# Geological Society of Malaysia

## PERSATUAN GEOLOGI MALAYSIA

# NEWSLETTER

Number 47 March 1974


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Issued bimonthly by the Geological Society of Malaysia,
c/o Department of Geology, University of Malaya, Kuala Lumpur,
Price to non-members: M$1/copy. Back issues M$0·50 to members.

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GEOLOGIC NOTES

## Some trace element analysis of West Malaysian and Singapore granites

C.H. Yeap, University of Malaya, Kuala Lumpur

This is an interim report on a study of some trace elements in West Malaysian and Singapore granites* which was carried out in conjunction with the writer's postgraduate research project at the Geology Department, University of Malaya.

The purpose of this study is to investigate whether there are trace element differences between granites from different parts of West Malaysia and Singapore and to relate, if possible, the chemical variations to known phenomena. The study is also of economic interest as some trace elements in granites from known mineralised areas and granites from areas with little or no mining activity are compared.

Preliminary qualitative work by the writer using X-ray spectrometry indicates that there are significant differences in the contents of Rb, Sr, Zr, Ba, Sn and Nb in granites from different localities (Fig. 1). Encouraged by these results about 300 more samples were later analysed more quantitatively for these elements (Fig. 2, sample localities). Tungsten was also included in the analyses as its content was claimed to have an important bearing on mineralisation by Beus (1969).

Rb, Sr, Zr and Ba were analysed quantitatively using X-ray spectrometry based on the method of element line and scattered background radiation (Kalman & Heller, 1962). International granite standards and synthetic "granite" containing the required elements were used to construct calibration curves. Pressed pellets were made from powder of split fractions of specimens (20 - 30 lbs). Rapid semi-quantitative colorimetric methods were used for the analyses of tin, niobium and tungsten (Stanton, 1966). Further details on experimental work can be found in Yeap (in manuscript).

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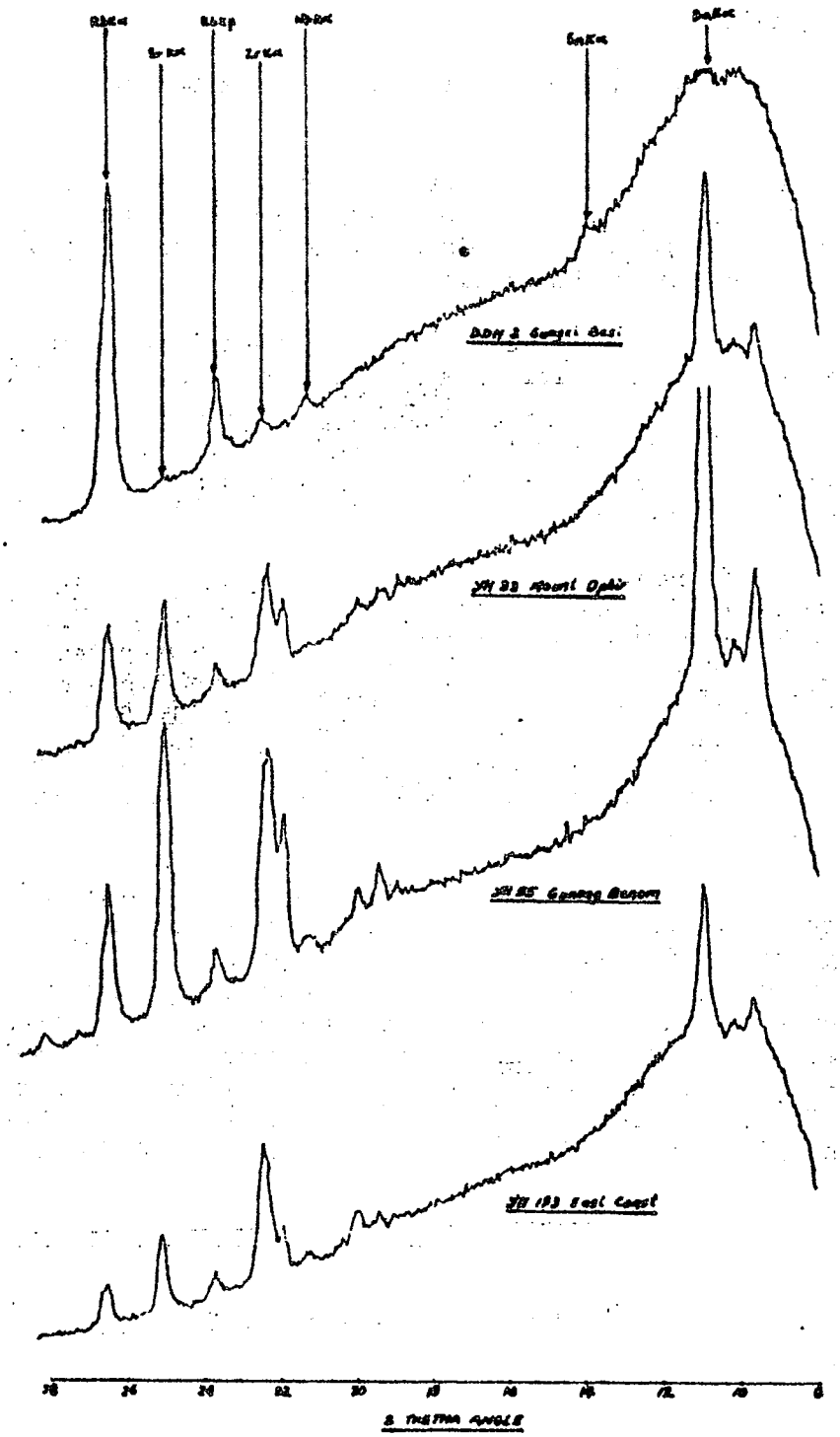
* Granite is here used loosely for all coarse grained acid igneous rocks.

## XRF SCAN ON MALAYSIAN GRANITES Fig. 1



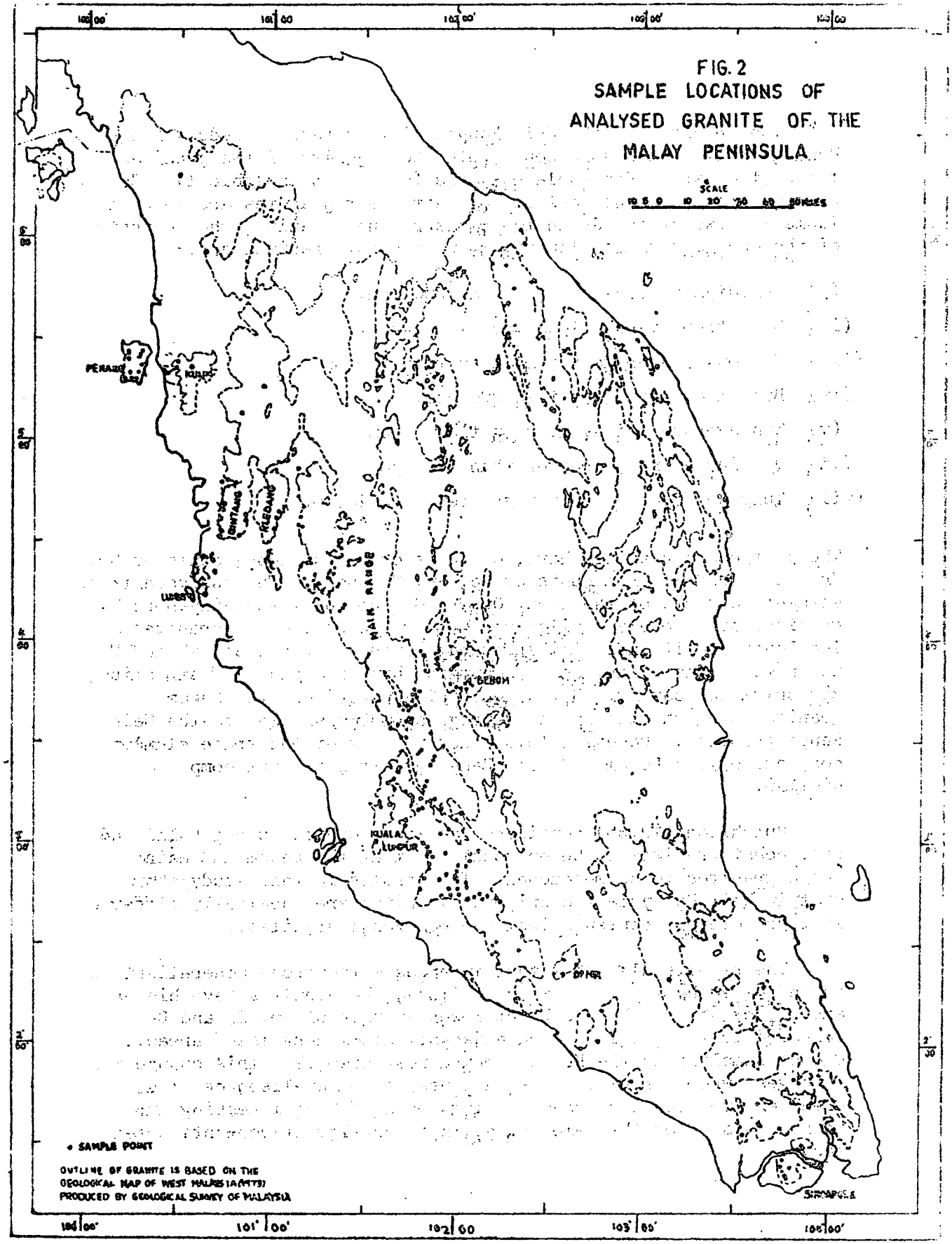


FIG. 2
SAMPLE LOCATIONS OF
ANALYSED GRANITE OF THE
MALAY PENINSULA
SCALE
10 5 0 10 20 30 40 50 MILES
PENANG
KEDAH
MAIN RANGE
KUALA LUMPUR
SINGAPORE
• SAMPLE POINT
OUTLINE OF GRANITE IS BASED ON THE
GEOLOGICAL MAP OF WEST MALAYSIA (1973)
PRODUCED BY GEOLOGICAL SURVEY OF MALAYSIA

The granites of the Main Range, Bintang Range, Kledang Range, Penang, Kulim and Johore constitute the majority of the granites on the west-coast of Peninsula Malaysia (No. 1 - 6 in Table 1). Some average trace element contents of west coast granites are shown in Table 1. Except for Sr in the Bintang Range granite, the contents of the analysed trace elements in west coast granites are:-

(i) Rubidium average greater than 300 ppm.

(ii) Strontium average less than 110 ppm.

(iii) Zirconium average mainly less than 120 ppm.

(iv) Barium average less than 800 ppm.

(v) Tin average mainly greater than 6 ppm.

(vi) Niobium average greater than 5.8 ppm.

(vii) Tungsten average mainly greater than 2 ppm.

The east coast granites have, on the average, higher amounts of Sr, Zr and Ba and lower amounts of Rb, Sn, Nb and W. The analysed trace element contents of the Mount Ophir, Gunong Pulai and Singapore granites are closely similar to that of the east coast granites. The Benom granite has similar average amounts of Rb, Sn, Nb and W as in west coast granites but contains higher amounts of strontium, zirconium and barium. Hutchison (1973a) considers the Benom granite to be chemically and petrographically similar to the Main Range granites. However, this study shows that the trace element contents of the Benom and Main Range granites are not completely similar.

Hutchison (1973b) considers the Mount Ophir, Gunong Pulai and east coast granites to be epizonal and that the Benom and Main Range granites to be mesozonal. The results in this study show that in West Malaysia the epizonal granites are chemically different in trace element contents from the mesozonal granites.

The results also show that in areas with strong mineralisation, as indicated by intense mining activity, the granites have higher amounts of Rb, Sn, Nb and W but lower amounts of Sr, Zr and Ba compared to the granites from adjacent "non-mineralised" areas. Closer sampling in the Kuala Lumpur area shows that this change is strongest where granitic rocks are nearest mineralised centres. Granites from the east coast mining areas of Sungei Lembing and Gambang also show the same change in trace element contents noted above.

Within the Main Range, where the K-Ar ages of granites are mainly Triassic, Bignell (1972) has dated granites which are Carboniferous and Permian. Examples of these are the granites in the Chenderiang Valley, Cameron Highlands, Bujang Melaka and the area north of Genting Sempah. The granites from these areas were found to have relatively higher amounts of strontium, zirconium and barium but lower amounts of rubidium and tin than in other Main Range granites.

Further work on trace analysis for chlorine, fluorine, lithium, copper, lead and zinc, including also the major elements in granites are being processed and will be reported later.

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Bignell, J.D. and Snelling, N.J. (1972). The geochemistry of the Thai-Malay Peninsula. Geol. Soc. Malaysia. Abstracts of Papers. Annex to Newsletter No. 34 p. 62.

Hutchison, C.S., (1973a). Tectonic Evolution of Sundaland: A Phanerozoic Synthesis. Geol. Soc. Malaysia, Bull. 6, p. 61-86.

Hutchison, C.S. (1973b). Plutonic activity. In "Geology of the Malay Peninsula: West Malaysia and Singapore". Eds. D.J. Gobbett and C.S. Hutchison. John Wiley-Interscience, New York. p. 215-252.

Kalman, Z.H., and Heller L., (1962). Theoretical Study of X-ray Fluorescent Determination of Traces of Heavy Elements in a Heavy Matrix. Analytical Chemistry Vol. 34, No. 8, p. 946-951.

Stanton, R.E. (1966). Rapid Methods of Trace Analysis for Geochemical Applications. Edward Arnold Ltd. London.

TABLE 1 - Average trace element content in ppm

| | AREA | Rb | Sr | Zr | Ba | Sn | Nb | W | No. of Samples | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. | MAIN RANGE | 531 | 53 | 103 | 365 | 7.3 | 7.2 | 4.3 | 160 | |
| | a. Bujang Melaka | 340 | 25 | 154 | 475 | 6.4 | 7.0 | 1.8 | 4 | Perm |
| | b. Fraser's Hill | 583 | 51 | 100 | 280 | 8.3 | 8.5 | 7.6 | 28 | |
| | c. Cameron Highlands I | 709 | 21 | 60 | 124 | 7 | 9 | 5 | 4 | |
| | d. Cameron Highlands II | 468 | 65 | 195 | 497 | 5.7 | 7.8 | 4.7 | 14 | U. Carb. |
| | e. Negeri Sembilan | 511 | 68 | 111 | 396 | 7.4 | 8.7 | 2.4 | 48 | |
| | f. Genting Sempah I | 574 | 56 | 133 | 358 | 9.1 | 7.3 | 1.8 | 8 | |
| | g. Genting Sempah II | 342 | 101 | 186 | 725 | 5.4 | 7.7 | 5.3 | 6 | Carb (?) |
| | h. Chenderiang | 384 | 64 | 176 | 877 | 6 | n.d. | 1 | | Carb (?) |
| | i. Kuala Lumpur - fringe area | 528 | 59 | 92 | 482 | 10 | 9 | 3 | 14 | |
| | j. Kinta Valley | 603 | 4 | 61 | 219 | 7 | 8 | 6.5 | 3 | M |
| | k. Kuala Lumpur | 658 | 25 | 69 | 145 | 8 | 7 | 5.7 | 30 | M |
| 2. | BINTANG RANGE | | | | | | | | | |
| | a. Taiping | 738 | 41 | 64 | 6 | 11 | 7 | 720 | 3 | M |
| | b. Other areas | 426 | 164 | 243 | 577 | 5.6 | 7.7 | 1.8 | 8 | M |
| 3. | KLEDANG - KINTA VALLEY | 624 | 13 | 77 | 183 | 6 | 8 | 9.2 | 5 | |
| 4. | PENANG | 466 | 40 | 85 | 330 | 7.9 | 7.4 | 1.3 | 13 | |
| 5. | KULIM | 481 | 109 | 115 | 550 | 9.1 | 5.8 | 1 | 6 | |
| 6. | JOHORE | | | | | | | | | |
| | a. South Johore | 348 | 19 | 109 | 253 | 5.4 | 9.2 | 3.2 | 10 | |
| | b. Bekok | 222 | 122 | 125 | 1441 | 5 | 6 | 1.3 | 3 | |
| 7. | LUMUT | 652 | 4 | 77 | 149 | 8.7 | 7.5 | 5.3 | 4 | M |
| 8. | GUNONG BENOM | 323 | 186 | 16.2 | 694 | 6.3 | 6.9 | 5.8 | 17 | |
| 9. | MOUNT OPHIR | 289 | 207 | 128 | 825 | 5 | 5 | 1.2 | 5 | Cret-Tert |
| 10. | GUNONG PULAI | 146 | 193 | 135 | 808 | 5.8 | 5.7 | 1.3 | 4 | Cret-Tert |
| 11. | SINGAPORE | 186 | 66 | 107 | 984 | 4.3 | 3.2 | 1.5 | 11 | |
| 12. | EAST COAST | 216 | 158 | 142 | 838 | 5.6 | 6 | 1.6 | 45 | |

(M = Area of strong mineralisation)

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Abstracts of Papers*: AGM Discussion Meeting, February 22nd 1974

## A fossilized bee comb from Batu Caves, Selangor

P.H. Stauffer, Department of Geology, University of Malaya

A piece of reddish, calcareous cave earth collected from the quarry rubble at Kenneison Bros. quarry, Batu Caves, in 1970, was found to contain a structure, in white calcite, having the form of a bee comb: two layers of regular hexagonal cells, the layers back to back. Comparison of the fossil with combs built by wasps and bees indicates that it can only have been a comb of honey bees (tribus Apinidae). The dimensions of the fossil comb fit very well with combs built by Apis (Sigmatapis) javana (Enderlain 1906), but not with combs from the other two species of honey bees known from the Malay Peninsula, identifying the former as the probable architect. Preservation was in two stages: first the comb was coated by a layer of clear calcite (almost certainly under water), then the organic matter was replaced by more calcite. The age of the fossil is not known, but is likely to be Quaternary. The mode of preservation is interesting and suggests that similar fossils might be expected to be found in such cave earths.

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## Petrology of some Malayan conglomerates and their implications

P.H. Stauffer, Department of Geology, University of Malaya

Two late Paleozoic conglomeratic deposits show interesting features: A submarine channel fill in the Singa Formation, at Genting, Pulau Singa Besar, Langkawi, was evidently emplaced by mass flow, possibly in deep water. It is highly calcareous and contains shell fragments, implying resedimentation from shallow (and warm?) marine waters. The megaclasts include a variety of rock types: sandstone, fossiliferous limestone, shales, acid tuffs and ignimbrites, and acid plutonics. The relative absence of metamorphic rocks suggests that the plutonics formed a crystalline basement beneath the sediments. Since the sediments probably include eroded parts of the Cambrian Machinchang Formation, that basement must have been Precambrian.

* The abstracts of the other papers presented at this meeting were not submitted.

A submarine pebble mudstone or diamictite in the "Raub Group" a few kilometers east of Raub town, Pahang, shows the character of a large slump or debris flow deposit. Most of its bulk is made of distorted soft shale fragments, partly disaggregated to form the "matrix", implying resedimentation due to slumping. Rare calcareous fossils and shell fragments prove it is marine. Hard megaclasts include metamorphic rocks, granitic plutonics, and numerous intermediate to basic volcanic fragments, some serpentinized with a sheared matrix. Some of the basic tuff fragments were clearly soft at deposition, and the "matrix" contains many euhedral to subhedral feldspar grains, all of which implies contemporaneous volcanism of island arc character. An incipient slaty cleavage appears to have formed while the sediment was soft.

These characters suggest that the Singa deposit formed in a tectonic trough within or at the edge of a continental platform, while the Raub deposit may represent a deep sea trench adjoining a volcanic arc. Both deposits are of a probable Carboniferous age.

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Extracts from, and comments on, Mr F.J. Stephens' "Mineral Features of Pahang, Malay Peninsula"

K.F.G. Hosking, Department of Geology, University of Malaya

In 1900, Mr F.J. Stephens wrote a short paper on the "Mineral Features of Pahang, Malay Peninsula" which was based on observations when he had been, 'for a short time', assistant superintendent of the mines of Pahang Corporation, Ltd., at Sungei Lembing and Jeram Batang. After nearly three-quarters of a century, it seems worthwhile to resurrect the following comments of Stephens:-

Raised-beaches

"It is evident that there has been a considerable recession of the sea along the shores of Pahang at a comparatively recent period.

A low-lying tract of country, consisting of clays and coralline detritus, stretches back for many miles to the foot-hills". (p. 421).

Primary tin deposits in limestone

"In many parts of Pahang limestone is met with. It is asserted that tin ore has been found in situ associated with this limestone, but there is, I think, no proof that this was anything but an accidental association" (p. 421).

(Obviously Stephens' experience of the Cornish tin deposits made him very loathe to believe that primary tin deposits could occur in limestone. Much more recently the writer has met more than one eminent ore-geologist who have held, sometimes as a result of physico-chemical considerations, that such deposits could not exist, and this, in spite of the well-documented Malaysian occurrences! (K.H.)).

Gold

"The Raub Australian gold mine was started under somewhat shady circumstances, with little expectation of finding payable gold; but the average value of the quartz has steadily increased, until it is now about 1 oz. to the ton. The reefs .... (are) of the nature of irregular deposits. ..... it is too early to judge the permanent value of the Malay god deposits" (p. 422).

(This is one example of an aspect of mining economics that tends to be suppressed in the text-books! (K.H.)).

Tin

(i) "The interesting feature of Pahang is its tin lodes, worked extensively by the Pahang Corporation, Ltd., at Sungei Lembing and Jeram Batang, and about to be developed at Bundi in the adjoining state of Tringannan".

(ii) "There is in fact a well-defined mineral zone or belt, some 2 or 3 miles wide, and many miles in length, consisting of parallel lodes or reefs which in places produce rich shoots of tin. Very probably many other zones of stanniferous rocks exist in Pahang, but nowhere have the lodes shown such continuity and richness as at the points named" (p. 423). (It is interesting to compare this view with what is known today of the deposition and nature of the primary tin deposits of the East Coast (K.H.)).

(iii) "A peculiar feature of the lodes in the Kuantan District (i.e., at Sungei Lembing and Jeram Batang) is that as one lode ceases to be rich a parallel lode enters on a better course of ore, and as this in its turn becomes poor a third lode improves. Thus these mines consist of a series of step-like workings when looked at in the plans. In Cornwall, parallel lodes are often rich in parallel shoots, "ore against ore", in the Straits Settlements, the converse seems to hold good. Not only is this case in the main lodes, but in the structure of the lodes themselves the same step-like continuation of layers of rich ore occurs" (p. 423).

(With the development of the lodes in the mines in question, both laterally and in depth, the pattern of lodes and shoots is seen to be considerably more complex than appeared to be the case three-quarters of a century ago. However, the above extract demonstrates the long established mining practice of endeavouring to unravel the pattern of ore-distribution (and, of course, to base their exploration and development on their findings "(K.H.)).

(iv) In the Sungei Lembing and Jeram Batang mines "the colour of the tin stuff also varied greatly; in fact, it was quite easy to distinguish from which part of the mines any particular pile of stuff came (p. 424)".

(This holds, also, for some at least, of the Cornish mines. The writer could, for example, differentiate between the ore from the various lodes of the South Crofty Mine when he was visiting it frequently. In addition, in thin section, the general colour, nature and degree of zoning, etc., of the cassiterite permitted one to tell from which lode, or vein-swarm, any specimen under examination had been taken. (K.H.)).

(v) "There are many other tin lodes here and there in Pahang, and in other parts of the Malay Peninsula, but not approaching in continuity, depth, or value the Kuantan, lodes, nor giving any promise of permanency (p. 424)".

(This statement is still valid today. (K.H.)).

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Reference

STEPHENS, F.J. 1900. Mineral Features of Pahang, Malay Peninsular. Trans. Inst. Min. Metall., 9, 419-424.

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## MEETINGS OF THE SOCIETY

### Annual General Meeting: 22 February 1974

This AGM, following the patterns of previous year, was preceded by a Discussion Meeting. A number of papers on various geological topics were presented. The abstract of two of these papers appear earlier in this Newsletter. It is hoped that the abstracts of the other papers would be submitted for publication in the next issue of the Newsletter.

The annual business meeting of the Society received the reports of the various officials of the Society for 1973/74. Copies of these reports are enclosed together with this issue of the Newsletter. The Treasurer's report together with the statement of the Society's finances were discussed at some length. Several problems regarding the management of the Society's accounts were pointed out by the Treasurer who also proposed certain changes which would hopefully overcome these problems in the coming year.

Following this business meeting, the outgoing President announced the names of the Officers for 1974/75. The full list of these Officers appears in the inside ofront cover.

The outgoing President, Mr R.W. Murphy in departing from the tradition of previous years, announced that his Presidential Address would be delivered to the Society later in the year and not at the AGM. Instead of the Presidential Address, Mr Murphy gave a brief talk regarding the future role of the Society. Mr Murphy explained that this talk could not be published without permission from his company. Such views of the role of the Society in Malaysia seem to be very appropriate at this stage of the Society's development and perhaps Mr Murphy could be persuaded one day to have it written up and published in the Newsletter for the benefit of those members who were not present at the AGM.

Members attending the AGM were then entertained to a Satay/Beer Party given by the outgoing President. The Satay were delicious and the atmosphere was ideal for this once a year get-together of the Society. It seems a pity that more members did not avail themselves for this splendid opportunity.

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Meeting of 6th March 1974; Professor G.D. Garland

Professor G.D. Garland of the Geophysics Laboratory, Department of Physics, University of Toronto (External Examiner in Physics to Universiti Sains, Malaysia) gave a talk to members of the Society and the Department of Geology, University of Malaya on Wednesday, 6th March 1974 at 4.30 p.m. in the Geology Lecture Hall, University of Malaya.

Professor Garland talk was originally entitled "Geomagnetism and Palaeomagnetism". Professor Garland however gave a talk on the application of Geophysics to geological problems.

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NEWS OF THE SOCIETY

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formerly of: B.R. Yates, 247 Coode Street, Como, Perth, W. Australia 6152

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Indonesian Petroleum Association - Convention
June 3 and 4 1974

Venue - Hotel Borobudur Intercontinental, Jakarta, Indonesia

Program

| | | | |
|---|---|---|---|
| Sunday | - June 2 - | 6.00 p.m. | Opening Cocktail Party |
| Monday | - June 3 - | 9.30 a.m. | Opening Addresses |
| | | 10.30 a.m. | Technical session |
| | | 2.00 p.m. | Technical session |
| Tuesday | - June 4 - | 9.30 a.m. | Technical session |
| | | 2.00 p.m. | Technical session |
| | | 7.30 p.m. | Dinner Dance |

Post-Convention Field Trips to Balikpapan area of East Kalimantan and Medan/Lake Toba area will be available.

Technical sessions will include exploration papers on Central and North-west Java. Papers will also be given on deep sea drilling, geothermal energy and production practices.

Detailed program available from Secretary - IPA, Jalan Menteng Raya 3, Jakarta, Indonesia.

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