PP 2509/8/2000

ISSN 0126-5539

PERSATUAN GEOLOGI MALAYSIA

WARTA GEOLOGI

NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MALAYSIA

GEOLOGICAL SOCIETY OF MALAYSIA

Jilid 26
No. 5

Volume 26
No. 5

Sept– Oct
2000

KANDUNGAN (Contents)

DIKELUARKAN DWIBULANAN
ISSUED BIMONTHLY

PERSATUAN GEOLOGI MALAYSIA
Geological Society of Malaysia

About the Society

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

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

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

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

CATATAN GEOLOGI
Geological Notes

Possible dropstone transportation on tree trunks

T.T. KHOO
43 Jalan SS 21/46
Damansara Utama
47400 Petaling Jaya

Abstract: A rainforest tree in the Belum Forest Reserve, north Peninsular Malaysia has been found to bear a granite boulder on its trunk with the boulder hanging a few metres above the ground. The possibility of tree trunks transporting dropstones is suggested.

INTRODUCTION

Dropstones in sediments have been known to be transported by various mechanisms and Bennett *et al.* (1996) have given a clear review of the various mechanisms which can transport dropstones. They warned that more care should be exercised to interpret the origin of dropstones as otherwise misinterpretations of the palaeogeography could be made. For example, by their requirements for the recognition of glacial dropstones, interpretations of glacial dropstone origin for pebbles in Upper Palaeozoic pebbly mudstones in Southeast Asia (e.g. Stauffer and Lee, 1989) would not be convincing with serious implications for the plate tectonics reconstruction of Southeast Asia.

Vegetation is noted by Bennett *et al.* (1996) to play a role in the transportation and examples were given of pebbles and even boulders transported by roots of floating drift-wood. In northwest Peninsular Malaysia I have noted fallen coconut palm trees on beaches and also in the sea with sand, pebbles and shell fragments entangled among the fibrous roots of the coconut tree. The clasts are made more coherent by some calcification of the deposit. For this example, the implication is that in addition to exercising care for the interpretation of dropstones for palaeogeographic studies, transportation of shelly remains by vegetation could also give rise to palaeoecological misinterpretations.

CONCLUSIONS

Vegetation rafting appears to be usually effected by the roots. I report here a possible transportation by the tree trunk. Figure 1 is a majestic rainforest tree in the Belum Forest Reserve in north Peninsular Malaysia (Fig. 2). A boulder of granite is partially wrapped round by plant tissues of the tree. The boulder is hanging about 2.5 m above ground level and is tightly held up by the tree trunk. It is possible for the tree trunk to transport the boulder if the tree has fallen on an expanse of water. In relation to the size of the tree trunk, it is unlikely the tree trunk can be anchored by the boulder.

This mode of transportation, however, ought to be very rare. It appears that the boulder was incorporated when it impinged on the tree trunk at almost the same level as it is now. It is unlikely that the tree had lifted the boulder from ground level as most of the vertical tree growth is from the top up and not from the root level. Possibly a landslip carrying boulders had occurred abutting against the tree trunk. Subsequently the boulder was incorporated but

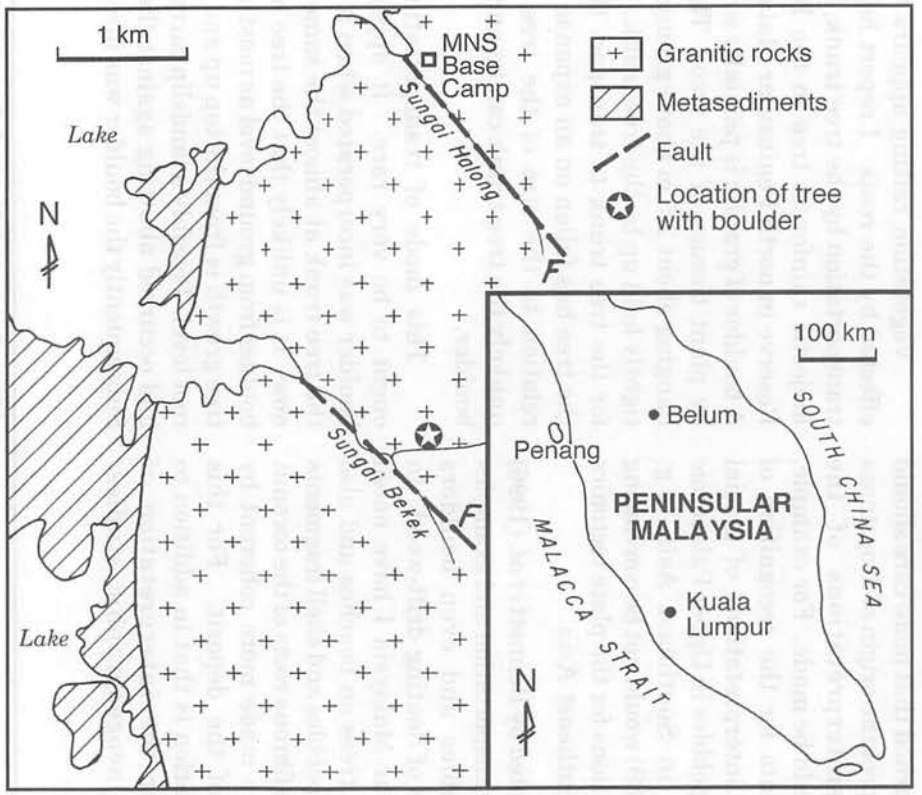

Figure 1. Geological sketch map of the Belum area, Perak, Peninsular Malaysia. MNS, Malaysian Nature Society's camp. Geology from Hatta (1995).

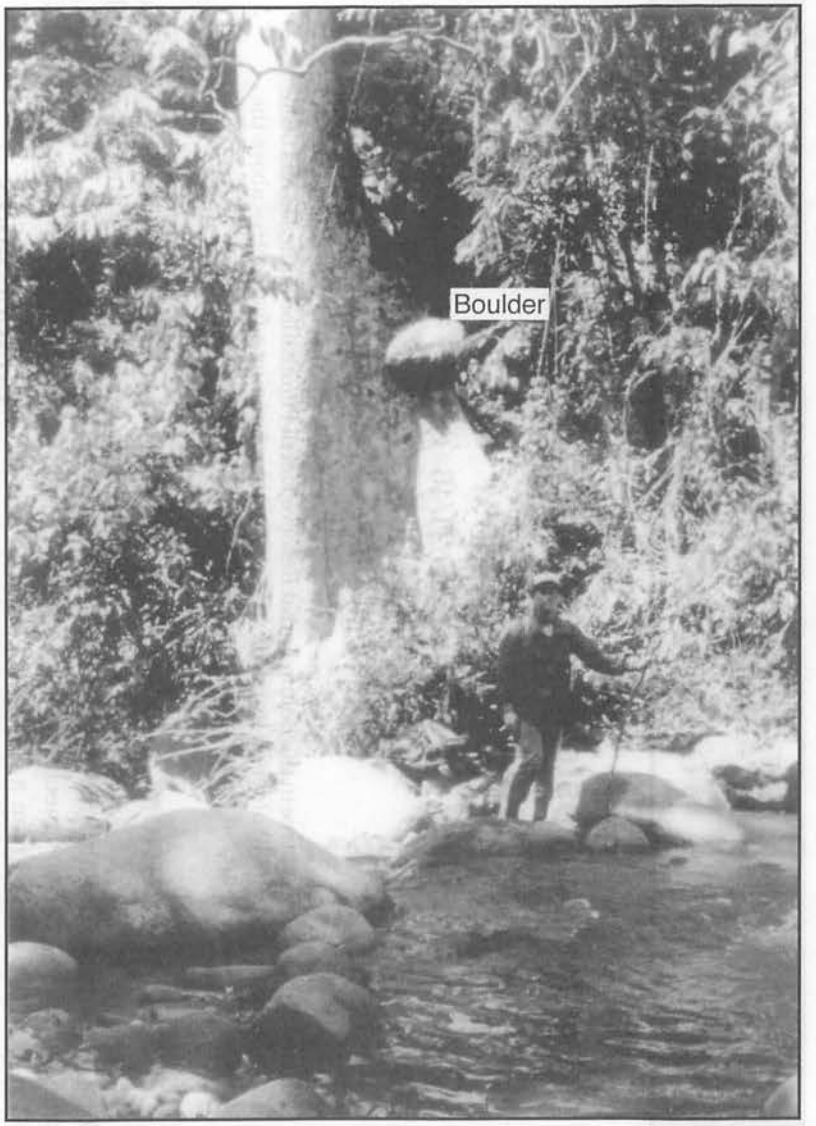

Figure 2. Granite boulder incorporated into tree trunk at 2.5 m above ground level. Location: Sungai (River) Bekek, Belum.

the soil has now been eroded away. This origin for the hanging boulder would be a rare occurrence and so dropstones transported by tree trunks would be very rare but possible.

ACKNOWLEDGEMENTS

The Department of Geology, University of Malaya and the Malaysian Nature Society are thanked for providing support and cooperation for the work.

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Manuscript received 14 April 2000

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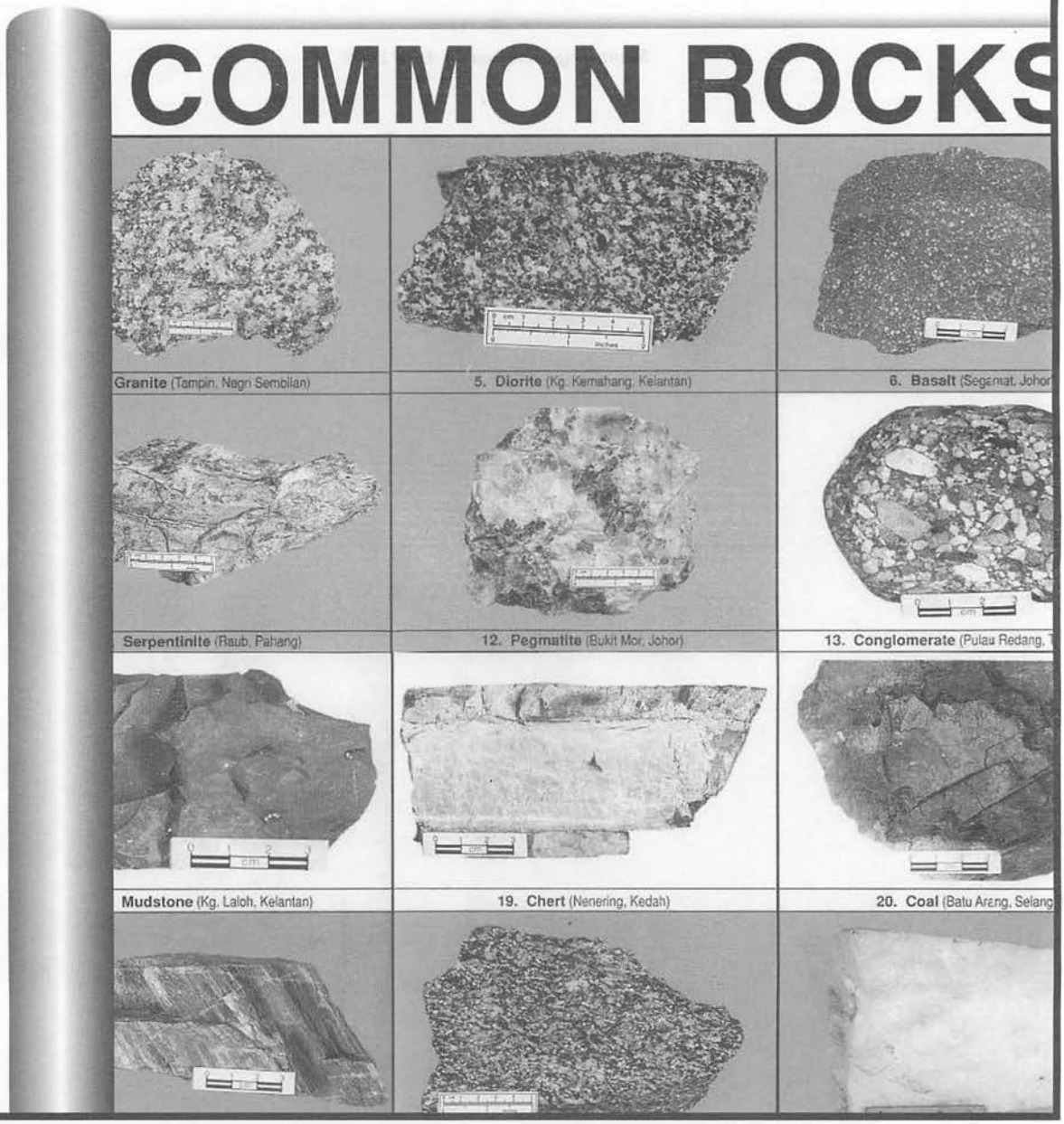

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PERTEMUAN PERSATUAN
Meetings of the Society

Ceramah Teknik (Technical Talk)

Nuclear Magnetic Resonance (NMR): changing the shape of formation evaluation in SEA

RAGHU RAMAMOORTHY

Laporan (Report)

This technical talk by Mr. Raghu Ramamoorthy, Principal Petrophysicist, Schlumberger, is in collaboration with the AAPG-Malaysia Student Chapter. It was held at 10.00 on Wednesday 13th September 2000 at the Mineral & Petrography Lab, Department of Geology, University of Malaya, and attended by 25 participants.

In introducing the speaker, Bachir Ouzani, President of the AAPG-Malaysia Student Chapter, thanked Mr. Raghu for consenting to be the first speaker in what he hoped will be a monthly affair.

Research opportunities in ocean drilling: ocean drilling for the 21st Century — Integrated Ocean Drilling Project

HAZIMU KINOSITA AND KIYOSHI SUYEHIRO

Laporan (Report)

Dr. Hazimu Kinosita, Executive Director and Dr. Kiyoshi Suyehiro, Director, of the Japan Marine Science and Technology Centre (JAMSTEC), Yokosuka, Japan, gave the above talk on 21 September 2000 at 11.30 am at the Geology Department, University of Malaya.

The talk was chaired by the Head, Department of Geology, University of Malaya, Assoc. Prof. Dr. Azhar Hj. Hussin.

G.H. Teh

Magnetotelluric technique: a new geophysical tool for geological problems

T. HARINARAYANA

Deep crustal studies using magnetotelluric technique

T. HARINARAYANA

Laporan (Report)

Dr. T. Harinarayana of the National Geophysical Research Institute, Hyderabad, India, gave the first talk on Wednesday 27 September 2000 and the second on the 28 September 2000. Both talks were held at the Geology Department, University of Malaya and started at 5.30 pm.

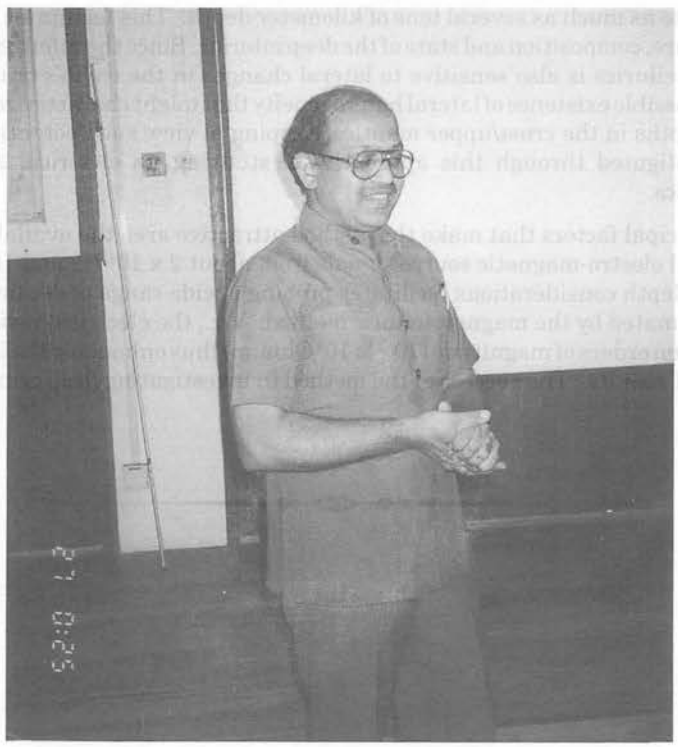
Magnetotelluric technique: a new geophysical tool for geological problems

T. HARINARAYANA

Abstrak (Abstract)

Magnetotelluric (MT) method aims at determining the subsurface electrical conductivity of the earth utilizing the natural electromagnetic signals of extraterrestrial origin. These signals referred to as "Magnetic Pulsations", are generated through the interaction of the Solar Wind with the Earth's Magnetosphere and of the Magnetosphere with the Ionosphere.

Frequencies of the pulsations can range from 5 Hz to several milli hertz. Further, the thunder storm activity occurring in the earth's ionospheric activity generates natural electromegnetic signals in the higher frequency range i.e. the Audio frequency band, extending up to a few tens of kHz.



Thus we have signals of natural electromagnetic field covering a wide band of frequencies ranging from a few thousands of secs (milli hertz) to a few kilohertz and these constitute the source field signals for the MT measurements.

The basic data acquisition in MT is accomplished through simultaneous measurement of orthogonal components of natural magnetic and the corresponding induced electric field variations. The relationship between the magnetic and electric field variations as measured on the earth's surface over through a parameter called impedance range of frequencies is expressed are converted into apparent resistivity and phase values and these provide the basic information about the earth's subsurface conductivity distribution. A study of the conductivity variation over a range of frequencies, and hence over a range of depth levels, provides a model for the subsurface geoelectric structure. Integration of this information with other geological and geophysical inputs leads to retrieval of realistic geological models.

The method is being increasingly deployed for handling a wide spectrum of geological/ geophysical problems, which includes deep crustal and mantle studies, sedimentary basin evaluation for hydrocarbon exploration, geothermal investigations and also for mineral exploration, engineering geology and other related problems. The success of the method in tackling various geological problems is discussed.

Deep crustal studies using magnetotelluric technique

T. HARINARAYANA

Abstrak (Abstract)

Magnetotellurics (MT) — a natural source electromagnetic method — provides information on the subsurface distribution of one of the most important physical properties of the earth's interior namely — the electrical conductivity. The electromagnetic waves generated through solar wind-magnetosphere interaction (0.5 Hz to a few milli Hz) and worldwide thunderstorm activity in the earth's ionospheric cavity (audio-frequency range — 10 Hz to several kHz) constitute the source signals for MT (including AMT) measurements.

MT studies would help to characterize the basic electrical nature of the crust from very shallow levels to as much as several tens of kilometer depth. This facilitates gaining insight into the structure, composition and state of the deep interior. Since the information obtainable from magnetotellurics is also sensitive to lateral changes in the earth's crust, they help in studying the possible existence of lateral heterogeneity that might characterize the subsurface at different depths in the crust/upper mantle. Keeping in view such potential, deep crustal block be investigated through this approach i.e. studying its electrical structure using magnetotellurics.

Two principal factors that make the method attractive are: the availability of a broad band of natural electro-magnetic source signals from about 2×10^4 Hz and 10^{-4} Hz which by virtue of skin depth considerations facilitates probing a wide range of depths. The physical parameter estimated by the magnetotelluric method. Viz., the electrical resistivity can vary over nearly seven orders of magnitude (10^{-1} to 10^6 Ohm.m) thus enhancing the interpretational potential of MT results. The success of the method in investigating deep crustal structure is discussed.

"Malam Geologis Muda IV/Young Geologist Nite IV"

Wednesday, 11th October 2000
Dept. of Geology, University of Malaya

Leaching column tests on three estuarine alluvial soils from South Wales, United Kingdom

WAN ZUHAIRI WAN YAACOB

Laporan (Report)

In this Malam Geologis Muda IV, held at 5.00 pm at the Geology Department, University of Malaya, two speakers were down to present their findings, however, only Dr. Wan showed up.

Dr. Wan Zuhairi Wan Yaacob gave a well illustrated and informative talk on leaching column tests on three types of estuarine alluvial soils collected at active landfill sites in South Wales, United Kingdom. There was a good discussion after the presentation.

Abstrak (Abstract)

Leaching column tests have been utilised to evaluate the attenuation capacity of three types of estuarine alluvial soils collected at active landfill sites in South Wales, United Kingdom. All soils have been tested with acidified leachate spiked with Pb, Cu and Zn to provide an extreme condition for the leaching column experiments. Concentrations of Pb, Cu and Zn collected in the effluents were analysed to produce breakthrough curves, which indicated that almost 99% of these heavy metals were retained in the soils with their relative concentration values ranging from 10^{-3} to 10^{-4}. Analysis on the soil slices after the termination of the leaching column tests produced the retention and migration profiles of Pb, Cu and Zn through the soil columns. All soils retained Pb, Cu and Zn mainly at the top part of the columns. Pb showed the highest amount retained; therefore least migration through the soil columns. On the other hand, Zn showed the lowest retained, hence highest mobility through the columns. The results also showed correspond high pH values of the effluents and pore waters, which indicated good buffering capacity of the soils against extreme acidic leachate after five pore volumes of leaching.

Ordovician and Silurian global geography

ROBIN COCKS

The life, habits and distribution of trilobites

RICHARD FORTEY

Laporan (Report)

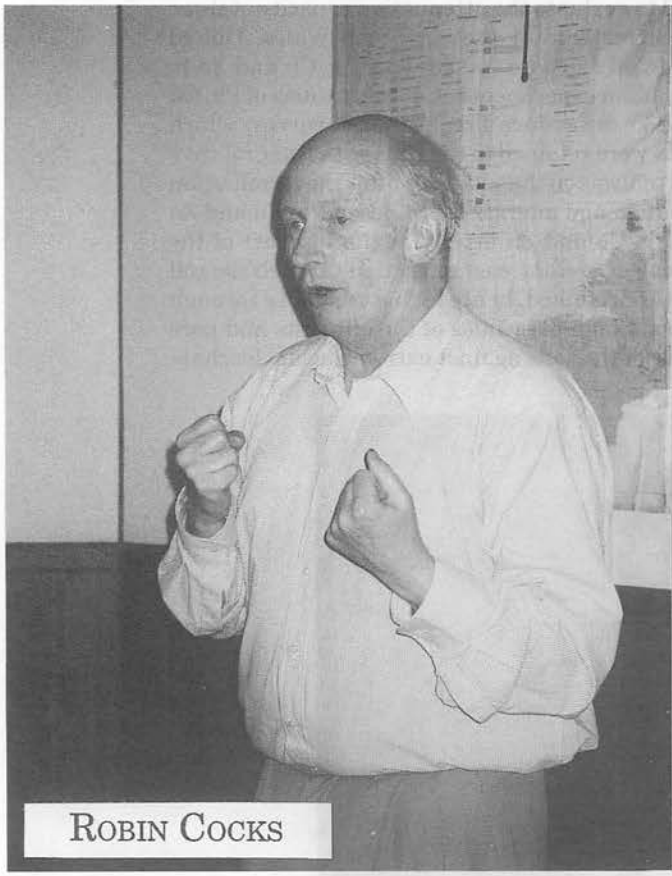
On Wednesday, 25th October 2000, the Society was treated a rare event, 2 technical talks by 2 personalities from the British Museum of Natural History from 4–6.15 pm at the Geology Department, University of Malaya.

Dr. Robin Cocks gave a good insight of the Ordovician and Silurian global geography.

Next Dr. Richard Fortey gave a fascinating account of the life, habits and distribution of trilobites.

Despite the late hour, there was an interesting round of discussions after the talks.

G.H. Teh



ROBIN COCKS

RICHARD FORTEY

Annual Geological Conference 2000

Shangri-La Hotel, Penang

8-9 September 2000

Report

The 14th Annual Geological Conference was organised by the Geological Society of Malaysia at the Shangri-La Hotel, Penang from 8th to 9th September 2000. The conference was officiated by Y.B. Dato' Dr. Hilmi bin Hj. Yahaya, the Deputy Chief Minister of Pulau Pinang, on behalf of the Chief Minister Y.A.B. Tan Sri Koh Tsu Koon. About 200 participants registered for the conference, comprising geoscientists from universities, government agencies and the private sector.

In view of the many challenges facing geoscientists due to lack of awareness about the importance of geoscience in national development among policy and decision makers, the theme of the conference was "Increasing the Relevance of Geoscience in the 21st Century". Preceding the scientific programme, a forum was held to discuss the conference theme. The primary objective of the forum was to evaluate the current status of geoscience in Malaysia, with respect to education, research and development, as well as the institutional set-up. Six background papers were presented. The topics covered were geoscience education, geoscience research and development, strengthening of geoscience institutions, marketing of geoscience services and registration of geologists to enhance professionalism.

The scientific programme of the Conference was organised to accommodate the wide interest of Malaysian geologists under eight themes. These were Tectonics and Structural Geology, Petrology and Petrography, Sedimentology and Stratigraphy, Conservation Geology and Geotourism, Environmental Geology, Engineering Geology and Hydrogeology, Mineral Resources, and Geoscience Tools and Techniques. Foremost geoscientists from universities and research institutions in Malaysia presented nine keynote addresses to highlight the important contribution of geoscience in national development. A total of 55 oral presentations and eight posters were presented covering all eight themes. The papers served to increase the current knowledge and understanding of the geology of Malaysia. The full papers have been published by the Society and can be purchased from the Secretariat at a cost of RM60.00.

In addition to the forum and the scientific programme, two meetings were held during the conference. En. Yunus Abdul Razak of the Minerals and Geoscience Department and Prof. Ibrahim Komoo of Universiti Kebangsaan Malaysia convened a dialogue on the "Role of Geologists in Site Investigation". This initiative was held under the aegis of the Institute of Geology Malaysia and the Malaysia IAEG. Prof. Ibrahim also held a meeting of the Geological Heritage National Core Group. The group comprises academicians and government officers directly involved in conservation of natural resources.

A total of three fieldtrips were organised during the conference. Prof. Yeap Ee Beng of Universiti Malaya led the pre-conference fieldtrip on Geotourism of Penang Island. This trip saw 12 geoscientists discovering the geological heritage of the Island. Dr. Chow Weng Sum of the Minerals and Geoscience Department of Malaysia led the post-conference field trip on Geohazards in Penang Island. About 15 geoscientists obtained first hand information on the

geotechnical problems faced in the urban centres of the Island. Prof. Teh Guan Hoe of Universiti Malaya and Dr. H.D. Tjia of Petronas Research and Scientific Services jointly led the Peninsular Malaysia Geological Transect. This two-day post-conference fieldtrip started in Penang via Baling, Grik, Nenering, Kuala Terengganu and Temerloh, and ended in Kuala Lumpur. About 20 participants obtained hands on experience of the structure, sedimentology and stratigraphy of the Peninsular Malaysia geology, and its significance to petroleum resources.

During the closing ceremony, Dr. Joy J. Pereira, the Conference Chairperson, announced the most interesting papers of the conference, as selected by a committee headed by Dr. C.S. Hutchison and Dr. Azhar Hj. Hussin. The selection did not include the keynote papers but focused on younger presenters for their quality and demonstration of enthusiasm and promise. The criteria for selection included originality, quality of content, contribution to geoscience, presentation and visual style as well as clarity of delivery. The most interesting papers at the Annual Conference 2000 in alphabetical order are as follows:

- Azman Ghani for his papers on the granitoids of eastern Peninsular Malaysia
- Ismail Che Mat Zin for the paper on the Tatau Horst of Sarawak
- Marilah Sarman for her work on the glacial features of Kundasang-Ranau
- Mohd Rozi Umor for two papers on the Benta Complex of Pahang
- Noraini Surip for her papar on StereoSAR DEM for mapping geological structures
- Ros Fatihah for her work on conservation of Badak Cave C of Lenggong

Dr. Pereira also thanked Malaysia Mining Corporation, PETRONAS, OYO International (M) Sdn. Bhd., ESSO Production Malaysia Inc., Projek Lebuhraya Utara Selatan Berhad (PLUS), Kinta Kellas dan Malaysia Airlines for their generous sponsorship. Members of the organising committee and sub-committees were also thanked for their invaluable assistance.

The Closing Address was delivered by Dr. Mohd Shafeea Leman, the Chairperson of the Annual Geological Conference 2001, which is scheduled to be held on 2–3 June 2001 at Pangkor Island, Perak Darul Redzuan. Dr. Shafeea congratulated the organising committee of the conference for a job well done and looked forward to the support of all GSM members for the next conference in 2001.

Annual Geological Conference 2000

Shangri-La Hotel, Penang

8-9 September 2000

Programme

Thursday, September 7, 2000

0800 – 1600 : ***Pre-Conference Fieldtrip:***
Geotourism of Penang Island

1930 – 2230 : ***Barbecue***
(Host: Malaysia Mining Corporation Bhd.)

Friday, September 8, 2000

0800 – 0900 : ***Registration***

Opening Ceremony

0900 – 0910 : Welcoming Address by Dr. Joy J. Pereira, Chairperson, GSM Annual Geological Conference 2000

0910 – 0920 : Address by Dr. Abd. Ghani Rafek, President, Geological Society of Malaysia

0920 – 0940 : Opening Address by YB Dato' Dr. Hilmi bin Hj. Yahaya, Deputy Chief Minister of Pulau Pinang

0940 – 1000 : Coffee Break

1000 – 1200 : Forum on Conference Theme

1200 – 1500 : Lunch/Prayer Break

1500 – 1620 : Technical Sessions

1620 – 1640 : Tea Break

1640 – 1800 : Technical Sessions

1800 – 1930 : Dialogue on Role of Geologists in Site Investigation

1930 – 2230 : Dinner (Host: Kerajaan Negeri Pulau Pinang)

Annual Geological Conference 2000

Shangri-La Hotel, Penang

8-9 September 2000

Programme

Saturday, September 9, 2000

0820 – 1000	:	Technical Sessions
1000 – 1020	:	Coffee Break/Poster Presentation
1020 – 1300	:	Technical Sessions
1300 – 1400	:	Lunch Break
1400 – 1600	:	Technical Sessions
1600 – 1620	:	Tea Break/Poster Presentation
1620 – 1820	:	Technical Sessions
1820 – 1900	:	Closing Ceremony

Sunday, September 10, 2000

0800 – 1600 : ***Post-Conference Fieldtrip 1:***
Geotechnical Aspects of Penang Island

Sunday, September 10 to Monday, September 11, 2000

0800 (Departure) ***Post-Conference Fieldtrip 2:***
Peninsular Malaysia Geological Transect

Annual Geological Conference 2000

Shangri-La Hotel, Penang
8-9 September 2000

Ucapan Aluan Dr. Joy J. Pereira, Pengerusi Jawatankuasa Pengelola, Persidangan Geologi Tahunan 2000

Yang Berusaha Tuan Pengerusi Majlis,
Y.B. Dato' Dr. Hilmi bin Hj. Yahaya, Timbalan Ketua Menteri Pulau Pinang, selaku Wakil YAB Tan Sri Ketua Menteri Pulau Pinang
Yang Berbahagia En. Balasubramaniam, Wakil Ketua Setiausaha Utama, Kementerian Perusahaan Utama
Yang Berbahagia Dr. Abdul Ghani Rafek, Presiden Persatuan Geologi Malaysia.
Ahli-Ahli Yang Berhormat
Tuan-tuan dan puan-puan serta hadirin yang dihormati sekelian

Salam sejahtera kepada semua. Terlebih dahulu saya mengucapkan selamat datang ke Persidangan Tahunan Geologi 2000, yang julung kalinya diadakan di Pulau Pinang. Saya ingin mengucapkan selamat datang dan ribuan terima kasih kepada Y.B. Dato' Dr. Hilmi bin Hj. Yahaya, Timbalan Ketua Menteri Pulau Pinang, selaku Wakil YAB Tan Sri Ketua Menteri Pulau Pinang, kerana sudi hadir ke Majlis pada pagi ini dan seterusnya merasmikan persidangan kita kali ini. Saya juga mengucapkan ribuan terima kasih kepada Y.B. Dato' Dr. Hilmi bin Hj. Yahaya dan Kerajaan Pulau Pinang kerana sudi menjamu para peserta pada malam ini, di kediamaan YAB Tan Sri Ketua Menteri Pulau Pinang bersempena persidangan kita pada tahun ini.

Dikesempatan ini juga, izinkan saya mengucapkan ribuan terima kasih kepada Malaysia Mining Corporation yang merupakan penaja utama dalam menjayakan persidangan pada kali ini. Terima kasih juga diucapkan kepada PETRONAS, OYO International (M) Sdn. Bhd., ESSO Production Malaysia Inc., Projek Lebuhraya Utara Selatan Berhad (PLUS), Kinta Kellas dan Malaysia Airlines atas sumbangan dan sokongan mereka. Terima kasih juga ditujukan kepada Jabatan Mineral dan Geosains dan Universiti Malaya kerana memberi sumbangan kemudahan kenderaan untuk kerjalapangan. Penghargaan juga ditujukan kepada Universiti Kebangsaan Malaysia, Universiti Sains Malaysia, Kementerian Perusahaan Utama dan Institut Geologi Malaysia kerana sudi bekerjasama dalam menjayakan persidangan ini.

Tuan-tuan dan puan-puan yang saya hormati sekalian, pada Persidangan tahun ini, buat pertama kalinya, prosiding kertas kerja telah diterbitkan dan diedarkan kepada para peserta semasa pendaftaran. Di sini saya mengucapkan ribuan terima kasih kepada semua penyumbang, pentaksih sepakar dan ahli jawatankuasa kecil penyunting yang telah bertungkus lumus untuk memastikan prosiding tersebut diterbitkan untuk diedarkan kepada semua peserta pada hari yang berbahagia ini.

Ucapan terima kasih juga ditujukan kepada semua ahli Jawatankuasa Penganjur, yang walaupun sibuk dengan tugas masing-masing, masih sudi meluangkan masa untuk menjamin kejayaan persidangan ini. Semoga objektif dan matlamat persidangan tercapai selama dua hari persidangan ini dijalankan.

Akhir kata, saya sekali lagi mengucapkan ribuan terima kasih kepada Y.B. Dato' Dr. Hilmi bin Hj. Yahaya, Timbalan Ketua Menteri Pulau Pinang, kerana sudi menghadiri majlis ini dan merasmikan persidangan tahunan kali ini.

Sekian, terima kasih.

Annual Geological Conference 2000

Shangri-La Hotel, Penang

8-9 September 2000

Ucapan Aluan Dr. Abd. Ghani Rafek, Presiden Persatuan Geologi Malaysia

Yang Berusaha Tuan Pengerusi Majlis,
Yang saya hormati, Y.B. Dato Dr. Hilmi bin Hj. Yahya,
Timbalan Ketua Menteri Pulau Pinang,
Yang Berbahagia En. Balasubramaniam, Wakil Ketua Setiausaha Utama, Kementerian Perusahaan Utama,
Yang Berusaha, Dr. Joy Jacqueline Pereira,
Pengerusi Jawatankuasa Penganjur, Persidangan Tahunan Geologi 2000,
Ahli-ahli yang berhormat,
Para jemputan,
Rakan-rakan geologis,
Tuan-tuan dan puan-puan sekelian,

Assalamualaikum dan salam sejahtera,

Saya bersyukur kepada Allah kerana dengan limpah kurniaNya dapat kita bersama pada pagi yang indah ini. Saya mengucapkan selamat datang kepada Y.B. Dato Dr. Hilmi bin Hj. Yahaya, Timbalan Ketua Menteri Pulau Pinang, selaku wakil YAB Tan Sri Ketua Menteri Pulau Pinang, kerana sudi meluangkan masa untuk bersama kita pada Majlis pagi ini dan seterusnya merasmikan Persidangan Tahunan Geologi 2000. Selamat datang ke Persidangan Geologi 2000 juga ingin saya ucapkan kepada tuan-tuan dan puan-puan sekelian.

Seperti yang telah disebut tadi oleh Dr. Joy, persidangan tahunan geologi tahun ini merupakan kali pertama diadakan di Pulau Pinang. Persidangan Tahunan Geologi 2000 merupakan persidangan ke-14 siri persidangan tahunan; satu tradisi yang dimulakan pada tahun 1986. Persidangan di Pulau Mutiara ini mencatatkan beberapa perkara yang pertama kali dilakukan. Di antaranya ialah penyediaan Prosiding Persidangan yang mengandungi tidak kurang daripada 63 kertas kerja penuh yang membentangkan hasil penyelidikan dan penyiastan geologi dalam lapan bidang tema program saintifik persidangan. Satu tema baru iaitu Geopelancongan dan Geologi Pemuliharan diperkenalkan pada persidangan tahun ini. Perisidangan ini akan dimulakan dengan satu forum berkenaan dengan tema persidangan "Increasing the Relevance of Geoscience in the 21st Century" iaitu Menambahkan kerelevanan Geosains dalam abad ke-21; forum sedemikian juga diadakan kali pertama. Forum ini dianjurkan bersama dengan Institut Geologi Malaysia dengan sokongan Kementerian Perusahaan Utama dan disertai oleh perwakilan Universiti tempatan yang menawarkan kursus geosains, Kementerian Perusahaan Utama dan Jabatan Mineral dan Geosains Malaysia. Resolusi forum ini akan diedarkan kepada semua pihak yang berkaitan dengan Geosains.

Tuan-tuan dan puan-puan,

Memandangkan peranan dan sumbangan geologis khsusnya geologis kejuruteraan dalam penyiasatan tapak satu sesi dialog tentang peranan geologis akan diadakan pada petang pertama persidangan ini. Dialog ini dikelolakan oleh "Malaysian IAEG National Group" bersama dengan Institut Geologi Malaysia.

Senarai perkara yang pertama kali ini tidak lengkap jika tidak dirakamkan di sini bahawa pengerusi jawatankuasa penjanjur kali ini pertama kali merupakan wanita! Iaitu Dr. Joy.

Tuan-tuan dan puan-puan,

Persidangan seperti ini tidak dapat diadakan tanpa sokongan dan bantuan beberapa pihak. Izinkan saya mengambil kesempatan ini untuk merakamkan penghargaan dan terima kasih kepada: YAB Tan Sri Ketua Menteri Pulau Pinang, Y.B. Dato Dr. Hilmi bin Yahaya dan Kerajaan Negeri Pulau Pinang, Syarikat Malaysian Mining Corporation, PETRONAS, OYO International Sdn. Bhd., ESSO Malaysia, Projek Lebuhraya Utara Selatan Berhad (PLUS), Kinta Kellas, Malaysian Airlines, Jabatan Mineral dan Geosains, Universiti Malaysia, Universiti Kebangsaan Malaysia, Universiti Sains Malaysia, Kementerian Perusahaan Utama, Institut Geologi Malaysia, Dr. Joy dengan jawatankuasa beliau, dan semua penyumbang kertas kerja, pentaksih sepakar dan semua peserta persidangan.

Akhir sekali saya memohon ma'af atas segala kekurangan. Sekian terima kasih.

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Ucapan Perasmian oleh Y.A.B. Tan Sri Ketua Menteri Pulau Pinang, disampaikan oleh Y.B. Dato' Dr. Hilmi bin Hj. Yahaya, Timbalan Ketua Menteri Pulau Pinang

Yang Berusaha Tuan Pengerusi Majlis,
Yang Berbahagia Dr. Abdul Ghani Rafek, Presiden Persatuan Geologi Malaysia,
Yang Berbahagia En. Balasubramaniam, Wakil Kementerian Perusahaan Utama,
Yang Berbahagia Dr. Joy Jacqueline Pereira, Pengerusi Jawatankuasa Pengelola Persidangan,
Ahli-Ahli Tuan-tuan dan puan-puan serta hadirin yang dihormati sekalian

Saya merasa amat gembira diberi kesempatan untuk berucap kepada para peserta persidangan ini yang terdiri daripada geosaintis dari universiti tempatan dan juga mereka yang berkhidmat dengan Kerajaan, Badan-Badan Berkanun dan dari sektor swasta.

Saya difahamkan Persidangan Tahunan Geologi yang ke-14 buat julung kalinya diadakan di Pulau Pinang dan dihadiri oleh hampir 150 peserta. Saya percaya suasana Pulau Pinang dengan alam sekitar yang indah, nyaman dan tenteram akan membantu tuan-tuan dan puan-puan melahirkan ide-ide lebih bernas bukan sahaja untuk meningkatkan mutu akademik dan profesion geosaintis tetapi juga dapat memberi sumbangan yang bermakna di dalam bidang masing-masing ke arah pembangunan negara.

Kehadiran tuan-tuan dan puan-puan di sini jelas menunjukkan betapa pentingnya persidangan ini bukan saja kepada Persatuan malah kepada negara. Tidak boleh dinafikan bahawa tuan-tuan dan puan-puan merupakan tenaga penting yang terlibat secara langsung di dalam penjelajahan dan pembangunan sumber asli kekayaan negara seperti petroleum, gas, air tanah, mineral logam, mineral industri dan sebagainya. Memandangkan bahawa sumber asli tersebut kebanyakkannya tidak dapat diperbaharui, maka sebahagian daripada tanggungjawab tuan-tuan dan puan-puan adalah untuk memastikan penggunaan sumber tersebut dilakukan secara mampan supaya ianya dapat dimanfaatkan oleh generasi kini dan generasi akan datang.

Saya juga difahamkan bahawa sumbangan tuan-tuan dan puan-puan amat kritikal bagi mengelakkan kejadian bencana seperti tanah runtuh, amblesan, hakisan, banjir dan banjir kilat serta penentuan kesesuaian tapak dalam projek pembangunan. Sumbangan tersebut penting bagi memastikan kesejahteraan masyarakat terjamin dalam mencapai pembangunan yang mampan di alaf baru. Di samping itu, tuan-tuan dan puan-puan juga memainkan peranan penting bagi memastikan pemuliharaan dan pemeliharaan alam sekitar bagi menjamin pembangunan mampan terlaksana.

Saya juga difahamkan bahawa profesion geosains telah memberikan pelbagai sumbangan dalam pembangunan Pulau Pinang dan kawasan-kawasan di sekitarannya ini termasuk aktiviti pemetaan geologi, eksplorasi mineral khususnya untuk mineral perindustrian, hidrogeologi

serta kajian geologi kejuruteraan. Dalam hal ini saya ingin merakamkan ucapan terima kasih kepada Jabatan Mineral dan Geosains yang telah banyak memberi input teknikal kepada kerajaan negeri Pulau.Pinang khasnya semasa kejadian tanah runtuh di Paya Terubong. Baru-baru ini satu kajian integrasi geologi juga telah dilaksanakan oleh Jabatan tersebut di Pulau Pinang sebagai input untuk perancangan pembangunan negeri ini.

Tuan-tuan dan puan-puan,

Dalam menghadapi cabaran alaf baru ahli geosaintis perlu menjadi lebih proaktif sebagai agen pembangunan yang menyumbang kepada pembuatan dasar dengan menyuarakan pendapat dan memberi nasihat bila difikirkan perlu. Di samping itu geosaintis juga perlu menjaga mutu kerja secara lebih profesional supaya produk yang dihasilkan tidak diragui. Saya percaya kelulusan "Akta Profesional Geologis" yang telah lama tuan-tuan dan puan-puan kemukakan kepada Kementerian Perusahaan Utama akan membantu mengawal profesion geologis di samping menjaga kepentingan masyarakat akibat kerja-kerja geologi yang dilakukan oleh mereka yang tidak berkelayakan. Saya difahamkan bahawa suatu forum telah dirancang pada hari ini untuk membincangkan cara-cara untuk meningkatkan kerelevanan geosains pada abad ke 21. Saya harap bahawa aspek mengenai cara-cara meningkatkan profesionalisma ahli geosains melalui "Akta Profesional Geologis" akan dibincang mendalam semasa forum ini dengan wakil-wakil kanan Kementerian Perusahaan Utama kerana ianya penting bagi memastikan hanya sumbangan geosains berkualiti dan releven disalurkan kepada kerajaan dan masyarakat dengan efisien.

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

Justeru daripada itu, saya mengucapkan tahniah kepada apa yang telah dicapai sehingga kini dan menyeru supaya tuan-tuan dan puan-puan menggunakan peluang bermesyuarat di Pulau Pinang untuk melahirkan ide-ide lebih bernas bagi menghadapi cabaran pada abad yang ke 21 dalam membantu usaha pencapaian pembangunan mampan di Malaysia.

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

Dengan ini, saya dengan sukacita menyempurnakan dan merasmikan Persidangan Tahunan Persatuan Geologi Malaysia 2000.

Sekian. Selamat bersidang.

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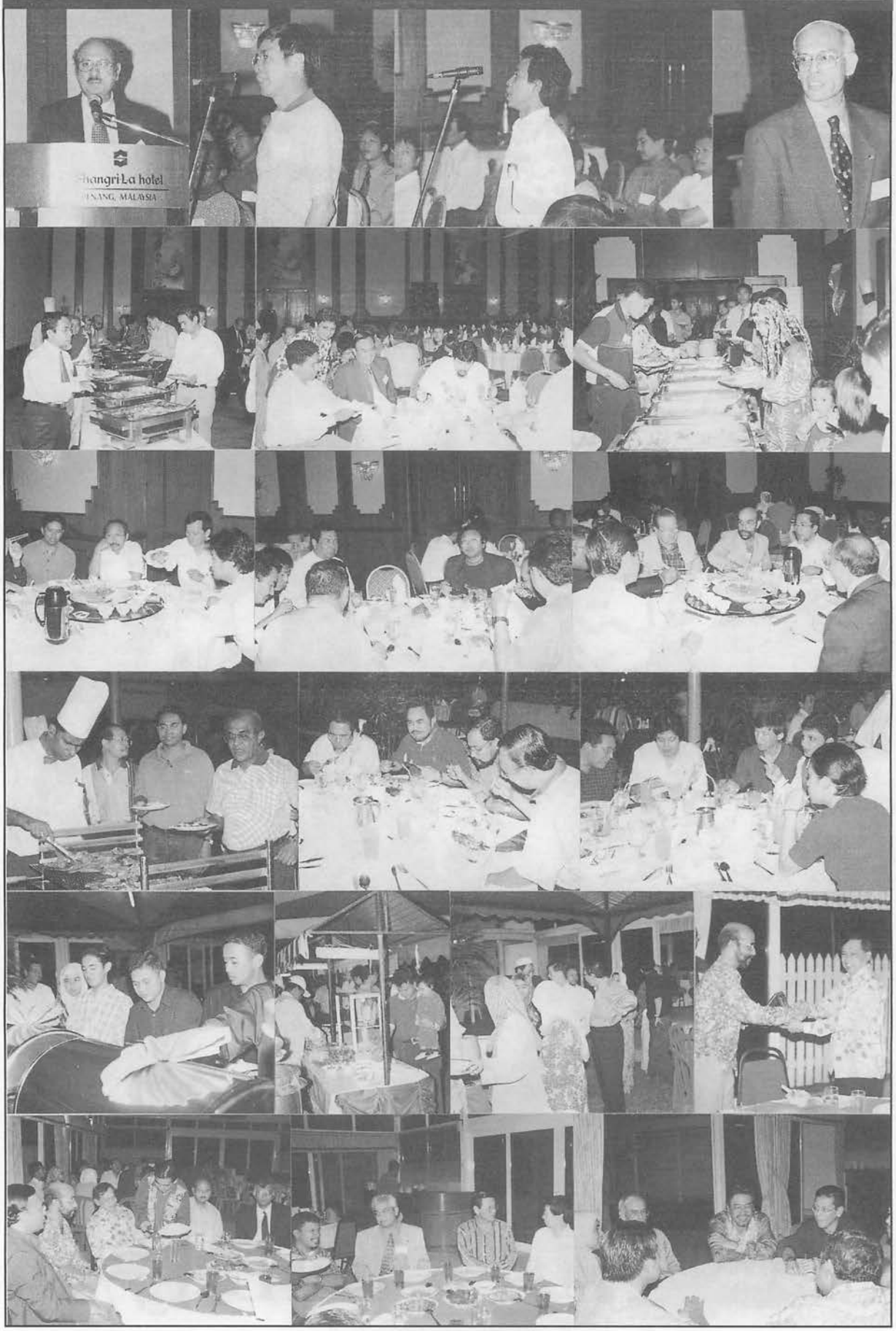

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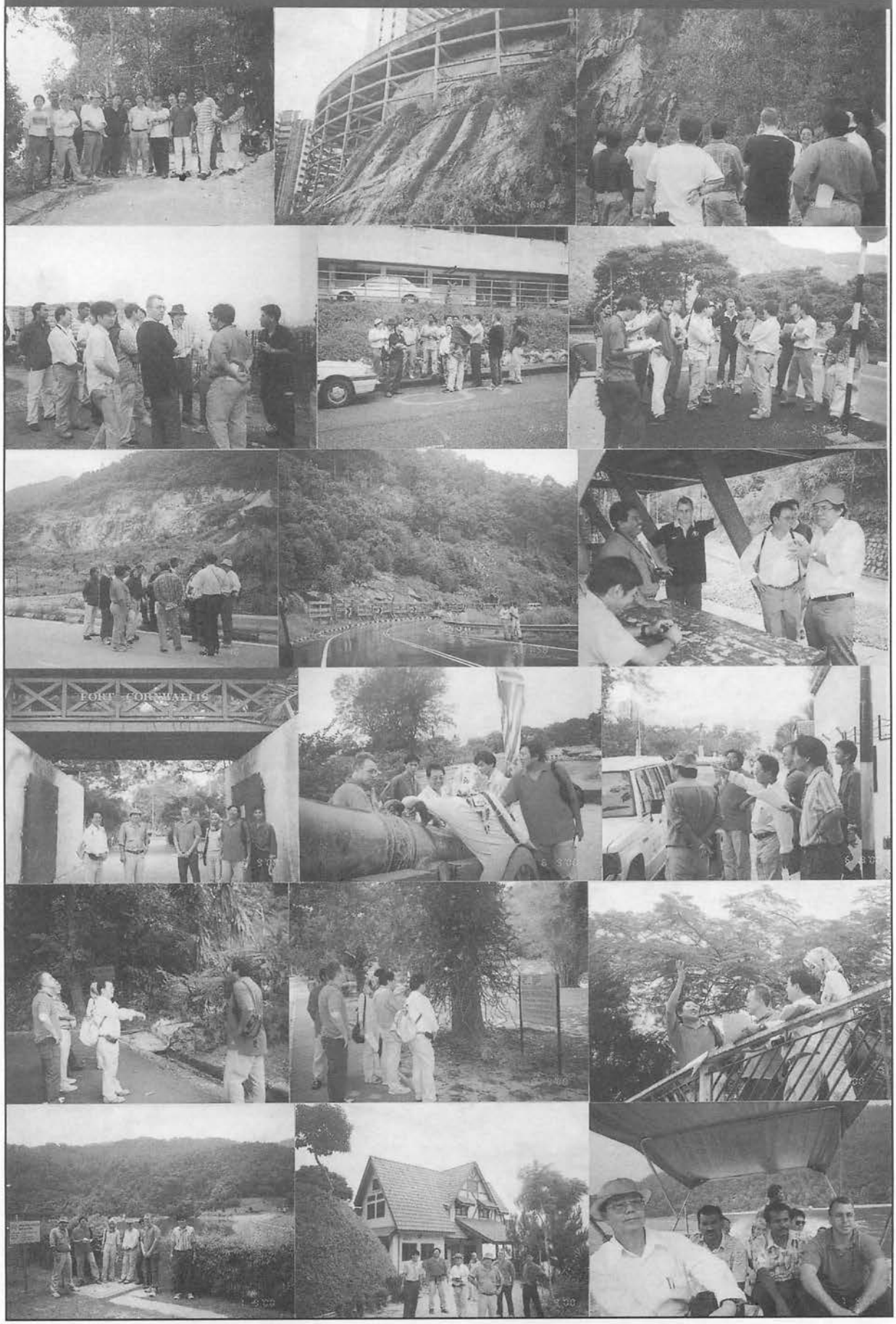

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Abstracts of Papers & Posters

Tectonic and Structural Development of Cenozoic Basins of Malaysia

H.D. TJIA

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The Cenozoic Malaysian basins are (1) located in the interior of semicratonic continental crust (Malay basin, its satellite basins, and the Penyu basin); (2) located in marginal belts of semicratonic continental crust (small, faulted depressions in the Strait of Melaka and onshore Peninsular Malaysia); (3) straddling collisional plate boundaries (Sarawak and NW Sabah basins); (4) associated with a microcontinent (Sandakan, Labuk Bay, Malawali and Tidung basins, and the circular basins of Sabah). The basin development shows the following pattern. Rifting, thermal subsidence and modification by transtensional and/or transpressional wrench faulting are the tectonic processes that operate on depressions underlain by continental crust. The crust could belong to large plates or represent a microcontinent. The basins may develop as (a) aulacogens atop a mantle-plume dome (Malay and Penyu), or (b) pullaparts where wrench faulting is the main reactivator of basement fractures. The onshore Tertiary basins of Peninsular Malaysia and the Strait of Melaka are of this type. Inverted structures are the rule, as are reversals of slip sense on the wrench faults. (c) At collisional plate boundaries, large depressions are initially formed by active subsidence of the basin floor in the subduction trench. The growing accretionary prism on the landward side of the trench wall enhances the basin depth. After subduction ceases, isostatic adjustments depresses the basin further, increasing its holding capacity. (d) The NE Sabah and Tidung basins originated as rifts in the break-up of the East Sabah microcontinent. (e) The origin and development of the circular basins of Sabah are unresolved issues. Their main features include the predominantly extensional character shown by their structures, rounded planimetric outline, and kink-like geographical distribution of which the ends are in Sandakan Bay and at Cowie Harbour.

The Occurrence of Thrusts in North Kedah and Perlis

ZAITON HARUN & BASIR JASIN

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Several thrust faults were observed at Bukit Jabi, Bukit Kerangan, Bukit Tunjang and Kampung Binjai. The faults are high angle thrusts and dip towards the east. They exhibit more or less the same structural features. The faults displace the Lower Paleozoic Mahang and Setul Formations onto the Kubang Pasu Formation.

Joint Patterns and Structural Analysis of Pulau Bunting, Yan, Kedah

IBRAHIM ABDULLAH & CHE AZIZ ALI

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The rocks of Pulau Bunting, which consist of metasediments and quartz porphyry, are faulted, sheared and fractured. Metasediments occur in the northern coast and the most eastern part of the island. In the northern coast of the island the metasediments form a broad open syncline plunging northwards, while in the eastern end of the island the rocks were tightly folded into a small anticline and syncline compressed within the axial zone of a broader syncline plunging into NNE direction. From the aerial photograph, several lineaments were traced. The lineaments are trending in the NNE-NE and NNW-NW directions. The lineament directions are in very good agreement with the observed faults and shear zones. Joint analyses indicate that there are five joint sets in the area, two of them partly filled by quartz to form quartz veins. Based on the field relationship of the structures observed, it is interpreted that the metasediments have undergone two phases of compression before the igneous intrusion, which took place during Jurassic-Cretaceous time. Following that, a tensional phase was responsible for normal faulting and quartz veins. The last compression took place in the area during Early Tertiary and resulted in the lateral faults and shear zones. This activity was also responsible for the formation of the foliation in the quartz porphyry.

Antara Mitos dan Neotektonik Bukit Putri, Terengganu

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Peti Surat 11110, 50736, Kuala Lumpur, Malaysia

Bukit Putri yang terletak di Daerah Besut, Terengganu mempunyai lagenda tersendiri dan dikawal oleh Puteri Bunian yang mentadbir secara spiritual. Pelbagai perkara pelik sukar diceritakan secara saintifik dirasai oleh masyarakat setempat. Ia bernilai intrinsik (saintifik) yang tinggi dan bakal menjadi tumpuan ahli geosains untuk mengkaji keunikannya. Jujukan lapisan sedimen tak konsolidat berskala besar yang tersingkap dan membentuk Bt. Putri pada ketinggian 188 m merupakan gravel. Ia terdiri daripada klasta-klasta pelbagai jenis batuan, bersaiz batu tongkol, berbentuk bundar ke subbundar, berjulat 5–60 cm garispusat, terapung dalam matriks bersaiz pasir dan kelikir. Singkapan terdapat pelbagai struktur sedimen primer dengan perlapisan yang jelas berjurus 290°; miring 30° ke arah SSW dipercayai berlaku semasa lewat Kainozoik. Bt. Putri yang terletak dalam zon sesar Terengganu, mungkin mengalami pengangkatan isostatik igneus Banjaran Sempadan berbentuk diapir. Fenomena hentaman meteorit berskala besar mungkin berlaku berdasarkan fitur berbentuk bulat di bahagian utara Bt. Putri. Misteri kewujudan Bt. Putri yang unik perlu dikaji secara saintifik dengan lebih komprehensif.

Geologi dan Geologi Struktur Kepulauan Tenggol, Terengganu

MOHAMAD SARI HASAN[1], IBRAHIM ABDULLAH[2], KAMAL ROSLAN MOHAMED[2], ASKURY ABD KADIR[1] & CHE AZIZ ALI[2]

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Batuan di Kepulauan Tenggol boleh dibahagiakan kepada dua jenis iaitu batuan granitoid dan batuan volkanik. Rejahan-rejahan kecil terutamanya daik mikrodiorit atau dolerit (?), daik kuarza-feldspatik, daik

lamprofir dan telerang kuarza ditemui di dalam batuan volkanik dan granit. Batuan volkanik terdapat di Pulau Tenggol dan Pulau Daik di bahagian selatan. Batuan volkanik ini mempunyai klas-klas pecahan batuan terutamanya dari punca volkanik sendiri. Klas ini berbentuk sub-sudut hingga sub-bulat dan bersaiz sekitar beberapa cm hingga sekitar 50 cm. Terdapat juga klas-klas yang berbentuk pipih dan tersusun selari. Klas granit merah jambu di dalam batuan volkanik ini, dan ini mencadangkan usia batuan volkanik ini adalah lebih muda dari batuan granit tersebut. Tekstur aliran semasa pengenapan batuan volkanik ini juga jelas diperhatikan di lapangan. Batuan granit terdiri daripada granit biotit-hornblend dan seinit kuarza. Batuan granit ini banyak terdapat Pulau Nyirih dan pulau-pulau kecil di bahagian utara Pulau Tenggol. Daripada analisis struktur geologi yang dicerap di Kepulauan Tenggol, ditafsirkan terdapat 4 fasa canggaan yang dialami oleh batuan yang terdapat di sini. Canggaan pertama merupakan fasa mampatan timur-tenggara, diikuti oleh fasa regangan timur-barat sebelum berlaku sekali lagi fasa mampatan pada arah timur-barat dan, diakhiri oleh regangan ke arah selatan-tenggara. Urutan canggaan ditentukan melalui perkaitan antara struktur sesar-sesar yang ada dan juga daik yang terdapat di Kepulauan Tenggol.

Rekontruksi Tegasan Kuno di Kawasan Penjom, Kuala Lipis, Pahang Berdasarkan Data Mesoskopis Gelinciran Sesar

HERU SIGIT PURWANTO, IBRAHIM ABDULLAH & JUHARI MAT AKHIR

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Geologi kawasan Penjom, Kuala Lipis sangat menarik, terutama struktur geologi yang mengawal geologi kawasan tersebut. Kajian terperinci dilakukan di kawasan lombong daripada syarikat "Penjom Gold Mine" yang mempunyai singkapan batuan yang sangat baik. Kawasan Penjom secara dominan terdiri daripada tuf, tuf lapili, batu pasir, batu lodak dan syal daripada Formasi Gua Musang. Di beberapa tempat terdapat batuan sedimen agak berkarbon dan batuan berusia Perm Akhir direjahi oleh mikrogranit dan telerang kuarza. Tren struktur utama kawasan ini ialah U-S dan TL-BD. Tren tersebut dipotong oleh beberapa zon sesar, sama ada sesar ricih atau sesar mendatar. Kebanyakan sesar yang bersudut curam berarah U355°-005°T atau hampir Utara Selatan dan U300°-310°T atau Baratlaut-Tenggara menunjukkan gerakan atau gelincir ke kanan, manakala yang berarah U035°-045°T atau Timurlaut-Baratdaya menunjukkan gelincir ke kiri. Sejarah tegasan atau tegasan kuno yang beroperasi pada masa atau selepas pembentukan sesar ditentukan oleh pergerakan atau gelincir yang berlaku di atas satah sesar berkenaan dengan menggunakan semua maklumat yang didapati daripada data struktur meso yang diperhatikan di atas satah sesar. Sejarah tegasan kuno yang telah bertindak ditentukan berdasarkan perkaitan saling memotong antara satah-satah sesar yang terdapat. Berdasarkan kepada data gelinciran sesar (satah sesar, tukikan dan arah tukikan), disimpulkan bahawa dua tegasan kuno yang awal merupakan tegasan mampatan, masing-masing bertindak dari UTL-SBD ($\sigma1$ = 17°-22°–> U203°-209°T) dan U-S ($\sigma1$ = 13°-14°–>U182°-204°T), diikuti oleh keadaan ekstensi ke arah TTG-BBL ($\sigma3$ = 66°–>U137°T). Akhir sekali kawasan ini mengalami keadaan mampatan dari arah BL-TG ($\sigma1$ = 14°-21°–>U324°-326°T).

Synsedimentary Tectonic Control of the Permo-Triassic Central Basin Sedimentation

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The sediments in the Central basin can be divided into 2 depositional sequences. The first depositional sequence (Permian-Early Triassic) consists of continental sediments at its base that grade into shallow marine and then to deeper marine at the top. The sequence marks the opening of the basin. The second sequence (Middle Triassic

to Late Triassic) begins with deep marine turbidites and volcaniclastics that grade into shallow marine sediments to the top. These sequences mark the rifting of the basin and then followed by the initiation of the gradual closure of the basin. Numerous direct evidences for syn-sedimentary tectonism are found within the strata of the Central Basins. These include slumps, syn-sedimentary normal and strike-slip faults, syn-sedimentary folds, and shale injection structures. The evidence that comes from these syndepositional structures is that sedimentation has been continuous with transcurrent fault movements. From the sedimentological and syndepositional structural characteristics, the Permo-Triassic Central Basin can be considered to have a graben-like configuration. The graben had a roughly N-S trend and is defined as follows: (1) The graben has its western and eastern margins as the Bentong-Raub Zone and the Lebir Fault Zone, respectively. (2) It has a shallow rapidly subsiding platform along the margins and the northern part. (3) It has a deep basinal area in the central and axial areas represented by the Semantan formation. (4) The transitional zone is defined as the area inboard of the basin characterized by intimate relations between volcanism, tectonism and sedimentation. The nature of the margin fault zones with steeply dipping faults that have the downthrown side into the basin and exhibiting dextral transpressive and transtensive character suggest that the basin is a strike-slip control basin.

The Olistostromes in the Bentong Area, Pahang and their Tectonic Implications

MUSTAFFA KAMAL SHUIB

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50603 Kuala Lumpur, Malaysia

Two types of olistostromes are recognized in the Bentong area. They are a) olistostromes that are intercalated with cherts and b) olistostromes that are intercalated with sandstone/shale layers. The features found within the various olistostrome outcrops indicate that they are gravity flow deposits in which several types of mass transport were operative. They have been deformed by sub-vertical dextral and sinistral strike-slip faults. The bedded cherts contain radiolaria suggesting that the bedded chert-olistostrome association were deposited in a deep marine environment. However, the olistostrome-sandstone/shale association shows a marked contrast in lithology and environment of deposition. They are very shallow marine to continental sediments. The position of the red layers within the chert-argillite stratigraphy is unknown but could possibly be unconformably overlying the olistostromes bedded chert association (chert-argillite unit). It is concluded that the chert-argillite unit was not deposited on the floor of a wide ocean, but on a basin that received abundant continental derived detritus, very near to the continental margin. Dextral transcurrent movements had resulted in the uplift and inversion of the chert-argillites. This also leads to the development of pull-apart basins filled with shallow marine to continental sediments and olistostromes. These basins occurring along and within the Bentong-Raub Zone were inverted by the Triassic. By Late Triassic, these deposits would have been further tectonized in a dextral transpressive regime.

How Geochemical Data Substantiate Findings in Lithostratigraphy with Specific Reference to Characterizing Lithodemes

HAMZAH MOHAMAD

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There are three main factors which hinder accurate characterisation and correlation of a metamorphic complex, supersuite, suite or a lithodeme. The factors are related to the direct dependence of type and nature of metamorphic rocks (i.e. mineral composition, texture and microstructure) on (1) The specific type of metamorphism affecting the area, (2) The intensity of the metamorphism, and (3) The initial composition of the protoliths. Before using mineral composition, texture and microstructure as prime rock characters, detailed understanding about the

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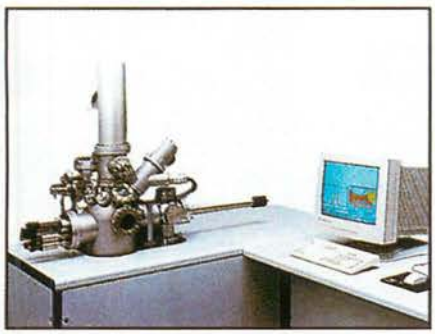

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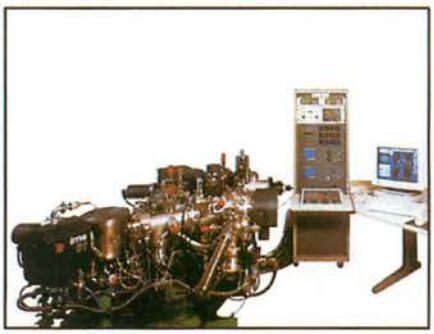

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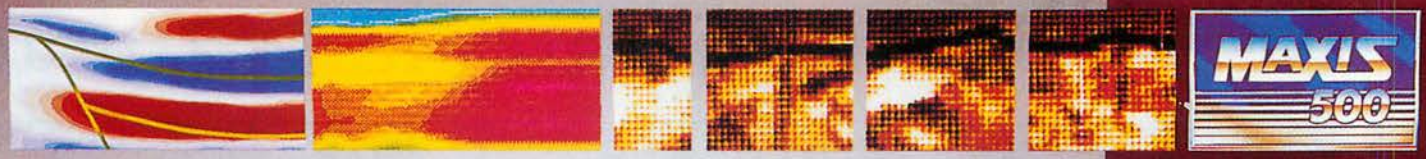

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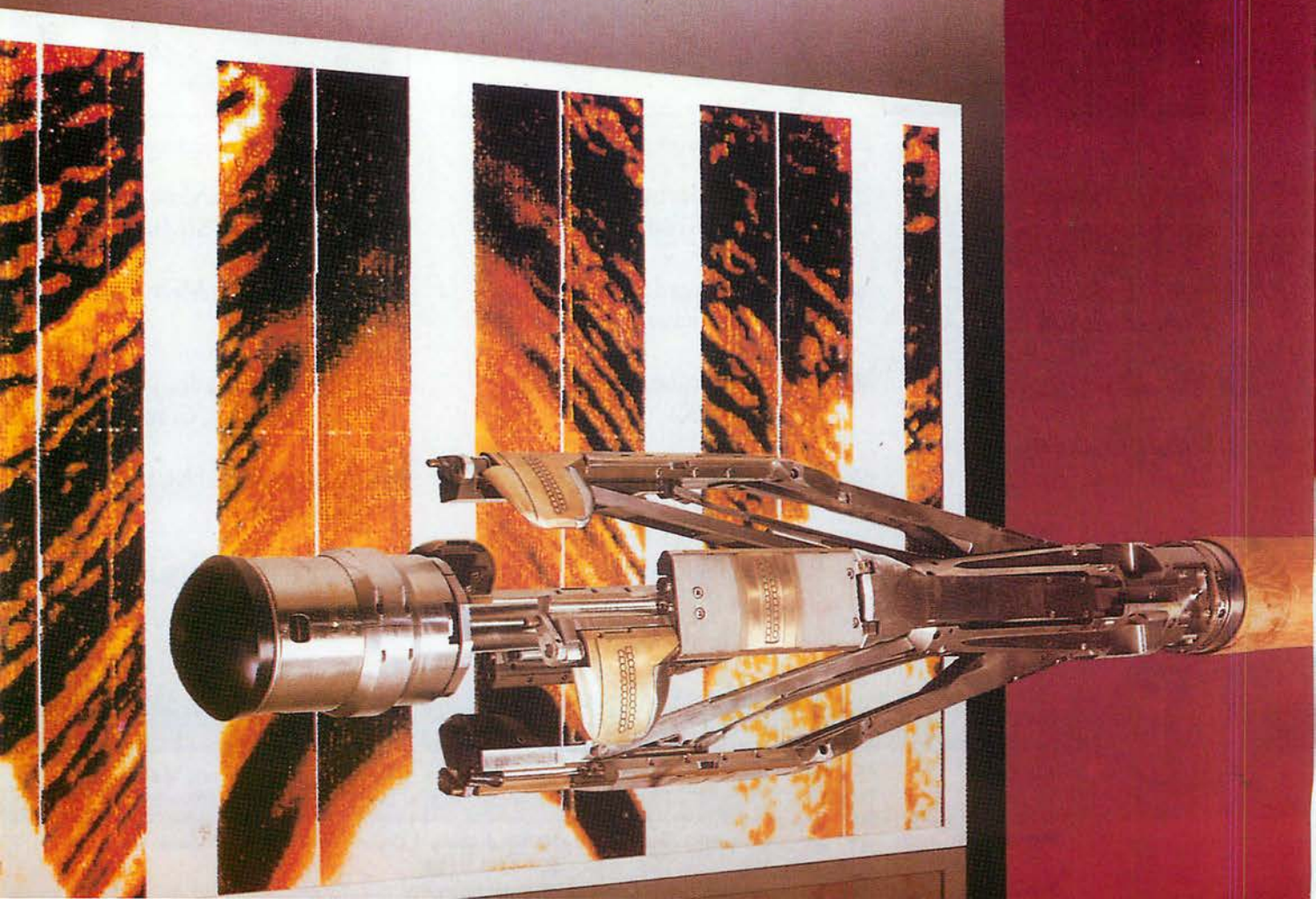

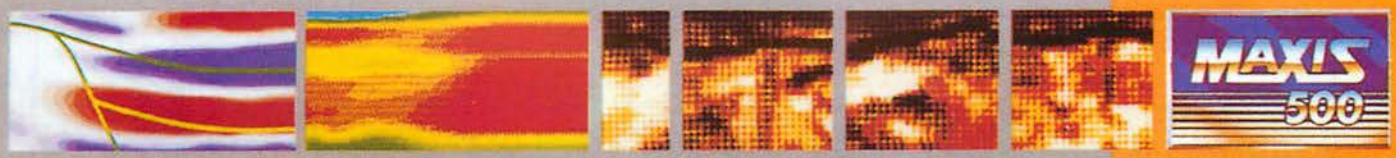

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relation between the three factors and the metamorphic rocks is very important in order to avoid, amongst others: (1) Mixing up of lithostratigraphic and lithodemic nomenclature, (2) Giving more than one name to a single lithodeme, and (3) Mixing up of ranks in lithodemic units, i.e. complex, supersuite, suite and lithodeme. The proven isochemical nature of regional metamorphism of metapelites, except for H_2O and CO_2, has enabled the bulk chemical composition to be treated as an additional rock character in characterising lithodemic units. In this study the chemical character is represented by Niggli numbers si, al, alk, and fm. Four correlations based on the these Niggli numbers and their derivatives have been formulated to discriminate lithodemic units, as follows: (1) si vs. al-alk, (2) si vs. alk, (3) si vs. fm, and (4) si vs. [fm/(fm + alk)]. The correlations have been applied to the Scottish Highlands metapelites near Angus District, and three formal and informal lithodemes in Semenanjung Malaysia, i.e. Kenny Hill formation, Taku Schist, and the East-West Highway metapelites. All lithodemic units portray common trends of slopes in all correlations, but any individual lithodeme is distinguishable from the others by the si ranges, as well as the gradients of curves. The strongest discriminating correlation is si vs. al-alk.

Sempah Volcanic Complex, Pahang

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The Sempah volcanic complex occupies the central part of the Main Range Batholith to the east of Kuala Lumpur. The complex intruded the Selut Schist (pre-Devonian), Gombak Chert (Late Devonian-Early Carboniferous), and Sempah Conglomerate (Permian), which were collectively known as the Bentong Group (Alexander 1968). The complex consists of two main rock types namely orthopyroxene-lacking rhyodacite (OLR) and orthopyroxene-bearing rhyodacite (OBR). Geochemical evidence indicates that the OLR and OBR are not related by simple fractional crystallization. The difference is indicated by a compositional gap at 69.1 to 70.7% SiO_2, different ACNK values, different ACNK trends with increasing SiO_2 and contrasting behaviour for the major and trace elements, particularly K_2O and Ba. This is supported by major element modelling where both OBR and OLR have different mineral extract proportions.

Geochemistry of the Granitic Rocks from North of the Lawit Batholith, Besut, Terengganu

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The Lawit batholith consist of a very coarse, inequigranular, biotite granite as a central core known as the Peda granite, bordered to the east and west by the earlier hornblende bearing Guntong granodiorite. This paper describes in detail the petrological and geochemical differences of the northern part of the Lawit batholith. The main petrological differences between these two rocks are that the granodiorite contains hornblende and biotite whereas the granite contains only biotite as the main mafic phase. The petrological, field and chemical data indicate that the Guntong granodiorite and Peda granite are made up from separate individual melts. The different behaviour of most of the trace elements in the Peda granite and Guntong granodiorite suggests that each unit of the Lawit batholith may not be related by a simple magma fractionation from the margin to the centre of the pluton.

Hornblende Chemistry and its Application to Geobarometry of the Noring Pluton, Stong Complex, Kelantan

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One of the main mafic silicates in the Noring pluton is hornblende. It is euhedral to subhedral with grain size ranging from 1 to 4 mm across. Electron microprobe results show that the hornblende from the Noring granite have high MgO contents compared to other calc alkaline plutons and can be classified as magnesio-hornblende. The deduced magmatic crystallisation interval for the hornblende using the T-sensitive cations Ti and Al^{4+} gave values from 660 to 780°C (±70°C). The pressure of crystallisation of hornblende was estimated using the Al^{tot} pressure calibrations to give a mean value ranging from 1.89 to 3.08 kbar.

Tren Unsur-Unsur Surih dan Nadir Bumi Batuan Kompleks Benta, Pahang sebagai Petunjuk kepada Proses Pembentukan dan Evolusi Batuan

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Sebanyak 3 jenis batuan, iaitu diorit kuarza, sienit porfir dan monzonit dari Kompleks Benta, Pahang telah dianalisis dengan menggunakan teknik Pendaflour Sinar-X (XRF) dan Analisis Pengaktifan Neutron Instrumentasi (INAA) bagi mendapatkan nilai kepekatan 21 unsur surih dan 9 unsur nadir bumi. Unsur-unsur surih dan nadir bumi ini dikelompokkan kepada 6 kumpulan iaitu, kumpulan unsur LILE (large ion lithophile elements), unsur HFSE (high field strength trace elements), unsur logam peralihan (trace transition metal), unsur logam (trace metal), unsur tidak stabil dan unsur nadir bumi (rare earth elements). Daripada pengiraan indeks pembezaan, didapati arah pembezaan batuan adalah dari diorit kuarza kepada sienit porfir dan kemudian monzonit. Kesemua unsur-unsur ini telah diplotkan melawan indeks pembezaan, kecuali unsur nadir bumi. Tren plotan graf unsur-unsur ini menunjukkan keselarian dengan teori perubahan unsur di dalam pembezaan batuan yang dicadangkan oleh penyelidik lain. Daripada tren perubahan unsur-unsur surih ini juga diketahui proses peleburan separa yang berlaku terhadap diorit kuarza yang mana leburannya membentuk sienit dan sienit pula mengalami peleburan separa dan leburannya dicemari oleh diorit dan membentuk monzonit. Disokong dengan cerapan lapangan dan petrogarfi batuan, maka sejarah pembentukan batuan di Kompleks Benta boleh disintesis. Selain daripada itu, punca asalan batuan juga diketahui berdasarkan tren unsur-unsur nadir bumi. Ia merupakan jasad granit jenis I.

Petrography and Mineral Chemistry of the Perhentian Kecil Syenite, Perhentian Kecil, Besut, Terengganu

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The Perhentian Kecil syenite consists of a variety of igneous rocks ranging in composition from syenitic to monzonitic to gabbroic rocks. The essential minerals in Perhentian Kecil syenite are K-feldspar, plagioclase,

hornblende, pyroxene, quartz, biotite, sphene, epidote, apatite, zircon and magnetite. Composition of K-feldspar in the Perhentian Kecil syenite is near to pure orthoclase with An percentage less than 1%. Plagioclase compositions range from oligoclase-andesine ($An_{27.2-37.3}$). Magnesio-hornblende is the main amphibole type and the crystals show an increase of TiO_2 and Al^{iv} and decrease in CaO from core to rim. The deduced magmatic crystallisation interval for the hornblende in the Perhentian Kecil syenite range from 660 to 780°C (±70°C). Composition of the sphene plot in the igneous sphene field are similar to those from the Victoria Range granitic rocks, south island New Zealand. Apatite can be divided into clear and clouded parts. Chemical analysis of the clouded part has higher SiO_2, K_2O, Fe^{tot} and BaO, and both CaO and P_2O_5 have wider range in the clouded part compared to the clear part.

Petrografi dan Kimia Mineral Syenit Perhentian Kecil, Perhentian Kecil, Besut Terengganu

Syenit Perhentian Kecil terdiri daripada pelbagai batuan igneus berjulat daripada komposisi syenit-monzonit-gabro. Mineral yang lazimnya wujud dalam syenit Perhentian Kecil terdiri daripada K-feldspar, plagioklas, hornblend, piroksen, kuarza, biotit, sfen, epidot, apatit, zirkon dan magnetit. Komposisi K-feldspar dalam syenit Perhentian Kecil hampir kepada ortoklas tulen dengan peratusan An kurang dari 1%. Komposisi plagioklas menjulat dari oligoklas-andesin ($An_{27.2-37.3}$). Hornblend-magnesio adalah jenis amfibolit utama dan kristal menunjukkan pertambahan TiO_2 dan Al^{IV} dan penurunan CaO dari pusat ke bingkai. Sela pengkristalan magmatik untuk hornblend dalam syenit Perhentian Kecil berjulat dari 660–780°C (±70°C). Komposisi sfen dalam plot lapangan sfen igneus mempunyai kesamaan dengan batuan granit Banjaran Victoria, di pulau selatan New Zealand. Apatit boleh dibahagikan kepada bahagian yang cerah dan berkabus. Analisis kimia bahagian yang berkabus mengandungi SiO_2, K_2O, Fe^{tot} yang tinggi, dan BaO dan P_2O_5 mempunyai julat yang luas dalam bahagian berkabus berbanding dengan bahagian yang cerah.

Field Relations and Petrochemistry of the Jeli Igneous Complex, North Kelantan: Preliminary Observations

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The Jeli Igenous Complex is located about 1 km north of Jeli town, Kelantan which is part of the Jeli granite. Four main rock types occur in the area namely (in decreasing age) coarse grained foliated biotite granite (CFBG), grey microgranite (GM), medium grained foliated biotite granite (MFBG), and hornblende biotite basaltic dyke (HBBD). The field evidence suggests that both GM and MFBG magmas are synplutonic. The CFBG, MFBG and GM consists of typical granitic (s.l) mineral that is quartz, plagioclase, K-feldspar, biotite, zircon, apatite, sphene, allanite and opaque phase whereas the HBBD contains hornblende, quartz, plagioclase, biotite, apatite, sphene and opaque phases. Petrographic study shows that the rocks in the area have undergone both magmatic and high temperature solid-state deformation.

Jujukan Usia Batuan di Dalam Kompleks Benta, Pahang Berdasarkan Cirian Lapangan dan Penentuan Usia Batuan Secara K/Ar Keseluruhan Batuan

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Terdapat lima jenis batuan di dalam Kompleks Benta yang mempunyai hubungan sejarah dan genetik di dalam pembentukan batuan di kawasan yang dikaji, iaitu Jeram Besu dan bekas kuari JKR Benta, Pahang. Batuan ini ialah gneis psamit, diorit kuarza, sienit porfir, monzonit porfir dan telerang. Gneis psamit berlainan genetik dengan keempat batuan selebihnya, sedangkan diorit kuarza, sienit porfir dan monzonit boleh dikelompokkan di dalam suit batuan alkali berdasarkan unsur geokimia dan boleh ditentukan jujukan usia relatif berdasarkan cirian lapangan. Sementara telerang yang sememangnya paling muda didapati mempunyai cirian geokimia yang berbeza dengan batuan alkali. Bagi memastikan kesahihan jujukan usia secara relatif di lapangan, maka penentuan usia radiometri secara nisbah Potassium-Argon (K/Ar) keseluruhan batuan dilakukan. Perbandingan usia relatif batuan di lapangan dengan usia radiometri K/Ar menunjukkan keselarian. Dipercayai gneis psamit yang merupakan batuan metamorf berusia paling tua, diikuti oleh diorit kuarza (Jura Tengah), sienit porfir (Kapur Bawah) dan kemudian monzonit (Kapur Atas?) dan paling muda adalah telerang.

Significance of Mesozoic Radiolarian Chert in Sabah and Sarawak

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Mesozoic radiolarian cherts are exposed in west Sarawak and Sabah. The cherts are dated by detailed studies of the radiolarian faunas. The oldest datable chert is from the Serian Volcanics which is Plienbachian-Toarcian, Early Jurassic. The chert sequence at the base of Pedawan Formation yielded late Tithonian-Berriasian radiolarians. Three different ages were identified from the chert blocks of the Lubok Antu mélange; late Tithonian, Valanginian to Barremian and Albian-Cenomanian. The age of the chert from the ophiolitic and mélange associations in Sabah ranges from Valanginian to Cenomanian. The environment of deposition is determined by using rock association. All the cherts were deposited in deep-marine environment. The occurrence of bedded chert was very much related to the plankton productivity. There were high productivities during the Early Jurassic and Early to early Late Cretaceous.

Stratigraphic Position of the Rangsi Conglomerate in Sarawak

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The Rangsi conglomerate that outcrops in the Tatau Horst area in Sarawak has for a long time been regarded as the basal unit of the Tatau formation. The interpretation was, however, primarily based on the succession of the geological formations, and no detailed stratigraphic work was done to support the interpretation. A study conducted in this area using seismic stratigraphic technique shows that the Rangsi conglomerate is much younger than the Tatau

formation. This conglomeratic rock unit is possibly equivalent to the Balingian formation that is of late Miocene age. Furthermore, the area that is called Tatau Horst, seismically does not represent structural feature such as a "horst" of extensional tectonics. Instead, it is characterized by positive flower structure, suggesting that the structure was formed as a result of a transpressional strike-slip tectonic episode, during early to late Miocene times.

On the Palynomorph Assemblage from the Panti Sandstone, Kota Tinggi, Johor

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A fairly well-preserved palynomorph assemblage is described from a rock sequence of the Panti Sandstone which is exposed at a quarry to the north of Kota Tinggi, Johor. The rock sequence overlies an older granite body, and it consists of predominantly mudstone, siltstone and thinly-bedded sandstone layers followed by coarser-grained sandstone and conglomerate layers towards the top of the succession. The most common palynomorph genera present in the assemblage are *Classopollis*, *Cicatricosisporites*, *Aequitriradites*, *Ischyosporites* and *Ephedripites* together with genera that are of relatively rarer occurrence, which include *Dictyophyllidites*, *Polycingulatisporites*, *Baculatisporites*, *Concavissimisporites*, *Leptolepidites* and *Neoraistrickia*. Based on the palynomorph assemblage it appears that the rock sequence is Lower Cretaceous (Berriasian-Valanginian) in age and the climate during the deposition of the sediments was warm and dry.

Some Mid-Permian Fossils from Felda Mayam, Central Peninsular Malaysia

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A small suite of fossils consisting of ammonoids, brachiopods, bivalves, crinoids and plants were recovered from an outcrop in the Felda Mayam area, central Pahang, Peninsular Malaysia. The fossil locality represents the northern-most extent of a new rock unit, the Bera Formation. The peculiar permianellid brachiopod genus *Dicystoconcha* is recorded in Peninsular Malaysia for the first time. The assemblages of ammonoids and brachiopods indicate a Roadian to Wordian (early Guadalupian/Middle Permian) age. The brachiopod assemblage suggests warm-water Tethyan affinities.

On the New Permian Bera Formation from the Bera District, Pahang, Malaysia

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A new rock unit, the Bera Formation, is introduced for the newly found Permian strata exposed in the Bera District, Pahang. The lithology of the strata consists predominantly of mudstone/shale, siltstone and sandstone, with subordinate conglomerate. The lower part of the formation is made up of massive mudstone, thick to massive tuffaceous sandstone, siltstone and mudstone, and thinly bedded siliceous mudstone. The upper part of the formation consists of thinly to thickly bedded shale, siltstone, sandstone and conglomerate. Several fossiliferous horizons were discovered within the formation; they yield brachiopods, cephalopods, trilobites, bivalves, gastropods, fusulinids, plants and trace fossils. The faunal assemblages indicate a general Middle Permian age. The sedimentological and palaeontological aspects of the Bera Formation suggest a shallow marine depositional environment.

Aspek Paleontologi Formasi Pedawan Kawasan Batu Kitang – Bau, Sarawak

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Tafsiran usia batuan Fomasi Pedawan di kawasan Batu Kitang-Bau dilakukan berdasarkan data paleontologi yang diperolehi. Sebanyak 17 sampel yang berpotensi telah dikutip dari 11 lokaliti dikawasan ini. Kajian ini juga melihat sebab kesukaran memperolehi data paleontologi daripada kawasan ini dan melihat kemungkinan kajian lanjutan mengenai fosil dilakukan.

Development of Mudcracks in a Partially-Dried Tropical Pond

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Mudcracks formed in a partially-dried, tropical rain-water pond display distinctive crack patterns. The development of these cracks are governed and influenced by their position within the pond (which determines the thickness of the top mud layer), the rate and extent of drying that they undergo, and the length of exposure to drying period. Two generations of cracks were recognised — a first generation of mudcracks which developed within the top mud layer and a second set which forms within the underlying silty-mud layer. The first generation mudcracks begin its development at the pond margin areas where the mud layer is thin and the rate of drying is rapid. These cracks are then progressively propagated towards the pond centre where the rate of pore water expulsion (evaporation) from the thick, water-laden layer of mud is much slower. Rapid drying within the pond margin areas accelerate the development of several orders of shallow and wide cracks, and result in the formation of well-dried,

small and thin concaving mud polygons. In the region at the centre of the pond, the thickness of the mud layer retards the drying process, thus resulting in the formation of widely-separated, deep and narrow cracks which join up to form large polygons. The development of the second generation of cracks are restricted to the pond margin areas. Prolonged drying result in the contraction of the underlying silty-mud layer exposed by the earlier, wide-opening first generation cracks. These second-level cracks may develop as central fissures on first-generation crack terraces.

Coastal Sedimentation and Recent Coastline Changes Along the Seberang Perai Coast, Pulau Pinang

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The coast of Seberang Perai can be distinctly separated into a northern sandy coast and a southern muddy coast. The mixed sand-mud tidal beach in the north is made up of a clean, fine- to medium-grained sandy supratidal beach, a dirty (muddy) medium- to coarse-grained upper-intertidal sand and a lower-intertidal silty mudflat. The dominant grain size for the sandy supratidal zone display a southward decreasing trend. The grain size ranges between 1.25–2.5 ϕ (~ 0.42–0.18) in the north and between 2.5–3.25 ϕ (0.18–0.105 mm) in the south. This segment of the coast is also characterized by intensive infrastructure development. Large scale man-made structures here are the Dermaga Butterworth, Pengkalan Sultan Abdul Halim and the new North Port. A major coastal embankment and beach filling project is being carried out to slow down coastal erosion, and is nearing completion in Bagan Ajam, Bagan Lebai Tahir, Permatang Kucing and Bagan Belat. Muddy intertidal sedimentation prevails along the southern coast from Pengkalan Sultan Abdul Halim in the north, extending southward to the mouth of Sungai Kerian and the northern coast of Kuala Kurau. This coastal mudflat accretion, which may extend seaward several hundreds of metres and may reach a thickness of more than 1 m thick, is undergoing gradual stabilization and prograding seaward. Maps of the southern coast for the year 1962, 1970, 1977, and 1985 show that the mudflat accretion occurred steadily from 1962 to 1977; however, a very marked change in the rate and pattern of mudflat buildout occurred between 1977 and 1985. The buildout near Batu Kawan by 1985 indicate a significant increase in the rate of mudflat accretion. The mainland coastal mudflat has joined up with the mudflat of Pulau Gedung and Pulau Aman. This may have been related to the construction of the Penang Bridge. The marked contrast in coastal sedimentation between the northern and southern coast may be a function of the geology, the climatic regime and the prevailing marine processes. Sandy beach ridges of the Matang Gelugor Member of the Holocene Gula Formation underlies the northern coastal areas while the southern coast is underlain by the older Undifferentiated Member of the Gula Formation which is composed of clay, silt and sand. Climatically, the northern coast received more precipitation then the south. This may have some influence on the weathering pattern and runoff efficiency in the coastal areas. Sediment transport in the Seberang Perai coast may have been affected by both the south-eastward current and the north-westward current (the flood and the ebb current). The southward-fining trend in sand grain size observed along the northern coast of Seberang Perai may have been the result of the south-eastward longshore drift. On the other hand, the southern muddy coast clearly show evidences of northward rivermouths displacements and mudflat 'spits' deflections that must have been caused by the prevailing west-northwest longshore currents.

Conservation Geology: A Multidisciplinary Approach in Utilization of Earth Resources Without Destruction

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The new field of conservation geology requires the input of the entire traditional fields of geology. A successful research and development programme for the advancement of this field requires expertise from other disciplines such as planning, law, tourism and management. Geologists should lead the development efforts and multidisciplinary networking in order to ensure that geology contributes to the aspirations of sustainable development.

Geoart — Turning Rocks Into Art

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Geoart is the study and appreciation of the beauty that is found in the landforms, rocks, minerals and fossils of the Earth. It exists on many scales from the whole planet captured on film from outer space to the pictures of atoms and molecules captured by cutting edge electron microscopes. Most geoart that is accessible to the general public are in between them, from images of landscapes and rock outcrops to collections of rocks, minerals and fossils. Geoart can be categorized into natural or modified, image or object depending on whether it is natural or had been artificially worked on and whether it has been captured on film and other media or is an actual three dimensional object or not. The most important tool for geoart is a keen eye for beauty in rocks. Three ways of popularising geoart is to be a geoartist, a geoart promoter or a geoart patron. Geoart is therapeutic as it brings us closer to nature. Rocks are not only there to be used but also to be loved.

Proposed Conservation of Badak Cave C, Lenggong as Vertebrate Fossil Site Extraordinary

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Remnants of three extraordinary beds of calcified alluvial sediments containing numerous teeth and bones fossils from a number of species of mainly large herbivorous vertebrate were found in the Badak Cave C in the Lenggong Hills, Ulu Perak. These alluvial beds which appeared to be deposited at slightly different time probably in the Late Pleistocene, represent fillings of the cave floors by sediments brought in by floodwaters. The richness of these fossil remains within the three beds (from 50 cm to about 1 metre thick) is extraordinary. One or more catastrophic flood events are believed to have caused the mass death of mainly herbivores trapped in front of the tower limestone hills close to the cave entrance. The remains were then subsequently transported into the cave and deposited with the sandy sediments of granitic origin after another flood. The fossil parts of the large vertebrate consist of mainly teeth and numerous skeleton parts. There could be tens or more of individual vertebrates though identified large herbivore species include seladang (one adult and one juvenile), sambar deer, the bucking deer and probably a young elephant and other herbivores and a civet cat. Because of its richness in fossil bones and teeth and its unique occurrence, it is proposed that the Badak C cave with its fossil remains be studied systematically in detail

and be preserved and gazetted as a Geological Site of Special Scientific Interest. By itself it shows good potential for attracting tourist and in conjunction with the Paleolithic Kota Tampan and the nearby epi-palaeolithic Perak Man site, can form an archeological-geological eco-tourist complex of great significance for Malaysia.

Tourism Geoscience: A New Subdiscipline in Geoscience Education

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Tourism Geoscience is a new subdiscipline of geoscience education. It is also a paradigm for understanding the earth environment for long-term nondestructive utilisation of its heritage. The subdiscipline focuses on geoscientific assets management, land use planning and development of the human habitat. These are the main components of its elaboration. The other major trust of Tourism Geoscience is resource evaluation. It converges on the interrelationships between geoscape foundation, biotic system and human culture. We can visualise the premise as anthro-bio-geo-ecosystem. This leads us to appreciate ideas such as (1) Intrinsic value, (2) Non-destructive Resource Utilisation, (3) Dynamic Equilibrium and Continuum of Ecosystem, (4) Human Habitat Planning and Earth Environmental Foundation Management, and (5) Touristic Development Abstraction as the Precursor of Tourism Development. The Tourism Geoscience subdiscipline can now be described as a fusion process for achieving sustainability. It involves evaluating, planning and managing geoscape resources. The main goal is towards sustainable development of a human industry. The career of a tourism geoscientist would span the entire life span of geoscape utilisation. It covers a wider range of responsibilities from exploring, discovering, planning and managing. This is in response to new emerging industrial trends, rising standard of living and greater leveraging of knowledge. It is imperative that initiatives for a broader approach to geoscience training are explored. As the science for understanding the earth, geoscience can become a popular science. Only then can the prospect for statutory recognition and a greater role of geoscientist in society can be realised. At the School of Environmental and Natural Resources Sciences, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, Tourism Geoscience has now been offered as an option. All students of the school can register for a package or a module in Geology and Environmental Science programmes, respectively.

The Characteristics and Origin of Some Limestone Caves in the Sungai Perak Basin

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Caves are commonly found in limestone hills throughout Sungai Perak Basin as a result of the action of various factors such as structure, drainage and previous climate, which control the rising and lowering of previous sea levels and determines the level of the groundwater table. Their characteristics such as the levels of the caves, shape, cave deposits as well as the origin are significantly related to the surrounding rocks and climate during the Quaternary. These caves were interpreted to have been formed by the action of freshwater. The active caving in Gua Tempurung is made possible by the constant allogenic water source from the neighbouring granitic hill. Some chambers are still being enlarged by percolating meteoric water through cracks and joints and form vertical and horizontal scallops.

Kundasang-Ranau: Dataran Warisan Ais Gunung

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Kawasan Kundasang-Ranau merupakan satu-satunya geotapak di Malaysia yang menunjukkan proses bahan endapan tiloid yang meluas yang terawet di kawasan tropika lembab. Endapan Gravel Pinausok dikatakan diendapkan pada masa Pleistosen Akhir iaitu kira-kira 37,000 tahun atau lebih tua berdasarkan kepada jumpaan fosil kayu yang ditentukan usianya melalui teknik radiokarbon. Ia terdiri daripada dua unit batuan iaitu Unit Bawah dan Unit Atas yang menggambarkan dua fasa pengendapan iaitu fasa pertama melibatkan pengendapan batuan oleh pengglasieran dan fasa kedua akibat aliran lumpur kuno. Hasil kajian petrografi, batuan punca Gravel Pinausok adalah berasal daripada batuan sedimen Tertier iaitu Formasi Trusmadi dan Formasi Crocker, batuan granodiorit daripada jasad batuan rejahan Gunung Kinabalu sementara bongkah ultrabasik daripada batuan ultrabasik yang membentuk sempadan antara batuan rejahan granitoid dan batuan sedimen Tertier disekeliling Gunung Kinabalu. Memandangkan nilai saintifik yang tinggi, pemuliharaan perlu dilaksanakan dengan mengisytiharkannya sebagai landskap terpelihara. Zon semulajadi ini dipantau oleh organisasi seperti Majlis Daerah dan Taman-Taman Sabah.

Pantai: Sumber Geopelancongan Berpotensi

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Secara tradisinya, fungsi pantai tertumpu kepada perikanan dan pelancongan. Kajian ini mengetengahkan satu lagi fungsi tambahan pantai iaitu sebagai sumber geopelancongan. Sumber geopelancongan merupakan satu komponen Sumber Warisan Geologi dan Landskap. Namun demikian, nilai warisan geologi yang wujud di pantai agak kabur walaupun telah lama dieksploitasi. Sumber Geopelancongan pantai telah dikaji bagi menentukan nilai warisan geologi yang terdiri daripada nilai estetik, rekreasi, saintifik dan budaya.

Chemical Pollution in Acid Sulfate Soils

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Soils containing pyrite (FeS_2) formed by natural processes under anaerobic conditions are widespread in Southeast Asian countries. It is possible that the pyrite contains As and Cd. These soils, classified as acid sulfate soils, are utilized for crop cultivation. Studies conducted in Malaysia indicate that toxic materials can be released into the soils and groundwater in the surrounding areas when the pyrite in the soils undergoes oxidation. This paper reports release of toxic materials into the soils and the surrounding environment when acid sulfate soils are drained to make way for development. Soil samples were selected from among the acid sulfate soils in the country. Some of the samples were maintained in unoxidized state, while others were exposed to the atmosphere. They were analyzed by various methods, including standard chemical methods, XRD and SEM-EDAX. Pyrite was found in the unoxidized state, while jarosite [$KFe_3(SO_4)_2(OH)_6$] and natrojarosite [$NaFe_3(SO_4)_2(OH)_6$] were present in oxidized samples. The Fe to S ratio of the pyrite structure was 1:2, indicating that accessory elements were absent within the pyrite structure. Oxidation of the pyrite would not lead to contamination of As and Cd in the soils. In the oxidized samples, some Mn were also detected. The metal along with Fe and Al were present in large amounts

in the water extract of the oxidized samples. This means that Al and Fe toxicity are a common problem in the areas covered by acid sulfate soils.

Landslide Hazard Zonation Mapping Using Statistical Approach

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Numerous research projects on slope stability hazards have been done over the last thirty years. Initially the investigations were mainly oriented to solving instability problems on site and techniques were developed by engineers to appropriately design a planned structure, to prevent slope failure. In order to solve this problem and considering that hazard assessment has to be based on careful study of the natural conditions of an area and an analysis of all the possible parameters involved in the slope stability processes, several types of landslide hazard analysis techniques have been developed. The statistical approach is a well known methodology and has been used worldwide. The results of slope stability investigations using the Information Value Method and Weight of Evidence approach delineated the most hazardous zones. Most of these zones are located along the east of the mapsheet and situated on the hilly areas. These are Dengkil, Serdang Lama, Sg. Besi and part of the Keramat and Melawati areas.

Geochemical Evaluation of Contaminated Soil for Stabilisation with Lime

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Stabilisation of heavy metals by addition of lime is proposed to protect water and soil from contamination. Two contaminated soil samples namely clayey soil and waste sediment from Ranau, Sabah, were treated with hydrated lime [$Ca(OH)_2$] in this study. According to the physico-chemical properties, the clayey soil sample is more capable of being stabilised with the addition of lime, thus reducing the amount of leachate to the environment whereas the waste sediments may need more lime to arrest the heavy metals.

Heavy Metal Pollution of the Semenyih River

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A study was conducted on the heavy metal concentrations along the Semenyih River under different landuses. Four areas were selected to represent different landuse namely: forests, settlements and industry, agriculture and

mixed farming (crop and animal production). Water samples from a total of 11 stations were collected and analysed for heavy metals. Statistical analysis of the data show that the differences in heavy metal concentrations in the Semenyih River under different landuse are significant except for the forest areas.

Geological Input for the Development of the Paya Terubong-Relau Area, Pulau Pinang

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The Paya Terubong-Relau area was investigated to provide geological information to enable development of the area. The results of the investigation will assist town planners to prepare landuse zoning maps and engineers to prepare preliminary construction design.

Perubahan Garis Pantai dan Susutan Darat: Cadangan Geoindikator Yang Berpotensi

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Pengurusan bersepadu zon pinggir pantai perlu dijalankan bagi mengatasi masalah persekitaran pinggir pantai yang sebahagian besar berkaitan dengan proses-proses geologi. Proses-proses geologi memainkan peranan penting dalam menyebabkan perubahan garis pantai dan susutan darat. Antara geoindikator yang dicadangkan bagi memantau perubahan garis pantai ialah perubahan aras laut, perubahan geomorfologi, perubahan tindakan fizikal dan perubahan guna tanah. Beberapa parameter telah dikenalpasti bagi geoindikator tersebut.

Penterjemahan Maklumat Geosains untuk Perancangan dan Pengurusan Geobencana

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Kejadian geobencana merupakan salah satu kriteria yang harus dipertimbangkan dalam perancangan dan pengurusan gunatanah. Kebanyakkan kejadian geobencana bandar di Malaysia dapat dielakkan sekiranya maklumat geosains diintegrasikan dalam proses perancangan. Peta-peta terbitan geosains yang kaya dengan maklumat pada kebanyakan kes tidak dipakejkan untuk golongan bukan geosains menyebabkan aspek geobencana sukar digunakan dalam proses perancangan. Peta-peta yang lebih mesra pengguna diperlukan supaya perancang dapat mengambilkira impak geobencana semasa membuat keputusan.

Rainfall and Slope Failures in the Granitic Bedrock Areas of Peninsular Malaysia

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Most slope failures in the granitic bedrock areas of Peninsular Malaysia occur during, or following, short periods (< 3 hr) of intense rainfall, or longer periods (> 1 day) with somewhat continuous rainfall. These failures usually occur when the total cumulative rainfall exceeds 70 mm and include debris flows that occur at steep (> 40°) natural ground slopes and embankments in mountainuous terrain. Slump-flows occur at embankments in undulating to hilly terrain. Earth falls and shallow slips occur at steeply sloping (> 60°), low cuts, and upper benches of high cuts (> 10 m high), that expose completely weathered bedrock materials (Morphological Zone 1). These failures occur long after the end of excavation and are usually preceded by the development of tension, and desiccation, cracks. Where the low cuts intersect groundwater tables in undulating terrain, slumps can sometimes occur. Small to large, slumps and slump-flows, occur at high cuts (> 10 m high) excavated at moderate overall angles (usually > 45°, though mostly > 55°), that expose completely weathered, and highly to moderately weathered, bedrock materials (Morphological Zones I and II). These failures occur towards, as well as some months to several years after, the end of excavation; the slumps only occurring at cuts where unweathered bedrock is found close to the ground surface. The slump-flows occur as a result of several converging factors, including the presence of a triggering factor that can be provided by passing heavy vehicles. Wedge failures, block slides and rock falls can occur at the steep (> 60°) lower benches of some high cuts that expose unweathered bedrock (Morphological Zone III)

Physico-Chemical Properties of Graphitic Schist Soils in the Rawang Area, Selangor

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Graphitic schist soils in the Rawang area have been analysed for their physico-chemical properties. Results indicate that the graphitic schist soils are characterised by their silty nature, low plasticities, generally low compacted densities, highly acidic pore fluids (low pH's), and dispersive behaviour. These results support the previous findings on graphitic schist soils conducted in other areas such as the Melaka and South Johore areas.

Pencirian Geomekanik Jasad Batuan Riolit, Genting Sempah, Selangor-Pahang: Beberapa Hasil Awal

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Pemetaan profil luluhawa dan pengimejan kerintangan geoelektrik di satu cerun potongan batuan riolit di Jalan Genting Sempah-Gohtong Jaya menghasilkan keputusan berikut:-

1. Lima gred luluhawa, daripada gred I, batuan segar, sehingga gred V, batuan terluluhawa lengkap, dapat

dipetakan. Tanah baki iaitu gred VI tidak ditemui, manakala gred IV merupakan gred luluhawa yang paling dominan.

2. Taburan dan ketebalan gred-gred luluhawa adalah berbeza-beza dan menunjukkan ketidakhomogenan peluluhawaan. Umpamanya batuan segar, iaitu gred I bukan sahaja ditemui pada dasar cerun potongan tetapi juga di bahagian pertengahan cerun.
3. Satu lagi ketidakhomogenan yang ditemui ialah kehadiran bahan dengan gred luluhawa lebih tinggi dikelilingi bahan bergred luluhawa lebih rendah. Perkara ini dikaitkan dengan keamatan satah ketakselanjaran. Bahagian dengan keamatan ketakselanjaran lebih tinggi mengalami peluluhawaan yang lebih pesat dan wujud di dalam bahan yang kurang terluluhawa.
4. Pengimejan kerintangan geoelektrik dapat memetakan bahagian-bahagian yang segar dan terluluhawa sedikit daripada yang terluluhawa tinggi berdasarkan nilai-nilai kerintangan spesifik daripada satu datum ke datum yang lain.

Preliminary Design Parameters Based on Laboratory Shear Test of Core Samples

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It is essential that the preliminary design data for a civil engineering structure is reliable and can be acquired at minimal cost. For a structure that requires excavation of rock mass, the shear strength of critical rock joints is among the fundamental data required. Rock core samples collected during preliminary sub-strata investigation of a project site are the most appropriate source of information for the *in situ* rock. In the laboratory, specific equipment can be used to test these core samples. However, the reliability of laboratory data as design parameters greatly depends on how they are assessed and interpreted. With regard to joint shear strength, the assessment must include consideration on factors which affect shear behaviour of the joint.

Perkaitan Antara Saiz Butiran, Indeks Keplastikan dan Kandungan Mineral Lempung Dengan Kestabilan Cerun di Bukit Arang, Universiti Malaya, Kuala Lumpur

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Kajian yang dijalankan keatas tanah disekitar Bukit Arang Universiti Malaya, bertujuan untuk menganalisis taburan saiz butiran, had plastik, had cecair, indeks keplastikan dan jenis mineral lempung pada batuan yang telah terluluhawa dengan gred yang berbeza. Objektif kajian ialah untuk mengenal pasti samada parameter–parameter tersebut mempengaruhi kestabilan sesuatu cerun. Dari analisa yang telah dijalankan didapati had plastik, had cecair dan indeks keplastikan tidak dipengaruhi oleh saiz butiran. Walaubagaimanapun kehadiran mineral lempung, terutamanya daripada jenis kaolinit menurunkan nilai indeks keplastikan tanah dan seterusnya mendorong kepada penurunan kestabilan sesebuah cerun, terutamanya pada masa kerpasan yang tinggi.

Relict Structures and Cut Slope Failures in Highly to Completely Weathered Rocks Along Jalan Tg. Siang, Kota Tinggi, Johor

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A new road to Tg. Siang was completed in late 1998 as a by-pass to Tg. Balau and Tg. Siang from the main Kota Tinggi road. The by-pass transverses a gently undulating terrain of metasedimentary rocks of the Mersing Group (Permo-Carboniferous), consist of interbedded phyllite, slate and quartzite with minor intercalation of metavolcanics. The regional structural strike is in the NW-NNW direction and is dominated by dextral transpressional shear zones, intervened by zones of multiply deformed, tight to isoclinal folds. A slope failure survey conducted in September 1999, followed by geological mapping in April 2000, found that the number of slope failures increased from 10 to 18 cases. All the failures involve slopes cut in zones of highly-completely weathered rocks (grade IV-V) and residual soils (grade VI). The presence of relict structures has been identified as the main geological factor in controlling the failures, in addition to water and slope materials. Most of the slope cut failures in highly weathered rock (engineering soils) took place in the form of undercutting-induced failures. Instabilities of the slopes were initiated by ravelling of the loose materials, rill and gully erosions, which was subsequently followed by earth falls, shallow slips, earth wedges and/or slumping. The failure planes are largely controlled and defined by relict structures (e.g. relict joints, foliations, bedding and/or shear zones). Results of this study highlight the importance of geological input, especially on the nature and orientation of relict structures in slope engineering. Cut slopes in highly-completely weathered rocks should not be oversimplified and treated as homogeneous soil slopes. Instead, they should be treated as discontinuity-controlled soil or weak rock mass in order to successfully implement safe and economic design. It is always a good practice for the slopes to be mapped by engineering geologists with sound structural background or vice-versa, structural geologists with some knowledge of engineering geology. The structural mapping should be carried out during the site investigation stage to choose the most suitable alignment, and during construction to check the results and interpretation made in the earlier pre-construction stage.

The Characteristics and Engineering Properties of Soft Soil at Cyberjaya

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This paper provides information on the distribution and characteristics of peat and organic soil which is distributed around the Multimedia Super Corridor area. Peat and organic soils are the ultimate soft soils in engineering terms. The behaviour of peat and organic soils is usually determined using the concepts and methods developed for inorganic soil. However, important anomalies exist, and these are given emphasis in the present overview of the mechanical behaviour of these soils. Peat and organic soils are difficult to sample and test using normal soil techniques, and in fact there is not even an adequate engineering system in place for classifying these soils. The characteristics and engineering properties of these soils are presented with respect to its earthwork and geotechnical performance. A preliminary classification system of these soils are also proposed.

The Prospects for Hardrock Gold and Tin Deposits in Malaysia

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Tin and gold mineralization in Peninsular Malaysia is found as distinctive parallel belts, which are apparently related to the structures and the tectonic setting of this region. Sarawak and Sabah, across the South China Sea, are hosts to gold deposits related to the magmatism of the region. Tin deposits in the Western and Eastern belts of Peninsular Malaysia that had been mined using hardrock methods are: quartz topaz aplite, cassiterite-magnetite skarn, cassiterite-malayaite skarn, skarn pipes in limestone, greisen, structurally-controlled complex lodes, sheeted veins, and replacement ore bodies in granite. Primary tin deposits mined as soft rock deposits using alluvial mining technologies include: cassiterite-bearing pegmatites, greisen type, xenothermal vein swarm and sheeted veinlets. The best potential for hardrock tin deposits are: (1) Structurally controlled lodes; (2) Greisen types (massive greisens and greisen-bordered veins); (3) Sheeted veins and veinlets, and (4) Cassiterite-magnetite skarns. The Greisen type and sheeted vein types are potential targets for modern opencut bulk mining techniques. Old "lampanned" areas on higher ground upstream of very rich alluvial tin deposits are good targets for systematic exploration and evaluation for hardrock and soft-rock mining. The rather widespread gold mineralization in Peninsular Malaysia is dominated by the deep source Mesozoic mesothermal veins hosted largely in the strongly folded and weakly to moderately metamorphosed rocks of Paleozoic to Triassic age. Based on the style and the location, the primary gold mineralization can be divided into 4 distinct N-S belts. Recent prospecting of long abandoned hardrock gold mines in Gold Belt 2 and 3 had lead to the opening of one hardrock opencut mine (Penjom) while two more (Selinsing and Buffalo Reef) are on stream. In Belt 4, the gold rush of 1989–1991 in the Lubok Mandi area, Terengganu had yielded a hardrock mine exploiting multiple mesothermal gold-quartz veins in shear zone mineralization in Upper Carboniferous metasediments. The most prospective sites for commercial gold deposits are along the 340° to 350° striking regional fractures in Gold Belts 2 and 4, which tap deep source gold-bearing solution. In Gold Belt 3, commercial veins and gold mineralized zones are expected to strike along 345° and 030°. Central Kelantan and northern Pahang show potential for gold-bearing volcanogenic massive sulphides. In East Malaysia, economic gold mineralization in Bau, Sarawak is regarded as the classical epithermal Au-Ag-As-Sb-Pb-S vein type associated with dacitic igneous intrusives of Miocene age. Cu-Mo-Au porphyry, Cu-Au skarns, replacement ore bodies in shales and limestones and disseminations in shales have recently been identified. The Bau area and its extensions towards the north and south are being investigated presently. In Central Sarawak, (Sibu-Sarikei) a younger and still not fully exposed Au-Sb-Ag-Hg mineralized zone is a good prospect for large gold deposits. In the Sabah, gold had been commercially produced from a small Cu-Au porphyry deposit (Mamut) that was genetically related to the Gunung Kinabalu granodiorite-diorite intrusive. Mamut located within the Central Sabah geochemically anomalous belt which shows potential for porphyry, epithermal, massive sulphide and classical Au-Sb-As-Hg vein types gold deposits. It is predicted that the Central Sabah geochemically anomalous belt will become one of the most sought after area for exploration of gold and other metals in the near future.

Tembaga Porfiri di Pelepah Kanan, Kota Tinggi, Johor

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Permineralan besi skarn dan timah di Pelepah Kanan, Johor cukup terkenal dan mendapat perhatian banyak pengkaji. Litologi kawasan tersebut terdiri daripada batuan metasedimen (hornfels kalka-silikat) berusia Perm Akhir yang direjahi granit serta mikrogranit berusia Trias Akhir. Struktur utama di kawasan ini ialah sistem sesar mengarah N140°E/80° dan N300°E/80°, yang mengawal rejahan igneus dan telerang kuarza. Daripada kajian ini,

selain daripada mineral-mineral besi-skarn dan timah, terdapat juga mineral-mineral tembaga primer dan sekunder yang terbentuk selepas permineralan besi-timah, yang dikaitkan dengan rejahan mikrogranit. Perubahan batuan dinding iaitu pensilisifikasian, penargilitan dan pempropilitan juga dikenalpasti berkaitan dengan permineralan tembaga ini. Kajian geokimia dan unsur surih menunjukkan batuan igneus kawasan kajian berkaitan dengan subduksi. Berdasarkan maklumat-maklumat tersebut, maka dibuat kesimpulan bahawa selain daripada mengandungi besi dan timah, Pelepah Kanan juga adalah kawasan permineralan tembaga porfiri.

Construction Aggregate Resources in the Federal Territory and Central Selangor

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The Federal Territory of Kuala Lumpur and Selangor have produced 29% of the total crushed rock production in Malaysia. The average consumption per capita in 1998 was 3.74 tonnes of aggregates. It is estimated that the current rock reserve in this area can only cope with the demands of this region for the next 30 years. Thus, the exploitation of aggregate resources must be planned carefully and integrated with other types of landuse.

Unsur Surih di dalam Pemineralan Bijih Besi Primer dan Hasil Luluhawanya di Kawasan Sungai Merbok

HABIBAH BT HJ JAMIL & WAN FUAD WAN HASSAN

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Bijih besi primer yang dominan di Sungai Merbok adalah hematit. Ia mengandungi As dan Co yang tinggi dan wujud sebagai mineral kalkofil. Zn dan Cu wujud dalam kepekatan yang sederhana sebagai bendasing (impurities). Pb dan Cr pula tidak terdapat di dalam bijih besi. Terdapat tiga jenis taburan unsur surih di dalam sedimen. Pertama, kepekatan unsur surih di dalam bijih dan sedimen adalah hampir sama, iaitu Co. Kedua, kepekatan unsur surih di dalam sedimen adalah lebih rendah berbanding dengan bijih besi, iaitu As dan Zn. Ketiga, kepekatan unsur surih di dalam sedimen adalah lebih tinggi walaupun unsur tersebut tidak terdapat di dalam bijih besi, iaitu Pb dan Cr. Kehadiran unsur-unsur tersebut dipengaruhi oleh batuan sekitar yang menempati sebahagian besar kawasan Sungai Merbok iaitu Formasi Mahang. Selain daripada Co dan Zn, unsur surih cenderung untuk berada di dalam sedimen yang bersaiz kasar.

Relevance of Geoscience in Quarrying

KHOR PENG SEONG

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The relevance of geoscience in quarrying seems pretty obvious as quarrying is the extraction of rock resource from the ground. What is less obvious is that geoscience knowledge can assist in improving productivity, health, safety, environmental and value creation in quarrying. Good drilling and blasting is the frontline of productivity in quarrying operations and geoscience assists in evaluation of drillability, blastibility and crushibility of rocks. The

structure and nature of rock being quarried affect face stability and types of dust produced. Good geoscience knowledge of the quarry grounds enables better control of environmental impacts of quarrying operations and reduces potential anomalous environmental impacts. Detail geological evaluation of rock deposits assist in selective quarrying, producing higher valued industrial products rather than cheap rock materials. Quarry management should realise the importance of geoscience knowledge of their site and use it to improve their quarrying operations and profitability.

Petrofabrik Batu Kapur Formasi Chuping, Perlis dan Kesannya Pada Kereaktifan Kapur

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Kajian ini dilakukan untuk mengenalpasti kesan beberapa parameter petrofabrik batu kapur, seperti saiz butiran, jenis mineral dan struktur liang pada sifat kereaktifan kapur. Batu kapur Formasi Chuping ini boleh dikelompokkan kepada empat litofasies utama iaitu biomikrit, biopelmikrit, biosparit dan dolomit. Perbezaan tekstur keempat-empat litofasies ini dicerap menggunakan mikroskop geologi dan mikroskop imbasan elektron. Ia juga disokong secara kuantitatif oleh nilai pekali tekstur (TC) daripada analisis menggunakan alat penganalisis imej. Sebanyak 36 sampel yang mewakili keempat-empat litofasies batu kapur Formasi Chuping telah dikalsin selama 1 jam 30 minit pada empat peringkat suhu iaitu 900°C, 950°C, 1,000°C dan 1,050°C. Kereaktifan kapur yang terhasil diuji berdasarkan kenaikan suhu maksimum selepas dua minit kapur ditindakbalaskan dengan air. Batu kapur yang melimpah dengan kalsit, berbutiran halus dan berkeliangan tinggi mempunyai kereaktifan yang tinggi pada tahap pengkalsinan optimum. Kapur dengan kereaktifan yang tinggi memenuhi kriteria utama yang diperlukan oleh kebanyakan sektor komersil yang menggunakannya.

Towards Sustainable Development — Indicators for the Minerals Industry

JOY J. PEREIRA & IBRAHIM KOMOO

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

Indicators provide the minerals industry with a means of informing all stakeholders about their contribution to ensure socio-economic well-being and actions that have been taken to improve environmental performance. This paper describes indicator development initiatives for the minerals industry in Canada, Australia and Malaysia. The Canadians are in the process of developing a conceptual framework to identify sustainable development criteria and indicators for the mineral industry to fulfil institutional requirements. Indicator development in Australia and Malaysia is still at the research stage.

Recent EPMA Applications in Geology and Industry

G.H. TEH

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The electronprobe microanalyzer or EPMA has proved to be a useful analytical tool in earth science research and the industry in Malaysia. The EPMA has been harnessed in the characterisation and exploration for gold, nickel, cobalt, tin, and heavy minerals as well as mineralogical research where quantitative analyses and structural formulae are required. The majority of samples come from the industry where variations in the composition of samples and contaminants are important. Elemental distribution patterns revealed in X-ray maps are sought after in the types of remedial measures taken to improve the quality of the products.

Application of Geoelectrical Resistivity Imaging for Site Investigation

ABDUL RAHIM SAMSUDIN, UMAR HAMZAH, ABD. GHANI RAFEK & RAHMAN YAACUP

Program Geologi, Pusat Pengajian Sains Sekitaran dan Sumber Alam
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Two dimensional geoelectrical resistivity imaging has the ability to image the subsurface by analysing the resistivity distribution within the earth. It provides general information on subsurface geological strata and the depth to the bedrock below the lines of traverse. The resistivity imaging surveys carried out basically measures and maps the resistivity of subsurface materials. The resistivity anomalies may indicate the presence of geological features, which may introduce geotechnical hazards in an area planned for development. This paper briefly describes some results of geoelectrical resistivity imaging surveys to assist in understanding the underground conditions at three development sites in Malaysia. The surveys were conducted using the ABEM SAS300C terrameter with LUND ES464 electrode selector system. The resistivity imaging surveys in these studies were used to investigate the occurrence of sinkholes and cavities in the limestone bedrock, to help in delineating the bedrock profile at the development sites and to characterise the weathering profile of a quartz mica schist slope cut at km 67 of the east west highway, north of Peninsular Malaysia.

Penggunaan Teknik Geofizik dan Geokimia Untuk Mencirikan Struktur Subpermukaan dan Akuifer di Sekitar Olak Lempit, Selangor

UMAR HAMZAH, ABDUL RAHIM SAMSUDIN, ABDUL RAHMAN YACCUP,
RASHID BACHIK & ABDUL GHANI RAFEK

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Satu kajian geologi, geofizik dan geokimia air tanah telah dilakukan disekitar Dengkil hingga ke Olak Lempit, Selangor untuk mengkaji struktur bawah tanah dan ciri-ciri akuifer yang terdapat dalam lembangan tersebut. Kawasan kajian dibatasi oleh garis lintang 2°46'U hingga 2°53'U dan garis bujur 101°30'T hingga 101°41'T serta mencakupi keluasan disekitar 260 km^2. Hampir 80% dari kawasan kajian dilitupi oleh enapan Kuaterner dari Formasi Gula dan Formasi Beruas yang berusia Holosen. Terenap dibawah aluvium ini ialah Formasi Bukit Kenny yang sebahagian darinya tersingkap disekitar Bukit Tampoi, Dengkil. Singkapan tersebut menunjukkan ciri litologi dan struktur yang sedikit berbeza dari yang pernah dilaporkan. Ciri-ciri metamorfisme yang terdapat tidak begitu jelas, batuan gunung berapi yang belum pernah dilaporkan sebelumnya telah ditemui di lokaliti berhampiran dengan Bukit Tampoi. Batuan andesit (?) ini dipercayai berasal dari letupan bom volkano yang datangnya dari tempat yang

berlainan. Kajian geofizik berpusat di sekitar hampir kesemua lubang gerudi yang terdapat di kawasan kajian yang digunakan untuk pemantauan air bawah tanah oleh Jabatan Mineral dan Geosains. Teknik-teknik survei yang dijalankan termasuklah survei seismos biasan, seismos pantulan dan survei kerintangan geoelektrik. Survei-survei tersebut dilakukan khususnya untuk mentafsir struktur bawah tanah dan kedudukan akuifer. Peralatan yang digunakan termasuklah ABEM TM3, ABEM SAS 300C dan ABEM AC Terrameter. Survei seismos dijalankan secara konvensional manakala survei pengprofilan geoelektrik dijalankan menggunakan susunatur Wenner. Kesemua hasil yang diperolehi adalah dalam bentuk keratan rentas 2-D. Hasil survei geofizik akan dirujuk kepada maklumat lubang gerudi untuk pentafsiran selanjutnya. Pada amnya survei seismos berhasil untuk menbahagikan bahan bawah tanah di kawasan kajian kepada beberapa lapisan berdasarkan kepada julat halaju yang dihitung. Bahan yang berhalaju di sekitar < 600 m/s dikelompokkan sebagai lapisan tanah atau aluvium teratas yang biasanya lembut dan tepu air. Manakala halaju seismos yang diukur dalam julat 1,000-3,000 m/s ditafsirkan sebagai mewakili lempung berpasir dan pasir berkerikil. Bahan berhalaju melebihi 3,000 m/s dianggap mewakili batu dasar yang terdiri dari batuan metasedimen terluluhawa. Gambaran mengenai kemasinan air bawah tanah dan kadangkala jenis batuan yang diwakilinya dapat dianggarkan dan hasil survei keberintangan geoelektrik. Bahan berkeberintangan < 10 Ωm digolongkan kedalam kelompok berair masin, manakala zon air payau berkeberintangan diantara 10 hingga 70 Ωm dan zon air tawar pula adalah dalam lingkungan 100 hingga 200 Ωm. Nilai keberintangan > 1,000 Ωm adalah mewakili batuan dasar. Analisis kimia yang dijalankan terhadap sampel-sampel air dari telaga pemantauan cetek dan dalam menguatkan lagi penemuan zon-zon air yang ditentukan oleh survei geoelektrik. Survei seismos pantulan yang dijalankan disekitar satu telaga telah dapat mengprofilkan bentuk batu dasar metasedimen pada kedalaman disekitar 50 meter yang gagal diterokai oleh survei geofizik yang lain.

Kajian Geofizik Kejuruteraan Dalam Penentuan Satah Gelinciran di km 6, Jalan Temerloh-Mentakab, Pahang

RAHMAN B. YACCUP, ABDUL RAHIM SAMSUDIN, UMAR HAMZAH & ABDUL GHANI RAFEK

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Satu kajian geofizik kejuruteraan telah dilakukan secara terperinci untuk mengkaji gelinciran tanah, di km 6, Jalan Temerloh-Mentakab, Pahang. Hasil kajian menunjukkan, terdapat tiga satah lemah yang mungkin mewakili satah gelinciran untuk cerun potongan jalan yang dikaji. Satah-satah ini dijumpai di kedalaman 5.45 m, 10.1 m dan 15.45 m dari permukaan. Satah pertama dicirikan oleh nilai N = 6, peratusan bahan bersaiz < 63 μm lebih daripada 63%, perubahan halaju gelombang P dari 510 m/s ke 1,700 m/s dan gelombang S dari 250 m/s ke 960 m/s. Satah kedua dicirikan oleh perubahan halaju purata gelombang P dari 670 m/s ke 2,210 m/s, perubahan halaju sela gelombang S dari 320 m/s ke 870 m/s dan kadar penusukan mata gerudi 10 cm/minit. Sementara satah ketiga dicirikan oleh purata halaju gelombang P yang berubah dari 610 m/s ke 2,300 m/s, gelombang S dari 180 m/s ke 890 m/s, halaju penusukan mata gerudi yang pantas iaitu berjulat 6.33 cm/minit–10 cm/minit dan nilai kerintangan penusukan piawai N = 10.

The Magnetic Anomaly Across Peninsular Malaysia Between Muar and Endau

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The aeromagnetic anomaly by Agocs and Paton (1959, 1966) between Muar and Endau has been studied. A major part of the anomalies form circular and linear features. The circular features are probably caused by isolated sources such as concentration of magnetic minerals in granite bodies. The linear features are caused by alignment of elongated magnetic anomalies. These are probably due to concentrations of magnetic minerals along fracture zones. Four sets of anomaly alignments are observed, which can be correlated to the major fracture system of Peninsular Malaysia between Endau and Muar.

StereoSAR DEM for Mapping of Geological Structures in Selangor, Malaysia

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Radar is ideally suited for the study of tropical countries, which have extensive cloud cover. These countries are usually heavily vegetated and although radar does not penetrate the vegetation cover, its sensitivity to subtle topographic features means that geological structures are clearly visible. Stereo radar images can also be used to generate a Digital Elevation Model (DEM). Images acquired with Radarsat modes S2 and S7 were used to generate a DEM for Selangor, Malaysia. The resultant DEM shows that Selangor can be divided into two sub-areas comprising rugged hills to the east and a flat, coastal, plain to the west. The topography was enhanced by applying a synthetic sun illumination to the DEM with elevation of 60° and azimuths of 030°, 120°, 210°, and 300°, respectively. From this image the topography was used to interpret geological lineaments. Three major directions trending between 240°–300°, 285°–330° and 350°–045° are identified. These features are present in both the flat regions and the hilly regions and represent a pervasive regional structural trend.

GIS Aided Groundwater Potential Mapping of the Langat Basin

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Groundwater constitutes an important source of water supply for various purposes, such as domestic industries and agriculture needs. In the hydrological cycle, groundwater occurs when surface water (rainfall) seeps to a greater depth filling the spaces between particles of soil or sediment or the fractures within rock. Groundwater flows very slowly in the subsurface toward points of discharge, including wells, springs, rivers, lakes and the ocean. In this study, the integration of remote sensing and geographic information system (GIS) methods were used to produce a map that classified the groundwater potential zone to either very high, high, moderate, low or very low in terms of groundwater yield. Almost all alluvial plains have a high potential of groundwater occurrence. Meanwhile, in the hard rock areas, groundwater potential is in the high density lineament zones.

Pemetaan Geomorfologi Bahagian Hulu Lembangan Langat Dengan Bantuan Fotograf Udara

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Pemetaan geomorfologi merupakan salah satu kaedah saintifik untuk memetakan morfologi yang bertujuan untuk menggambarkan bentuk muka bumi suatu kawasan dengan lebih terperinci. Peta geomorfologi yang mengandungi maklumat tentang bentuk bumi berguna untuk pelbagai kegunaan. Sehubungan dengan itu, sebuah peta geomorfologi telah dibuat di bahagian hulu Lembangan Langat. Maklumat awalan bentuk bumi (teren) ditafsirkan berdasarkan peta topografi dan juga imej satelit. Peta topografi juga digunakan bagi penentuan kecerunan cerun. Fotograf udara yang mampu memaparkan bentuk bumi secara tiga matra menjadi sumber maklumat utama dalam kerja pemetaan geomorfologi ini. Unit-unit geomorfologi dikelaskan berdasarkan morfologi dan asalmula yang dikenali sebagai morfogenesis (van Zuidam, 1985). Hasil kajian ini menunjukkan kawasan kajian terdiri daripada lima jenis teren iaitu teren mendatar hingga landai, teren bercerun landai hingga sederhana (cerun lurus), teren bercerun landai hingga sederhana (teren beralun), teren sederhana curam hingga curam dan teren sangat curam (teren perbukitan dan pergunungan) yang boleh dikelaskan pula kepada unit-unit geomorfologi asalan denudasi, fluvial dan asalan struktur.

Advanced Level Geology in the United Kingdom: A New Approach by the Welsh Joint Education Committee

C. DICKINSON, C.E. BROOKS, M. BROOKS & P. LOADER

The Welsh Joint Education Committee (W.J.E.C.) is one of two providers of Advanced Level (AL) geology in the United Kingdom. The Dearing review (1998) of the post-16 curriculum entitled 'Qualifying for Success' suggested a number of fundamental changes to the existing provision. The W.J.E.C.'s new AL geology specification (syllabus) is a response to this review. The specification offers an attractive, relevant science programme for students. It aims to retain and expand the place of geology in the new post-16 structure by attracting a wider cohort of one-year students through the Advanced Subsidiary (AS) course, and demonstrating depth and rigour, whilst retaining interest as students progress onto the A2, and thus complete the AL course.

Confirmation of the Yan Magnetic Anomaly by Gravity Data

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The well-defined Yan aeromagnetic anomaly located north of Gunung Jerai in Kedah was investigated further by running a detailed gravity traverse over it in an approximately north-south direction. After the standard reductions to the raw gravity data were made, a Bouguer gravity profile was obtained. A clear regional trend, with gravity values decreasing uniformly towards the south, is apparent. This is attributed to the major granite intrusion centred at Gunung Jerai. Superimposed on this regional trend are two negative and one positive gravity anomalies. The middle anomaly with a magnitude of –1.2 mgal coincides with the Yan magnetic anomaly. Mathematical modelling indicates that the causative body is an igneous intrusion with its top at approximately 31 m below the surface. This gravity model is entirely consistent with the magnetic model based on detailed ground magnetic data of previous surveys.

Kehadiran Anomali Magnet Yan Berdasarkan Data Graviti

Takrifan terbaik anomali aeromagnetik Yan yang terletak di utara Gunung Jerai Kedah dikaji lebih lanjut dengan menjalankan kajian terperinci rentasan graviti pada arah lebih kurang utara-selatan. Selepas sahaja reduksi piawai dilakukan terhadap data graviti mentah, profil graviti Bouguer akan diperolehi. Tren rantau yang jelas, dengan penurunan nilai graviti secara seragam ke arah selatan dapat dilihat. Ini merupakan kesan intrusi granit utama di bahagian tengah Gunung Jerai. Pertindanan kawasan rantau ini memberikan dua anomali graviti negatif dan satu anomali positif. Anomali tengah dengan magnitud –1.2 mgal sama dengan anomali magnet Yan. Model matematik mencadangkan jasad penyebab adalah intrusi igneus dengan puncak lebih kurang 31 m bawah permukaan. Model graviti ini berkadar terus dengan model magnetik berdasarkan data terperinci magnetik bumi yang telah dibuat dahulu.

Geological Applications of AIRSAR/TOPSAR Data in the Tubau Area, Bintulu, Sarawak

FREDDY ANAK HEWARD CHINTA

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During the early period of geological investigation, aerial photographs were the only source of remotely sensed data for analyzing geological features. With the advance of technology in remote sensing, radar images are available and readily provides a helpful tool to analyze geological features. Geological interpretation of AIRSAR/ TOPSAR images identification revealed numerous interesting findings, both in the local and regional scales. The images were then used to extract lithologic information, structural interpretation and digital terrain models. There are three lithological units that can be identified from these images based on their morphological and textural appearances, namely: riverine alluvium, Neogene Peripheral Basin and Folded Rajang Group. Several major faults were also identified, namely: the Bukit Mersing Line, the Tubau Fault, the Kalo Fault and another four newly named faults; the Merirai Fault, Hulu Merirai-Unan Fault, Kupa Fault and Tingang Fault. The imagery can enhance the topographic features, which are controlled by geological elements. The colour composites using 3 multi-polarization bands have improved the visual interpretability of land covered features compared to the single SAR data. With the correct choice of bands, the information extracted could be maximized.

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News of the Society

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2. Mohd Basri Abdul Rahman
   Jabatan Geologi, Universiti Malaya, 50603 Kuala Lumpur
3. Mohd Anuar Ismail
   Jabatan Geologi, Universiti Malaya, 50603 Kuala Lumpur
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8. Nor Hafizi Mohd Khalid
   Program Geologi, Universiti Kebangsaan Malaysia, 43600 Kuala Lumpur.
9. Nor Farizah Abdul Muhid
   Program Geologi, Universiti Kebangsaan Malaysia, 43600 Kuala Lumpur.

GSM

PETUKARAN ALAMAT (Change of Address)

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

1. Aniza Abdul Rahman
   Nagawaja Sdn. Bhd., Lot 23A, Jalan 3/4C, Desa Melawati, 53100 Kuala Lumpur
2. Munawir Muslim
   D4-14, Inai Apartment, Jalan Pandan Indah 21, Pandan Indah, 55100 Kuala Lumpur
3. Mohamed Taher A. Teha
   45-7-11 The Forum, Jalan Inai, 55100 Kuala Lumpur, Malaysia.
4. Low Teng Huat
   Asiagro Resources Sdn. Bhd., No. 27, Jalan Batai Laut 5, Taman Intan, 41300 Klang.

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CURRENT ADDRESSES WANTED

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

1. Wong Wei Khiang
formerly of Tameron Sdn. Bhd., 37A, Jalan SS21/1A, 47400 Petaling Jaya, Selangor.

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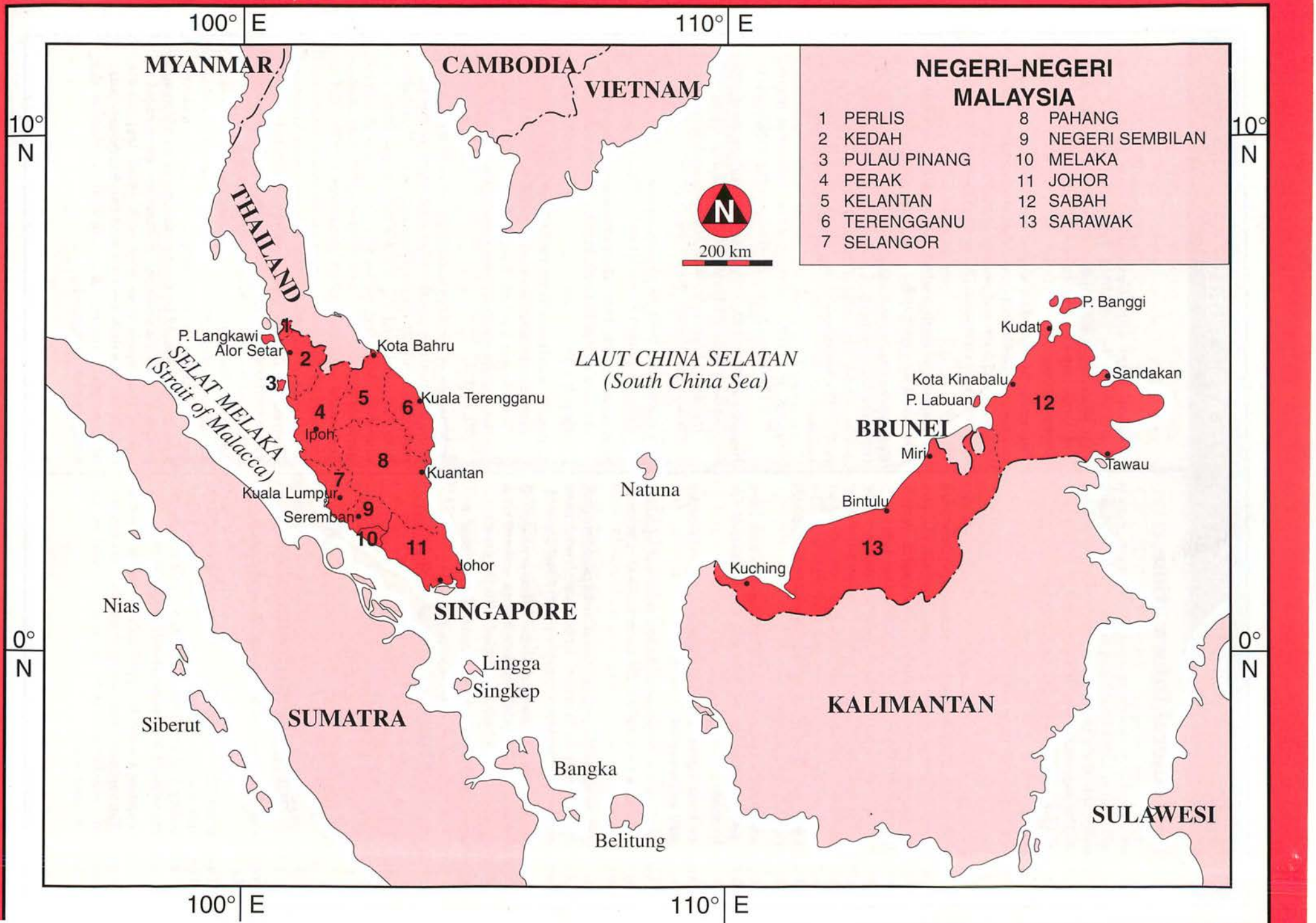
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2001

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MID-PALAEOZOIC BIO- AND GEODYNAMICS: THE NORTH GONDWANA-LAURUSSIA INTERACTION, Joint meeting of the 'International Geological Correlation Program (IGCP) 421' and the 'Subcommission on Devonian Stratigraphy (SDS)' hosted by the 'Senckenbergische Naturforschende Gesellschaft', Frankfurt am Main at the 'Forschungsinstitut und Naturmuseum Senkenberg' Frankfurt am Main, Germany. (Contact: G. Plodowski, Forschungsinstitut Senckenberg, Senckenberganlage 25. D-60325 Frankfurt am Main. Tel: ++49-69-97075127; Fax: ++49-69-97075137; E-mail: gplodows@sngkw.uni-frankfurt.de)

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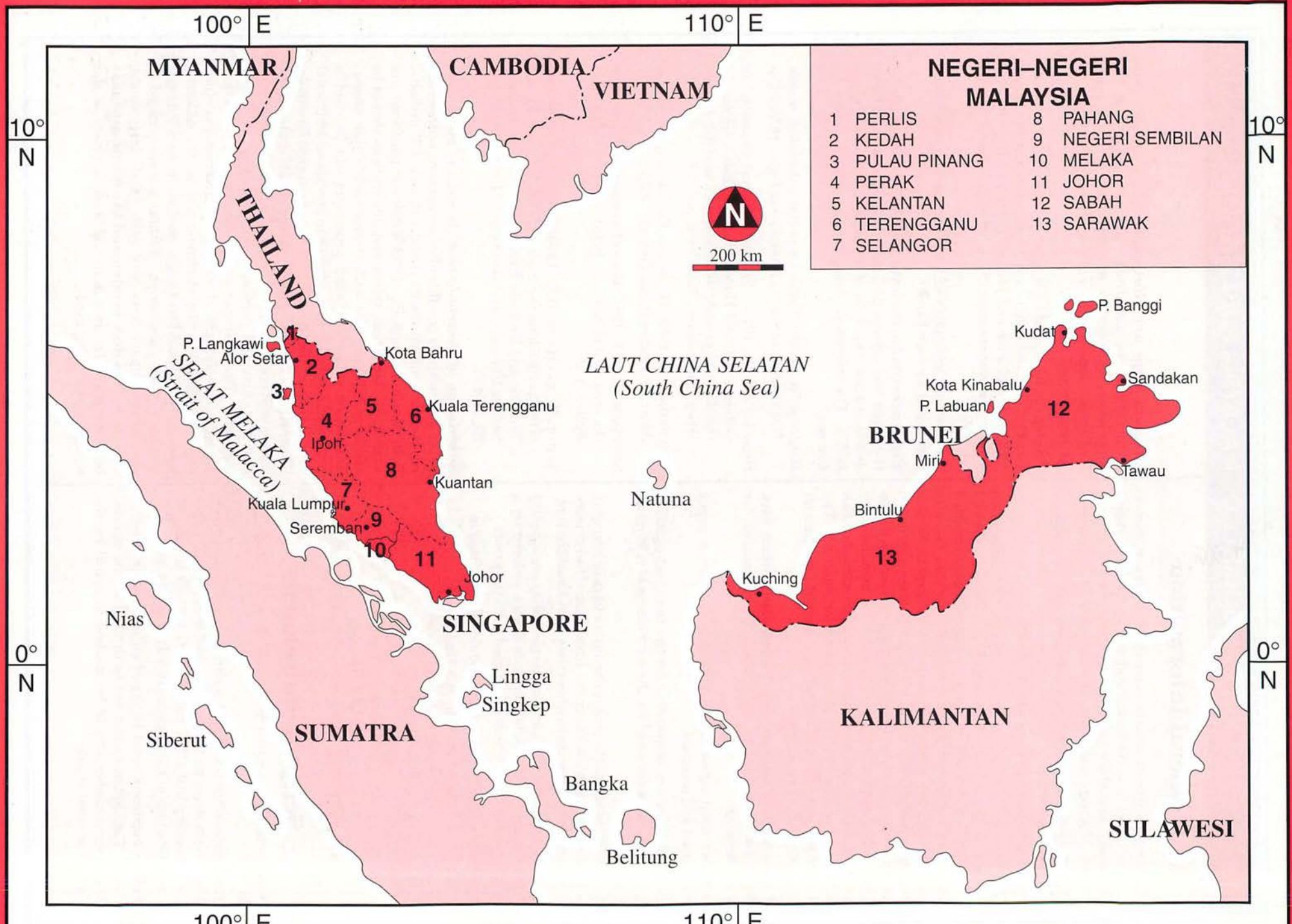
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