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P E R S A T U A N   G E O L O G I   M A L A Y S I A
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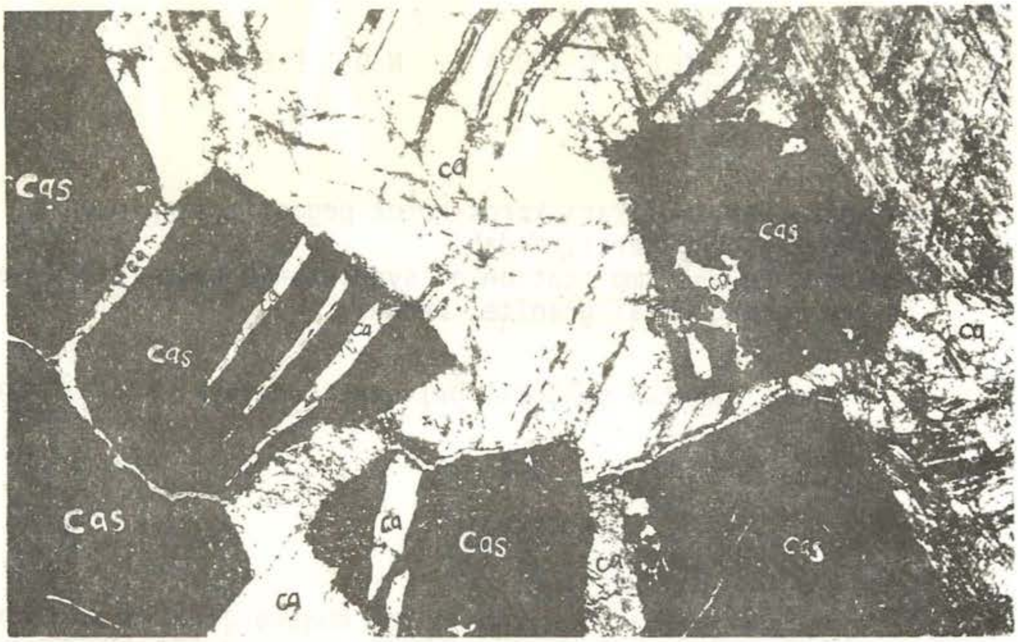
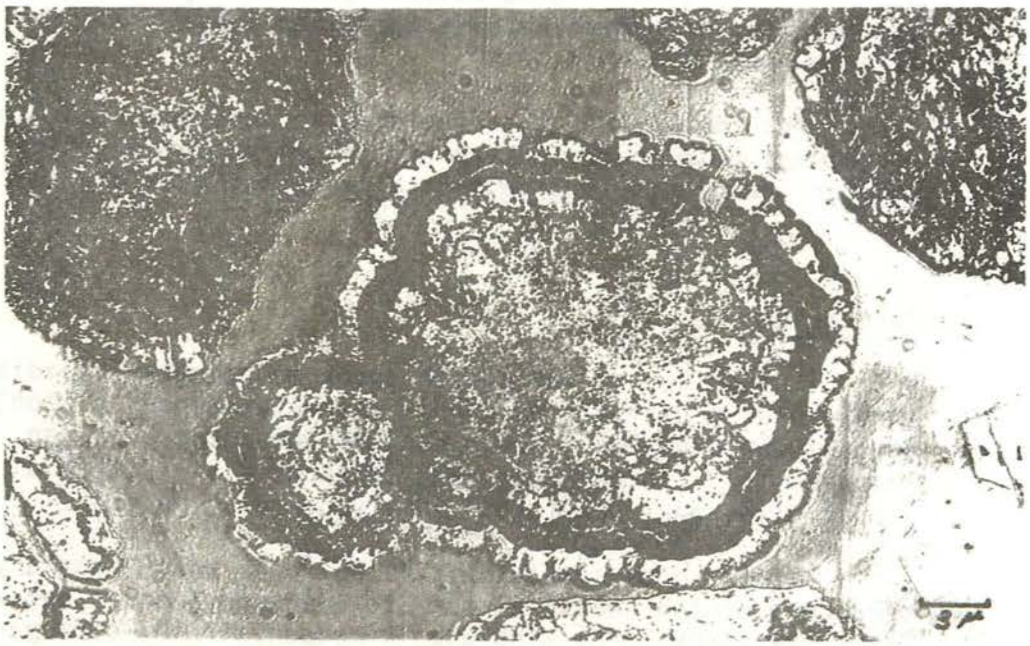


(EBY)

Cassiterite (cas) in marble, Pengkalen
Pipe, Perak (x40)



(KFGH)

Siderite spherulites, Bidor Dredge,
Bidor, Perak.

GEOLOGICAL NOTES

Kejadian dan implikasi korok-korok pegmatit sinplutonik digranit Gunung Jerai, Kedah
(Occurrence and implication of synplutonic pegmatite dykes in the Gunung Jerai granite, Kedah)

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Abstract

Some pegmatite dykes in the Gunung Jerai granite at Merbok, Kedah have been found to be sheared and displaced. The shear zones, however, have been annealed by the granite which indicate that the dykes are synplutonic and therefore coeval with the granite. At the same outcrop a few of the pegmatite dykes have swollen parts with circular to elliptical cross-sections. These bulbous parts are probably formed by upwelling of pegmatitic materials into a still viscous granite host.

The recognition that the granite and pegmatite are coeval may help in the interpretation of geochronological data on the granite and pegmatite presented by Bignell (1972).

Pendahuluan

Tujuan kertas ini adalah untuk menerangkan kejadian korok-korok pegmatit sinplutonik (serentak dengan pluton) digranit Gunung Jerai, Kedah dan membincangkan keertian kejadian ini. Korok-korok yang tersebut disini telah di jumpai di Merbok, dekat kuil lama yang telah meroboh.

Korok-korok sinplutonik ialah korok-korok ignais yang menerobos pluton semasa pluton itu keadaannya panas dan kental. Akibatnya korok-korok sinplutonik mempunyai ciri-ciri yang bolih digunakan untuk mengenalkannya. Ciri-ciri tersebut telah dibincangkan olih Pitcher dan Read (1960), Pitcher dan Berger

(1972) dan Child (1972). Berikut menerangkan satu ciri yang bolih digunakan untuk mengenalkan korok-korok sinplutonik.

Korok-korok sinplutonik telah dijumpai dibeberapa kawasan granit seperti Granit "Main Donegal" di Eire (Pitcher dan Read, 1960; Pitcher dan Berger, 1972) dan Batolit "Coastal" di Peru (Child, 1972). Di kawasan granit di Semenanjung Malaysia selain daripada contoh dari Merbok juga berjumpa korok-korok mikrogranit sinplutonik digranit diselatan Pulau Tuba, Langkawi. Di Pulau Ubin, Singapura, Seet (1974) telah melihat korok amfibolit sinplutonik di pluton batuan granit. Dari pengajiannya adalah kemungkinan dimana banyak lagi korok-korok sinplutonik bolih didapati di kawasan granit di Semenanjung Malaysia jika ciri-ciri untuk mengenalinya telah diketahui.

Korok-korok pegmatit sinplutonik dari Gunung Jerai

Di Merbok banyak korok pegmatit telah menerobos granit yang kadang kali mempunyai foliasi yang ditunjukkan olih tentuarahan terpilih felsparnya. Pegmatit bergarnet dan petrografi pegmatit telah disiasat dengan rapinya olih Bradford (1972), Paramanathan (1964) dan Rao (1972).

Beberapa korok di tempat tersebut mempunyai ciri yang terbaik untuk mengenali korok-korok sinplutonik kerana korok-korok itu telah tergerakalih dan tericih olih sesar-sesar tetapi batuan granit yang berhampir tidak menunjukkan apa-apa bukti kericihan (Raj. 1). Menurut Pitcher (hubungan perseorangan) perlihatan ini bolih disimpulkan seperti berikut. Sebelum penerobosan granit itu membeku ianya panas dan kental, magma korok-korok bolih menerobos granit itu mungkin melalui sistem kekar yang telah dibentuk. Sesar-sesar pun bolih memotong pluton granit yang belum pejal. Korok-korok yang sudah terbentuk mungkin digerakalih dan juga diricih olih sesar-sesar tersebut. Walaubagaimanapun, tempat yang diricih mungkin "disepoh-lindap" (annealed) olih granit kerana granit itu masih panas dan kental. Itulah sebabnya mengapa tempat yang diricih tidak menunjukkan apa-apa bukti kericihan pada masa sekarang.

Di singkapan yang mengandungi korok-korok pegmatit sinplutonik tersebut dijumpai beberapa korok pegmatit lain. Korok-korok ini berbungkul-bungkul dan keratan lintang bungkul-bungkul itu ada rupaan yang berbulat dan berelipsoid (Raj. 2). Mungkin bahagian-bahagian berbungkul telah dibentuk olih magma pegmatit yang membuak dari bawah granit yang sedang panas dan kental.

Ulusan

Umur terobosan granit dan pegmatit di Gunung Jerai telah disiasat olih Bignell (1972) dan beberapa usia untuk granit dan pegmatit yang dicandang olih Dr N.J. Snelling telah dipersembahkan olih Bradford (1972). Menurut Bignell (1972) ^{87}Sr telah dipindahkan dari beberapa jenis mineral ke mineral lain dalam batuan granit dan pegmatit. Beliau memberikan usia 307 juta tahun (Rb-Sr) bagi satu contoh granit dan 279 juta tahun (Rb-Sr) bagi satu contoh pegmatit. Beliau yakin bahawa 279 juta tahun ialah yang mungkin termuda sekali untuk pegmatit dan berpendapat bahawa usia 309 juta tahun adalah semasa terobosan granit dan pegmatit. Bukti korok-korok pegmatit yang sinplutonik bolih menyokong pendapatan ini.

Bradford (1972) telah memberi bukti bahawa permineralan timah di kawasan Gunung Jerai bersekutu dengan pegmatit dan batuan yang terjadi dalam tempoh masa pneumatolisis. Dari pendapatan ini ada kemungkinan dimana proses permineralan timah di kawasan Gunung Jerai adalah berlaku pada masa Karbon.

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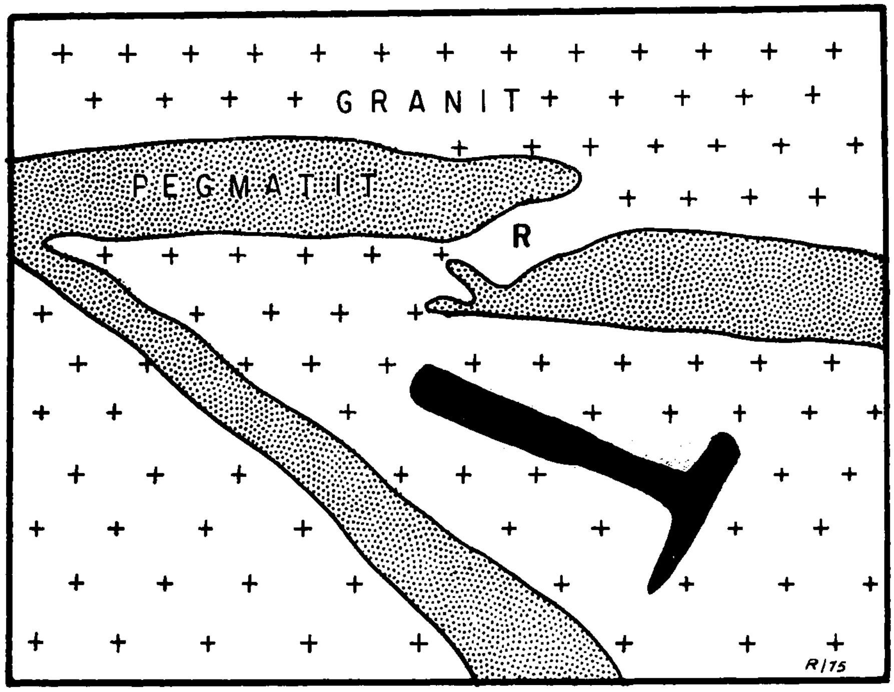
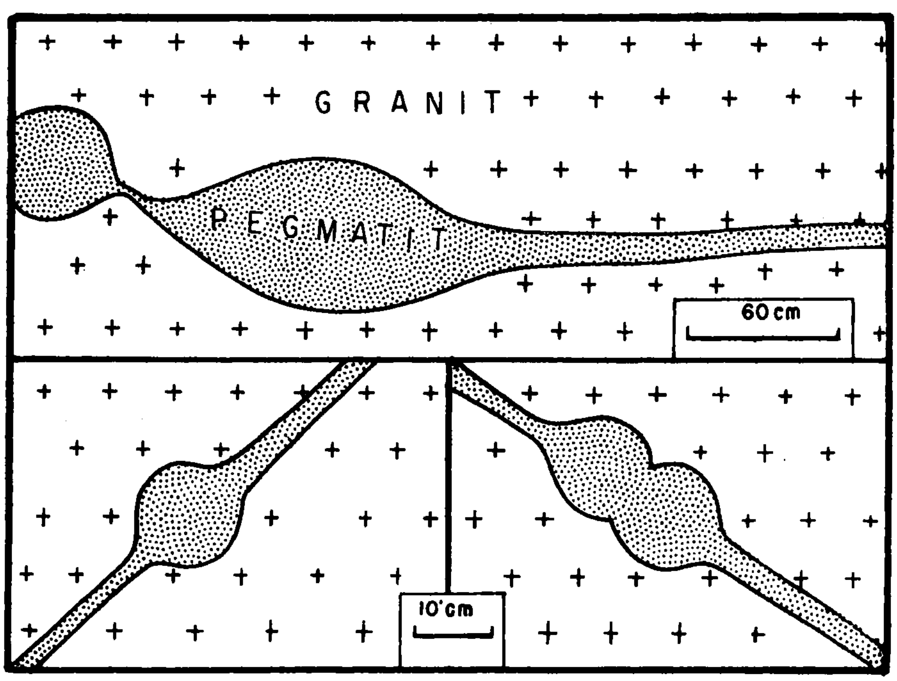


Rajah 1. Korok pegmatit sinplutonik dari Merbok, Kedah. Granit di (**R**) tidak menunjukkan apa-apa kericihan.



Rajah 2. Gambarajah ini menunjukkan korok-korok pegmatit yang berbungkul-bungkul di granit Gunung Jerai, Kedah.

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Floated shells of Nautilus Pompilius in the south part of the Andaman Sea

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Nautilus is a "living fossil", the last survivor of a large group of shelled cephalopods that originated in the Ordovician and were a dominant group in the oceans until the late Palaeozoic. Since that time they have declined in abundance until only the genus Nautilus survives, which includes 5 species, of which N. pompilius is the most common, and the only species with an extensive distribution. The known living range of the species is from the Philippine Islands to Samoa (Stenzel, 1964). Living species of Nautilus are known only from the western margin of the Pacific Ocean and the margins of Australia. Nautilus shells float after death, and the shells have much wider distribution than the living animal. This difference in distribution is important in understanding the distribution of fossils species.

Floated shells of Nautilus pompilius occur commonly in some parts of the Indian Ocean, far outside the known living range of the species. They are most abundant in the southern part of the Andaman Sea portion of the Indian Ocean, but it is not clear where the shells have floated from. The nearest known living area for the species is in the Philippine Islands, nearly 1500 miles distant by the most direct sea route to the Andaman Sea. The common occurrence of the shells there suggests that there may be a living population in the Andaman Sea, where conditions are similar to those of the Philippines. A search has been made to recover living specimens there, but without success at this date. If the animal does not live in the Indian Ocean, the major question is why it is missing. Physical conditions are very similar in many parts of the Indo-Pacific province, yet Nautilus has only been found in the western edge of the Pacific Ocean and on the margins of Australia.

In attempting to work out the true range of Nautilus, the distribution of floated shells in the Andaman Sea is of considerable interest. Verified occurrences of floated shells have been noted at Phuket Island, Ko Phe Tra (Ship Island), and Ko Terutau in Thailand, and the Langkawi Islands in Malaysia. In all cases these shells have been found on offshore islands, and not on the mainland coast. Shells are so common on the north-west shore of Ko Terutau that the occurrence was reported in a publication by Toriyama and others (1966). In the Langkawi Islands shells are less common, but occur in a number of locations.

Over the last three years I have visited most of the beaches of the Langkawi Island group, and have found shells on several of them (Fig. 1). The distribution of shells is irregular. Floated shells are found usually on the high strand line of small sand beaches lying between rocky headlands. They do not occur noticeably on long sand beaches, and the implication is that longshore currents carry the shells past the long beaches, and that they are trapped only on the more irregular shorelines of the rocky coasts.

Shells are common only on the west coasts of the Langkawi Islands and Ko Terutau. This distribution suggests that oceanic currents are important in concentrating the shells, but does not indicate the source of the shells. If they live in the Andaman Sea, then they probably live to the west of the islands. On the other hand, if they come from the Philippines, then their abundance on these islands and great scarcity at intermediate points along the Straits of Malacca and South China Sea is hard to explain. A possible answer to this problem is that the south part of the Andaman Sea is an area where major ocean surface currents meet during part of the year, leading to a concentration of floating shells.

Ocean currents from the Andaman Sea and Straits of Malacca converge in this region during the summer months, when surface currents of the Indian Ocean are predominantly flowing to the northeast or east, forming a southward flowing current through most of the Andaman Sea, which meets the northward flowing currents of the Malacca Straits (Knauss, 1963). Relatively little water flows out as surface currents. This could lead to a concentration of shells in the region, which then drift onto the shores of the adjacent islands. The shallow Straits of Malacca normally have fast currents in them, which may well account for the absence or rarity of occurrence of *Nautilus* shells in that area. Similarly, shells are unlikely to be found on coastlines fronted by wide shallow areas of continental shelves, because of the regular strong currents.

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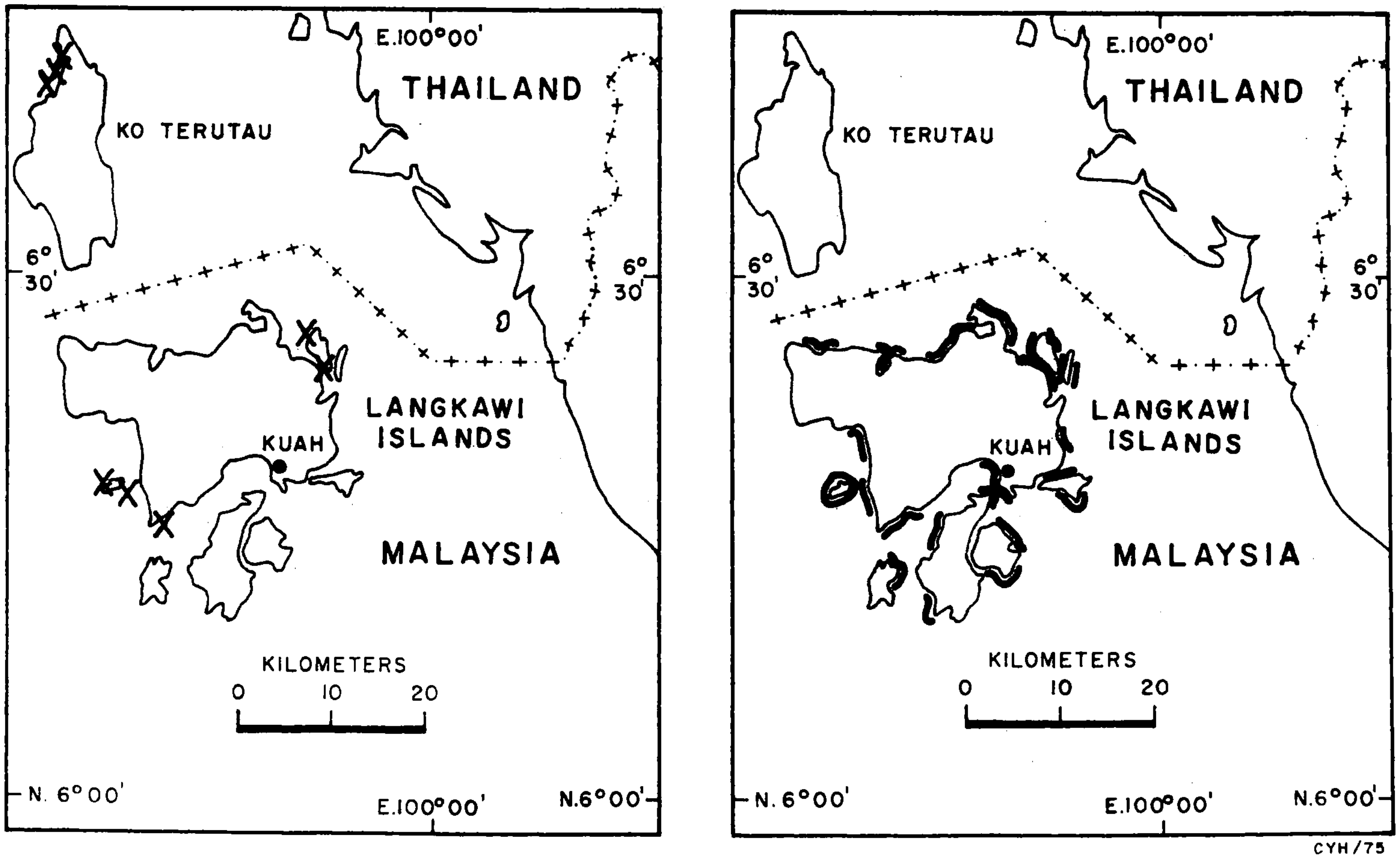
Figure 1a -- Verified occurrences of floated *Nautilus* shells on beaches of the Langkawi Islands and Terutau Island. Occurrences in the Langkawi Islands have been personally observed during the period 1972-1974. Occurrences on Terutau Island are from Toriyama and others (1966).

1b -- Shorelines of the Langkawi Islands which have been visited and checked for *Nautilus* shells. Note the absence of finds along the northwestern coast of main island.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A B

Figure 1.

Structure of the Kenny Hill Formation, Kuala Lumpur and Selangor

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Tjia (1974) from his study of sedimentary structures in one outcrop of the Kenny Hill formation postulated that the sedimentary succession is overturned and suggested that the major structure is either isoclinal or recumbent folding. This interpretation of the overall structure of the Kenny Hill formation agrees with E.H. Yin's views (cited by Stauffer 1973, p. 90) that repetition of sections within these rocks due either to to strike faults or unrecognized folds must be present. If this isoclinal or recumbent folding does exist on a major scale, then current ideas not only as to the formation's stratigraphic thickness but also its age and stratigraphic relationships to the adjacent rocks need to be revised, as the evidence for both these postulations are based to a large extent on differences in structural style between the intensely deformed Kuala Lumpur Limestone and the gently folded structures normally ascribed to the Kenny Hill formation. We, however, do not believe that repetitive sequence through strike faulting or recumbent folding is a major feature of this formation and it is the purpose of this note to present evidences in support of this viewpoint. Some of the evidences cited in this note in support of our belief, especially those relating to small scale sedimentary structures have been recorded before by one of us (EBY) in an unpublished thesis (Yeap, 1970).

Bedding in the Kenny Hill formation commonly dips less than 30°. Folding of the beds giving rise mainly to gentle or open folds is evidenced from changes in dip directions in different outcrops though occasionally a few smaller folds may be observed. This simple tectonic structure is complicated in a few localities either by faulting or the presence of sedimentary structures. Faulting besides causing vertical or horizontal displacements of the beds also affects their dips at the vicinity of the fault plane. The most spectacular fault displaying this feature is exposed at a cutting beneath on electricity pylon at the Happy Garden housing estate off Old Kuchai Road (GR* 478739). Here the beds near the fault plane

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* GR refers to Grid References on the New Series Topographic Map, Sheets 94 and 93 published by the Director of National Mapping, Malaysia

have been dragged from a gentle inclination to their present vertical position. The effects of these faults are only local and no evidence could be found to suggest that faulting in the Kenny Hill formation could give rise to overturning of the beds on a large scale.

Sedimentary slump features are visible in a number of localities. These may range from small scale slumps or rip-up structures to fairly large structures (up to 50 m) with tight recumbent folds. The best outcrops for viewing these recumbent folds are at i) Overseas Union Garden (GR 474733) and ii) at the housing estate, Shah Alam (GR 291717). At both these localities, it is clear from the rocks adjacent to these recumbent folds that these features are only of limited extent. These "slump folds" occur only in the siliceous or thinly bedded cherty horizons and the adjacent sandstone and mudstone beds are unaffected by the slumping and have the usual low dips.

The orientations of organic tubes and burrows which are widespread in the shales of the Kenny Hill formation always indicate that the beds are still in their upright sequence. These simple non-branching and cylindrical burrows with diameters approximately 1 cm initially run parallel to the bedding for about two to three centimeters and then bend perpendicularly downwards and run for an appreciably longer distance before terminating. The fillings of the burrows are usually of sand and most show curved laminations, less than 0.2 mm thick, with the concave ends directed towards the openings. These burrows are generally found in shaly beds, with their openings and their curved laminated sandy fillings directed towards the top bedding planes.

Other sedimentary structures found in the sediments of the Kenny Hill formation further support the presence of an upright succession. Graded beds which are fairly common, show normal upwards grading from coarse or medium-grained sand containing a few granule size materials to fine or very fine grained sand. In a few instance, the beds grades from medium grained sand to dark coloured shaly material. Medium scale cross-bedding showing a normal succession occurs at the base of the Kenny Hill sediments directly overlying the Kuala Lumpur Limestone at Salak South (GR 512724).

The rocks of the Kenny Hill formation are almost entirely devoid of any tectonic features indicative of intense compression or stretching such as slaty cleavage, boudinage or tectonically deformed clasts or mineral grains. If the succession is isoclinally folded, at least some of these tectonic features can be expected to be present. The only suggestion of a cleavage in these rocks is the development of an incipient cleavage in the phyllitic mudstone, a rock which if intensely folded can be expected to develop a more pronounced slaty cleavage or schistosity. Stretched and flattened pebble size clasts do exist but these clasts are composed invariably of clay and the matrix surrounding these clasts is quartzose. The deformation of these soft clasts is most likely due to burial or to the gentle folding and does not necessitate any strong tectonic compression. The more competent quartz clasts occasionally found together with these flattened clay clasts do not show any signs of stretching or flattening whatsoever. Organic tubes and burrows are also remarkably well preserved with their original cylindrical form undeformed, suggesting further the absence of strong folding movement.

All the features described above makes it unlikely that repetition of sections with overturned successions exists on a major scale within the Kenny Hill formation or that the exposed thickness of the unit is appreciably greater than its true thickness. The thickness of at least 1200 m given by Yeap (1970) seems therefore to be a more realistic value than the lower figure of 300 m obtained by assuming repetition of the sequences. The interpretation of the sedimentary structures at Bukit Pantai by Tjia (1974) as indicative of overturned succession is contradictory to all the other features found in the Kenny Hill rocks and further evidences as to the reliability of these sedimentary structures as indicators of facing directions in these rocks seem warranted, especially as this interpretation has several important implications on the stratigraphy, structural history and geology of the Kuala Lumpur and adjacent areas.

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The analysis of fluoride in tropical soils by selective ion electrode methods and its possible application to the search for sub-outcropping tin deposits in Peninsular Malaysia

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Introduction

During recent years the development of analytical methods in which selective ion electrodes play a key role has permitted a number of elements (fluorine, sulphur, chlorine, etc.), of considerable interest to the applied geochemist, to be determined fairly simply and rapidly, over considerable concentration ranges. This prompted the writers to consider the possibility of using fluorine as a path-finder element during the search for primary, sub-outcropping tin deposits in Peninsular Malaysia. The results of the initial study form the substance of this note.

Details of the study

Two requirements were demanded of this initial study. The first was to investigate, in the laboratory, certain published procedures for the determination of cold-extractable and total fluorine, as fluoride, in geological samples, and to modify, if necessary, the best of these in order to obtain optimum results when local soil is the subject of analysis. The second was to establish the total and cold-extractable fluoride distribution patterns in the soil of a chosen stanniferous area and to determine if the establishment and analysis of such patterns would facilitate the search for sub-outcropping tin deposits there, and possibly in similar areas elsewhere in the country.

To some considerable extent the two objects were intertwined as the soils used in the study as a whole were those obtained from Tekka Hill in Perak, which is known to contain primary tin deposits. The soils were collected by one of us (GHT) from the B horizon, at points 50 feet apart, and along 3 traverses (Fig. 2), and for analysis the minus-80-mesh (B.S.S.) fraction of the oven-dried samples was used. Previous to the work under review GHT had analysed this fraction of each of the samples for tin and arsenic. However, during the initial laboratory work aimed at establishing the best analytical procedures for fluoride, International Rock Standards (see Table 1) were used as the yard-stick, and these were repeatedly analyzed.

THE ANALYTICAL ASPECT

Instrumentation

For the instrumental stages of the analysis a fluoride-sensitive electrode (Orion Research Model 94-09A) and a reference electrode (Orion Research Model 90-01-00) were used in conjunction with a direct-reading, expanded-scale, millivoltmeter (either Orion Research Model 801, or 801A). The fluoride sensitivity of the electrode depends on the potential difference between the faces of a LaF_3 single crystal, which is embedded in the end of the electrode (Fig. 1). The outer side of the crystal is in contact with the sample solution whilst the inner side is bathed by the internal electrolyte consisting of a mixture of 0.1M NaF and 0.1M KCl.

Space does not permit discussion of the theory upon which this instrumental method is based. However, it can be found in the analytical papers referred to below.

Analytical procedures

Cold-extractable fluoride

The method for determining cold-extractable fluoride, which was designed by Plüger and Friedrich (1972) was tested and found to be satisfactory. This involved treatment, in a beaker, of 0.5 g of the minus-80-mesh (B.S.S.) soil fraction with 25 ml of cold 0.01N HCl. During the attack of 30 minutes duration, the content of the beaker was stirred with a magnetic stirrer. The solution was then diluted with citric acid/di-sodium hydrogen phosphate buffer, at pH 6, and the electrode potential of the solution was compared with those of similarly prepared standards. From the readings the 0.01N HCl-extractable fluoride content was determined. This method allows fluoride to be determined over the range 1.0 to 5,000 p.p.m., and 70-80 complete analyses can be made per 8-hour, man-day.

Table 1

A comparison between the total fluoride content of certain International Standard rocks as recorded in the literature with that obtained by the writer using the modified method by Kesler et al (1973).

Sample	Literature values (ppm)	The writers' results			
		mean value (ppm)	No. of repli-cates	Standard deviation	Relative Standard deviation %
(i) USGS-GSP-1 Granodiorite	3900, 3800 4000, 3700	3907	6	481	12.3
(ii) CRPG-GA Granite	440, 487 500	588	8	88	14.9
(iii) CRPG-GH Granite	3000, 3100 3600, 4550	3624	5	258	7.1
(iv) CRPG-BR Basalt	990, 1100	964	5	187	19.4

(i) Flanagan, F.J. (1969). US Geological Survey Standards-II. First compilation of data for the new U.S.G.S. rocks. Geochem. et Cosmochimica Acta Vol. 33, pp. 81-120.

(ii)-(iv) Roubault, M., de La Rouche, H. and Govindaraju, K. (1968). Report (1966-1968) on geochemical standards: Granites GR, GA, GH; Basalt BR; ferriferous Biotite Mica-Fe; Phlogopite Mica-Mg. Sciences de la Terra, Tome XIII, no. 4, pp. 379-404.

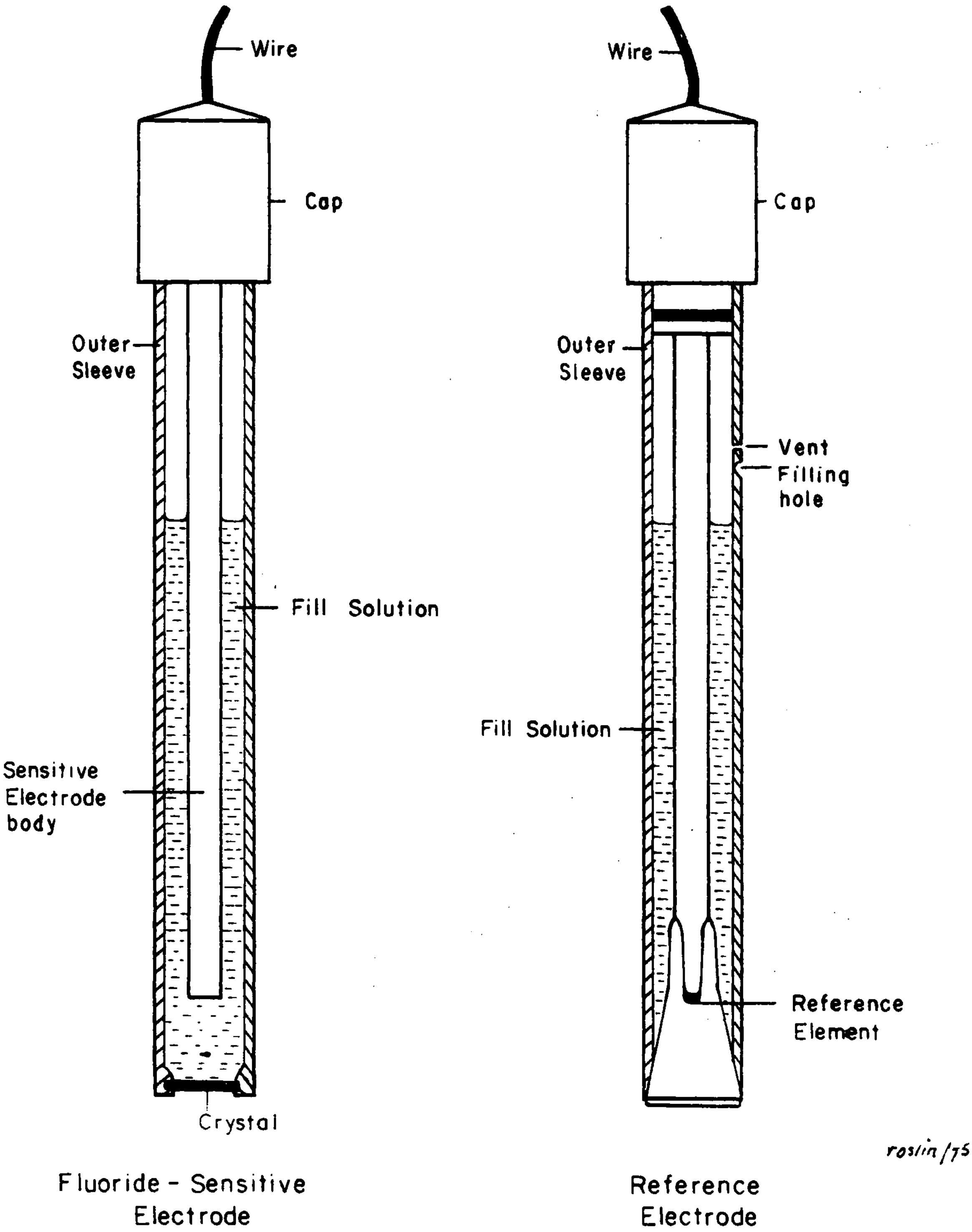

Fig. 1 Cross-section of Fluoride-Sensitive Electrode and Reference Electrode

Total-fluoride

Initially, in an endeavour to determine the total fluoride content of the soils under examination, the total fluoride method of Plüger and Friedrich (1972) was employed, but this was abandoned as replicate analysis of International Standard rocks suggested that only c. 60-70 per cent of the total fluoride present was extracted. So, the writers' attention was turned to the method of Kesler, van Loon and Bateson (1973) and this, after certain minor modifications, provided results, when certain International Standards were analyzed by the method, that were sufficiently close to the published values to be acceptable. (See Table 1.)

Briefly the slightly modified analytical procedure is as follows:-

i. Place 0.1 g of the sample in a nickel crucible then add 10 pellets of Analar NaOH.

ii. Fuse for 2½ hours in a furnace at 620° ± 10°C.

iii. Remove crucible from furnace. Cool: then half-fill it with distilled water, and allow it to stand for 10 minutes.

iv. Transfer contents to a beaker and stir to disperse the gelatinous precipitate. Then add conc. HNO_3, with stirring, until the precipitate just dissolves.

v. Dissolve 25 g. ammonium citrate in the solution and then dilute it to 100 ml. with water.

vi. Insert electrodes and take mV reading. Compare the latter with those from similarly-prepared standards and determine the p.p.m. fluoride in the sample.

This method allows fluoride to be determined over the range 500-50,000 p.p.m. with an accuracy of c. ± 11 per cent at the 95 per cent confidence level.

30-40 analyses can be carried out per 8-hour, man-day.

Interferences

The fluoride electrode responds to hydroxyl ions, and when the concentration of the latter is greater than c. 10 per cent of that of the fluoride ions present, the results are not acceptable. In addition, low results can be obtained as a result of fluoride ions being removed from the system either as undissociated HF (this happens when the hydrogen ion concentration is high) or as complexes of Si^{4+}, Al^{3+}, Fe^{3+}, and Be^{2+}. Buffering minimises these interference problems.

Results of the Tekka orientation survey

Plots of the results obtained by analyzing the Tekka soils for tin and arsenic, both by Stanton's methods (1966, pp. 81-84, and 44-47) and for total fluoride, are provided in Fig. 2. The concentrations of all three vary more or less sympathetically, although in this area total fluoride appears to be a somewhat better path-finder for tin than arsenic is. Furthermore, over the anomalous zone there is a good correlation between total and cold-extractable fluoride (Fig. 3 & 4) and hence, in some localities, the less expensive and more rapid cold-extractable method can be used to advantage in an exploration programme. However, such a decision should only be taken after an appropriate orientation study had justified it.

Finally, in view of the common occurrence of anomalous concentrations of fluorine in and adjacent to tin deposits, where it is most prone to report as fluorite or in the micas, and because of the comparative ease with which the element can now be determined, it may soon become one of the more commonly used path-finder elements by those seeking tin deposits by geochemical methods.

Acknowledgements

The writers wish to record their thanks to Professor K.C. Chan, Head of the Chemistry Department, University of Malaya, for allowing them to carry out the fluoride analyses in his department, and to extent their thanks to Dr M.C. Lim of the same department for permitting them to use his millivoltmeter and reference electrode.

References

Kesler, S.E., van Loon, J.C. and Bateson, J.H. (1973). Analysis of fluoride in rocks and an application to exploration. J. Geochem. Explor. Vol. 2 pp. 11-17.

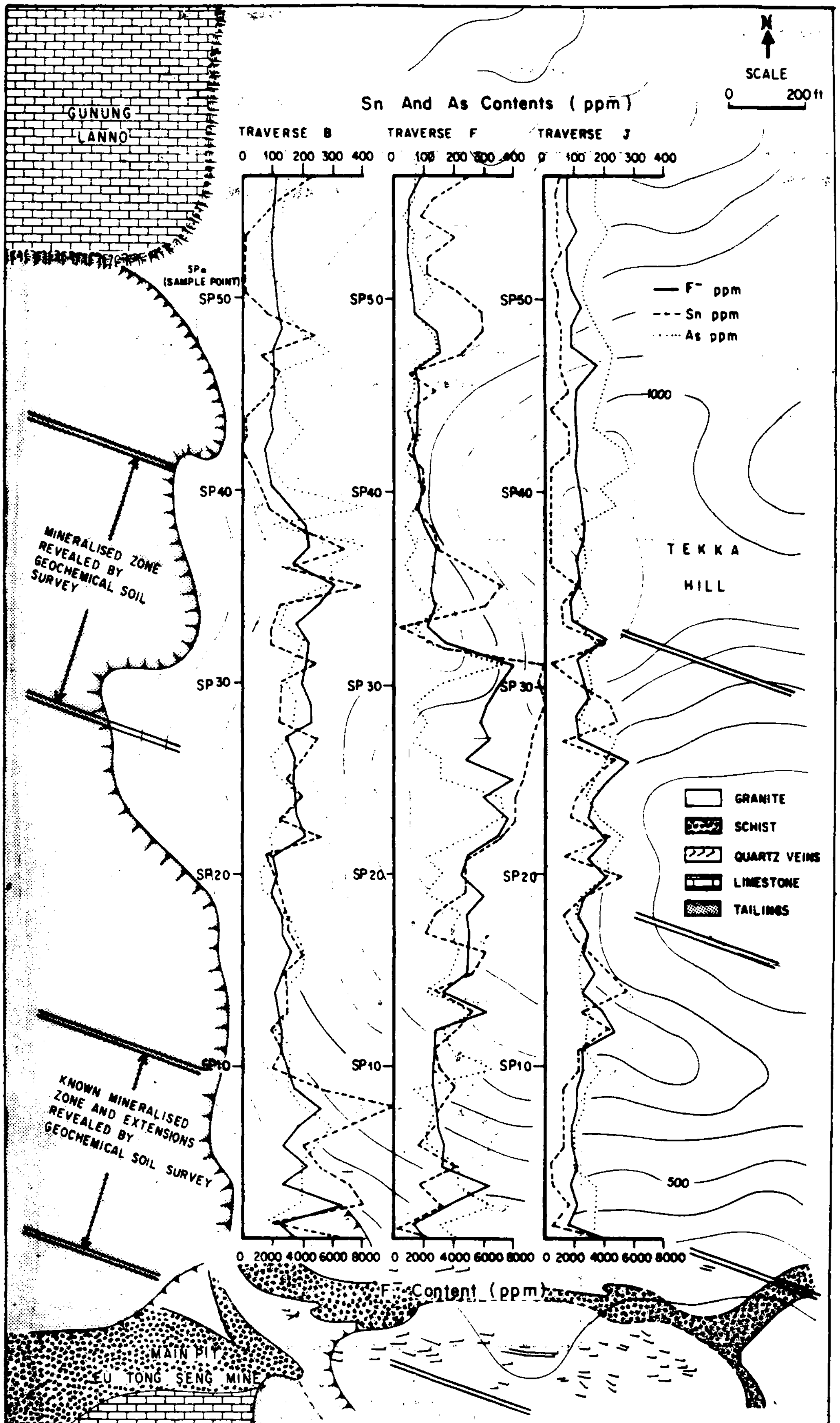

Figure 2. The fluoride, tin and arsenic content of the minus-80-mesh fraction of B-horizon soil samples from Tekka Hill, Perak.

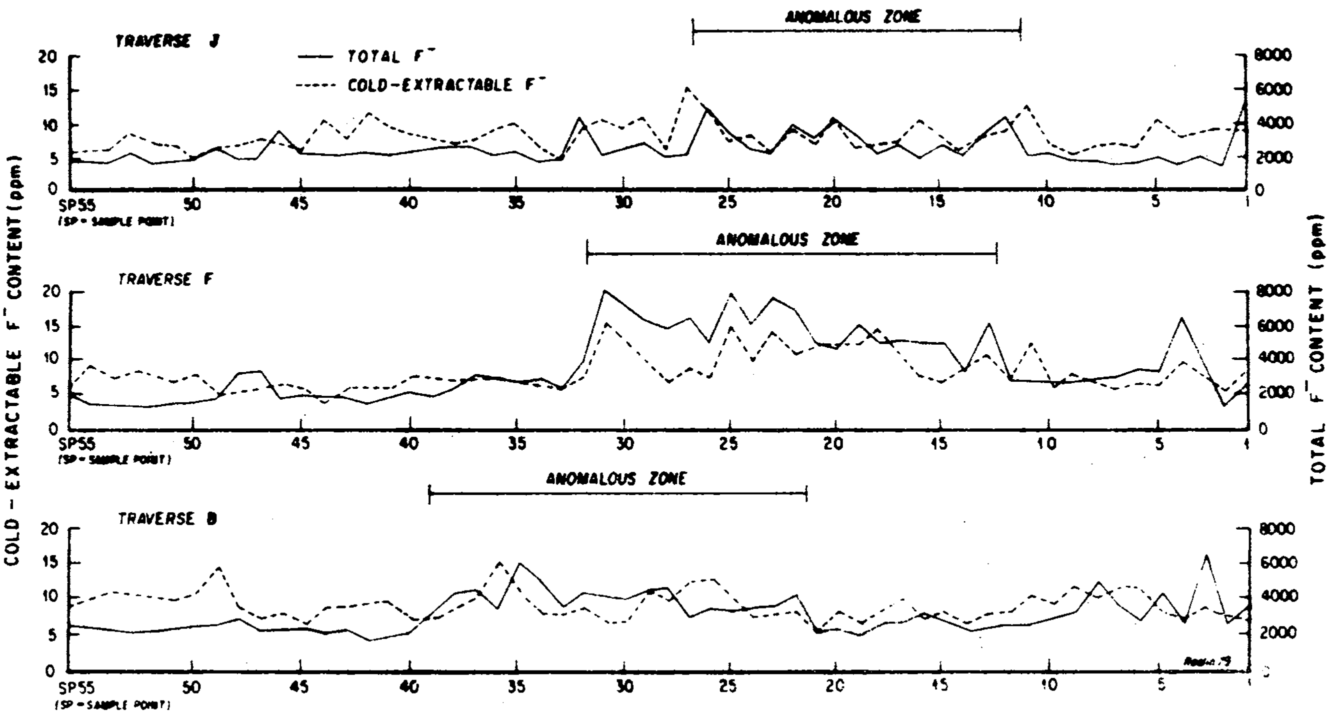

Figure 3. The total and cold-extractable fluoride content of the minus-80-mesh fraction of B-horizon soil samples from Tekka Hill, Perak

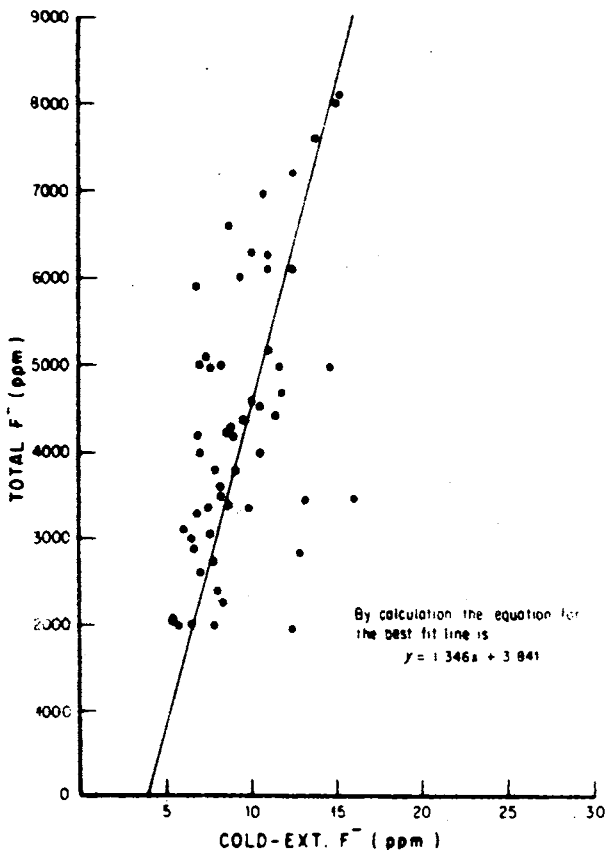

Figure 4 Correlation between the total and cold-extractable fluoride content of the minus-80-mesh fraction of B-horizon soil samples from Tekka Hill, Perak

Plüger, W.L. and Friedrich, G.H. (1972). Determination of total and cold-extractable fluoride in soils and stream sediments with an ion-sensitive fluoride electrode. In: M.J. Jones (Editor), Geochemical Exploration 1972. Proc. 4th Int. Geochem. Explor. Symp. - Institution of Mining & Metallurgy, London pp. 421-427.

Stanton, R.E. (1966). Rapid methods of trace analysis. Edward Arnold Ltd., London 96 pages.

M E E T I N G S O F T H E S O C I E T Y

7 May 1975, 5 p.m.

"Deltaic Sedimentation and Penecontemporaneous Deformation" was the topic of a stimulating talk and discussion meeting of the Society on May 7, when Dr R.J. Weimer, of the Colorado School of Mines, Golden, Colorado, addressed the Society. Dr Weimer was visiting Kuala Lumpur after a 3½ month working visit to the Bandung Institute of Technology, Indonesia, where he had been teaching, and studying sedimentary tectonics of deltaic deposits in Borneo, particularly the Mahakam delta at Balikpapan, Kalimantan. Although the talk was arranged on short notice, a large and responsive group of people attended the talk.

The association of deltaic sedimentation and penecontemporaneous deformation is deliberate, because it is in deltaic sediment accumulations that this type of deformation is characteristic. The talk concentrated on highly constructional deltas, that is on deltas rapidly depositing large amounts of fine grained sediment, and building its own landforms without significant reworking by waves or longshore drift. These deltas have large masses of prodelta clays and silts overlain by thin or thick sand sheets of delta front silts and sands, deposited in distributary channels or in the littoral zone (down to 10-15 meters). These sand sheets are heavier than the shales, and cap them, leading to an unstable situation where the sands tend to founder and the shales tend to be diapiric. There is a great similarity here between salt diapirism and shale diapirism. The shales have low density and develop high pore pressures, due to the heavy loading above, and the lack of permeability of the pore waters. Pore pressures approach lithostatic pressures, and these low density, high pressure shales are very susceptible to flow.

Shale tectonics of that classic delta, the Mississippi delta, were described because of the large body of data on it. In the modern Birdfoot lobe there has been up to 700 feet of deposits in the last 500 years, versus an average thickness of 150 feet of deposition during this time in other parts of the delta. The sediments are interbedded silts and clays, with common organic shales and rippled silts up to a few cm thick. These sediments are overlain by distributary sands, and are very commonly deformed into shale diapirs which form the "mud lumps" of the Mississippi delta. These are generated along faults that are steepest near the surface and become horizontal with depth.

Similarly well known examples from the Texas Gulf Coast Tertiary basins were discussed. Here, deep seismic profiling has shown the presence of a number of partly diapiric structures associated with growth faults - that is, a penecontemporaneous fault that develops in the sediments, and has more than 25% thickening on one side. These faults often die out near the surface, as the sedimentation depocenter moves away from the site of the fault. The faults curve toward the Gulf (oceanward) side, and are developed in low density - high pressure shales. In fact, the nonmarine and continental shelf sediments of this region are all underlain by low density-high pressure shales where lithostatic pressures are partly converted to fluid pressures, and the shales begin to flow. The least confined directions is towards the ocean, and growth faults curving towards the ocean develop in response to this. Along the faults are developed "roll-over" structures, and horst-graben structures, which are natural traps for hydrocarbons.

Shale diapirism is well known in Borneo, and it is natural that shale tectonics are important in the Tertiary basins of Borneo. Dr Weimer has studied the Mahakam delta at Balikpapan because there is a well formed modern delta in the area, and a thick sequence of Tertiary sediments which are fairly well known as a result of the discovery of oil fields in the area. The occurrence of carbonate reefal deposits in the offshore areas complicates the picture, as does the fact that the basement there may be of oceanic crust, which suggests that deep-seated tectonics may play a significant part in the sedimentary deposits of the area. It appears that there are some major basement faults which control the development of basins there, such as the Kutei and Tarakan basins. These basins do have overpressured shales, and diapiric structures are recognized in some of the back basins. No diapiric shale structures have been recognized in the outer basins yet. One very interesting problem that affects studies of this type in southeast Asia, and which has not been considered yet, is how the presence of rigid carbonate masses affects deltaic and shale tectonics. Reefal deposits are a normal occurrence in most areas, but the mechanics of limestone deformation are at the opposite extreme from shale deformation.

It was a stimulating talk.

T.E. Yancey
Jabatan Geologi
Universiti Malaya

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26 May 1975, 7 p.m.

Dr M.W. Haas, President of the AAPG, gave an interesting talk on "The New Breed" to the Society on 26 May 1975. An abstract of his talk is given below.

Abstract

Meeting the challenge of future energy needs will require a new breed of explorers who have a broad scientific background and the ability to integrate a wide variety of geological, geophysical and geochemical data. Although specialists will continue to be needed in each of these fields, there will be an increasingly greater need for geologists who can interpret geophysical data and for geophysicists who have a thorough understanding of the geological significance of geophysical data.

The integration of geophysics and geology has been made inevitable by the exponential rate of progress in exploration technology. In recent years, spectacular advances have taken place, for example, in (1) digital recording, computer processing, and improved interpretation of seismic data; (2) more sophisticated subsurface geological tools and concepts; and (3) computer storage, retrieval, plotting, and mapping of exploration data.

Looking to the future we can expect exploration technology to continue its dramatic evolution. These coming advances in knowledge and methodology make it imperative that industry, academia, and the professional societies work together to develop the "Explorationists" of the future - the new breed of oil finders - blend of geologist and geophysicist.

N E W S O F T H E S O C I E T Y

Nomination Committee

A nomination committee consisting of Encik A.S. Gan (Chairman), Encik T. Sunthralingam and Encik C.H. Yeap has been formed to nominate members for office in the 1976/77 Council of the Society. Encik Gan and Encik Sunthralingam are from the Geological Survey of Malaysia and Encik Yeap is from the Associated Mines.

Circum-Pacific Plutonism Conference

Our Society will host the 5th meeting of the IGCP Circum-Pacific Plutonism Project in Kuala Lumpur from 12-13 November 1975. The meetings will be held in Lecture Theatre III, Science Faculty, University of Malaya. The theme of the meetings will be on "The relations between granitoids and ore deposits in the Circum-Pacific region" and in addition papers reporting timely new research and general descriptions of plutonism in the region may also be presented.

After the meetings there will be field excursions which are as follows:-

14-15 November - Granitoids and mineralisation of the Kuala Lumpur area

16 November - Journey to Ipoh and overnight stay

17 November - Journey to Penang and overnight stay

18 November - Journey to Thailand

19-23 November - Granitoids and mineralization of the Chiang Mai area, Thailand.

The field excursions in Thailand will be organized by the Thai Dept. of Mineral Resources, Bangkok.

The Society has formed an organising committee consisting of Dr T.T. Khoo (Chairman), Dr C.S. Hutchison (Field Excursion), Encik A.S. Gan (Technical) and Encik E.B. Yeap (Accomodation) to organize the conference and field excursions in Malaysia. All members of the Society are invited to participate in the Conference and, if possible, also to present papers. Members will be kept informed of further developments either through the Warta Geologi or special circulars. Those members who wish to participate should reply to the First Circular already sent out or inform Dr T.T. Khoo, Jabatan Geologi, Universiti Malaya, Kuala Lumpur of your intentions and difficulties regarding attending the Conference.

IMA Subgroup

The Society has a number of copies of "Mineralogy and materials news bulletin for quantitative microscopic methods" 1974 (No. 3) for free distribution. It describes among other things reflectance standards for ore minerals and coals and determinative tables. Any member interested in obtaining a copy of the publication should write to the Editor.

C.S. Hutchison
(Chairman, IMA Subgroup)

Exchange of Publications

The Council has agreed to exchange publications with the Central Library, Geological Survey of India.

Membership

The following applicants were elected to membership:

Full members

Sandra Marie Barr
Dept. of Geological Sciences
University of Chiengmai
Chiengmai, Thailand

Grayson Michael Hajash
EXXON Production Malaysia Inc.
P.O. Box 857
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15 Jalan SS2/14
Taman Bahagia
Petaling Jaya, Selangor

Student members

Tan Aik Min
378A Jalan Raja Laut
Kuala Lumpur.

N E W S O F M E M B E R S

Appointment

Dr M. Ayob, a Council member, has left Jabatan Geografi, Universiti Malaya, and has joined Petronas, P.O. Box 2444, Kuala Lumpur.

New Addresses

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Kuala Krai
Kelantan

J. Stocklin
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c/o Royal School of Mines
Imperial College
Prince Consort Road
London SW7, England

V.T. Pun
Osborne & Chappel
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Ipoh, Perak

OTHER NEWS

Name Change

Esso Exploration Malaysia Inc. should now be known as EXXON Production Malaysia Inc. The donation of $3600 to the Society (Warta Geologi, Vol. 1, p. 20) was given by EXXON Production Malaysia Inc. and not Esso Exploration Malaysia Inc.

M.Sc. Thesis, Universiti Malaya

The following thesis is unfortunately not included in the list of theses from local Universities published in Warta Geologi Vol. 1, No. 2.

Aw, P.C. (1973). Geological and geochemical studies of the primary sulphide occurrences of south Kelantan, Peninsular Malaysia. Unpubl. M.Sc. thesis, University of Malaya, 286 pp.

AAPG Election Results

The American Association of Petroleum Geologists' election results for the 1975-76 term have been announced. John D. Moody, will serve as president-elect and assume the presidency in July, 1976; Frank C. Crawford, was elected vice-president; Robey H. Clark, will begin a two-year term as secretary; and John W. Shelton, was elected to a two-year term as editor.

Carrying over from this year's executive committee will be John E. Kilkenny, president-elect, who will assume the presidency on July 1, and George C. Grow, treasurer.

Also serving on the 1975-76 executive committee will be Robert N. Hacker, who was elected chairman of the AAPG's House of Delegates at its annual meeting in Dallas in April.

NEW BOOKS

Owen, Edgar W. (1975). Trek of the Oil Finders: a History of Exploration for Petroleum Geologists. Publ. by AAPG, 1600 pp., US $38 (Available from AAPG, P.O. Box 979, Tulsa, OK 74101).

Winkler, H.G.F. (1974). Petrogenesis of Metamorphic Rocks. 3rd Edition, 320 pp., Springer-Verlag New York. Soft cover, $26.30 (Malaysian).

EDITORIAL

The Society's newsletter has at last reappeared again with its familiar old gold cover after a lapse of four months. The new cover now carries a properly and appropriately designed masthead. In addition this issue also has an old gold back cover showing a map of Malaysia and adjacent countries. This map, in addition to its decorative purpose, is intended to serve as a geographical map for readers who are not familiar with the location of various States of Malaysia which are often mentioned in geological notes of our newsletters. Between the covers, readers will also notice that the quality of printing has much improved compared to previous issues. Our newsletters will in future be similarly printed.

The above-mentioned improvements have been achieved with only a slightly higher cost of production. This has been made possible by the purchase of paper in bulk from dealers and also the cooperation and advice of many people to whom the Society should be grateful.

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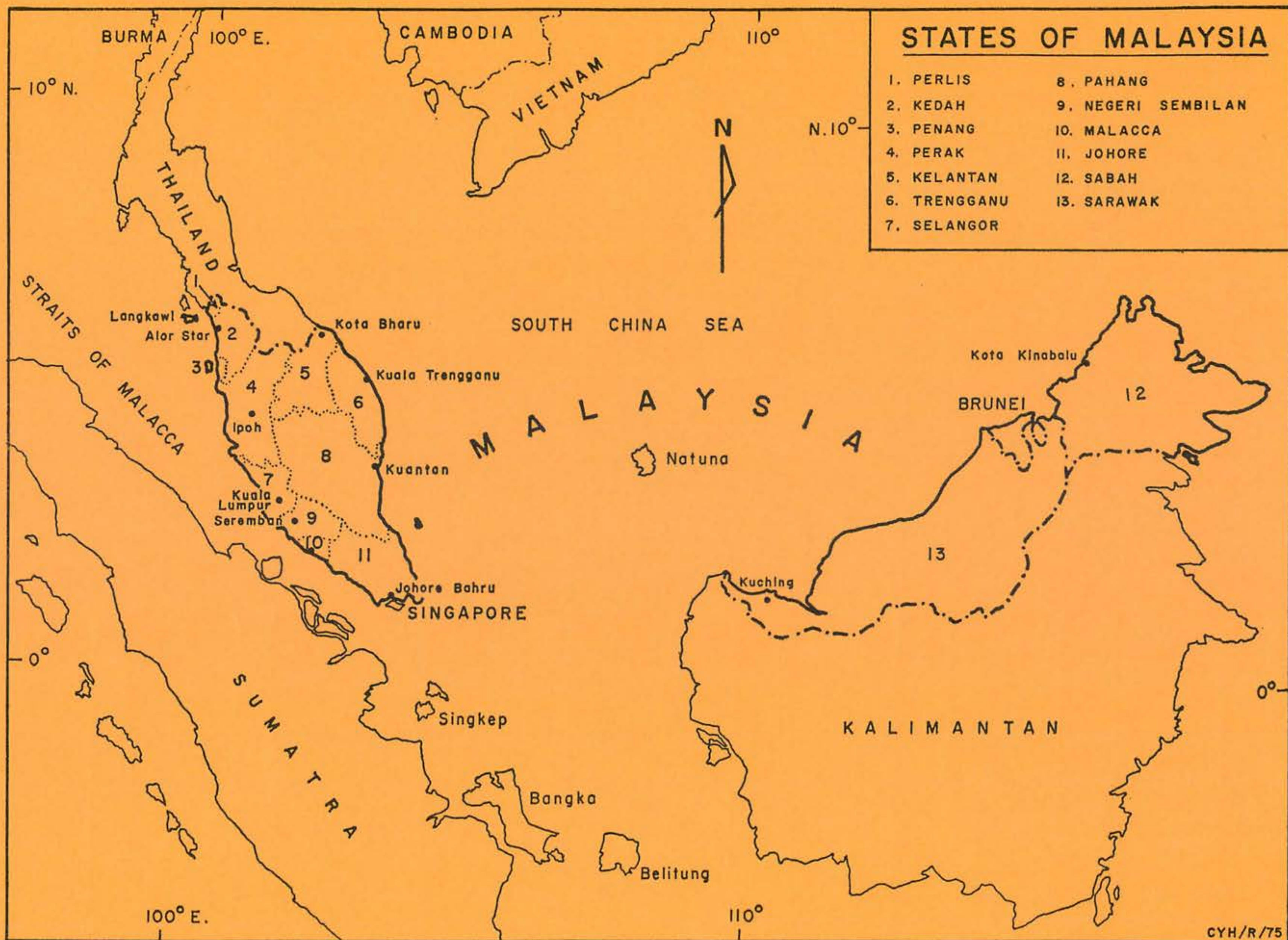
STATES OF MALAYSIA
1. PERLIS
2. KEDAH
3. PENANG
4. PERAK
5. KELANTAN
6. TRENGGANU
7. SELANGOR
8. PAHANG
9. NEGERI SEMBILAN
10. MALACCA
11. JOHORE
12. SABAH
13. SARAWAK
BURMA
100° E.
CAMBODIA
110°
10° N.
VIETNAM
N
N.10°
THAILAND
STRAITS OF MALACCA
Langkawi
Alor Star
Kota Bharu
Kuala Trengganu
Ipoh
Kuantan
Kuala Lumpur
Seremban
Johore Bahru
SINGAPORE
SOUTH CHINA SEA
MALAYSIA
Natuna
Kota Kinabalu
BRUNEI
Kuching
0°
SUMATRA
Singkep
Bangka
Belitung
KALIMANTAN
100° E.
110°
0°
CYH/R/75