 6–12
IAGM2001 (THE ANNUAL CONFERENCE OF THE INTERNATIONAL ASSOCIATION FOR MATHEMATICAL GEOLOGY), Cancún, Mexico. (Contact: IAMG2001 Conference Secretariat, c/o Jorgina A. Ross, Kansas Geological Survey, 1930 Constant Avenue, Lawrence, KS 66047-3724, USA. Tel: +785-864-3965; Fax: +785-864-5317; E-mail: aspiazu@kgs.ukans.edu; Website: http://www.kgs.ukans.edu/Conferences/IAMG/index.html)

September 8–15
MAEGS-12 (12TH MEETING OF THE ASSOCIATION OF EUROPEAN GEOLOGICAL SOCIETIES), “Carpathians Palaeogeography and Geodynamics: Multidisciplinary Approach”, Kraków, Poland. (Contact: Polish Geological Society, MAEGS-12, Oleandry 2a, PL 30-063 Kraków, Poland. Fax: +48 12 633 2270; E-mail: ptg@ing.uj.edu.pl)

September 9–14
SOCIETY OF EXPLORATION GEOPHYSICISTS (71st Annual Meeting and International Exposition), San Antonio, Texas, USA. (Contact: SEG Business Office, Tel: +1-918 497 5500; Fax: +1-918 497 5557; Website: seg.org)

September 9–15
INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS, “New Approaches to Characterising Groundwater Flow” (31st International Congress), Munich, Germany. (Contact: Munich 2001, Institute of Hydrology, GSF National Research Centre of Environment and Health GmbH, Ingolstädter Landstr. 1, D-85764 Neuherberg, Germany. Tel: +49 89 3187 2585; Fax: +49 89 3187 3361; E-mail: seiler@gsf.de; Website: agh.isaag.geo.uni-muenchen.de)

September 17–21
7TH INTERNATIONAL CONFERENCE ON PALEOCEANOGRAPHY, Sapporo, Japan. (Contact: Prof. Helmut Weissert, Geological Institute, ETH-Zurich, CH-8092 Zurich, Switzerland. Tel: +41 (0)1 632 37 15; Fax: +41 (0)1 632 10 30; E-mail: helmi@erdw.ethz.ch; Website: http://www.iijnet.or.jp/jtb-cs/icp7/)

September 24–26
ARCHEAN SYMPOSIUM (4th International), Perth, Western Australia. (Contact: Website: redback.geol.usa.edu.au/~ias/)

September 25–29
SIXTH INTERNATIONAL SYMPOSIUM ON LAND SUBSIDENCE (SISOLS 2000), Ravenna, Italy. (Contact: Dr. Laura Carbognin, CNR-ISDGM, S. Polo 1364, 30125, Venezia, Italy. Tel: +39-041 5216826; Fax: +39 041 5216892; E-mail: jane@isdgm.vc.cnr.it)

November 5–8
GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Boston, Massachusetts, USA. (Contact: GSA Meetings Dept., P.O. Box 9140,
2002

March 10-13
AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (Annual Meeting), Houston, Texas, USA. (Contact: AAPG Conventions Dept., P.O. Box 979, Tulsa, OK 74101-0979, USA. Tel: +1 918 560 2679; Fax: +1 918 560 2684; E-mail: dkeim@aapg.org; Website: http://www.aapg.org/)

April 7-10
AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (Annual Meeting), Houston, Texas, USA. (Contact: AAPG Conventions Department, P.O. Box 979, 1444 S. Boulder Ave., Tulsa, OK 74101-0979, USA. Tel: +1 918 560 2679; Fax: +1 918 560 2684; E-mail: dkeim@aapg.org)

May 27-30
EUROPEAN ASSOCIATION OF GEOSCIENTISTS AND ENGINEERS (63rd Conference & Technical Exhibition), Florence, Italy. (Contact: Website: http://www.eage.nl/)

July 7-12
16th INTERNATIONAL SEDIMENTOLOGICAL CONGRESS, Auckland Park, Gauteng, South Africa. (Contact: Bruce Cairncross, Department of Geology, Rand Africans University, P.O. Box 524, Auckland Park, 2006, South Africa. Tel: +27 11 489 2313; Fax: +27 11 489 2309; E-mail: bc@na.rau.ac.za; Website: http://general.rau.ac.za/geology/announcement.htm)

September 16-20
INTERNATIONAL ASSOCIATION OF ENGINEERING GEOLOGY AND THE ENVIRONMENT (IAEG), "Engineering Geology for Developing Countries" (9th International Congress), Durban, South Africa. (Contact: South African Institute for Engineering and Environmental Geologists, P.O. Box 2812, Pretoria, 0001, South Africa. E-mail: saieg@hotmail.com; Website: home.geoscience.org.za/saieg/2002.htm)

September 22-27
SOCIETY OF EXPLORATION GEOPHYSICISTS (72nd Annual Meeting and International Exposition), Las Vegas, Nevada, USA. (Contact: SEG Business Office, Tel: +1-918 497 5500; Fax: +1-918 497 5557; Website: seg.org/)

October 21-25
INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS, "Groundwater and Human Development" (32nd International Congress), Mar del Plata, Argentina. (Contact: Dr. Emilia Bocanegra, Centro de Geologia de Costas y del Cuaternario, Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Mar del Plata, Casilla de Correo 722, 7600 Mar del Plata, Argentina; Tel: +54 223 475 4060; Fax: +54 223 475 3150; E-mail: eboconege@mdp.edu.ar; or download Circular)

October 28-31
GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Denver, Colorado, USA. (Contact: GSA Meetings Dept., P.O. Box 9140, Boulder, CO 80301-9140, USA. Tel: +1 303 447 2020; Fax: +1 303 447 1133; E-mail: meetings@geosociety.org; Website: http://www.geosociety.org/meetings/index.htm)

2003

28 September – 3 October
SOCIETY OF EXPLORATION GEOPHYSICISTS (73rd Annual Meeting and International Exposition), Dallas, Texas, USA. (Contact: SEG Business Office, Tel: +1-918 497 5500; Fax: +1-918 497 5557; Website: seg.org/)

November 2-5
GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Seattle, Washington, USA. (Contact: GSA Meetings Dept., P.O. Box 9140, Boulder, CO 80301-9140, USA. Tel: +1 303 447 2020; Fax: +1 303 447 1133; E-mail: meetings@geosociety.org; Website: http://www.geosociety.org/meetings/index.htm)
General Information

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

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

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

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

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

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

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

Twenty-five reprints of each article published are supplied to be checked for printer's errors. In the case of two or more authors, the costs for additional reprints are to be borne by authors.

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

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


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

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

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

Script Requirements

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

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

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