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PERSATUAN GEOLOGI MALAYSIA
Geological Society of Malaysia

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

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Description and implication of micro-structure in mafic microgranular enclaves from the Bukit Labohan granite, Terengganu

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Abstract: Detailed petrographic description of the mafic microgranular enclaves from the Bukit Labohan granite are described. The enclaves are invariably darker coloured and finer grained than the enclosing granitic rocks. They usually have sharp contact with the granitic host. Occurrence of acicular apatite in the enclave indicates that the crystals are quenched, probably formed when a globule of relatively mafic (enclave) magma comes into contact with cooler granitic magma (granitic host). Occurrence of the quartz-hornblende ocellar reflected hybridism of the two magmas.

INTRODUCTION

Mafic microgranular enclaves are probably the most common type of enclaves in granitic plutons (Vernon, 1983a, 1983b, 1991; Vernon *et al.*, 1988; Barbarin and Didier, 1991, 1992; Fourcade and Javoy, 1991). The enclaves are invariably darker coloured and finer grained than the enclosing granitic rocks (e.g. Barbarin, 1991). They usually have sharp contact with the granitic host. Fine grained margin, if present, are usually considered to represent the chilled margin which resulted from the quenching of hot mafic magma against cooler felsic magma (e.g. Vernon, 1983b).

A similar type of enclaves are found in granitic rocks from the Bukit Labohan area, the Terengganu (Fig. 1). The granite is the most easterly granitic pluton of the Eastern Belt of Terengganu mainland. The pluton is rather a small body having a compositional range from diorite to monzogranite. They consist of plagioclase, K-Feldspar, quartz, hornblende, biotite, clino-pyroxene, apatite, opaque phase and sphene (Azlan Mohamad, 1999). In this paper, we will summarise some of the microstructural features of the mafic microgranular enclaves found in the granite, emphasizing their significance.

FIELD OCCURRENCE AND PETROGRAPHY OF THE MAFIC MICROGRANULAR ENCLAVES

The mafic microgranular enclaves found in this granite are usually from 1 cm to 50 cm in size. The enclaves are finer grained and darker coloured than their host and usually have a well defined, sharp contact with the surrounding host granite. Sometimes they show a porphyritic texture (Fig. 2). Their distribution, however is not restricted to any particular part of the granite as observed in other granites (e.g. Didier, 1991). Microscopically the enclaves are holocrystalline and consists of K-Feldspar, quartz, plagioclase, biotite, hornblende, clinopyroxene, apatite, zircon, magnetite, chlorite and epidote. The mafic mineral constitutes about 30 to 70% of the enclaves and are mainly of biotite, hornblende and clinopyroxene. Hornblende sometimes rim a quartz crystal, giving a quartz-hornblende occeli texture (detailed description is given below). Biotite occurs as euhedral to subhedral crystals with the colour range from reddish brown to green. Large phenocrysts of K-Feldspar occur in some of the enclaves and their occurrence can vary to about 20% of the total modal enclaves. Plagioclase crystal is usually zoned and the composition ranges from An_{27} to An_{32}. Apatite crystals of acicular and equant shapes are found as accessory minerals. The significance of the acicular type of apatite is given below.

Detailed description

a) Rapid quenched apatite

Apatite occurs in two habits in the mafic microgranular enclaves. The first type of apatite are large equant free crystal inclusions with hexagonal cross sections up to 0.2 mm across, which occur most commonly along grain boundaries of biotite crystals. The second type are small prismatic to acicular crystals up to

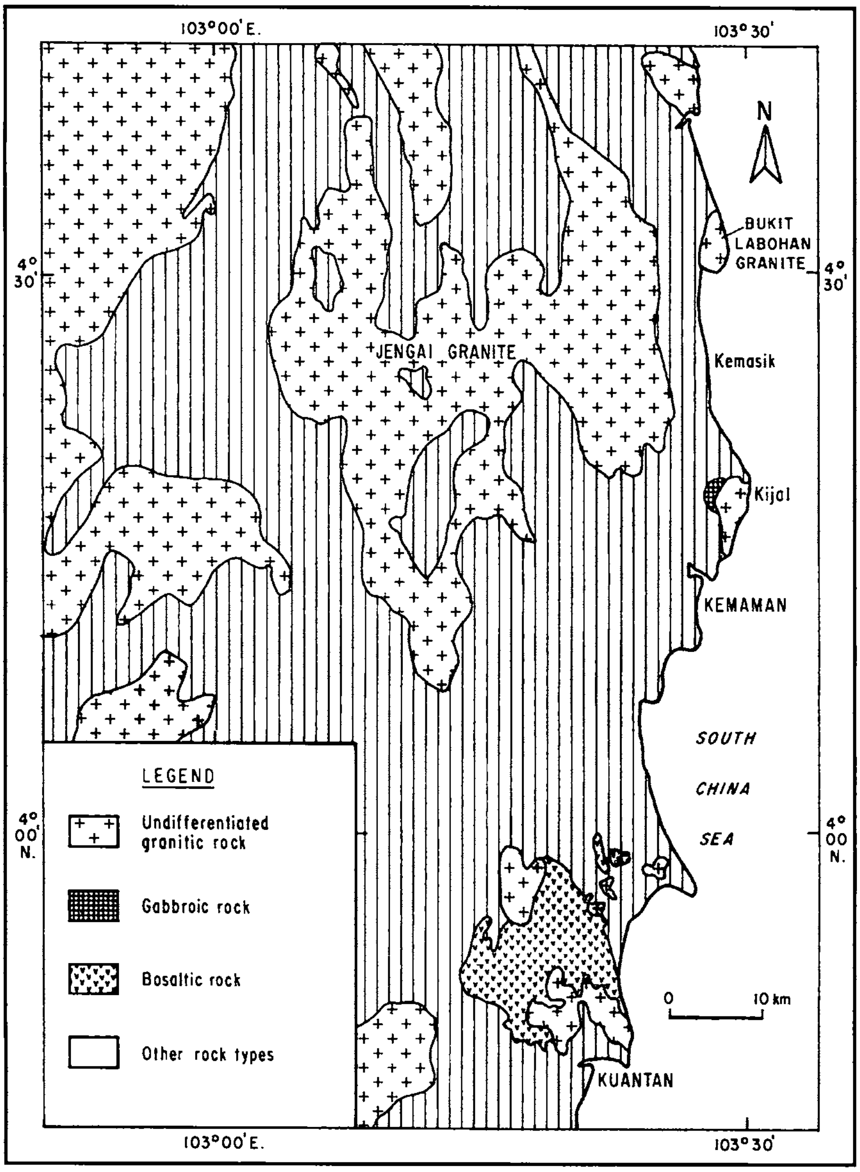

Figure 1. Map showing location of the Bukit Labohan granite.

Figure 2. Mafic microgranular enclave from Bukit Labohan granite with euhedral to anhedral feldspar crystals.

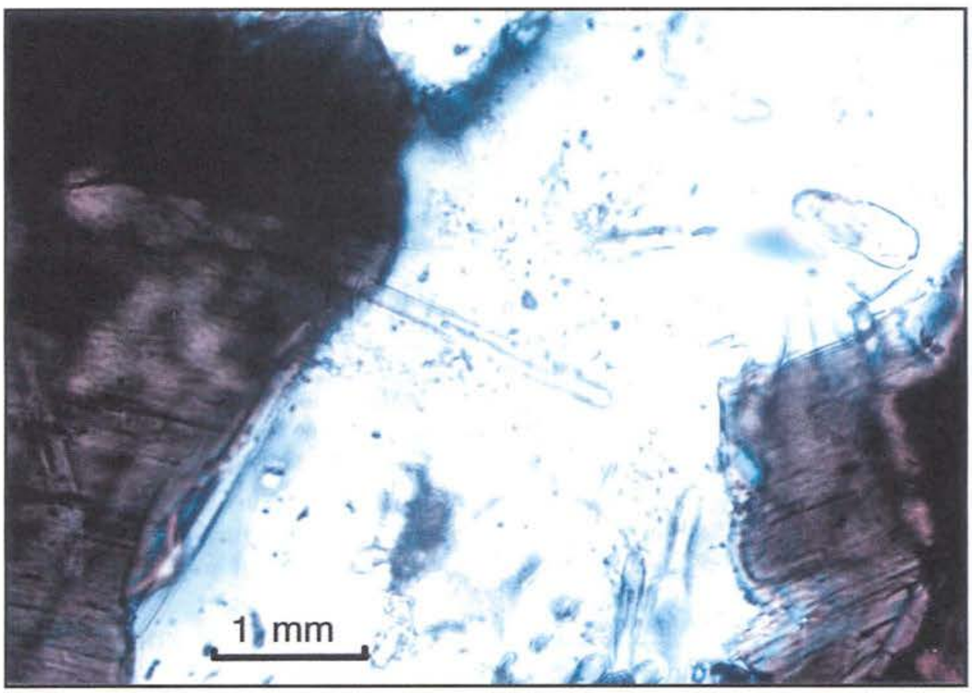

Figure 3. Photomicrograph show acicular apatite with hollow ribbed cores.

0.4 mm long (Fig. 3). The smaller acicular apatite have an average length to breadth ratio of 10:1. The ratio decreases with increasing crystal size. These acicular apatites are usually associated with biotite clots. When examined in detail, the cores are seen to be hollow ribbed cylinders (Fig. 3). Oglethorpe (1987) also found the same type of apatite in the contact facies of Thorr granite, Donegal and suggested that the cylinders consist of solid + gas. Other possible candidates are fluid inclusions.

b) Quartz-hornblende ocelli

Quartz-hornblende ocellar texture consists of relatively large quartz crystals with small hornblende crystals included in its rim zone (e.g. Angus, 1962; Sabatier, 1980; Vernon, 1990; Hibbard, 1991). The texture can occur up to 6.5 mm across in the mafic microgranular enclaves (Fig. 4). The rim consists of subhedral to euhedral hornblendes with sizes less than 0.5 mm across. The thickness of the hornblende rim ranges from 0.5 to 1 mm. Inner quartz crystals can be up to 4 mm across.

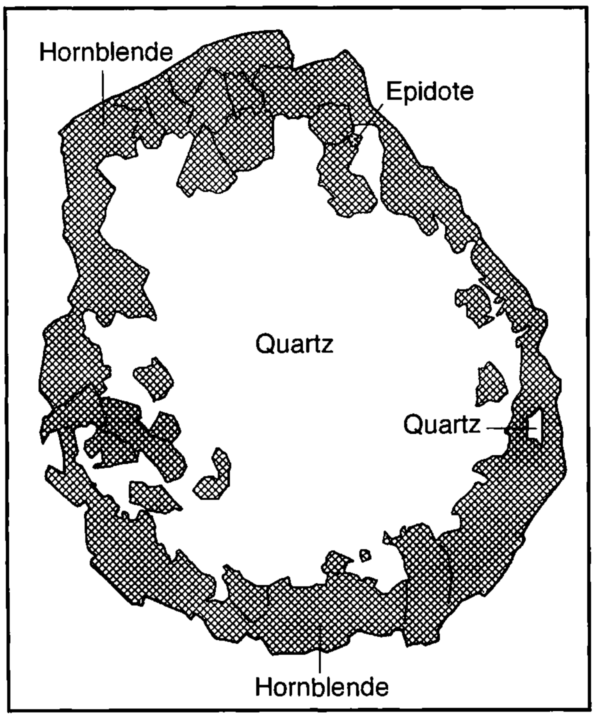

Figure 4. Quartz-hornblende occelli texture found in the mafic microgranular enclave from the Bukit Labohan granite. Longest diameter of the texture is 5 mm.

DISCUSSION

The relative fine grained size of the enclaves is consistent with a high nucleation rate and low growth rate, which applies when the degree of undercooling of a magma is relatively large. This can occur when a globule of relatively mafic magma comes into contact with the granitic magma. This implies that magma of the globule is much more undercooled than the granitic magma with respect to its liquidus (Vernon, 1983b). Occurrence of large K-feldspar crystals in enclaves have been interpreted in various ways, including phenocrysts/megacrysts (Furman and Spera, 1985; Vernon, 1986; Frost and Mahood, 1987), porphyroblasts (Pitcher and Berger, 1972; Augustithis, 1973; Le Bas, 1982) and foreign crystals (Cantagrel *et al.*, 1984). Occurrence of igneous microstructures such as inclusions of biotite in the K-feldspar large crystals (cf. Stone and Austin, 1961) and glomeroporphyritic texture formed by the large crystals may suggest that they are phenocrysts or megacrysts. Vernon (1986) suggests that the large size of the megacrysts is evidently due to nucleation difficulties for K-feldspar in granitic melts.

Occurrence of the acicular apatite indicates that the crystals are quenched, probably formed when a globule of relatively mafic magma (the enclave) comes into contact with cooler granitic magma (cf. Wyllie *et al.*, 1962). Gardner (1972) reported similar quenched apatites from the supercooled roof zone of a basic magma chamber. The presence of quenched apatite in the mafic microgranular enclave is significant since apatite is judged to be an early crystallising phase (Azlan Mohamad, 1999). This implies that the basic magma must have been virtually crystal free when it was injected into the felsic granitic magmas. Both magmas are probably mixed. This is evident from the occurrence of the quartz-hornblende ocelli which reflected hybridism of two magmas (Vernon, 1991). He suggested that the texture probably formed in response to the instability of quartz in the mafic magma.

ACKNOWLEDGEMENT

Mr. Ching is thanked for drafting the geological map and the quartz-hornblende ocellar texture.

REFERENCES

ANGUS, N.S., 1962. Ocellar hybrids from the Tyrone igneous series, Ireland. *Geol. Mag.*, *94*, 2–27.

AUGUSTITHIS, S.S., 1973. *Atlas of the textural patterns of granites, gneisses and associated rock types.* Elsevier, Amsterdam, 378p.

AZLAN MOHAMAD, 1999. *Kajian granit, daik dan zenolit kawasan utara Sg. Kerteh, Kerteh, Kemaman, Terengganu.* Unpubl. B.Sc. thesis, Univ. of Malaya.

BARBARIN, B., 1991. Enclave of the Mesozoic calc-alkaline granitoid of the Sierra Nevada batholith, California. *In:* J. Didier and B. Barbarin (Eds.), *Enclaves and granite petrology.* Elsevier, 135–153.

BARBARIN, B. AND DIDIER, J., 1991. Microscopic features of mafic microgranular enclaves. *In:* J. Didier and B. Barbarin (Eds.), *Enclaves and granite petrology.* Elsevier, 253–262

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.: Earth Sciences*, *83*, 145–153.

CANTAGREL, J.M., DIDIER, J. AND GOURGAUD, A., 1984. Magma mixing: origin of intermediate rocks and "enclaves" from volcanism and plutonism. *Phys. Earth Planet. Inter.*, *35*, 63–76.

DIDIER, J., 1991. The main types of enclaves in the Hercynian granitoids of the Massif Central, France. *In:* J. Didier and B. Barbarin (Eds.), *Enclaves and granite petrology.* Elsevier, 47–61

FOURCADE, S. AND JAVOY, M., 1991. Sr-Nd-O isotopic features of mafic micro-granular enclaves and host granitoids from Pyrenees, France: Evidence for their hybrid nature and inference on their origin. *In:* J. Didier and B. Barbarin (Eds.), *Enclaves and granite petrology.* Elsevier, 345–364.

FROST, T.P. AND MAHOOD, G.A., 1987. Field, chemical and physical constraints on mafic-felsic magma interaction in the Lamark Granodiorite, Sierra Nevada, California. *Geol. Soc. Am. Bull.*, *99*, 272–291.

FURMAN, T. AND SPERA, F.J., 1985. Co-mingling of acid and basic magma with implication for the origin of mafic 'I' type xenoliths, field and petrochemical relations of an usual dike complex at Eagle Peak Lake, Sequoia National Park, California, USA. *Jour. Volc. Geotherm. Res.*, *24*, 151–178.

GARDNER, P.M., 1972. Hallow apatites in a layered basic intrusion, Norway. *Geol. Mag.*, *109(5)*, 385–392.

HIBBARD, M.J., 1991. Textural anatomy of twelve magma-mixed granitoid systems. *In:* J. Didier and B. Barbarin (Eds.), *Enclaves and granite petrology.* Elsevier, 431–443.

LE BAS, M.J., 1982. The Caledonian granites and diorites of England and Wales. *In:* D.S. Sutherland (Ed.), *Igneous Rocks of the British Isles.* Wiley, Chichester, 191–201.

OGLETHORPE, R.D.J., 1987. *A mineralogical and chemical study of the interaction between granite magma and pelitic country rock, Thorr pluton, Co. Donegal, Eire.* Unpubl. Ph.D. thesis, Univ. of Liverpool.

PITCHER, W.S. AND BERGER, A.R., 1972. *The geology of Donegal: A study of granite emplacement and unroofing.* Wiley Interscience, London. 435p.

SABATIER, H., 1980. Vaugnerites et granites: une association particuliere de roches grenues acides et basiques. *Bull. Mineral.*, *103*, 507–522.

STONE, M., AND AUSTIN, G.C., 1961. The metasomatic origin of potash feldspar megacrysts in the granites of Southwest England. *Jour. Geol.*, *69*, 464–472.

VERNON, R.H., 1983a. Restite, xenoliths and microgranitoid enclaves: *Jour. Proc. Royal Soc. New South Wales*, *116*, 77–103.

VERNON, R.H., 1983b. Microgranitoid enclaves in granite-globules of hybrid magma quenched in a plutonic environment. *Nature*, *309*, 438–439.

VERNON, R.H., 1986. K-feldspar magacrysts in granite-phenocrysts, not porphyroblasts. *Earth Sci. Rev.*, *23*, 1–63.

VERNON, R.H., 1990. Crystallisation and hybridism in microgranitoid enclave magmas: microstructural evidence. *Jour. Geophys. Res.*, *95*, 17849–17859.

VERNON, R.H., 1991. Interpretation of microstructure of microgranitoid enclaves. *In:* J. Didier and B. Barbarin (Eds.), *Enclaves and granite petrology.* Elsevier, 277–291.

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

WYLLIE, P.J., COX, K.G. AND BIGGAR, G.M., 1962. The habit of apatite in synthetic systems and igneous rocks. *Jour. Petrol.*, *3*, 238–243.

Manuscript received 11 May 1999

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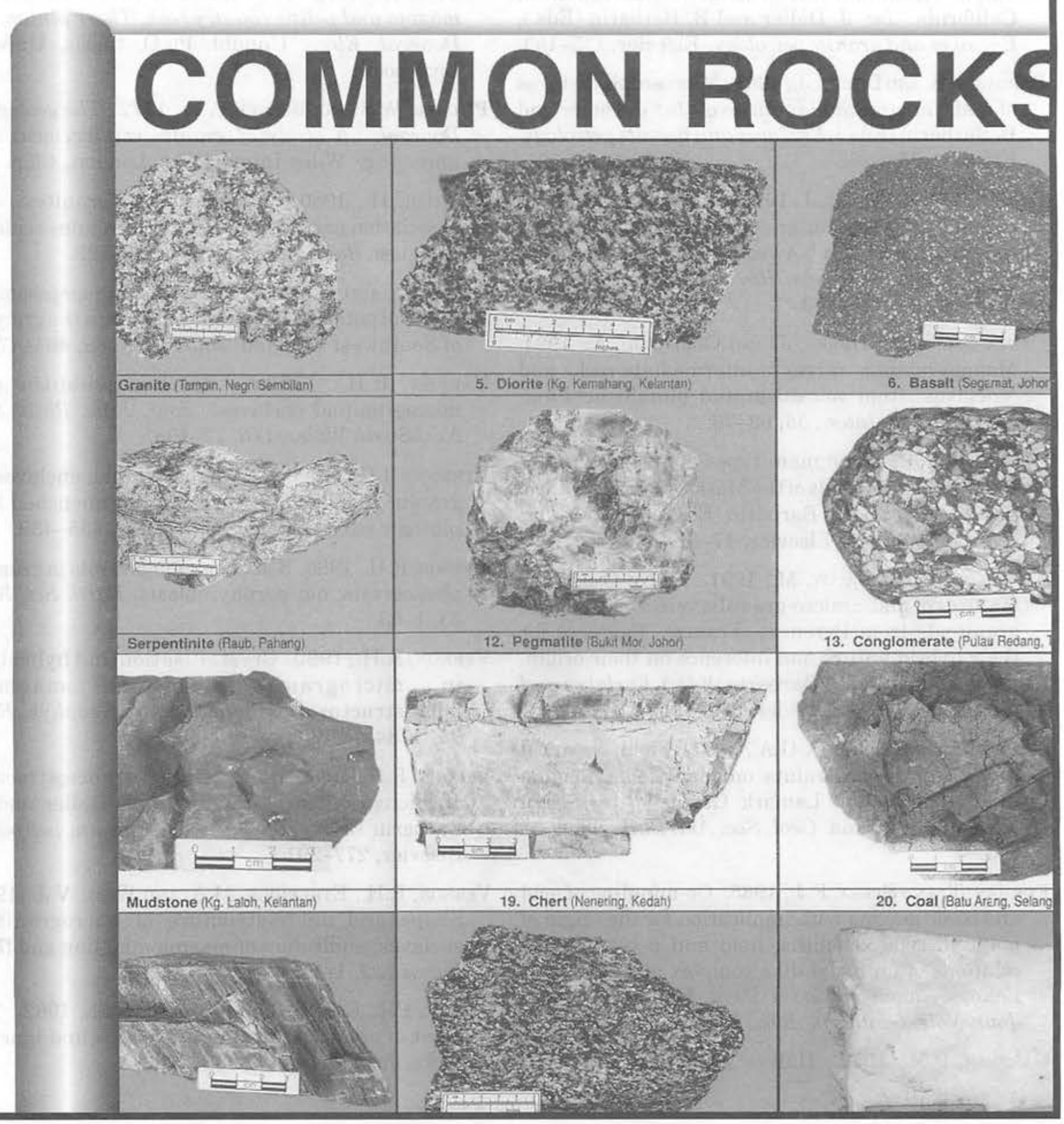

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PERTEMUAN PERSATUAN
Meetings of the Society

Ceramah Teknik (Technical Talk)

Needed new technologies for the 21st Century: new systems for sustainable development, urban, and rural

W.S. FYFE

Laporan (Report)

Prof. Fyfe, who is currently the external examiner at the Geology Department, University of Malaya, gave an informative talk on 30th July 1999 at 5.00 pm at the Geology Department, University of Malaya.

Abstrak (Abstract)

As we move to the 21st Century, we face a new world demography, a world population of at least 10 billion, with Europe and North American 10–12% of world population. Many of our present systems must change (urban planning, energy, transport, food production, waste management, use of materials for construction). There are great opportunities for sciences and engineering. Examples include those from Europe, North America, Brazil, China, and India. We can solve most of the future problems but we require new systems, TEAMS of experts, who can work together with economists and planners. ECO-logy, ECO-nomy, are not in conflict! Our fundamental life support systems include:

- Climate
- Air to breath
- Water to drink and for agriculture
- Soil of quality for food production
- Transport technologies
- Materials of all types derived from the Earth (fertilizers, wood, steel, concrete ......)
- The careful management of wastes of all types
- Energy, which at present is 90%, derived from oil, gas, coal
- Biodiversity

Almost all of these basic components of our life support systems are being seriously changed in ways, which could change the total ecology of our planet. Air quality is deteriorating in most of our giant urban complexes. Water quantity and quality is a growing concern in many nations. But perhaps most of all we are changing the climate, temperature, rainfall distribution, winds, by additions of various gases to our atmosphere. Many of our present technologies could lead to our destruction!

Can we produce the necessary sustainable technologies? The answer is yes! But we must develop new systems, new TEAMS of experts to address the critical problems. And these teams must include experts from sociology and economics, and such people must consider the long term impacts of development.

Specific examples discussed include:

- Removal of toxic elements from water
- Nuclear waste isolation

- Combustion gas disposal
- Soil remediation using wastes and minerals
- Soil erosion reduction
- Clean mining using microorganisms
- And, solar energy, light, wind, waves

For all such problems, knowledge for the Earth Sciences is at the foundation of the development of truly sustainable systems. All people on this planet must be educated to understand and respect their support systems, universal literacy, numeracy and sciency. Quality education is the key to survival and quality of life. We must respect our planet and biodiversity.

Every human uses several tons of rocks and minerals every year for the diverse needs of modern society. Such uses include those for construction, metals, fertilizers and energy. All our resources, and many of our waste disposal systems involve the manipulation of rocks and minerals of the outer few km of our planet.

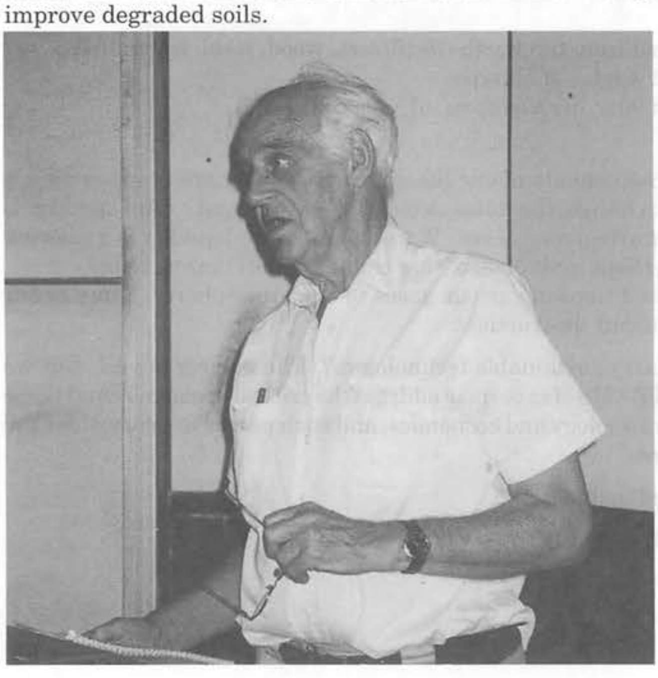
Recently, 1993, the former editor of Science, Koshland, wrote:

"First of all, it is important to identify the main villain as overpopulation. In the good old days (viewed through the myopia of nostalgia), the water, air, flora and fauna existed in an idyllic utopia. But, in truth, there were famine, starvation, horses and buggies that contributed to pollution, fireplaces that spewed forth soot from burning soft coal, and water contaminated with microorganism. The humans were so few, and the land so vast, that these insults to nature could be absorbed without serious consequence. That is no longer true."

We have been careless. First we have neglected quality control with many materials used on a large scale. Examples include the minor elements in coal (such as halogens, arsenic, uranium and many others), the minor elements in phosphate fertilizers, even the impurities in construction materials. Recent studies show vast areas of polluted soils with elements like arsenic, cadmium, lead.

We must improve our technologies and quality control of raw materials (all elements). The recent discoveries of microorganisms which exist to depths of over 4 km suggest exciting new opportunities for metal extraction. We could mine metals like copper and zinc in their sulphide ores using bacteria and avoid huge disturbance of land. Recent work in New Zealand has shown that certain trees can be used to concentrate gold from low-grade ores.

A growing world problem involves the deterioration of soil quality, soil erosion. We must learn to prevent erosion and to remineralize soil. During a recent visit to Japan I was impressed by the positive influences on soil fertility of volcanic ash. In Portugal we have shown that the sediments accumulated in dams and reservoirs can be very effective soil additives. Work in India and Canada has shown that with quality control, coal ash can greatly improve degraded soils.



W.S. Fyfe

The careful disposal or long term isolation of toxic waste products is a growing world problem. Over the next decades the world will spend many billions of dollars on nuclear waste isolation. Where are the best places on Earth to isolate such wastes? Where do we have massive rock volumes with very low permeability or time scales of millions of years? Which are the best rocks for absorbing toxic elements? Recently we have shown that certain types of basalts are excellent for the underground disposal of combustion gases and acid rain components. The processes are mediated by deep bacteria.

We can improve our technologies for the use of minerals and for the reduction of wastes. We need new economics which consider the long-term impacts of mineral use and the recycling of mineral products. It is also clear from recent work that there are vast metal resources on or near the seafloor, an international resource.

And, when advanced nations use the mineral resources of developing nations, the environmental laws which apply at home, must also apply in all foreign operations.

Malam Sains Tanah/Soil Science Night — Report

Tuesday, 10th August, 1999

Geology Department, University of Malaya

The above event was attended by about 30 members. Three prominent Soil Scientists, namely Prof. Shamshuddin (UPM), Sdr. Ghulam (MARDI) and Dr. Paramananthan (Consultant) presented interesting talks covering various aspects of soil science. It is interesting to note that geologists working in soil science not only have to deal with rocks and minerals, soil chemistry, but also a host of biological "components" such as worm casts, groundnuts, corns, etc. It is also interesting to note that in soil science, soil depths of > 150 cm (1.5 m) are considered very deep! — recall engineering soils?

A very lively Q&A session followed the three presentations.

The abstracts of the three papers presented for the Malam is enclosed below.

Footnote: Prof. Shamshuddin has kindly left behind reprints of the following papers (now lodged at Klompe) for members' reading pleasure:

i) Shamshuddin, J. and Ismail, H., 1995. Reactions of ground magnesium limestone and gypsum in soils with variable-charge minerals. Soil Science Soc. of America Jour., vol. 59, no. 1, Jan-Feb 1995, 106–112.

ii) Shamshuddin, J., Syed Omar, S.R. and Sharifuddin, H.A.H., 1997. Alleviating soil acidity in highly weathered tropical soils by limestone and gypsum applications. Trends in Soil Science, vol. 2 (1997), 205–215.

iii) Shamshuddin, J., Sharifuddin, H.A.H. and Bell, L.C., 1998. Longevity of ground magnesium limestone applied to an ultisol. Commun. Soil Sci. Plant Anal., 29(9 & 10), 1299–1313 (1998).

Tan Boon Kong
Chairman
Working Group on
Engineering Geology & Hydrogeology

Reactions of limestone and gypsum in soils under tropical environment

J. SHAMSHUDDIN

Abstrak (Abstract)

Being exposed to tropical environment, Malaysian soils are mostly weathered. These soils are infertile due to low pH, high Al and deficient in Ca and/or Mg in the subsoil. Maize and groundnut do not produce high yield unless the soils are treated with appropriate amendments. Limestone and gypsum available in large quantities in the country are often used to ameliorate the soils. This paper describes chemical reactions in Malaysian soils affected by limestone and gypsum.

Limestone application ameliorates the topsoil where soil pH goes up, followed by lowering of Al. The Ca and Mg from the lime accumulate in that zone. These Ca and Mg are held by the increased negative charge when the soil pH is raised. Hence, the subsoil is unable to benefit from this agronomic practice. The change in soil pH due to gypsum application is small. Some Ca from gypsum move into the subsoil. In the soils containing high Al there is a slight drop in pH. On the contrary, pH of soils with high oxides content increases slightly. There is also an increase in negative charge of these soils. The increase in pH and negative charge is due to replacement of OH^- by SO_4^{2-}. The chemical reactions mentioned have important management implication for sustainable crop production.

On-site nutrient depletion as a cause and an effect of soil erosion

GHULAM M. HASHIM

Abstrak (Abstract)

On-site nutrient depletion is an ongoing process in many parts of the world, especially tropical areas; in the words of E. Smaling, it is a 'quiet crisis' which is threatening sustainable agriculture and food security.

Soil erosion is one of several processes contributing to on-site nutrient depletion. Others include leaching, harvest of agricultural products and removal of crop residues. Although these processes are measurable, they are rarely all considered in the same experimental system, making assessment of their relative significance difficult.

Nutrient depletion can also be a contributing cause of soil erosion because, when nutrients are limiting, there is lower production of above- and below-ground biomass which protects the soil against erosion. This is less frequently recognised than the fact that nutrient depletion is an effect of soil erosion.

Nutrient loss by soil erosion is the product of soil loss and the nutrient content of sediment, but many also be predicted from soil loss and topsoil nutrient content. However, soil erosion is a selective process which preferentially removes the fertile top layers of the soil profile. This nutrient-rich sediment is further enriched during transport by the selective settling of relatively heavier particles. Thus, prediction of nutrient depletion must take these enrichment processes into account.

The concept of enrichment ratio (ER) is central to predicting nutrient loss from soil loss data, particularly with increasing scale. Unfortunately, ER is not constant, varying with soil type, erosion event and scale of measurement. Separating sediment into bed load and suspended load components is particularly useful in studying nutrient enrichment process.

The problem of scaling from experimental plot to catchment level remains a major difficulty. As scale increases, erosion mechanisms change, producing sediment with ER values approaching 1.

Nutrient balance studies, where the effect of added nutrients on soil loss can be quantified, help to identify those situations where nutrient depletion is a cause of soil erosion. In nutrient balances for low-input systems, nutrient loss by soil erosion can be large. Such balances highlight which interventions should receive priority.

Rock weathering and soil formation in Malaysia

S. PARAMANANTHAN

Abstrak (Abstract)

The term *soil* is a collective and general term that can describe all kinds of soils. To different people the term *soil* means different things. To the housewife it is the material found in gardens and in which flowers and vegetables are grown. A geologist considers the soil to be the loose material covering the rocks he/she wants to examine. An engineer looks at soils as materials that he/she has to manipulate or move to build foundations or dams or the material that can be used as road-bed material. To an agriculturalist, the soil is a medium for the growth of plants. A general definition of soil is that it is a natural body occurring on the earths surface and supporting or capable of supporting plants and consisting of minerals and organic materials. It is characterized by related horizons formed by the interaction of climate and vegetation on various parent materials (weathered rock) over varying periods of time and modified by local relief.

Soils can be divided into three broad groups — *in situ* soils, alluvial soils and organic soils. *In situ* soils are formed by the weathering of rocks in place. Alluvial soils are formed by the transport by water, wind or ice of weathered material and deposited in some place other than the original place of weathering. Organic soils are soils formed by the accumulation of organic soil material on the earth's surface either in waterlogged depressions or at high altitudes.

Soils are formed by the weathering of rocks. In temperate areas, low temperatures and low rainfall result in soils which are shallow and often rich in nutrients. Both diurnal and seasonal changes in temperature, presence of ice and frost are important soil forming factors in these areas. Physical weathering plays an important role in soil formation. In contrast, in the Tropics, continuous high temperatures and heavy rainfall results in soils which are deep and low in nutrients. Chemical weathering plays an important role in soil formation. In the Tropics therefore both the high temperature and high rainfall act on the different parent materials or rocks to produce the different soil types. The nature of the rock type, its chemical composition, texture of the rock and its weatherability can be expected to strongly influence the nature and characteristics of the soils formed over the different rock types.

The weathering of three igneous rock types namely granite, rhyolite and basalt are used in this paper to illustrate the influence of the parent rock on the genesis, physical, chemical and mineralogical properties of the soils developed over them. Both granite and rhyolite are acid igneous rocks which have similar chemical and mineralogical composition — consisting essentially of quartz, feldspar with minor amounts of muscovite and biotite, but differ in grain-size. In contrast, the basalt is a basic igneous rock and consists mainly of ferromagnesian minerals such as pyroxene, amphibole and plagioclase feldspar. The rates of weathering of these rock types under a tropical environment differ considerably.

Granite being a coarse grained rock can weather quite quickly. The free quartz which is coarse is relatively resistant to weathering and remains in the soil as coarse sand while the feldspar and micas (especially biotite) weather rapidly to give rise to clay-sized minerals — kaolinite and illite. Thus the resultant soil (e.g. Rengam Series) is deep (> 3 metres) has a brownish yellow colour and a coarse sandy clay texture. Chemically these soils have a low cation exchange capacity (CEC) (< 16 cmol(+)kg^{-1} clay) and a free iron content of less than 5%. The clay mineralogy is dominated by kaolinite with little goethite and some illite.

Rhyolite being fine grained rock is often a more compact rock which is more difficult to weather. Consequently the soils developed on this rock type tend to be shallow to moderately deep (< 1 metre). The soil developed over this rock type (e.g. Penyabong and Kulai Series) have fine sandy clay to silty clay textures. Silt contents often exceed 30% indicating a younger soil. Colours tend to be yellow to light gray. Chemically these soils tend to have a moderate CEC values (16–24 cmol(+)kg^{-1} clay). Free iron content is less than 5% and the clay mineralogy may be dominated by illite with smaller amounts of kaolinite.

Basalt being a fine grained basic igneous rocks is a highly weatherable rock type in the Tropics. The mineral present viz. pyroxene, amphiboles and calcium-rich plagioclase all weather rapidly to clay-sized particles. The soils developed over such rock types (e.g. Kuantan Series are deep (> 3 m) and have clay textures, red or brown colours and strong fine structures with a high porosity. These soils often have very

Table 1. Influence of geology (parent materials) on the soil characteristics and soil management.

NATURE OF ROCK TYPE					SOIL CHARACTERISTICS								MANAGEMENT IMPLICATIONS
Name	Origin	Grain-size	Dominant Minerals	Chemical Character	Colour	Texture	Soil Depth (cm)	Common Diagnostic Horizon	Clay % Consistence	Iron Content (%)	CEC cmol/kg soil	Trace Elements	
Granite	Acid Igneous	Coarse	Quartz, K-Feldspar, K-Mica, Fe-Mica	High silica. Moderate K. Low iron	Brownish yellow Strong brown	cosc	150 + V. deep	argillic	30–50/ friable	2–5	6–8	High Boron	Erodibility. Prone to large landslips. Low fertility.
Rhyolite	Acid Igneous	Fine	Quartz, K-Feldspar, K-Mica, Fe-Mica	High silica. Moderate K. 'Low iron'	Brown yellow –yellow	fsc-sic	50–100 Shallow to deep	argillic	30–40 silt > 20 /firm	2–5	6–8	High Boron	Firm consistence, less weatherable. High K levels. Steep terrain.
Basalt	Basic Igneous	Fine	Fe-rich minerals. Little Quartz	High Fe, Mg, Ca	Red/Brown	c	150 + V. deep	oxic	70 +/ friable	10–15	< 4	Low Boron High Ni/Cr	Prone to moisture stress. P-fixation. B deficiency. Ni/Cr toxicity possible.
Serpentinite	Ultrabasic Igneous	Coarse	No quartz. Fe, Ca/Mg rich. No quartz.	High Fe. High Ni/Cr. Low B	Reddish Brown	c	150 + V. deep	oxic	70 +/ friable	10–20	< 4	Low B. High Ni/Cr	P-fixation. Ni/Cr toxicity. B deficiency.
Sandstone	Sedimentary	Coarse	Quartz, others variable	High silica	Brownish yellow to reddish yellow	scl	75–150 Mod. to deep	argillic spodic on very sandy area	18–35/ friable	< 5 but variable	< 5	Low	Erodibility. Moisture stress. Low fertility especially K-levels.
Mudstone/ shale	Sedimentary	fine	kaolinite/ quartz	Variable	Light gray yellow to red	sic-c	75–150 Mod. to deep	argillic to oxic depending on iron content	35–70/ friable to firm	Variable 2–10	Variable 5–30	Low	***Low iron soils* —** impeded drainage and strong compact soils. ***High iron soils* —** well drained fine structured friable soils. Variable fertility. Somewhat higher K-levels.
Riverine Alluvium	Alluvium	Variable clay to sands	Quartz	Variable	Light gray to brownish yellow	Variable sands to clays	Deep > 100	Cambic/ argillic	Variable 5–70	< 5	Variable but often low 5–10	Low	Poor drainage. Low fertility status (especially K).
Marine Alluvium (Clay)	Alluvium	Fine	Montmorillonite	High in magnesium and calcium sulfate/sulfides	Blueish to gray to black	sic-c	Deep > 100	Cambic sulfuric/ Sulfidic	30–70 + silt 30+	Low < 5	High > 15	Low	Poor drainage/flooding. Salinity. Low K levels. High Mg/Ca levels. Acid sulfate conditions.
Beach Sands	Alluvium	Coarse	Quartz	Very low in all elements except SiO_2	White to yellow	sand	Deep 100 +	Spodic/ None	0–10	Low	Very low	Very low	Very low nutrient retention. Very low moisture retention. Acute trace element deficiency.

low CEC values (< 8 cmol(+)kg^{-1} clay) with free iron contents exceeding 10%. The clay mineralogy is dominated by goethite, gibbsite and some kaolinite.

From the above discussion it can be seen that in a tropical environment, the nature of the rock — its chemical composition, mineralogy and grain-size determines to a large extent the depth, colour, texture, structure, the CEC and clay mineralogy of the soils developed over them. These properties play an important role in the management of these soils. The influence of the geology for a range of rock types and alluvial deposits on the soil characteristics and soil management implications for agriculture are summarised in the attached table.

S.PARAMANATHAN

GHULAM M. HASHIM

J. SHAMSHUDDIN

Dynamic Stratigraphy & Tectonics of Peninsular Malaysia

Second Seminar:

The Western Belt & Palaeozoic of Peninsular Malaysia and neighbouring areas

Saturday, 14 August 1999

REPORT

The second seminar in the series of seminars under the theme *'Dynamic Stratigraphy & Tectonics of Peninsular Malaysia'*, organised by the society's Sedimentology & Stratigraphy Study Group, was recently held at the Department of Geology, University Kebangsaan Malaysia. Kamal Roslan, the UKM coordinator for the study group, organised the seminar while Shafeea Leman chaired the whole morning session. A total of eight full-papers were presented. The abstracts of all the papers can be found below.

Prof. Basir Jasin, the Head of the Department of Geology UKM, in his welcoming address, emphasized the need to revise and update the knowledge of the stratigraphy of Peninsular Malaysia. This, he said, is important because stratigraphy and historical geology is the basis of our understanding of the geology of the peninsula.

The seminar was attended by more than forty participants. All the papers presented were well received and responded with spirited, probing questions and well participated discussion.

Pak Tjia (Dr. H.D. Tjia from PRSS), who was one of the presenters, was invited by the seminar committee to give the closing remark. He gave an encouraging congratulatory remark to the committee for organising the seminar, but reminded them to make sure that the final, edited version of all the papers will eventually be published in the near future, as promised in the circulars.

The seminar ended at around 1.30 pm with a simple lunch.

Abdul Hadi Abd. Rahman

Dynamic Stratigraphy & Tectonics of Peninsular Malaysia

Dynamic Stratigraphy & Tectonics of Peninsular Malaysia

Second Seminar:

The Western Belt & Palaeozoic of Peninsular Malaysia and neighbouring areas

Saturday, 14 August 1999

ABSTRACTS OF PAPERS

Significance of radiolarian chert in the northwestern zone of Peninsular Malaysia

BASIR JASIN

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

Radiolarian cherts are found in the Mahang, Kubang Pasu, Semanggol, and Kodiang formations. The radiolarian faunas indicate that the age of the Kubang Pasu chert is Early Carboniferous. The age of Semanggol chert ranges from Early Permian to Middle Triassic and the age of the chert from the Kodiang Limestone is Late Triassic. The radiolarian chert is a good indicator of the deep water environment. The lithologic association of the chert and the geochemical data suggest that the chert was deposited on a passive continental margin which episodically received the supply of terrigenous material from the continent. During the Cambrian, both Machinchang and Jerai formations were deposited in a deltaic environment. The development of basin was started in Ordovician where the deep marine Mahang Formation was deposited and followed by depositional of the Kubang Pasu and Semanggol formations. In Langkawi and Perlis, the Setul, Singa/Kubang Pasu and Chuping/Kodiang were deposited on shallow marine continental shelf environment.

Structural overprinting in the northwest and west domains of Peninsular Malaysia

H.D. TJIA

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The regional SSE strike of Peninsular Malaysia and the western belt of Sundaland is indicated by the elongations of the peninsula, Straits of Melaka, as well as Sumatra. This trend is overprinted onto a less distinct regional N-S tectonic grain that shows up as the Bentong suture, the Eastern Tectonic Zone of gravity anomalies, and the groupings of small Tertiary basins in the Straits of Melaka. The Central Belt of the Peninsula is now considered to continue

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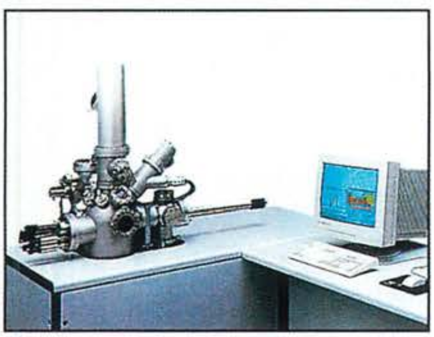

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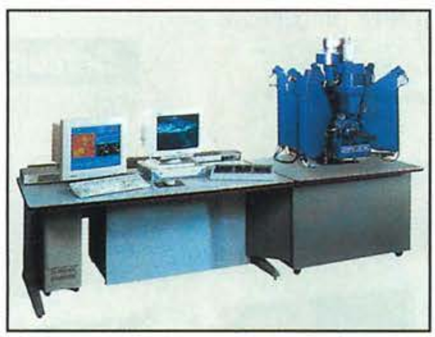

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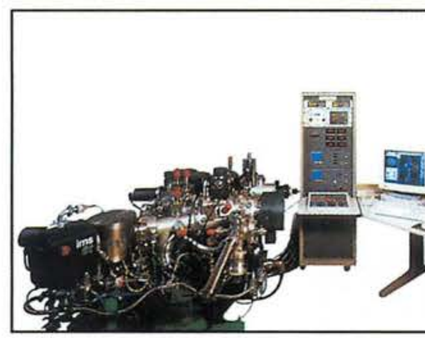

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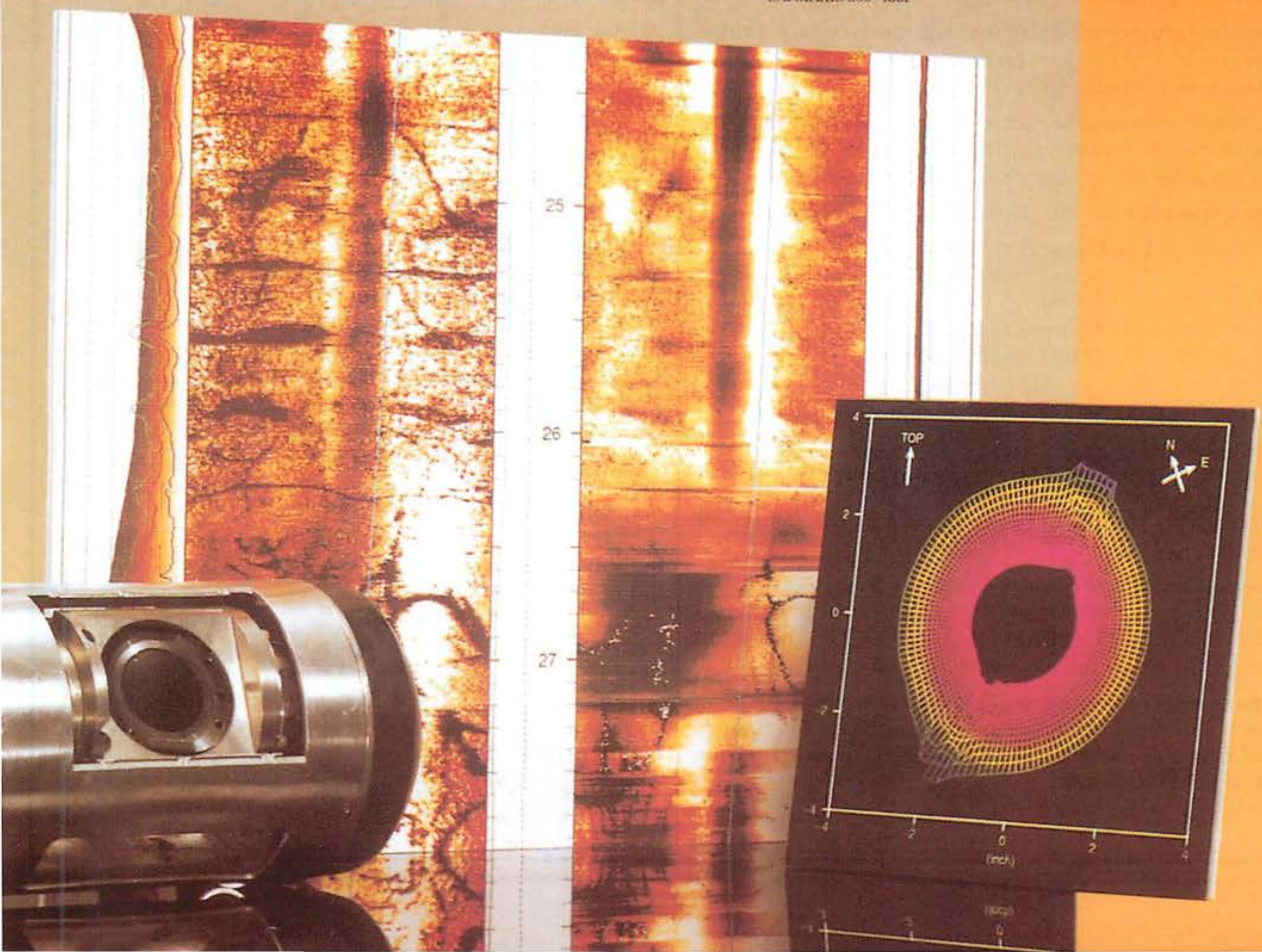

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HUTCHISON, C.S., 1989. *Geological Evolution of South-east Asia*. Clarendon Press, Oxford. 368p.

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.

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southward across the strait into Central Sumatra and is therefore oblique to a presumably younger geological strike. In descending order of magnitude the various overprinted structures in the peninsula are known as follows.

Intersection of zones of bouguer gravity anomalies and structural trends. An example exist in UKM's Bangi campus, where Upper Palaeozoic metaclastics strike as tight overturned, refolded folds in NNE direction while the bougeur gravity anomaly directions are perpendicular to the geological strikes.

Intersection of regional lineaments, that consist of folds, homoclinal ridges, faults and large fractures define seven domains in the peninsula. The tectonic grain is NNW to almost NW in domains 4 and 7 and are also present in domains 1 and 6. However, domain 1 has two more lineament trends, NNE and ENE. Each of domains 5 and 6 have two lineament directions, and together with domain 3 exhibit NE to ENE lineaments. A quarter century passed after these crossing lineaments were first noticed, but some of their origin are still unknown. The two intersecting lineaments in domain 5 represent N-S overturned fold trends in (?) Upper Palaeozoic metasedimentary rocks verging west, while the other belongs to tuffaceous phyllite and phyllitic schist deformed into refolded folds possibly overthrusted towards SE. It is not clear if SE-ward low-angle thrusting belongs to a separate deformation phase or if it represents back-thrusting during the regional west-verging deformation.

Other types of overprinting found in these two domains are:

- Multi-directional geological transport directions;
- Stacked layers rocks with different structural styles;
- Outcrop interference patterns where rootless folds or faults show up in two dimensions;
- Fold plunges of different trends and steepness;
- Refolded folds, coaxially or with divergent trends;
- Folded cleavage;
- Folded tectonic faults;
- Intersecting quartz veins of different internal structures;
- Intersecting and/or opposed sense of fault motions on the same fault or on parallel fault surfaces;
- Interpreted compression axes of different orientations in the same rock unit.

Western Belt granite of the Peninsular Malaysia

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The Western Belt granite is a huge mountain range along the western side of Peninsular Malaysia. The country rocks penetrated by the granites are predominantly isoclinally folded phyllitic Lower Paleozoic metasedimentary rocks including marble, and less strongly folded Upper Paleozoic formations. The granites are generally coarse to very coarse grained, primary texture, K-feldspar porphyritic biotite muscovite granite. Amphibole bearing granite is relatively rare and restricted to the northern part of the batholith. Mineralogical classification indicates that these granites are monzogranite to syenogranite with subordinate granodiorite. They are mildly metaluminous (ACNK = 0.92) to peraluminous (ACNK = 1.18). Although the granites in many aspects, are comparable to the 'S' type granites of the Lachlan Fold Belt, Australia, they also have some differences such as (1) occurrence of primary sphene, (2) the ACNK value in which the trend (with increasing SiO_2) is reverse to those observed in the 'S' type granite of the

Lachlan Fold Belt and (3) the behaviour of P in the Western Belt granite magmas contrast to the behaviour of P in the 'S' type magma of the Lachlan Fold Belt.

Stratigrafi Jalur Barat: korelasi dan permasalahan
(Stratigraphy of the Western Belt: Correlation and Problems)

KAMAL ROSLAN MOHAMED & BASIR JASIN

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Bangi, Selangor

Batuan di jalur barat Semenanjung Malaysia pada amnya boleh dibahagikan kepada tujuh unit; unit syis yang berusia Ordovisi hingga Silur (mungkin boleh dibahagi kepada dua unit ?), batu kapur Kuala Lumpur yang berusia Silur, unit rijang/argilit yang berusia Devon-Perm Awal, batu kapur Kinta (Devon-Perm Bawah), unit argilit (Karbon-Perm), unit lapisan merah berusia Jura Kapur, dan unit batu arang Tertiar. Unit-unit ini di sempadani oleh satah ketakselarasan. Unit syis seharusnya dijelaskan dalam unit litodem.

The rocks in the western belt of Peninsular Malaysia can be divided into seven major units; the schist unit which is Ordovician-Silurian in age (may be divided to two separate units ?), Kuala Lumpur limestone (Silurian), chert/argillite unit which is Devonian-Early Permian, Kinta limestone (Devonian-Lower Permian), argillite unit which is Carboniferous to Permian in age, red bed unit which is Jurassic-Cretaceous in age, and Tertiary coal bed unit. These units are bounded by unconformities. The schist unit should be explained in term of lithodemic unit.

The Upper Palaeozoic Singa-Kubang Pasu Mega-sequence: some thoughts on basin initiation, depositional and tectonic history

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The Early to Mid-Devonian deformation and metamorphic event which brings about the structural inversion of the Setul megasequence (the Machinchang & Setul Formation), was subsequently followed by a rifting episode, thus creating the nascent basin for the deposition of the Singa-Kubang Pasu megasequence. Initially, within an oxidising shallow marine environment, the basal red mudstones and sandstones facies were deposited. As the basin gradually deepens, clean, quartz-rich shallow marine sands were introduced into some parts of the basin. Further subsidence related to a more intense rifting phase, brought about significant changes to the spatial configuration of the Late Palaeozoic basin. This phase of tectonic movements resulted in the creation of at least two, and most possibly three, sub-basins. The westernmost Singa sub-basin is a small basin that remain *relatively stable* and shallow throughout the Late Palaeozoic. To the east, and separated from the Singa sub-basin by a half-graben type ridge, is the more extensive Kubang Pasu sub-basin, which can be separated into a shelfal-type and an abbysal-

type sub-basin. These sub-basins remain tectonically active throughout the Palaeozoic; these movements resulted in continuous, gradual subsidence that facilitated the accommodation of thick pile of clastic sediments.

The basinal configuration also governs the sediment supply into the different sub-basins. The smaller Singa sub-basin is starved of terrigeneous detritus due to the absence of great uplifts and the lack of well exposed siliciclastic provenance. This resulted in the dark-coloured, muddy facies with abundant thin siltstones and subordinate flat-bedded sandstones.

The Kubang Pasu sub-basin, characterised by a more extensive rifting and associated vertical movements, receive a good supply of quartzo-felsphatic materials. The shallower, shelfal-type sub-basin (Perlis area) is characterised by a general shallowing-upward, sanding-upward flysch-type succession resulting from turbidite deposition throughout a large part of its evolution. The depth extent of the eastern abyssal-type sub-basin is reflected by the distinct shale-chert interbedding in the lower part of the succession. The upper part recorded substantial amount of sands, possibly brought into as turbidite fan deposits.

Towards the Early Permian, due to a rapid fall in relative sea level and possibly coupled with a regional climatic change, sedimentation within the Singa-Kubang Pasu basin gradually transform from a siliciclastic-dominated deposition into a mix, clastic-carbonate one, as shown in the Lower Permian 'Passage Beds'. The commencement of the Chuping limestone indicate the termination of the terrigeneous-dominated Singa-Kubang Pasu regime, this possibly related to a new basinal order.

Petrogenesis of the Bukit Mertajam-Kulim granite

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The Bukit Mertajam-Kulim granite consists of three units, namely, the Mertajam, Bongsu and Panchor granites which were emplaced in a relatively short time span between 180 to 224 Ma. All three units consists of rocks ranging from equigranular fine to coarse grained syeno-to monzogranite with subordinate porphyritic types. The essential minerals in all granites are K-feldspar, plagioclase, quartz, biotite, muscovite, tourmaline, apatite, zircon, garnet and opaque phases. The range of SiO_2 for each of the units overlap: Mertajam granite (71.49–74.73%), Bongsu granite (73.59–76.27%) and Panchor granite (70.21–73.91%). The rocks in many aspects, are comparable to the 'S' type granites from the Lachlan Fold Belt of Australia. The mineral mixes predicted in the major elements modelling confirm the dominance of plagioclase and K-feldspar in the fractionation process.

The Lower Permian 'Passage Beds' of the Kubang Pasu Formation, Perlis: facies, stratification and significance

ABDUL HADI A.R.

Department of Geology
University of Malaya
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The Lower Permian 'Passage Beds' are the conformable clastic-carbonate transition between the Upper Palaeozoic Kubang Pasu and Singa Formations and the Permian Chuping Formation. The bedding characteristic (flat bedded, parallel laminated and lacks interbedded mudstone), the fossil content and its stratigraphic position below the Chuping limestone suggest a shallow marine environment of deposition. The presence of very well rounded quartz grains probably suggest some form of aeolian association.

The model for the deposition of mixed, shallow marine terrigeneous clastics and carbonate based on present day Gulf of Elat in the Red Sea (Friedman, 1988) can be suited to the Passage Beds of the Kubang Pasu Formation. This climatic and sedimentological model requires an arid to semi-arid coastal environment. The clean, quartz rich, angular-grained sandstones probably represent deposits of flash-floods during rare heavy rain-falls within a coastal, arid to semi-arid environment. At other times, carbonate-secreting organism thrives in a warm, shallow marine environment close to the coast. The well-rounded detrital quartz grains were probably brought into the shallow sea areas during strong winds, or desert storms.

Sempadan litostratigrafi batuan Paleozoik zon baratlaut Semenanjung Malaysia

ZAITON HARUN & BASIR JASIN

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

Apabila ada sempadan ketakselarasan yang ditemui, maka pembahagian formasi menjadi lebih mudah dan nyata. Di Malaysia, parameter ini jarang-jarang sekali ditemui. Oleh itu pentafsiran yang berdasarkan fosil (jika ada), bentuk sekitaran pengendapan menjadi salah satu daripada kriteria yang dipakai dalam membuat korelasi penyamaan ruang masa pengendapan. Jika tiada fosil penunjuk usia dan penunjuk sekitaran pengendapan yang jelas (misalnya Formasi Bukit Kenny) ditambah pula batuan telah mengalami sedikit metamorfisme, kerencaman struktur menjadi bahan utama yang dilihat. Kertas ini bertujuan untuk meninjau sejauh mana kerencaman struktur mempengaruhi stratigrafi baratlaut Semenanjung Malaysia dengan melihat beberapa contoh daripada jalur tersebut.

Penjom Gold Mine & Raub Australian Gold Mine — Site Visit

This fieldtrip, organised by the Working Group on Economic Geology, attracted 20 participants, who checked in at the Lipis Inn Hotel in Kuala Lipis on the evening of Saturday, 21 August 1999.

After a restful night, it was rise and shine early the next day, and after a quick breakfast, the group got into their 4WDs to be in time for the 7.30 am appointment at the Penjom Gold Mine.

The Chief Geologist of Penjom Gold Mine, Mr. Roy Kidd, gave a comprehensive account of the geology, mineralisation and mining activities at Penjom. The interested participants came up with numerous questions for a lively discussion. Next a representative from the Processing Plant briefed the group on all the processes involved in extracting the gold. Various specimens of gold was passed round to keep the participants better focused. The group then crowded into Mr. Kidd's room to be briefed on the computer applications in conducting mining activities and evaluation procedures.

The group was then shown the core shed to view the diamond drill cores available. Next was the site visit to the main pit of the Kalompong East area. The participants were taken down the pit to have a better view of the gold mineralisation. The participants then had a busy time trying to collect samples of gold.

The group was then taken on a tour of the Processing Plant to view the processes involved in extracting the gold.

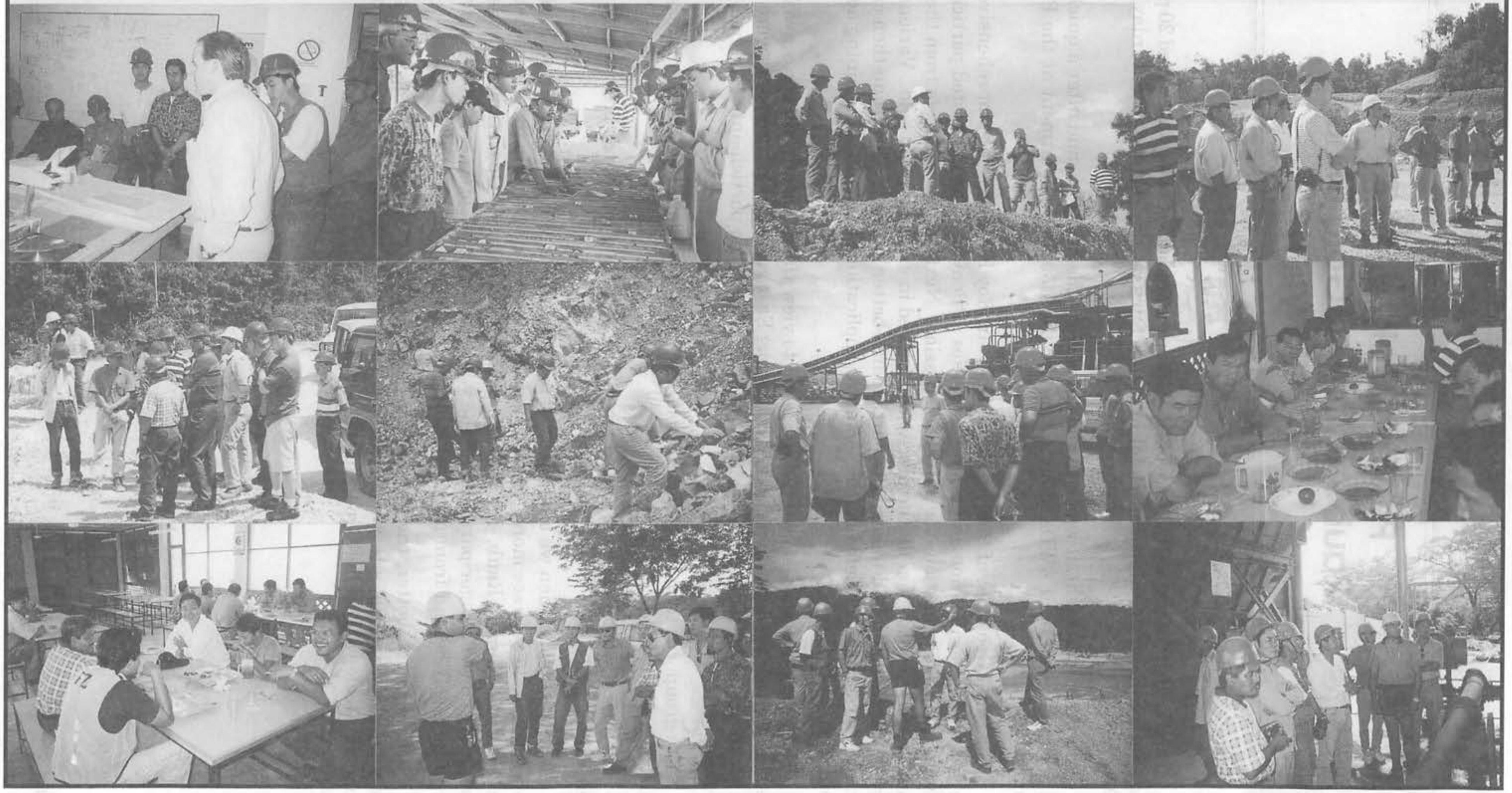
By then it was lunch time and to top it all a welcomed lunch was provided by the mine at their canteen.

It was 2.00 pm when we bade farewell to Penjom Gold Mine and since it was still early and everyone was eager to see more gold, we made an unscheduled visit to the Raub Australian Gold Mine at Bukit Koman, Raub. Mr. Peter Papacharalambous, the Operations Manager, was kind enough to show the eager participants the various innovative processes involved in processing the tailings left behind from previous mining activities.

Feeling much better, the group then headed back for Kuala Lumpur. The participants thoroughly enjoyed the site visits and hoped that more such visits could be planned by the Economic Geology Working Group in the near future.

G.H. Teh

Penjom Gold Mine & Raub Australian Gold Mine — Site Visit



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3. David Roger Wall
7th Floor, JSEB, KAV 52, Jalan Jenderal Sudirman, Jakarta 12190.

4. Mustaffa Kamal Shuib
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Student Members

1. Rosni Lokmanul Hakim
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Jabatan Geologi, Universiti Malaya, 50603 Kuala Lumpur.

9. Ku Zulianna Ku Mahamad
Jabatan Geologi, Universiti Malaya, 50603 Kuala Lumpur.

10. Jasmi Hafiz Abdul Aziz
Jabatan Geologi, Universiti Malaya, 50603 Kuala Lumpur.

11. Zulliani Khalid
Jabatan Geologi, Universiti Malaya, 50603 Kuala Lumpur.

12. Muhammad Fauzi Deraman
Jabatan Geologi, Universiti Malaya, 50603 Kuala Lumpur.

13. Hayati Turiman
Jabatan Geologi, Universiti Malaya, 50603 Kuala Lumpur.

PETUKARAN ALAMAT (Change of Address)

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

1. Mohd For Mohd Amin
Fakulti Kejuruteraan Awam, Universiti Teknologi Malaysia, 81310 UTM Skudai, Johor.

2. Roger Higgs
2a Harbord Road, Oxford OX2 8LQ, England.

PERTAMBAHAN BAHARU PERPUSTAKAAN (New Library Additions)

The Society has-received the following publications:

1. Episodes vol. 22, no. 2, 1999.
2. Tin International, vol. 72, no. 6, 1999.
3. Geosciences Journal, vol. 3, no. 2, 1999.
4. AAPG Explorer, June, July & August 1999.
5. Tin International, vol. 72, no. 7, 1999.
6. AAPG Bulletin, vol. 83/5, 83/6 & 83/7, 1999.
7. Journal of Geosciences, Osaka City University, vol. 42, 1999.
8. Geological Survey of Japan, Bulletin, vol. 50, nos. 3 & 4, 1999.
9. Natural History Research, special issue no. 6, 1999 & vol. 5, no. 2, 1999.
10. Journal of the Natural History Museum & Institute, Chiba, vol. 5, no. 2, 1999.
11. American Museum of Natural History, Bulletin nos. 239, 240, 1999.
12. Monthly statistics on mining industry in Malaysia, April, 1999.
13. U.S. Geological Survey Prof. Paper: 1998: no. 1597, 1386-1.
14. U.S. Geological Survey Bulletin: 1998: nos. 1995-w, x. 1997: 2144, 2143.
15. U.S. Geological Survey Circulars: 1997: 1142.

BERITA-BERITA LAIN
Other News

Local News

Steps to minimise damage to environs

Adequate measures will be taken to minimise environmental damage in major development projects, including road construction, Works Minister Datuk Seri S. Samy Vellu said.

He said in the construction of the RM1.54 billion Simpang Pulai-Lojing-Gua Musang-Kuala Berang highway project, for instance, about five per cent of the total cost of the project was dedicated to "environmental protection work".

These include Environmental Impact Assessment studies, slope rehabilitation and stabilisation work, constant monitoring of noise and dust pollution level as well as the water quality of affected rivers.

For this purpose, contractors are required to engage an independent consultant who will submit quarterly reports to the Department of Environment.

At the same time, Samy Vellu said, the recently set-up Public Works Department's Environmental Management Committee would monitor the situation and advise the contractors accordingly.

Speaking to reporters after a day-long visit to the project sites in three States yesterday, Samy Vellu said at least six EIA studies had been conducted before the commencement of the project as required under the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987, which came into force on April 1, 1988.

Except for the Simpang Pulai-Pos Slim stretch of the road, the highway stretching over 292 km covering Perak, Pahang and Kelantan, is in the initial stages of construction.

The Simpang Pulai-Pos Slim stretch covering 21 km, on which construction started in October 1990, has been completed.

The project is divided into eight packages and is carried out by eight different contractors.

The project, dubbed as the second east-west highway, from Simpang Pulai in Perak to Kuala Berang in Terengganu, passing through Kampung Raja in Pahang, and Lojing and Gua Musang in Kelantan, is expected to be ready in 2003.

Samy Vellu however admitted that despite the numerous measures, a certain level of environmental degradation did occur as a result of the massive clearing of land for the project.

However, he said this could be expected as otherwise there would not be any development.

"Nevertheless, contractors have been told to exercise due care and if the road passes through areas where there are rare or protected plant species, realignment would be necessary," he said.

NST, 18.8.1999

KALENDAR (CALENDAR)

1999

September
THE CONTINENTAL PERMIAN OF THE SOUTHERN ALPS AND SARDINIA (ITALY): Regional reports and general correlations (International Field Conference), Brescia, Italy. (Contact: Prof. G. Cassinis, Dipartimento di Scienze della Terra, Universita di Pavia, Via Ferrata, 1, I-27100 Pavia, Italy. Tel: 39 382 505834; Fax: 39 382 505890; E-mail: cassinis@ipv36.unipv.it)

September
INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS (29th Congress), Bratislava, Slovakia. (Contact: Prof. L. Melioris, Comenius University, Mylinska Dolina, 84215 Bratislava, Slovakia. Tel/Fax: +42 7 725 446; E-mail: podzvody@fns.uniba.sk)

September
INTERNATIONAL SOCIETY OF ROCK MECHANICS (9th International Congress), Paris, France. (Contact: Dr. S. Gentier, Secrétaire Général du CFMR, BRGM/DR/GGP, Avenue Claude Guillemin, B.P. 6009, F-45060 Orléans Cedex 2, France. Tel: +33 2 38 64 38 77; Fax: +33 2 38 64 30 62)

September 6–9
BIOGEO IMAGES 99 (International Conference sponsored by SEPM, Association de Paleontologie Francaise, and others), Dijon, France. (Contact: BGI 99, Biogeosciences-Dijon, UMR 5561 CNRS, 6 blvd Gabriel, 21000 Dijon, France. E-mail: BGI99@u-bourgogne.fr; Website: http://www.u-bourgogne.fr/BIOGEOSCIENCE/BGI99.htm)

September 6–10
INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS "Hydrogeology and Land Use Management" (29th Congress), Bratislava, Slovakia. (Contact: Marian Fendek, Geological Survey of Slovak Republic, Mylinska Dolina 1, 81704 Bratislava, Slovakia. Tel: +421-7 3705355; Fax: +421-7 371940; E-mail: IAHCONG@GSSR.SK)

September 6–12
MINING AND THE ENVIRONMENT II (International Meeting), Sudbury, Ontario, Canada. (Contact: Sudbury '99, Centre in Mining and Mineral Exploration Research (CIMMER), Laurentian University, Sudbury, Ontario, P3E 2C6, Canada. Tel: +705 673 6572; Fax: +705 673 6508; E-mail: cmosher@nickel.laurentian.ca *or* bevans@nickel.laurentian.ca)

September 12–15
OIL & GAS IN THE 21ST CENTURY — DAWN OF THE THIRD AGE (AAPG International Conference and Exhibition), Birmingham, UK. (Contact: AAPG Convention Dept., P.O. Box 979, Tulsa, OK 74101-0979, USA. Tel: 1 918 560 2679; Fax: 1 918 560 2684; E-mail: convene@aapg.org; Website: www.aapg.org)

September 16–17
NON-VOLCANIC RIFTING OF CONTINENTAL MARGINS: A COMPARISON OF EVIDENCE FROM LAND AND SEA (International Conference of Geological Society of London), London, United Kingdom. (Contact: R.B. Whitmarsh, Challenger Division, Southampton Oceanography Centre, European Way, Southampton U.K. SO14 3ZH; Fax: +44 1703 596554; E-mail: bob.whitmarsh@soc.soton.ac.uk; Website: http://www.soest.hawaii.edu/margins/; abstract deadline: April 16, 1999)

September 19–24
ABRAHAM GOTTLOB WERNER (1749–1817) AND HIS TIMES, Freiberg, Germany. Organized by TU Bergakademie Freiberg and the International Commission on the History of Geological Sciences (INHIGEO). (Contact: Dr. Peter Schmidt. Tel: +49 (0) 3731 39-3235; Fax: +49 (0) 3731 39-3289; E-mail: pschmidt@ub.tu-freiberg.de *or* Prof. Dr. Helmuth Albrecht. Tel: +49 (0) 3731 39-3406; Fax: +49 (0) 3731 39-3406; E-mail: halbrecht@vwl.tu-freiberg.de)

September 26 – October 2
VII INTERNATIONAL SYMPOSIUM ON MESOZOIC TERRESTRIAL ECOSYSTEMS, Buenos Aires, Argentina. (Contact: Georgina Del Fueyo, Avda. Angel Gallardo 470, 1405

Buenos Aires, República Argentina. Tel/Fax: 54-1 983-4151; E-mail: imposio@musbr.org.secyt.gov.ar)

September 26 – October 6
FIFTH INTERNATIONAL CONGRESS ON RUDISTS, Erlangen, Germany (with post-conference excursion to the Alps). (Contact: Prof. Dr. Richard Höfling, Institut für Paläontologie, Universität Erlangen-Nürnberg, Loewenichstrasse 28, D-91054 Erlangen, Germany. Tel: +49 9131-85 22 710; Fax: +49 9131-85 22 690; E-mail: richie@pal.pal.uni-erlangen.de)

September 27–30
PALEOCEANOLOGY OF REEFS AND CARBONATE PLATFORMS: MIOCENE TO MODERN (International Meeting), Aix-en-Provence, France. (Contact: Gilbert F. Camoin, Cerege BP 80, F-13545, Aix-en-Provence, cedex-4, France. Tel: +33 4 42 97 15 49; E-mail: camoin@cerege.fr)

October 3–6
VII INTERNATIONAL CONGRESS ON PACIFIC NEOGENE STRATIGRAPHY, Mexico City, Mexico. (Contact: Prof. A. Molina-Cruz, Inst. Cien, Mar. y Limnol., UNAM, Ap. Post 70-305, Ciudad Universitaria, Mexoco D.F. 04510. Tel: 52-5-6225816; Fax: 52-5-6160748; E-mail: amolina@mar.icymyl.unam.mx)

October 13–17
FOSSIL ALGAE (7th International Symposium), Nanjing, China. (Contact: Mu Xinan, Nanjing Institute of Geology and Palaeontology, Academia Sinica, 39 East Beijing Road, Nanjing 210008, China. Fax: +86-25 335 7026); E-mail: algae@pub.jlonline.com)

October 25–28
GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Denver, Colorado, USA. (Contact: GSA Meetings Dept., P.O. Box 9140, Boulder, CO 80301-9140, USA. Tel: +1 303 447 2020; Fax: +1 303 447 1133; E-mail: meetings@geosociety.org; WWW: http://www.geosociety.org/meetings/index.htm)

October 30 – November 4
SOIL SCIENCE SOCIETY OF AMERICA (Annual Meeting), Salt Lake City, Utah, USA. (Contact: SSSA, 677 So, Segoe Rd., Madison, WI 53711, USA. Tel: 1 608 273 8090; Fax: 1 608 273 2021; E-mail: rbarnes@agronomy.org)

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)

July 31 – August 4
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)

August 6–17
31ST INTERNATIONAL GEOLOGICAL CONGRESS, Geology and Sustainable Development: Challenges for the Third Millennium, Rio de Janeiro, Brazil. (Contact: 31st IGC Secretariat Bureau, Av. Pasteur, 404-ANEXO 31 IGC, Urca, Rio de Janeiro RJ, CEP 22.290-240 Brazil. Tel: +55 21 295 5847; Fax: +55 21 295 8094; E-mail: 31igc@cristal.cprm.gov.br; Website: www.31igc.org. To request current Circular, send e-mail to mailto:address@31igc.org)

September 3–8
GOLDSCHMIDT 2000 (International Conference), Oxford, UK. (Contact: P. Beattie, Cambridge Publications, Publications House, P.O. Box 27, Cambridge UK CB1 4GL. Tel: +44-1223 333438; Fax: +44-1223 333438; E-mail: Gold2000@campublic.co.uk; Website: http://www.campublic.co.uk/science/conference/Gold2000/)

October
INTERNATIONAL MILLENNIUM CONGRESS ON GEOENGINEERING, Melbourne, Australia. (More information soon)

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)

October 23–27
INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS (30th Annual Meeting), Cape Town, South Africa.

November 13–16
GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Reno, Nevada, 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)

November 19–24
GEOTECHNICAL AND GEOLOGICAL ENGINEERING — GEOENG 2000 (International Conference), Melbourne, Australia. (Contact: GeoEng2000, ICMS Pty. Ltd., 84 Queensbridge Street, Southbank, Vic 3006, Australia. Tel: +61 3 9682 0244; Fax: +61 3 9682 0288); E-mail: geoeng2000@icms.com.au; Website: http://civil-www.eng.monash.edu.au/discipl/mgg/geo2000.htm)

2001

March 22–25
NATIONAL EARTH SCIENCE TEACHERS ASSOCIATION (Annual Meeting), St. Louis, Missouri, 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 8–11
AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (Annual Meeting), Denver, Colorado, 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)

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)

2002

March 10–13
AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (Annual Meeting), Houston, Texas, USA. (Contact: AAPG Conventions Department, P.O. Box 979, 1444 S. Boulder Ave., Tulsa, OK 74101-0979, USA. Tel: +1 918 560 2679; Fax: +1 918 560 2684; E-mail: dkeim@aapg.org)

March 20–27
NATIONAL EARTH SCIENCE TEACHERS ASSOCIATION (Annual Meeting), San Diego, California, 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)

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

GEOLOGICAL SOCIETY OF MALAYSIA PUBLICATIONS

Back Issues Available

Bulletin 1 (Feb 1968). 79 p. Studies in Malaysian Geology. Edited by P.H. Stauffer. A collection of papers presented at a meeting of the Geological Society on 31st January 1967. Price: RM3.00. **Out of Stock.**

Bulletin 2 (Dec 1968). 152 p. Bibliography and Index of the Geology of West Malaysia and Singapore by D.J. Gobbett. Price: RM10.00 - Softcover, M$15.00.

Bulletin 3 (Mar 1970). 146 p. Papers in Geomorphology and Stratigraphy (with Bibliography supplement). Edited by P.H. Stauffer. Price: RM10.00.

Bulletin 4 (Jun 1971). 100 p. Papers in Petrology, Structure and Economic Geology. Edited by P.H. Stauffer. Price: RM10.00.

Bulletin 5 (Feb 1973). 70 p. The Search for Tungsten Deposits by K.F.G. Hosking. Price: RM10.00.

Bulletin 6 (Jul 1973). 334 p. Proceedings, Regional Conference on the Geology of Southeast Asia. A collection of papers, Kuala Lumpur, March, 1972. Edited by B.K. Tan. Price: RM22.00 – hardcover only.

Bulletin 7 (Jun 1974). 138 p. A collection of papers on geology. Edited by B.K. Tan. Price: RM12.00.

Bulletin 8 (Dec 1977). 158 p. A collection of papers on geology. Edited by T.T. Khoo. Price: RM12.00.

Bulletin 9 (Nov 1977). 277 p. The relations between granitoids and associated ore deposits of the Circum-Pacific region. A collection of papers presented at the IGCP Circum-Pacific Plutonism Project Fifth Meeting. 12-13 November 1975, Kuala Lumpur, Edited by J.A. Roddick & T.T. Khoo. Price: RM25.00. **Out of stock.**

Bulletin 10 (Dec 1978). 95 p. A collection of papers on the geology of Southeast Asia. Edited by C.H. Yeap. Price: RM10.00. **Out of stock.**

Bulletin 11 (Dec 1979). 393 p. Geology of Tin Deposits. A collection of papers presented at the International Symposium of 'Geology of Tin Deposits', 23-25 March 1978, Kuala Lumpur. Edited by C.H. Yeap. Price: RM50.00.

Bulletin 12 (Aug 1980). 86 p. A collection of papers on geology. Edited by G.H. Teh. Price: RM20.00.

Bulletin 13 (Dec 1980). 111 p. A collection of papers on geology of Malaysia and Thailand. Edited by G.H. Teh. Price: RM20.00.

Bulletin 14 (Dec 1981). 151 p. A collection of papers on geology of Southeast Asia. Edited by G.H. Teh. Price: RM30.00.

Bulletin 15 (Dec 1982). 151 p. A collection of papers on geology. Edited by G.H. Teh. Price: RM30.00.

Bulletin 16 (Dec 1983). 239 p. A collection of papers on geology. Edited by G.H. Teh. Price: RM30.00.

Bulletin 17 (Dec 1984). 371 p. A collection of papers on geology. Edited by G.H. Teh. Price: RM35.00.

Bulletin 18 (Nov 1985). 209 p. Special Issue on Petroleum Geology. Edited by G.H. Teh & S. Paramananthan. Price: RM30.00.

Bulletin 19 (Apr 1986) **& 20** (Aug 1986). GEOSEA V Proceedings Vols. I & II, Fifth Regional Congress on Geology, Mineral and Energy Resources of Southeast Asia, Kuala Lumpur, 9-13 April 1984. Edited by G.H. Teh & S. Paramananthan. Price for both Bulletins 19 & 20: Members – RM50.00, Non-Members – RM125.00.

Bulletin 21 (Dec 1987). 271 p. Special Issue on Petroleum Geology Vol. II. Edited by G.H. Teh. Price: RM40.00.

Bulletin 22 (Dec 1988). 272 p. Special Issue on Petroleum Geology Vol. III. Edited by G.H. Teh. Price: RM40.00.

Bulletin 23 (Aug 1989). 215 p. A collection of papers on the geology of Malaysia, Thailand and Burma. Edited by G.H. Teh. Price: RM35.00.

Bulletin 24 (Oct 1989). 199 p. A collection of papers presented at GSM Annual Geological Conference 1987 and 1988. Edited by G.H. Teh. Price: RM35.00.

Bulletin 25 (Dec 1989). 161 p. Special Issue on Petroleum Geology Vol. IV. Edited by G.H. Teh. Price: RM40.00.

Bulletin 26 (Apr 1990). 223 p. A collection of papers presented at GSM Annual Geological Conference 1989 and others. Edited by G.H. Teh. Price: RM40.00.

Bulletin 27 (Nov 1990). 292 p. Special Issue on Petroleum Geology Vol. V. Edited by G.H. Teh. Price: RM40.00.

Bulletin 28 (Nov 1991). 292 p. Special Issue on Petroleum Geology Vol. VI. Edited by G.H. Teh. Price: RM40.00.

Bulletin 29 (Jul 1991). 255 p. A collection of papers presented at GSM Annual Geological Conference 1990 and others. Edited by G.H. Teh. Price: RM40.00.

Bulletin 30 (Apr 1992). 90 p. Annotated bibliography of the geology of the South China Sea and adjacent parts of Borneo by N.S. Haile. Edited by G.H. Teh. Price RM20.00

Bulletin 31 (Jul 1992). 176 p. A collection of papers presented at GSM Annual Geological Conference 1991 and others. Edited by G.H. Teh. Price: RM35.00.

Bulletin 32 (Nov 1992). 283 p. Special Issue on Petroleum Geology Vol. VII. Edited by G.H. Teh. Price RM50.00

Bulletin 33 (Nov 1993). 419 p. Proceedings Symposium on Tectonic Framework and Energy Resources of the Western Margin of the Pacific Basin. Edited by G.H. Teh. Price: RM60.00.

Bulletin 34 (Dec 1993). 181 p. Bibliography and Index — Publications of the Geological Society of Malaysia 1967-1993. Compiled by T.F. Ng. Edited by G.H. Teh. Price: RM30.00.

Bulletin 35 (Jul 1994). 174 p. A collection of papers presented at GSM Annual Geological Conference 1992 & 1993 and others. Edited by G.H. Teh. Price: RM35.00.

Field Guide 1 (1973). A 7-day one thousand mile, geological excursion in Central and South Malaya (West Malaysia and Singapore). 40 p. by C.S. Hutchison. Price: RM5.00. **Out of stock.**

Abstracts of papers (1972). Regional Conference on the Geology of Southeast Asia, Kuala Lumpur, 1972. 64 p. 8 figs, 3 tables, many extended abstracts. Edited by N.S. Haile. Price: RM6.00.

Proceedings of the Workshop on Stratigraphic Correlation of Thailand and Malaysia Vol. 1. (1983). Technical Papers. 383 p. Price: RM25.00 (Members: RM12.00).

WARTA GEOLOGI (Newsletter of the Geological Society of Malaysia). Price: RM5.00 per bimonthly issue from July 1966.

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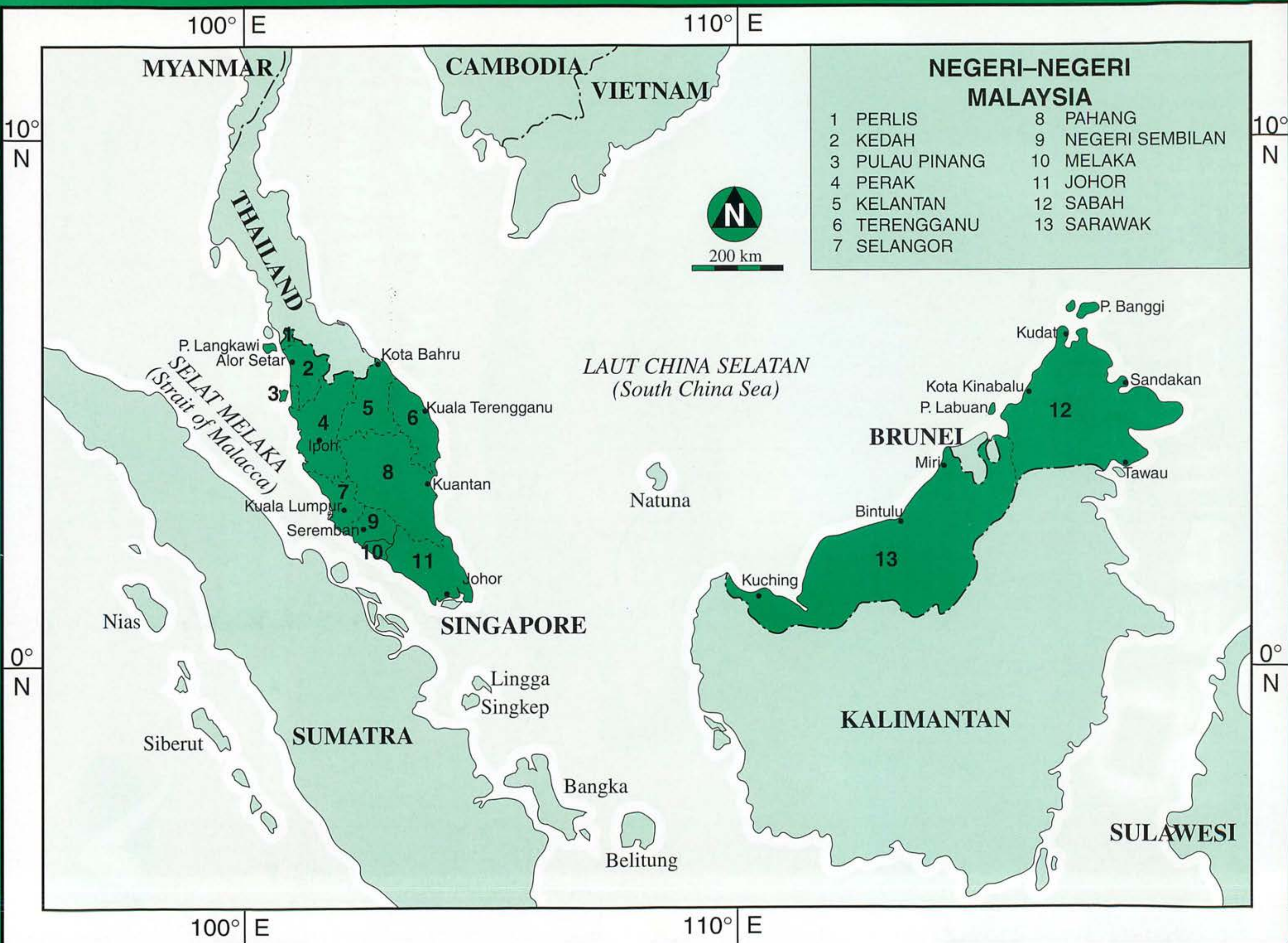
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