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

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

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CATATAN GEOLOGI
Geological Notes

Field relation of granite-volcanics interaction at Tioman Island, Pahang: more evidence for the occurrence of an older granite

AZMAN A. GHANI, NORAN A. SHAARANI AND HAIRUL AZHAR A. ANUAR
Department of Geology
University of Malaya
50603 Kuala Lumpur

Abstract: This paper reports new findings on the occurrence of an older granitic rock in Tioman Island. The granite is synplutonic with the felsic volcanics. Field relations show that interaction (mingling and mixing) occurs between these magmas.

INTRODUCTION

In 1976, Khoo wrote a short article which lead him to suggest the occurrence of an older granite in Tioman Island. Recently we had the opportunity to visit the area where he did the study. We reexamined the outcrop and found more evidence that support the existence of an older granite in the island. This paper will report new field evidence which we found to support the existence of an older granite in Tioman Island. The study area is located at the headland near the mouth of Sungai Bahru, north of Kampung Juara, Tioman Island (Fig. 1).

GEOLOGICAL OUTLINE OF TIOMAN ISLAND

Tioman Island is underlain by igneous and metamorphic rocks (such as metavolcanics) (Bean, 1972; Khoo, 1974) and is the largest of all islands off the east coast of Peninsular Malaysia. The igneous rocks in the island consist of gabbro, diorite and granite. A granite sample from Tioman Island was found to give a K-Ar age of 74±2 Ma (Bignell and Snelling, 1972) which may suggest that the rock is no younger than Late Cretaceous. Bean (1972) also showed that the host rocks (including volcanics) in the area as probably of Triassic age. The published geological map of Tioman Island by Bean (1972) shows that the granitic rocks in the island are of Jurassic age.

FIELD RELATION OF AN OLDER GRANITE

The outcrop of interest is located north of Kampung Juara, Tioman Island. The area is dominated by felsic volcanics with subordinate agglomerate, basic intrusives as dykes and granitic rocks. The former contain rounded fragments of a greyish white granitoid and black tuffaceous rock. Our new findings can be divided into two sections:

Granitic lobe in felsic volcanic host

In places the granitic lobe is found mingled with felsic volcanics (Fig. 2). The former sometimes show a porphyritic texture with phenocrysts aligned parallel to the margin of the lobe. The lobe is about 45 cm in length and 20 cm in width marked by necking and disrupting or pinching and swelling along their lengths. Magma of the felsic volcanics sometimes penetrate into the lobate and cuspate contacts between the rocks (Fig. 3).

This relationship shows that the granitic magma was injected into the consolidating volcanic host. The granite magma may have partially crystallised when it was intruded into the volcanic magma. This is evidence from the porphyritic nature of the granite.

Banded felsic volcanics in granitic host

Another field occurrence is banded rocks formed by the felsic volcanics and the granitic magma (Fig. 4). This banding resulted from the former being drawn out in the latter. The width of the volcanic band ranges from 10 to 15 cm and can be up to 1 m long. In an extreme case, the volcanic bands form a "schlieren-like" structure in the granitic rock. Comparing to the four mixing stages of Blake and Koyaguchi (1991), the finding is similar to stage b and c (Fig. 5). It clearly indicates that the volcanic magma has stretched into thin wisps which are narrow in the granitic magma.

IMPLICATIONS OF THE FIELD OCCURRENCE

The features described suggest that the felsic volcanic and granitic magmas are synplutonic. Occurrence of both granitic lobe and banded rock are influenced by the relative

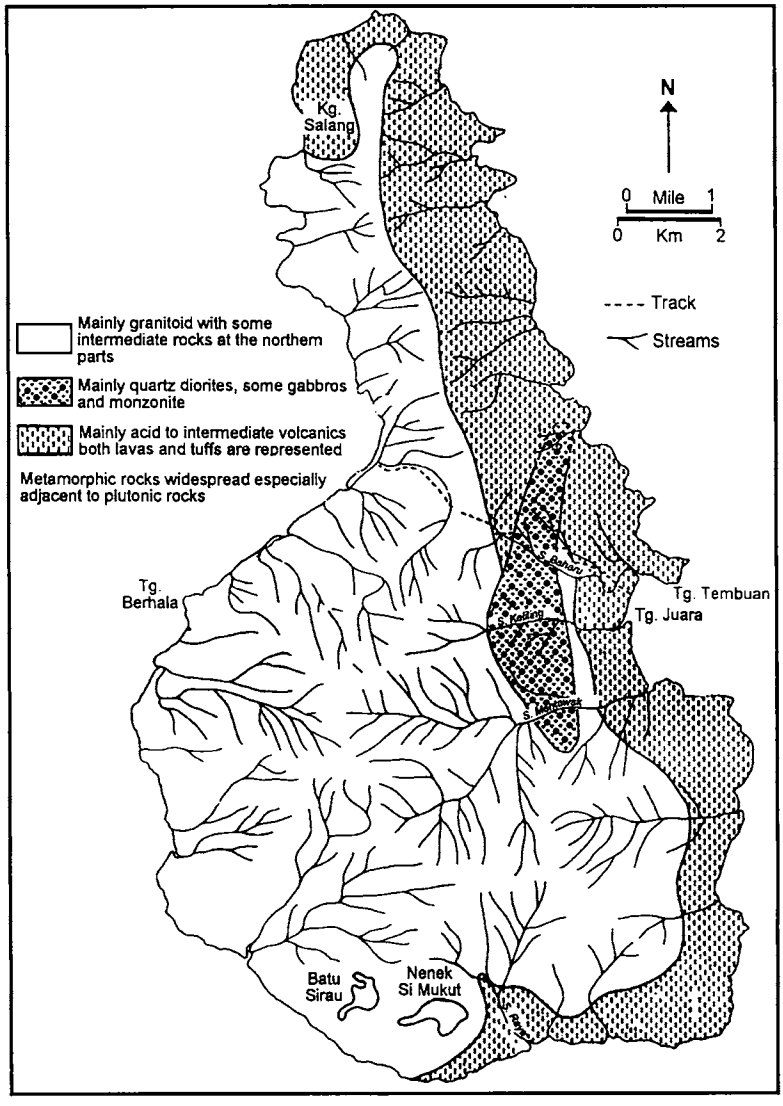

Figure 1. Geological map of Pulau Tioman (Tioman Island), showing the location of the study area (Telok Juara).

Figure 2. Older granitic lobe (whitish) and associate felsic volcanic rock (black).

Figure 3. Close up view of Figure 2 showing porphyritic nature of the granitic lobe. Note the cuspate and lobate nature of the contacts between the rocks.

Figure 4. Banded rocks formed by the felsic volcanic in the granitic rocks. Note the former sometimes stretched into thin wisps forming schlieren-like structure.

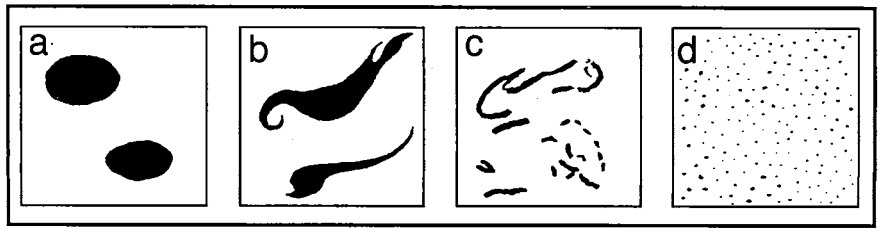

Figure 5. Cartoon snapshots of magma mixing, showing the progressive distortion of enclave in co-mingled magma (a, b and c) and ultimate diffusive transition to hybrid magma (d) (after Blake and Koyaguchi, 1991). Note that the banded rock in the present study is similar to stages b and c.

volumes, compositions, H_2O content, crystallinities, and subsequently by the relative rheology (Fernandez and Barbarin, 1991; Barbarin and Didier, 1992) of both felsic volcanic and granitic magmas. The lobate structure probably develops when the viscosity contrast between both magmas is large whereas the banded rock formed when the relative viscosity between the magmas is similar. The relative viscosity of the magma is influenced by the crystallinities. The porphyritic nature of the granitic lobe suggests that the granite magma (locally?) has partly crystallised and the viscosities increase due to the polymerization of the crystals and hence, the magma will behave as pseudoplastic bodies. This can explain why the granitic lobe formed in the more viscous volcanic magma. Implication of the above arguments is that, even in one magma body (granitic magma in the present case), the rheological properties may vary with crystallisation. It also depends on the shape, size and size distribution of crystals (Jeffrey and Acrivos, 1976) and aggregates of particles (Gillespie, 1983).

Lobate to crenulate contact and necking of the granitic lobe suggest the time of their intrusion is coeval to its host (e.g. Pitcher, 1991; Vernon *et al.*, 1988). The granitic magma was probably injected when the volcanic magma was partially crystallised and when both magmas were continuously moving (cf. Azman, 1998).

CHARACTERISTICS OF AN OLDER GRANITE AND COMPARISON TO THE MAIN GRANITE IN TIOMAN ISLAND

Apart from occurring in a very small volume compared to the Cretaceous granite (main granitic rock) (Fig. 2) in Tioman Island, the older granite coeval with the Triassic volcanics also have different microscopic characteristics. The older granite is characterised by the presence of garnet and the development of magmatic flow texture. Other minerals that are also present in the older granite are quartz, K-feldspar, plagioclase and green biotite. Garnet is absent in the Cretaceous granite to the best of our knowledge. This mineralogical contrast may suggest that both magmas are not co-magmatic. This is because the presence of garnet is characteristic of 'S' type granite (Chappell and White, 1974) whereas the Cretaceous granite show many characteristics of 'I' type granite. The latter contain subhedral to euhedral sphene and pale green to dark green hornblende. Occurrence of garnet in the older granite and sphene and hornblende in the Cretaceous granite indicate that the granites are peraluminous and metaluminous respectively.

IMPLICATION TO GEOLOGY OF TIOMAN ISLAND

The occurrence of granitic rock which is synplutonic to the volcanics in the Tioman Island indicates the possible presence of an older granite in the island. This supports Khoo's (1976) findings. He interpreted that the occurrence of the granite boulders in agglomerate indicate the possible presence of an older granitoid in the island. He further suggested that the granitoid boulder may be either fragment of a granitoid basement above which the paleo-volcanoes were built or the fragment of a coarse grained equivalent of volcanics formed at depth (Khoo, 1976). Whether both magmas are co-

magmatic is out of the scope of this paper. The implications for the present study are outlined below:

1. There are two types of granite possibly of different ages occurring in the Tioman Island.
2. The older granitic magma is synplutonic with the volcanic magma and interaction may occur between these magmas (mingling and mixing?).

ACKNOWLEDGEMENT

Useful comments from Dr. T.T. Khoo are much appreciated. Mr. Roshdy is thanked for drafting the geological map.

REFERENCES

AZMAN A. GHANI, 1998. Occurrence of synplutonic dykes from Perhentian Kecil island, Besut Terengganu. *Warta Geologi, 24 (2)*, 65–68.

BARBARIN, B. AND DIDIER, J., 1992. Genesis and evolution of mafic micro-granular enclaves through various types of interaction between co-existing felsic and mafic magmas. *Trans. Roy. Soc. Edinb., 83*, 139-144.

BEAN, J.H., 1972. Geology, petrography and mineral resources of Pulau Tioman, Pahang. *Map Bulletin 5, Geol. Surv. Malaysia.*

BIGNELL, J.D. AND SNELLING, N.J., 1972. The geochronology of Malayan granites. *Overseas Geology and Min. Resources, No. 47*, 1–72.

BLAKE, S. AND KOYAGUCHI, T., 1991. Insight on the magma mixing model from volcanic rocks. *In:* J. Didier and B. Barbarin (Eds.), *Enclaves and granite petrology*. Elsevier, 403-413.

CHAPPELL, B.W. AND WHITE, A.J.R., 1974. Two contrasting granite types. *Pacific Geol., 8*, 173–174.

FERNANDEZ, A.N. AND BARBARIN, B., 1991. Relative rheology of coeval mafic and felsic magma: Nature of resulting interaction processes. Shape and mineral fabrics of mafic microgranular enclaves. *In:* J. Didier and B. Barbarin (Eds.), *Enclaves and granite petrology*. Elsevier, 263–276.

GILLESPIE, T., 1983. The effect of aggregation and particle size distribution on the viscosity of newtonian suspensions. *Jour. Colloid Interface Sci., 94*, 166–173.

JEFFREY, D.J. AND ACRIVOS, A., 1976. The rheological properties of suspensions of rigid particles. *Am. Inst. Chem. Eng. Jour., 22*, 417–432.

KHOO, T.T., 1974. A glimpse at the geology of Pulau Tioman. *In:* Lee, D.W., Stone, B.C., Ratnasabapathy, M. and Khoo, T.T. (Eds.), The Natural History of Pulau Tioman. *Merlin Samudera Tioman*, 5-17.

KHOO, T.T., 1976. Evidence for the occurrence of an older granitoid in Pulau Tioman, Pahang. *Warta Geologi, 2(4).*

PITCHER, W.S., 1991. Synplutonic dykes and mafic enclaves. *In:* J. Didier and B. Barbarin (Eds.), *Enclaves and granite petrology*. Elsevier, 383–391.

VERNON, R.H., ETHRIDGE, M.A. AND WALL, V.J., 1988. Shape and micro-structure of microgranitoid enclaves: indicators of magma mingling and flow. *Lithos., 22*, 1–11.

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PERTEMUAN PERSATUAN
Meetings of the Society

Ceramah Teknik (Technical Talk)

EIA of the oil industry: case histories and their geological input

H.D. TJIA

Laporan (Report)

Dr. Tjia gave the above talk on Tuesday 7th September 1999 at the Geology Department, University of Malaya. Dr. Tjia touched on the requirements of the EIA of the oil industry citing case histories and their geological input for those he was actively involved in.

H.D. TJIA

Malam Sumber Mineral
(Mineral Resources Night)

Laporan (Report)

This Mineral Resources Night (Malam Sumber Mineral) organised by the Economic Geology Working Group was held on Thursday 16 September from 5 to 7 pm at the Geology Department, University of Malaya. We had 2 speakers from the new Department of Mineral and Geoscience Malaysia. The evening was attended by 30 participants.

International classification of reserve and resources (Solid fuels and mineral commodities)

LOH CHIOK HOONG

Abstrak (Abstract)

The United Nations International Framework Classification for Reserves/Resources (abbreviated: UN Framework Classification) is the latest effort to develop a universally and internationally applicable framework for assessing solid fuel and mineral deposits under market economy conditions. This new classification framework is designed to allow incorporation of existing terms into it, in order to make them comparable and compatible, thus enhancing international communication.

The UN Framework Classification provides information about (1) the stage of *Geological Assessment*; (2) the stage of *Feasibility Assessment*; and (3) the degree of *Economic Viability*.

The terms of the above stages are considered to be familiar to all users, not only to geologists and mining engineers but also to investors, bankers, shareholders, and planners engaged with solid fuels and mineral commodities. The terms and definition s currently sued in the existing national classification systems can easily be related to and assigned to the corresponding stages of assessment of the UN Framework Classification, allowing the national terms to be maintained and making them comparable at the same time.

Geological Assessment is subdivided into four consecutive stages which are, in order of increasing detail: *Reconnaissance*, *Prospecting*, *General Exploration* and *Detailed Exploration*.

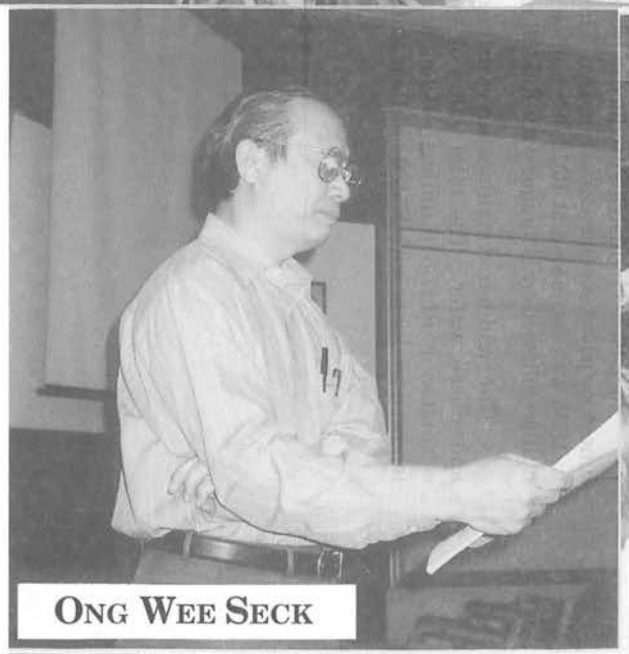
Feasibility Assessment is subdivided into three consecutive stages which are, in order of increasing detail: *Geological Study*, *Prefeasibility Study*, and *Feasibility Study / Mining Report*.

The Economic Viability, corresponding to the reserve/resource figures as obtained from the Feasibility Assessment, is reported as the third dimension. There are two categories of Economic Viability: *economic* and *potentially economic*, which are only quoted in the stages of Mining Report/Feasibility Study and Prefeasibility Study. In a Geological Study, the Economic Viability is not assessed but roughly estimated by adopting cut-off values and/or by comparison with mining activities carried out in similar deposits. Thus, in this case the resource figures are generally quoted as being in the range of "*economic to potentially economic*" and therefore of intrinsic economic interest.

The *Total Mineral Resource* is defined as naturally occurring concentrations of mineral raw material of economic interest and with specified geological certainty. A *Mineral Reserve* is the economically mineable part of Total Mineral Resource as demonstrated by Feasibility Assessment. The *Remaining Mineral Resource* is the balance of the Total Mineral Resource that has not been identified as a Mineral Reserve. According to the different stages of

Malam Sumber Mineral (Mineral Resources Night)

LOH CHIOK HOONG



ONG WEE SECK

assessment, Mineral Reserve and Remaining Mineral Resource are subdivided into a total of eight different classes namely, Proved Mineral Reserve, Probable Mineral Reserve, Feasibility Mineral Resource, Prefeasibility Mineral Resource, Measured Mineral Resource, Indicated Mineral Resource, Inferred Mineral Resource and Reconnaissance Mineral Resource.

The incorporation of existing classification systems into the UN Framework Classification and their comparison will be further simplified by means of codification acting as interface.

The principle behind the proposed codification of the UN Framework Classification, the three dimensions of categorization represented by the edges of a cube, the E (Economic) axis for Economic Viability, the F (Feasibility) axis for Feasibility Assessment, and the G (Geology) axis for Geological Study.

Numbers are used to designate the different classes; the lowest number, in accordance with the usual perception that the 1st is the best, referring to the highest degree of Economic Viability on the E axis, and the highest degree of assurance on the F axis and G axis.

Overview of the industrial mineral industry in Malaysia

ONG WEE SECK

Abstrak (Abstract)

The non-metallic mineral based industries cover a wide range of products that are made from clay, sand, limestone and granite. At the end of 1997, there were a total of 262 medium to large scale manufacturers in operation with a total investment of RM7,314.1 million and employing an estimated 37,080 workers. This does not take into account the many small clay-based industries producing bricks, potteries, etc.

The main clay-based industries are involved in the production of ceramic decorativeware, ceramic wall and floor tiles, clay pipes, sanitaryware, tableware, roofing tiles, ceramic formers, refractory, advanced ceramic components and activated clay. The total value of clay based products manufactured in 1998 was estimated at RM1,391 million. Selangor recorded the highest value of RM724 million followed by Johor with RM337 million and Sarawak RM132 million.

Rock-based industries produce marble dimension stone, granite dimension stone, lime, limestone powder, cement and terrazzo. The total value of rock-based products manufactured in 1998 was estimated at RM2,068 million. Johore recorded the highest value of RM1,082 million followed by Selangor with RM403 million and Perak RM378 million.

The sand-based manufacturers in the country produce glass, sodium silicate, filter sand and silicon wafer. The total value of sand-based products manufactured in 1998 was estimated at RM1,510 million. Selangor recorded the highest value of RM1,163 million followed by Johor with RM304 million and Pahang RM40 million.

EIA: issues and challenges

LEE HENG KENG

Laporan (Report)

Mr. Lee Heng Keng delivered his talk on the 17th September 1999 at the Geology department, Universiti Malaya. His talk focussed on the role and implementation of EIA in Malaysia. EIA is essentially a planning tool for preventing environmental problems in a project implementation. It is a study to identify, predict, evaluate and communicate information about the impacts on the environment of a proposed project and to detail out the mitigating measures prior to the project approval and implementation.

This talk was attended by about 30 members and was chaired by Dr. Saim Suratman.

Abstrak (Abstract)

I. ENVIRONMENTAL IMPACT ASSESSMENT

What is Environmental Impact Assessment (EIA)?

EIA is a study to identify, predict, evaluate and communicate information about the impacts on the environment of a proposed project and to detail out the mitigating measures prior to project approval and implementation..

Why do we need EIA?

EIA is essentially a planning tool for preventing environmental problems due to an action. It seeks to avoid costly mistakes in project implementation, costly either because of the environmental damage that are likely to arise during project implementation, or because of modification that may be required subsequently in order to make the action environmentally acceptable. In Malaysia, EIA is required under section 34A, Environmental Quality Act, 1974 (APPENDIX 1). EIA when integrated into the existing planning and decision-making machinery, provides additional information towards better decision-making.

Which activities are subject to EIA?

Activities subject to EIA are prescribed under the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order, 1987 (APPENDIX 2). A copy of this Order may be obtained from the Government Printers or from any office of the Department of Environment (APPENDIX 3).

How to conduct EIA?

To assist you in the preparation of environmental impact assessment reports, you may purchase a copy of "A Handbook of Environmental Impact Assessment Guidelines" from the Department of Environment, for RM10.00 per copy.

II. THE EIA PROCEDURE IN MALAYSIA

The EIA procedure adopted in Malaysia consists of three major steps. The steps in the EIA procedure, which are shown in Figure 1, can be described as follows:

Preliminary assessment relates to the initial assessment of the impacts due to those activities that are prescribed. Preliminary assessment is the stage of the EIA procedure that should normally be initiated at the pre-feasibility study stage of the development of an activity. Project options are identified at this stage and any significant residual environmental impacts are made known. The preliminary report that is prepared is reviewed by a technical committee in the DOE internally. However, where expertise within the Department is lacking, assistance from other government and non-government agencies may be sought.

Detailed assessment is undertaken for those projects for which significant residual environmental impacts have been predicted in the preliminary assessment. The assessment should ideally continue during project feasibility, and the detailed EIA Report be submitted for approval by the Director General of Environmental Quality prior to the giving of approval

by the relevant Federal of State Government authority for the implementation of the project. Detailed assessment is carried out based on specific terms of reference issued by an ad hoc Review Panel appointed by the Director General. The EIA Report that is prepared is reviewed by the ad hoc Review Panel chaired by the Director General.

Review of EIA Reports is carried out internally by the DOE for preliminary assessment reports and by an ad hoc Review Panel for detailed assessment reports. Recommendations arising out of the review are transmitted to the relevant project approving authorities for consideration in making a decision on the project. The normal period allocated for a review of a preliminary assessment report is one month while that for a detailed assessment report is two months. The DOE maintains a list of experts who may be called upon to sit as members of any Review Panel established. The selection of the experts depends on the areas of environmental impacts to be reviewed.

Other main features of the EIA procedure are shown in Figure 1 include the following:

The Approving Authority is the Government Authority that has the task of deciding, whether or not a project should proceed. The authorities include the following:

1. The National Development Planning Committee for Federal Government sponsored projects;
2. The Regional Development Authorities;
3. The State Planning Authorities for State Government sponsored projects; and
4. The Ministry of Trade and Industry or MIDA for industrial projects.

Recommendations arising from the review of the EIA Reports are forwarded to the relevant project approving authorities. At the completion of the review period for a detailed EIA, a **Detailed Assessment Review Document** is issued by the Review Panel. This document may include:

1. Comments on the Detailed Assessment report;
2. Recommendations to the project proponent and the project approving authority including any specific conditions attached to the project approval; and
3. Recommendation for environmental monitoring and auditing.

Saim Suratman

EIA: issues and challenges

Our Evolving Planet, Earth History in New Perspective: a Review

1-DAY TECHNICAL WORKSHOP

(Geophysics Working Group)

on

Our Evolving Planet, Earth History in New Perspective: a Review

by

Karsten M. Storetvedt

Laporan (Report)

This 1-Day Technical Workshop by Prof. Karsten M. Storetvedt, Research Professor, Institute of Geophysics, University of Bergen, Norway was held on 8th October, 1999 at the Geology Department, University of Malaya.

Summary

Does the plate tectonic model represent a 'quantum leap' in our understanding of the Earth as currently alleged? And will that model be a fruitful guide for the Earth sciences into the 21st Century? The answers to such questions is a definite NO!

Firstly, for the integrity of science it is now a task of paramount importance to openly admit that the once very promising plate tectonic model has gradually lost its alleged predictive and explanatory powers, and its credibility as a scientific theory is therefore at stake. Secondly, as the Earth sciences clearly need a new sense of direction, a safer foundation on which to build, an alternative theory of Earth evolution is proposed. The presently unduly complex plate tectonic scheme is replaced by a considerably simpler and much less mobilistic scenario governed by changes in planetary moments of inertia, in turn called forth by reorganization of mass in Earth's interior.

With the new model a range of unsolved problems and enigmatic observations can now be understood, and many unsuspected phenomenological relationships can be established. The strength of the new theoretical construction is that the body of the Earth is treated 'holistically', the ultimate future aim being to incorporate all major structural and evolutionary aspects of the Earth into a single coherent system. It is further hoped that the new global model has the latent capacity of becoming a general evolutionary theory for terrestrial planets.

About the Speaker and Author

Karsten M. Storetvedt has held the chair in geomagnetism at the University of Bergen since 1973. He graduated in 1962, and received his doctorate at the University of Bergen in 1969 after post-graduate and pre-doctoral studies at the University of Newcastle-upon-Tyne, partly under the late Prof. S.K. Runcorn. During the late 1980s his interests made a significant shift from paleomagnetism towards global geophysical theories, history and philosophy of science, and problems in science teaching (E-mail: karsten@gfi.uib.no).

Malam Jurutera — Laporan (Report)

Geotechnical assessment of slopes

S.S. GUE

Rockfall protection

L.H. OOI

Influence of geology & geological structures on cut slope stability

C.T. TOH AND S.K. CHEE

Laporan (Report)

The above event was held at the Geology Department, University of Malaya, on October 28th, 1999.

Three eminent engineers addressed the audience. The tropics covered include the geotechnical assessment of slopes, rockfall protection, and the influence of geology and geological structures on cut-slope stability. Materials covered include residual soils, hard rocks (granite) and also soft rocks (shales). Case histories were drawn from various parts of the country, including the 2nd Link Highway (Johor), rock slopes in Paya Tembung and other sites in Penang, KL, Sabah (Crocker Formation) etc.

Ir. Dr. Gue stressed on the need for thorough investigations for the assessment of slopes. These investigations would include geology, topography, laboratory tests, field investigations, etc. Detailed checking and interpretations of lab and field data are essential.

Ir. Dr. Ooi presented various methods for the protection of rockfalls, including the use of wire nets, cables, rock bolts and anchors, etc. Controlled, pre-split blasting is also most useful to create smooth rock slopes/faces with little protruding or overhanging blocks that are unstable.

Ir. Dr. Toh touched on the importance of geologic structures such as bedding planes and relict structures in the stability of rock and soil slopes. The importance of recognising the mode or mechanism of failure is fundamental to the successful evaluation of the stability of the slope. Some simple methods of stabilising granite boulders by concreting them together were also presented.

The event was attended by ~ 50 GSM members and friends from IEM. Lively discussions followed the presentation, as usual.

Tan Boon Kong
Chairman of Working Group on
Engineering Geology & Hydrogeology

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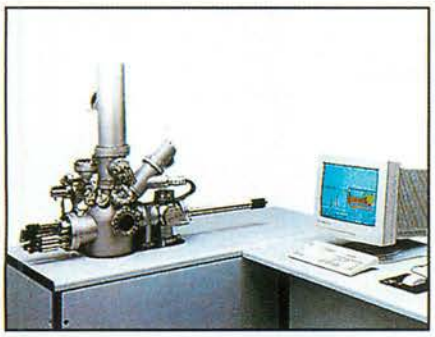

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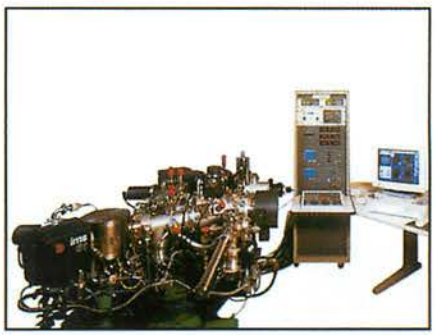

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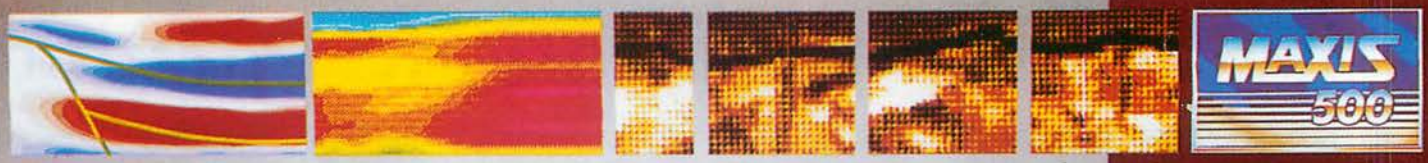

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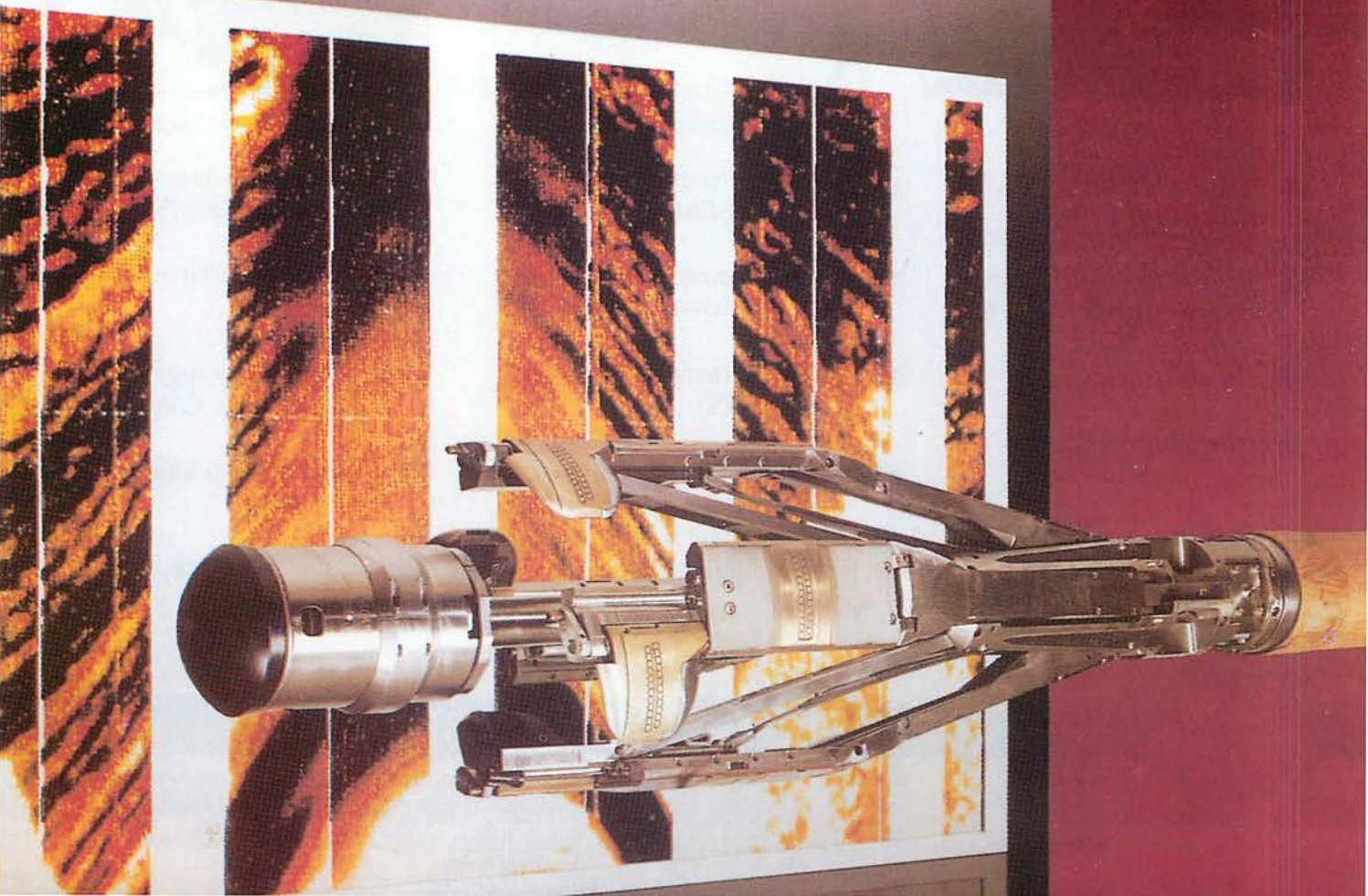

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GEOLOGICAL SOCIETY OF MALAYSIA PUBLICATIONS

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

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

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

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

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Correspondence: All papers should be submitted to

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c/o Geology Department
University of Malaya
50603 Kuala Lumpur
MALAYSIA
Tel: (603) 7957 7036 Fax: (603) 7956 3900

Script Requirements

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

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

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

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

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

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

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

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

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

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

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

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

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

BERITA-BERITA PERSATUAN
News of the Society

PETUKARAN ALAMAT (Change of Address)

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

1. Cheang Kok Keong
   Commercial Minerals (M) Sdn. Bhd., 67A, Jalan SS21/60, Damansara Utama, 47400 Petaling Jaya
2. Denis N.K. Tan
   Sarawak Shell Berhad (EPD-EXA), Level 23, PETRONAS Twin Towers 2, Kuala Lumpur City Centre, 50088 Kuala Lumpur.
3. Ausaf Rahman
   40733 Laguna Place, Fremont, California 94539-3749, USA.
4. Serials, Technical Services Division
   Central Library, National University of Singapore, 12 Kent Ridge Crescent, Singapore 119275.

PERTAMBAHAN BAHARU PERPUSTAKAAN (New Library Additions)

The Society has received the following publications:

1. American Museum Novitates, nos. 3273, 3272, 3271, 3268, 3269 (1999).
2. AAPG Explorer, September & October, 1999.
3. Monthly statistics on mining industry in Malaysia, May, June; February & July, 1999.
4. Geoscience, vol. 13, no. 1, 1999.
5. Tin International, vol. 72, no. 8 & 10, 1999.
6. Abstracts of the Geological Congress of Turkey, 1998.
7. Bulletin of the Geological Survey of Japan, vol. 50, nos. 5/6 & 7, 1999.
8. Earth Science Frontiers, vol. 1, nos. 1–4, 1994, vol. 3, nos. 3–4, 1996 and vol. 6, nos. 1–2, 1999.
9. The University of Kansas, Paleontological Contributions nos. 10, 11, 1999.
10. AAPG Bulletin vol. 83/8, 1999.
11. Geological Bulletin of Turkey (English edition), vol. 41, no. 1, 1999.
12. Geological Bulletin of Turkey (Turkish edition), vol. 41, no. 2 (1998) & vol. 42, no. 1 (1999).
13. Science Reports of the Institute of Geoscience, University of Tsukuba, vol. 20, 1999.
14. Oklahoma Geological Survey, Bull. 146, 1998.
15. Scripta Geologica, no. 116, 1999.
16. USGS Professional Paper, 1998: no. 1552-A; 1999: no. 1607.
17. USGS Circular: 1999, no. 1184.
18. USGS Bulletin: 1999: no. 2164.

BERITA-BERITA LAIN
Other News

Local News

MMC and Negeri in gold venture

Malaysia Mining Corporation Bhd. has signed a memorandum of understanding with the Negeri Sembilan Government to explore gold and other mineral deposits in the eastern region of the State.

Under the MoU, the State will grant MMC prospecting rights in a 4,690 sq km area covering Tampin, Jempol, Jelebu and Kuala Pilah.

Menteri Besar Tan Sri Mohamad Isa Abdul Samad said MMC had been given seven years to carry out the activity. Another joint venture agreement would be signed after the company submits an exploratory work report on the viability of the project.

"The Geology Department has reported that the areas are rich in gold and mineral deposit prompting us to work with MMC to explore their potential as the company has the experience and expertise to undertake such exploration work."

"This is the first time the State Government has ventured into gold and other mineral prospecting with a private company," he said after the signing ceremony at his office in Wisma Negeri, Seremban yesterday.

Mohamad Isa and State Secretary Datuk Mohd Ali Abdul Samad represented the State while MMC was represented by its group chief executive Tan Sri Ibrahim Menudin and executive director (operations and technical) Ab Sukor Shahar.

Mohamad Isa said the areas identified were mainly state land but if they involve private land, permission would be asked from the landowners as any mineral deposits found would belong to the State. Ibrahim said MMC would spend RM7 million on exploration work which would be carried out in stages covering field "reconnaissance" service to feasibility study, subject to results of each preceding stage to confirm any viable gold and other mineral deposits for mining.

The identified area is located in a prospective mineralised belt which is at the tail end of the main range that extended southward from Raub and Bentong in Pahang.

Ibrahim said the gold and mineral content of the designated area could only be determined after the exploratory work had been completed.

He said MMC had also received approval from the Sabah Government to undertake mineral deposit exploration work soon.

MMC had in the past participated in such ventures in the East Coast States.

In Pahang, he said the company had explored into gold and other mineral deposits mining such as copper, silver, zinc, lead and complex-four but found its extraction cost of RM250 million to be uneconomical.

NST, 2.9.1999

100-year-old Lahat Mines to be closed

The 100-year-old Lahat Mines, which was claimed by Bukit Merah new village residents to be the cause of the frequent sinkholes in their area, has been closed.

The open-cast mine will now make way for a mixed development project.

Mining activities have been blamed for the recurrence of sinkholes in nearby Bukit Merah new village since 1972 although it has not been positively established despite investigations by

the Geological Survey Department.

State Public Utilities Committee chairman Datuk Ong Ka Chuan, who announced the closure with immediate effect during a visit to the mine today, said its operator, the New Lahat Mines Sdn. Bhd., had agreed to cease operation and begin work on stabilising the areas around the mine.

He said the operator had agreed to diversify its activities and convert the mine into a pond for recreational activities, and the surroundings into residential and commercial areas. The operator has been given three months to come up with detailed plans for the proposed development.

"The area approved for the project is 200 ha. While waiting for the plans to be drawn up, the operator has agreed to fill up the 400-metre deep mine with water up to about 30 metres."

He said with rain, hopefully the water level would rise.

The water would also fill up the underground cavities, thereby strengthening and stabilising the whole area, he added.

Ong said the solution was a win-win situation for the mine operator and Bukit Merah new village residents who had been living in fear of sinkholes swallowing their homes over the past 20 years.

Mining, he said, played a major part in the company's operations. The mine produced about 150 tonnes of tin ore per month during the peak periods.

When the tin price was good, it fetched RM20,400 per tonne.

Now with the current reduced price of RM13,300 per tonne, production capacity has been reduced to about 80 tonnes per month.

The mine, covering an area of 280 ha, is visible from the Ipoh-Lumut Highway and is often referred to as "The Grand Canyon" of Malaysia.

New Lahat Mines bought over the mine 50 years ago from original owner Osborne and Chappel Ltd., a company which had worked on it since the 1900s.

Since 1972, numerous sinkholes have appeared, mostly in Lahat and the new village. The most recent was last week when three sinkholes appeared in Bukit Merah new village within a span of one week.

The sinkholes have caused the disappearance and destruction of some 50 of the more than 1,000 houses in the area since the early 1980s.

Bukit Merah residents welcomed the move and hope that it would be the end of their woes.

NST, 22.10.1999

More glitter in store for Malaysian gold industry

Malaysia's gold jewellery industry is poised for further growth because of several factors including improved consumer confidence and its rapid economic recovery, says Albert Cheng, World Gold Council's regional director for East Asia.

In addition, Malaysia's legal framework was conducive for the development of the gold jewellery industry while the Government is also supportive, especially of export-oriented manufacturers, he said in an interview.

Cheng said the industry had been doing well in the last few years as it benefitted tremendously from the Government's move to abolish import duty on gold.

Along with that, local jewellers have also sharpened their skills to produce better and more attractive gold jewellery.

Cheng said since Malaysia has a ready market for its gold jewellery items in countries like China, Singapore, the Philippines and the Middle East, there was more room for expansion.

The Asia gold industry, he said, was now in its full swing of development and this would further boost demand in the new millennium.

But he suggested that Malaysian jewellery manufacturers looked at opportunities in Europe as well and developed new skills for that market.

He believes that the local industry could expand because Malaysia has good gold jewellery manufacturers with fine jewellery-making skills.

Cheng said about 100 tonnes of gold were fabricated in Malaysia last year.

But only 30 tonnes were used in Malaysia because of her relatively small population while the rest was exported.

Cheng feels more can be done to put Malaysia gold jewellery makers on a stronger footing to enable them to be in a better position to penetrate foreign markets.

He said for a start the Ministry of International Trade and Industry should group them together.

Cheng also lauded Bank Negara Malaysia for aiding the gold jewellery industry by encouraging banks to provide financing to gold jewellery manufacturers.

"The future prosperity of the gold industry rests very much upon the competitive power of the jewellery trade in developing attractive products and services to create demand."

NST, 25.10.1999

Scrap archaic laws, say quarry owners

The Malaysia Quarries Association has urged the federal and state governments to do away with archaic laws which are discouraging foreign investment and preventing the industry from developing.

Association chairman Ghiathuddin Long said a revision of outdated laws and regulations governing the industry would help avoid overlapping of responsibilities and increase accountability when disasters occurred.

"Little do people know that the heavy investment on quarries coupled with outdated policies and insecure land tenures are discouraging foreign and local investors to expand," he said at the Second National Quarry Convention here yesterday.

He said quarry land itself was wrapped in massive red tape because land was a state matter subjected to different policies, laws, rules and royalty rates by different authorities.

"More often than not, there is overlapping authority among these government departments, resulting in various misunderstandings," he said.

Ghiathuddin said proper zoning of quarry areas and better guarantee of land tenure security would help the industry greatly.

"If we are given large tracts of land with long lease periods, we too can turn quarries into resort-like areas as done by a quarry in Johor with 320 ha of land," he said.

In his speech, guest of honour Mentri Besar Datuk Abu Hassan Omar said help would be given whenever possible, but relevant red tape would be maintained because the government had to take a firm stand to protect the public and the environment.

He said it was inevitable that a quarry operator needed approvals from many government departments, such as the Land Office, Forestry Department and Public Works Department, as public safety and environment protection came first.

"Overlapping responsibilities of the various government departments cannot be avoided as quarry areas are founded on land with different status."

Abu Hassan added the association could act as the link between various government departments and the quarry fraternity to help settle misunderstandings.

Star, 26.10.1999

PM, Chuan to sign pact on gas sales

The leaders of Malaysia and Thailand will sign a gas sales agreement on Saturday, the initial result from the Joint Development Area (JDA) of the two countries.

Prime Minister Datuk Seri Dr. Mahathir Mohamad and his Thai counterpart Chuan Leekpai will sign the agreement in Alor Star.

The agreement would be the final step before production, said Ismail Sulaiman, chief executive officer of the Malaysia-Thailand Joint Authority (MTJA) which was authorized to supervise and administer the area.

The JDA is approximately 7,250 square kilometres and is located offshore, about 150 km from Kota Baru and 260 km from Songkhla, Thailand.

In 1979, the two governments agreed to jointly explore for non-living natural resources and exploit them for the mutual and equal benefit of the two countries. Expenses and profit are split 50-50 between the two countries.

"Both countries have overlapping claims to the area, and the two governments agreed that rather than continue negotiations that might last for some time, it was mutually beneficial for all parties to cooperate in the exploration and exploitation of oil and gas," said Ismail.

He said the gas produced would be piped to Songkhla and it was expected that other downline joint ventures between the two countries would also be put on stream. Coincidentally, Petronas has a gas shortfall this year due to the postponement of the Bakun Dam project.

Production in this phase is expected to bring in US$3 billion (RM11.4 billion) worth of profits over the next 20 years. The total known reserves of the JDA have been estimated at 10 trillion cubic feet.

"That is very big. It is enough for several lifetimes ... even for our grandchildren," said Ismail.

However, the benefit of this joint venture did not lie only in the profit-making area for both governments, Ismail said. It has allowed the peoples of both countries to understand and work with each other better.

NST, 27.10.1999

Tasik Biru unsafe due to arsenic in water

Tasik Biru, a former open-cast gold mining pit which was recently rehabilitated and redeveloped as a tourist spot, has been declared unsafe for recreational and tourism activities due to the presence of a high level of arsenic in the water.

Natural Resources and Environmental Board's controller of environmental quality, Dr. James Dawos Mamit, said today tests conducted by NREB last week showed the arsenic level in the lake's water to be 0.87 parts per million.

"This is over 40 times higher than the permissible level of 0.02 parts per million allowed by the World Health Organisation," he told reporters after the opening of a RM618,000 foodcourt by Environment and Public Health Minister Datuk Amar James Wong.

He said in the first test conducted by NREB four months ago, the arsenic level was 0.7 parts per million.

"It sees that the arsenic level keeps on rising," he said.

He said the arsenic was brought to the lake by a stream.

James Dawos said the stream was extremely poisonous since it contained 2.5 parts per million or 200 times higher than the permissible level.

He said there was nothing the authorities could do to reduce the level of arsenic in Tasik Biru due to the presence of a natural source.

"We are not sure how deep is the underground source ... the rock could be huge and deep," he added, brushing aside a suggestion for the authorities to blast the rock.

James Dawos also ruled out the possibility of diverting the stream from flowing into the lake.

He said the first signs of arsenic poisoning on a human being were the loss of hair and fingernails becoming whitish.

He said a person suffering from arsenic poisoning would die a slow death.

" I strongly advise people not to swim in the lake or undertake any activity which could result in a person swallowing its water accidentally," he said.

The Tourism Ministry this year spent RM500,000 to rehabilitate and redevelop the lake.

This included the construction of a canteen, a pontoon, a gangway and an area for diving.

Another RM500,000 has been requested for the construction of safety features and sheds.

Tasik Biru was closed to the public in 1990 to enable a private company to extract gold ore on the bed and sides of the lake.

After the company stopped the extraction two years ago, the open-cast mining pit was rehabilitated and redeveloped into an eight-hectare lake. Before the closure, the lake was six hectares.

The former gold mine, operated by Borneo Company from 1896, was flooded in 1921 and became a lake.

The deepest part of the lake is about 100 metres.

Bau District Council turned the lake into a picnic spot by building limited facilities in 1975 before its closure in 1990.

NST, 28.10.1999

World's first Triple Well by Petronas Carigali

Petronas said its exploration and production arm, Petronas Carigali Sdn. Bhd., had completed the construction of the world's first Triple Well in the Bokor field, offshore Sarawak.

The application of the innovative Triple Well technology at the Bokor-C drilling platform allowed three independent wells with six production strings to be drilled through one shared conductor, the national oil corporation said in a statement yesterday.

The method, it added, reduced the number of conductors that had to be installed, which in turn would result in a significant reduction in the cost of the project.

The completion of the Triple Well followed the successful implementation of Petronas Carigali's Twin Well technology in its Tukau and Baram fields, also offshore Sarawak, last year.

Petronas said the Triple Well system was another technological achievement for Petronas Carigali in its continuous efforts to get more oil at lower costs and to find more ways to add value to its assets.

In 1996, the company made a major breakthrough in drilling technology when it successfully drilled a tri-lateral horizontal well — branches of three horizontal wells drilled from a single main trunk with each branch designed to drain an individual oil reservoir — in the Bokor field.

Petronas said Petronas Carigali planned to merge the Triple Well system with its other achievements in intelligent completion technologies for future field development projects.

This would result in improved project profitability and make future development of smaller fields attractive as the new technology would reduce the number of wells and size of platforms required to produce oil, it said.

NST, 29.10.1999

Common Rocks of Malaysia

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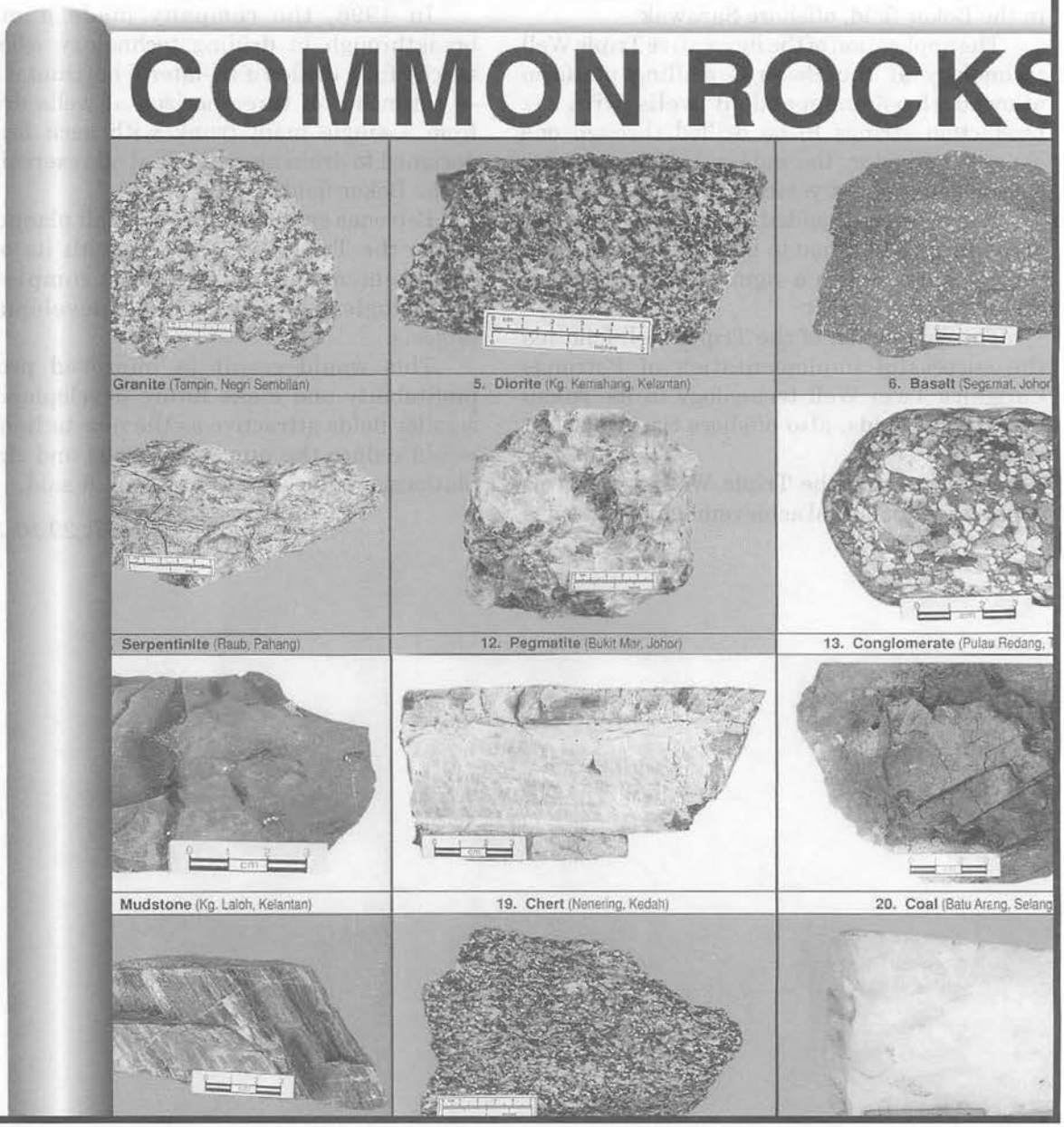

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KALENDAR (CALENDAR)

1999

November 7–10

ENVIRONMENTAL HYDROLOGY AND HYDROGEOLOGY (4th USA/CIS Joint Conference), San Francisco, California, USA. (Contact: American Institute of Hydrogeology, 2499 Rice Street, Suite 135, St. Paul, Minnesota 55113-3724, USA. Tel: +1 651 484 8169; Fax: +1 651 484 8357; E-mail: AIHydro@aol.com; Website: http://www.aihydro.org; abstracts deadline: February 28, 1999)

December 5–8

ADVANCED RESERVOIR CHARACTERIZATION FOR THE TWENTY-FIRST CENTURY (Research Conference sponsored by Gulf Coast Section of Society of Economic Paleontologists and Mineralogists Foundation), Houston, Texas. (Contact: GCSSEPM Foundation, 165 Pinehurst Rd., West Hartland, Conn. 06091-0065, USA. Tel: 800/436-1424; Fax: 860/738-3542; E-mail; gcssepm@mail.snet.net; WWW:http://www.gcssepm.org)

2000

January 24–28

OCEAN SCIENCES (Meeting sponsored by AGU), San Antonio, Texas, USA. (Contact: AGU Meetings Department, 2000 Florida Avenue, NW, Washington, DC 20009 USA. Tel: +1 202 462 6900; Fax: +1 202 328 0566; E-mail: meetinginfo@kosmos.agu.org; Website: http://www.agu.org)

March 6–9

SOCIETY FOR MINING, METALLURGY, AND EXPLORATION (Annual Meeting), Salt Lake City, Utah, USA. (Contact: SME, 8307 Shaffer Parkway, P.O. Box 625002, Littleton, CO 80162-5002, USA. Tel: 1 303 973 9550; E-mail: smenet@aol.com)

March 8–9

THE NATURE AND TECTONIC SIGNIFICANCE OF FAULT ZONE WEAKENING (International Research Meeting, sponsored by UK Tectonic Studies Group), London, UK. (Contact: R.E. Holdsworth, Department of Geological Sciences, University of Durham, Durham DH1 3LE, UK. Fax: +44 0191 374 2510; E-mail: R.E. Holdsworth@durham.ac.uk; Website: http://www.dur.ac.uk/~dgllms/reh.htm; abstract deadline: 30 September 1999)

April 6–9

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

April 16–19

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

May 7–11

SALT SYMPOSIUM, The Hague, The Netherlands. (Contact: Secretariat Organizing Committee, 8th World Salt Symposium, P.O. Box 25, 7550 GC Hengelo Ov, The Netherlands. Tel: 31 74 244 3908; Fax: 31 74 2443272; E-mail: Salt.2000@inter.NL.net)

May 15–18

GEOLOGY AND ORE DEPOSITS 2000: THE GREAT BASIN AND BEYOND (Conference), Reno-Spark, Nevada, USA. (Contact: Geological Society of Nevada, P.O. Box 12021, Reno, Nevada 89510, USA. Tel: +1-702 323 3500; Fax: +1-702 323 3599; E-mail: gsnsymp@nbmg.unr.edu; Website: http://www.seismo.unr.edu/GSN)

May 23–25

TRACERS AND MODELLING IN CONTAMINANT HYDROLOGY (International Conference), Liege, Belgium. (Contact: TraM'2000, LGIH, University of Liege, B19 Sart-Tilman, 40000 Liege, Belgium. Tel: +32 4 366 2216; Fax: +32 4 366 2817; E-mail: adassarg@lgih.ulg.ac.be)

June 24–30

INTERNATIONAL PALYNOLOGICAL CONGRESS (10th), Nanjing, China. (Contact: Secretary of the Organizing Committee for 10th International Palynological Conference, Nanjing Institute of Geology and Palaeontology, Academis Sinica, 39 East Beijing Road, nanjing 210008, China. Website: http://members.spree.com/sip/spore/index.htm)

July 16–22

APPLIED MINERALOGY — ICAM 2000 (6th International Congress), Gottingen & Hannover, Germany. (Contact: ICAM 2000 Office, P.O. Bx 510153, D-30631 Hannover, GERMANY. Tel: +49-511 643 2298; Fax: +49-511 643 3685; E-mail: ICAM2000@bgr.de; Website: www.bgr.de/ICAM2000; abstract deadline: September 1, 1999)

July 18–23

INTERNATIONAL ASSOCIATION OF VOLCANOLOGY AND CHEMISTRY OF THE EARTH INTERIOR (IAVCEI) GENERAL ASSEMBLY 2000, Bandung, Indonesia. (Contact: Secretariat, Volcanological Survey of Indonesia, Jalan Diponegoro 57, Bandung 40122, Indonesia. Tel: +62-22 772606; Fax: +62-22 702761; E-mail: iavcei@vsi.dpe.go.id; Website: http://www.vsi.dpe.go.id/iavcei.html; abstract deadline: February 29, 2000)

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JOINT WORLD CONGRESS ON GROUNDWATER, Forteleza, Brazil. (Contact: ABAS, Ceara Chapter, Avienda Santos Dumont, 7700 Papicu, Fortaleza, CEP 60 150-163, Brazil. Tel: +55 85 265 1288; Fax: +55 85 265 2212)

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October 15–18 (Provisional)

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (International Meeting), Bali, Indonesia. (Contact: AAPG Conventions Dept., P.O. Box 979, Tulsa, OK 74101-0979, USA. Tel: 1 918 560 2679; Fax: 1 918 560 2684)

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INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS (30th Annual Meeting), Cape Town, South Africa.

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August 23–28

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

November 5–8

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

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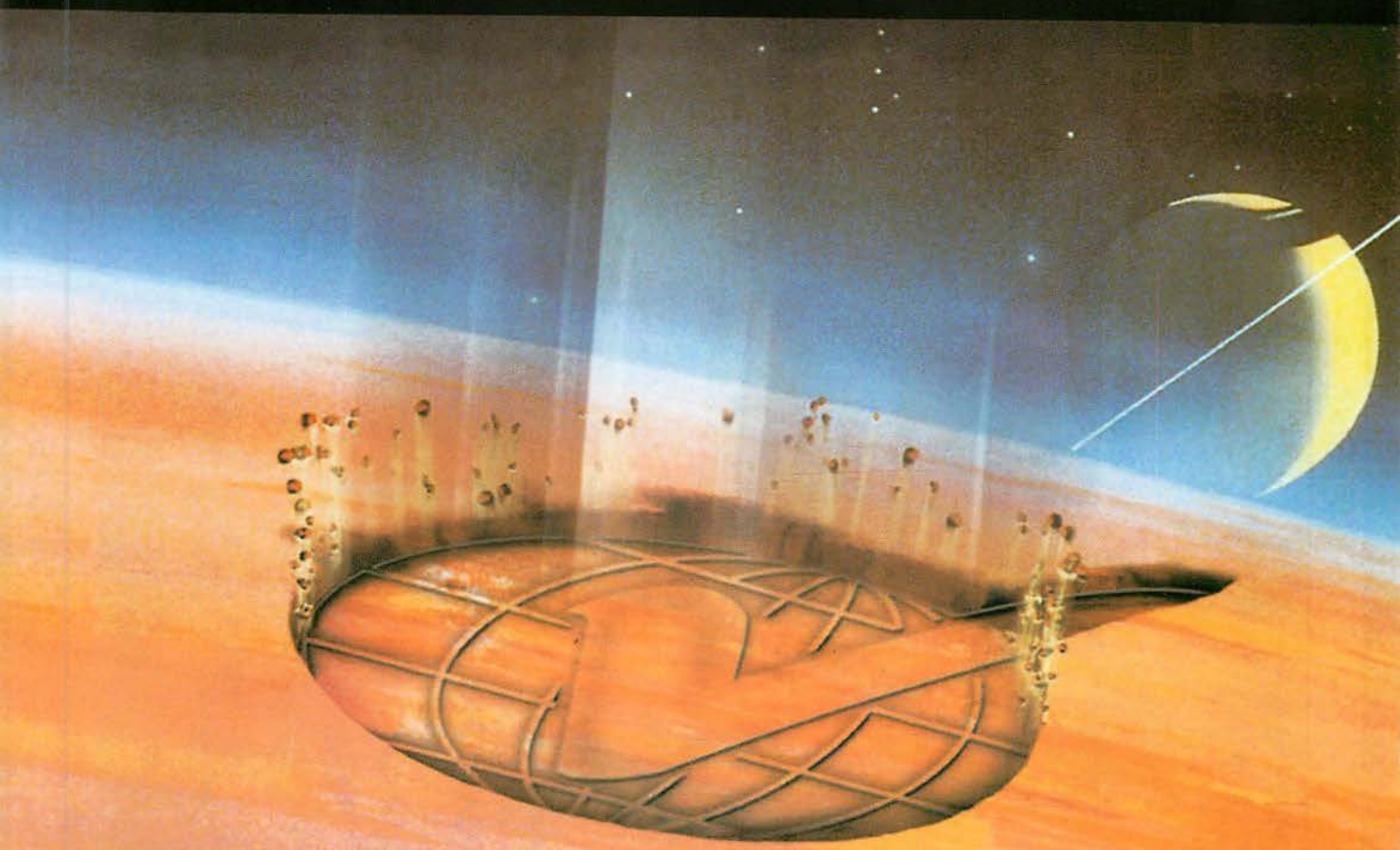

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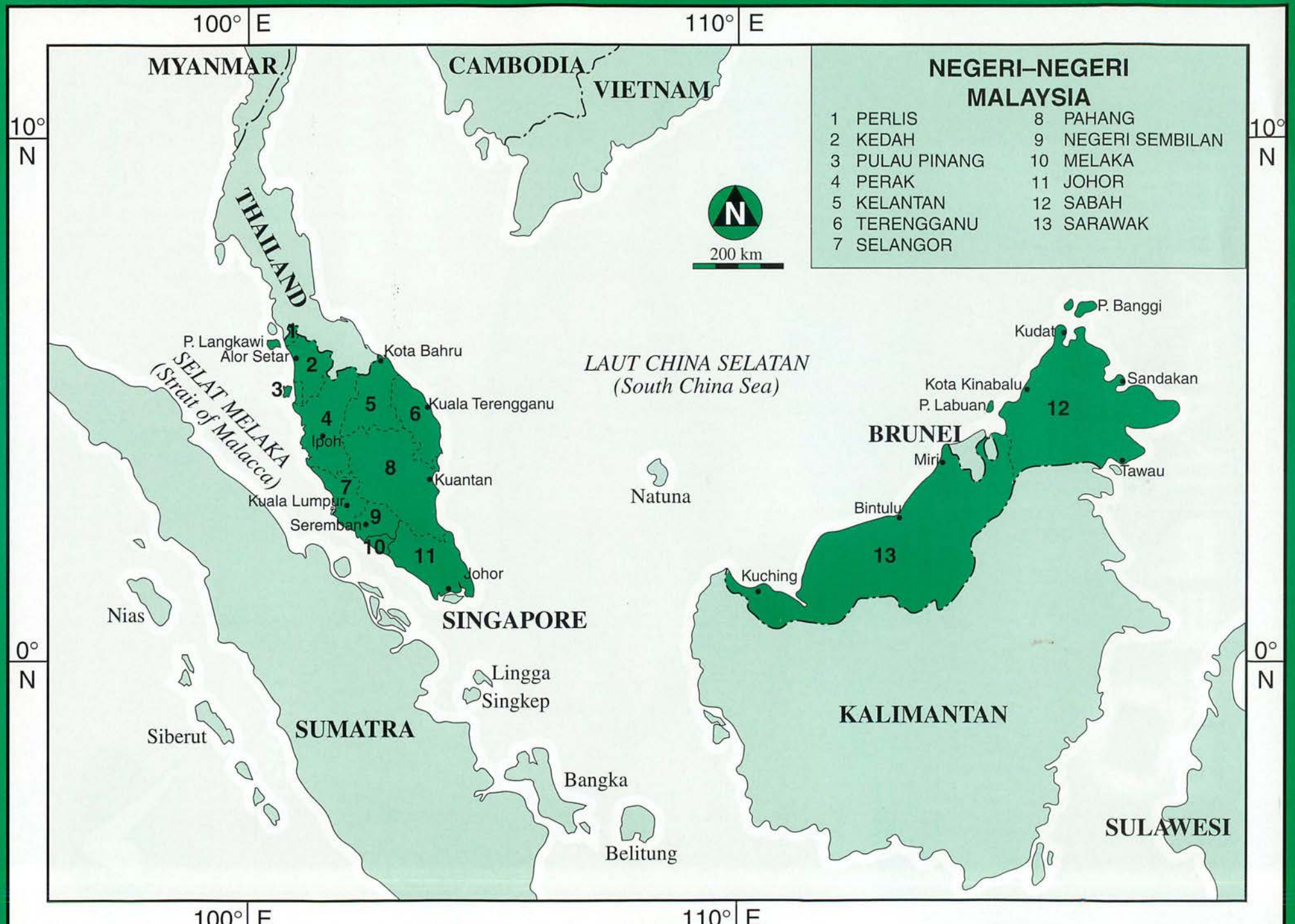
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