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GEOLOGICAL SOCIETY OF MALAYSIA
Officers - 1974/75

Editorial Note

The Newsletter of our Society are issued in odd months (Jan., March, ...). However, bimonthly Newsletters of most other Societies are issued in even months (Feb., April, ...). In the latter case the first Newsletter of the year (Jan-Feb) does not carry any news of the preceding year. To be in line with the usual practice, the Newsletter No. 52 is issued in December this year and not January next year and the next Newsletter will appear in February next year. As a result of this correction members will get an extra Newsletter this year and it is hoped that members will welcome the bonus.

The Editor wishes all members a Happy New Year and those members who are Hajis and Christians, a Selamat Hari Raya Haji and Merry Crhistmas respectively!

Metavolkanik berkloritoid dari Ulu Sokor, Kelantan
(Chloritoid-bearing meta-volcanics from Ulu Sokor, Kelantan)

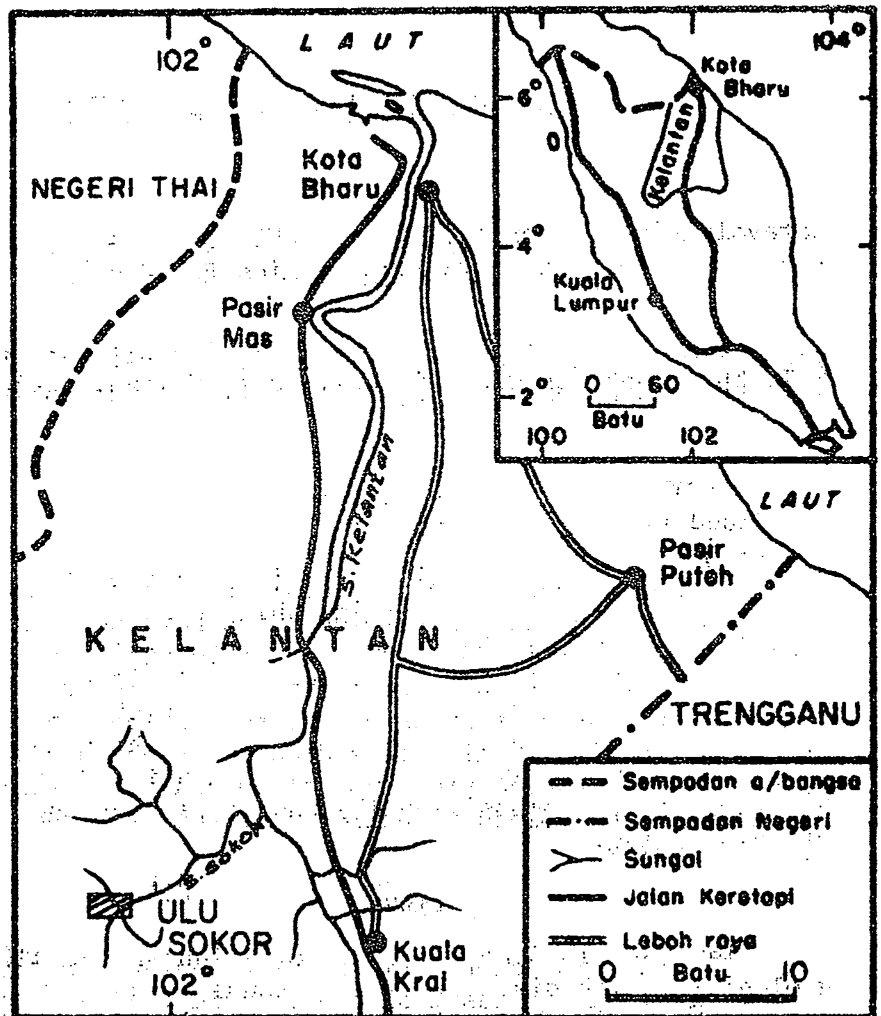
Y.F. Wong, Vallentine Dunne & Co., Peti Surat 242, Kuala Lumpur
T.T. Khoo, Jabatan Geologi, Universiti Malaya, Kuala Lumpur

Abstract

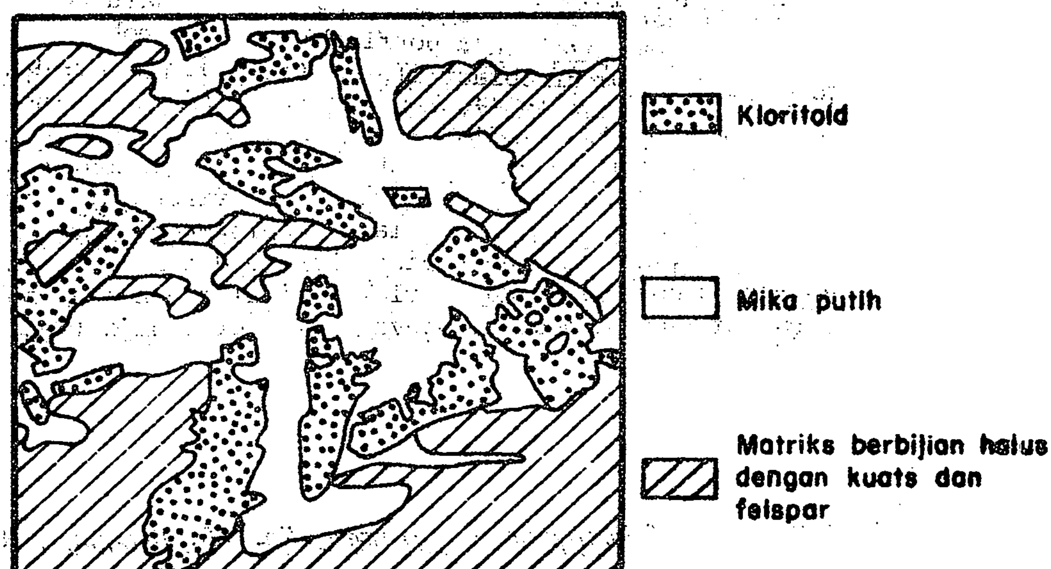
A metamorphosed acid volcanic rock from Ulu Sokor, Kelantan was found to contain chloritoids which have bever before been reported to occur in Malaysia. The chloritoids occur only in localised patches rich in white micas. It is argued that these patches may represent areas of the rock which have either been contaminated with kaolinitic sediments or which have been altered prior to metamorphism since normal or unaltered volcanic rocks are known to be compositionally unsuitable for the development of chloritoids.

Daerah Ulu Sokor terletak di Kelantan Barat (Raj. 1) dan geologinya telah disiasat oleh MacDonald (1967). Kemudian daerah itu disiasat oleh Wong (1970) dengan rapinya dan didapati didaerah itu marmar, filit-batusabak dan metavolkanik yang berkeselarasan. Didalam marmar dijumpai sedikit koral dan umur koral itu agaknya Trias (Wong, 1970).

Metavolkanik yang banyak sekali ialah tuf dan lava asid Batuan-batuan ini mempunyai matriks berbijian halus dengan kuats dan felspar. Di dalamnya ada juga sedikit biji kecil mika putih, klorit dan mineral legap. Akan tetapi satu contoh dari Sungai Sejana mempunyai juga porfiroblast-porfiroblast kloritoid. Porfiroblast-porfiroblast itu ialah keping-keping yang subhedral atau euhedral. Keping-keping kloritoid tersebut tidak memilik apa-apa tentuarahan dan terletak didalam bahagian-bahagian batuan tersebut yang mempunyai banyak mika putih saja (Raj. 2)



Rajah 1. — Peta menunjukan kedudukan daerah Ulu Sokor, Kelantan



Rajah 2. — Metarolkanik berkloritoid dari S. Sejana, Ulu Soko
(x 160)

Niggli (1912), Tilley (1925) dan Barth (1936, 1952) menerangkan bahawa kloritoid hanya boleh terjadi didalam batuan-batuan yang kaya dengan Al_2O_3 dan miskin dengan Na_2O, K_2O, CaO dan MgO. Tidak berapa lama selepas itu medan kandungan (compositional field) batuan-batuan berkloritoid telah ditentukan dengan lebih tepat oleh Hoschek (1967) dan Khoo (1974 dan dalam penulisan). Mereka berpendapat bahawa kandungan batuan-batuan gunungapi dan pluton yang biasa dan sedimen laut tidak sesuai untuk menerbitkan kloritoid. Oleh sebab itu kami percaya kandungan metavolkanik dari Ulu Sokor pun tidak sesuai untuk penerbitan kloritoid. Akan tetapi kloritoid Ulu Sokor terletak di bahagian-bahagian yang mempunyai banyak mika putih saja. Kami berpendapat kandungan bahagian-bahagian tersebut ialah sesuai untuk penerbitan kloritoid tetapi kandungan batuan itu sama sekali tidak sesuai. Bahagian-bahagian sesuai mungkin kerana pencemaran dengan sedimen berkaolin yang berasal dari tanah atau kerana perubahan sebelum metamorfisma.

Kami percaya tulisan ini ialah yang pertama yang memaklumkan terdapatnya kloritoid di Malaysia. Di Asia Tenggara kloritoid telah dijumpa hanya di Sulawesi (de Roever, 1956).

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A new type of complex Malaysian ore

E.B. Yeap & K.F.G. Hosking, Jabatan Geologi, Universiti Malaya

Introduction

Recently Mr Wallis, of Associated Mines Sdn. Bhd., gave one of us (K.H.) a piece of ore, about the size of one's fist, that had been recovered by Dredge No. 1 of the Ayer Hitam Dredging Property, Ayer Hitam, Selangor. To the naked eye the specimen appeared to consist of an aggregate of galena crystals, but examination of polished sections under the reflecting microscope showed that it is mineralogically quite complex (Fig. 1). It contained, amongst other species, bournonite that has hitherto only been described from one other Malaysian locality, namely Bidor in Perak (Hosking and Yeap, 1973), and tetrahedrite, that has not been identified by us in ore from the Sin Nam Lee Pipe Tambun and from Tekka (both localities being in Perak).

The ore under review is characterised by a mineral assemblage that has not hitherto been described from Malaysia.

Mineralogy of the Ayer Hitam Specimen

The following observations are based on the examination of a number of polished sections of the ore:-

Cassiterite:- Occurs, in small amount, as medium- to fine-grained euhedral crystals. A few are included in the small quantity of quartz present, whilst others are found in galena and are locally embayed by it.

Sphalerite:- Sizeable aggregates (> 5mm) of this species occur in the galena. It lacks dispersed exsolution bodies but locally chalcopyrite occurs as blebs outlining the grain boundaries, and as micro-veins in the sphalerite.

Stannite:- This species is not abundant in the ore, but occasionally a grain of it is associated with tetrahedrite (Fig. 2). Its paragenetic position is unclear.

Tetrahedrite:- This species is closely associated with the galena and may replace it (Fig. 3). On the other hand, the tetrahedrite, together with the bournonite, native bismuth and the galena, may all be essentially the products of unmixing of a single complex sulphide parent. In the immediate vicinity of sphalerite, galena and tetrahedrite commonly provide a pseudo-eutectic intergrowth texture (Fig. 4) whilst certain veins in the sphalerite contain tetrahedrite, in addition to galena and chalcopyrite. Cracks, some of which are filled with late chalcopyrite, are a common feature of the tetrahedrite and serve to facilitate identification of the latter species.

Initial identification of the tetrahedrite was established by determining its reflectance and micro-hardness (Table 1) and its identity was later confirmed by x-ray data.

Ayer Hitam "tetrahedrite"		Published values for tetrahedrite	
Vickers Hardness Number (VHN)	Reflectance λ (nm). Air.	Vickers Hardness Number (VHN)	Reflectance λ(nm).Air.(1)
325-336 (VHN 100) 329-385 (VHN 50) a) Concave & straight edges b) Star radial & shell fractures	470 ... 30.2-30.6 546 ... 30.3-30.7 589 ... 30.2-30.8 650 ... 28.4-29.5	306-340 (VHN 50)(1) 328-367 (VHN 100)(2)	470 ... 30.2-31.3 546 ... 30.5-31.3 589 ... 30.5-31.6 650 ... 28.9-30.3

Table 1: Reflectance and micro-hardness values of Ayer Hitam "tetrahedrite" compared with published values for tetrahedrite

(1) Values quoted from "International Tables for the Microscopic Determination of Crystalline Substances Absorbed in Visible Light". Publ. by the Commission on Ore Microscopy of the I.M.A.. Ed. by the Departmento de Crystalografia y Mineralogia, Universidad de Barcelona, 1970, p. 10.

(2) Bowie and Taylor, (1958).

[Note:- For the present work the reflectance standard used was BLK. Stand. Sika 88 (Silicon carbide). Further, using black, non-reflecting velvet, it was established that the primary flare correction was negligible. A Lanham stage was used during reflectance measurements.

Bournonite:- In the ore, bournonite is more abundant than tetrahedrite and it occurs in close association with galena. As in the case of tetrahedrite it is not clear whether the galena replaces the bournonite or whether they developed simultaneously from a complex sulphide parent and are truly intergrown. Occasionally, blebs of native bismuth are associated with the species under review and they seem to be preferentially deposited locally along the bournonite/galena boundaries. Etching with conc. HNO_3 and KI revealed the parquet twinning in the bournonite and at the same time corroded the galena (Fig. I).

As in the case of the tetrahedrite the identification of the bournonite was established by determining its reflectance and micro-hardness (Table 2) and its identity was confirmed by x-ray data.

Ayer Hitam 'bournonite'		Published values for bournonite	
Vickers Hardness Number (VHN)	Reflectance λ(nm) Air	Vickers Hardness Number (VHN)	Reflectance (3) λ(nm) Air
176-199 (VHN 100)	470 ... 37.1 - 38.5 546 ... 33.6 -34.3	166-212(VHN 20-50)(3) (010)163-194(VHN_{100})(4)	470...36.4-37.3 to 37.5-40.0
171-199(VHN 50)	589 ... 34.6 -35.4 650 ... 33.2 -35.3	(001)159-175(VHN_{100})(4) (100)168-133(VHN_{100})(4)	546...34.6-35.2 to 35.9-39.2
a) Slight fracture; concave & straight edges.			589...34.3-34.7 to 35.4-39.4
b) Star & side radials radials			650...33.3 to 34.6-39.3

Table 2: Reflectance and micro-hardness values of Ayer Hitam "bournonite compared with published values of bournonite.

(3) Uytenbogaardt and Burke (1971).
(4) Young and Millman (1964).

<u>Native bismuth:-</u> This species, as noted above, occurs locally as small blebs close to the bournonite/galena contacts. Additional small blebs of bismuth (some of which may only be 20μ in diameter) occur, sometimes quite abundantly, in both the galena and the bournonite and well away from the contacts. Furthermore, certain blebs are seen in the same environment as the native bismuth ones, but they are whiter than the bismuth and have not been identified.

Possibly both the native bismuth blebs and those of unknown composition are exsolved bodies and of the same age as the bournonite and the galena.

Chalcopyrite:- Small blebs occur in both the sphalerite and the galena but they are not abundant. Micro-veinlets of the species are also present in the sphalerite, tetrahedrite and galena, and probably more than one generation of chalcopyrite is present. Certain voids in the galena are lined with chalcopyrite and this must surely be of supergene origin.

Galena:- This is the most abundant of the species present and its relationship to the other primary minerals present has already been discussed in the preceding paragraphs so that no further remarks are necessary except to note that a slight development of cerussite or anglesite has occurred along some of the cleavages and plug marks.

Framboidal pyrite:- Pyrite framboids, of undoubted supergene origin, occur in some of the voids in the galena. The geometry of the framboids/galena relationship suggests that the pyrite boides were not transported into the voids but developed within them.

Discussion

Any attempt to construct a paragenetic table of this type of complex ore which has never been described in Malaysia before would be futile and the result might even be misleading as the spatial relationships between the various sulphides are far too complex for their temporal relationships to be determined with any degree of certainty. All that one can reasonably say is that early cassiterite and quartz were followed by a number of sulphides, all of assumed hypogene origin. To these were added supergene chalcopyrite, and pyrite of the framboidal type.

It is likely that superficial parts of the parent orebody were subject to oxidation and possibly supergene sulphide development during the deep excavation of the valleys that was caused by the marked fall of the sea-level during the Pleistocene. Later, when the sea-level rose, favourably situated low-lying oxidised deposits were subject to estuarine and locally reducing conditions.

Possibly in the case of the Ayer Hitam ore it was at this time that the voids between the galena crystals were lined with chalcopyrite and part-filled with framboidal pyrite.

The complex nature of the ore under review suggests that it has been derived from a xenothermal deposit, of which many are known in Peninsular Malaysia (Hosking, 1973a). Evidence has been presented elsewhere (Hosking, 1973b) in support of the contention that those xenothermal deposits occurring to the west of the Main Range may be genetically related to upper Cretaceous granitoids whose local presence has been indicated by radiometric studies of Bignell (1972).

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Fig. 1. Tracing from photomicrograph of polished section showing irregular grains of bournonite (Bou) in galena (Ga). Note the parquet twins (centre of diagram) of the bournonite revealed by etching with conc. HNO_3 and KI. Galena was corroded during the etching process.

Fig. 2. Tracing from photomicrograph of polished section showing the association of tetrahedrite (Tet.) with sphalerite (Sl) in galena (Ga). Rare grains of stannite (St) occur with tetrahedrite in the ore. Voids (v).

Fig. 3. Tracing from photomicrograph of polished section showing tetrahedrite (Tet.) probably replacing and filling in between the grains of galena (Ga). Bournonite (Bou) also occurs locally with the tetrahedrite.

Fig. 4. Tracing from photomicrograph of polished section showing the tetrahedrite (Tet.), sphalerite (Sl) and galena (Ga) association. Tetrahedrite may occur either as coarse blebs or as a "pseudo-eutectic intergrowth" with galena (as at the top left of the diagram). Voids (v).

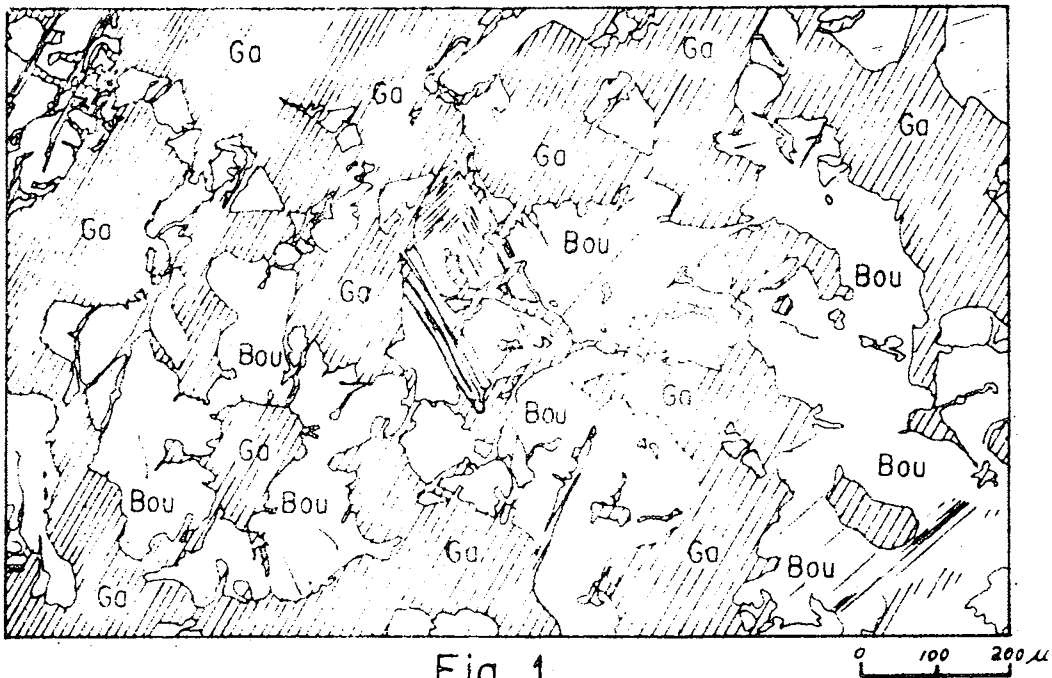
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Fig. 1

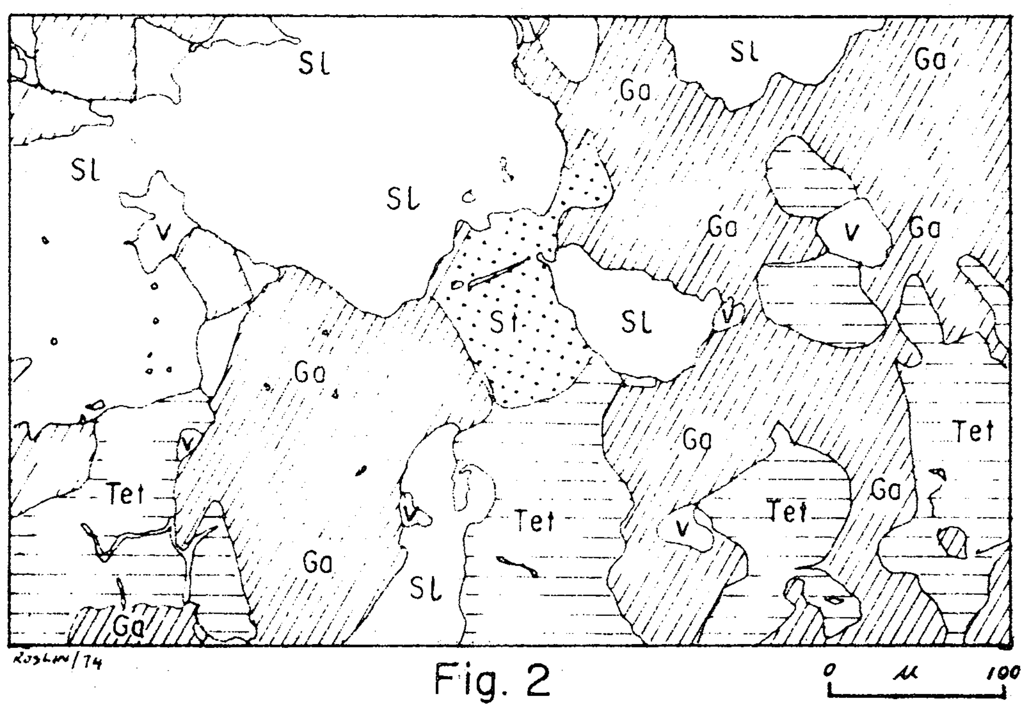
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Fig. 2

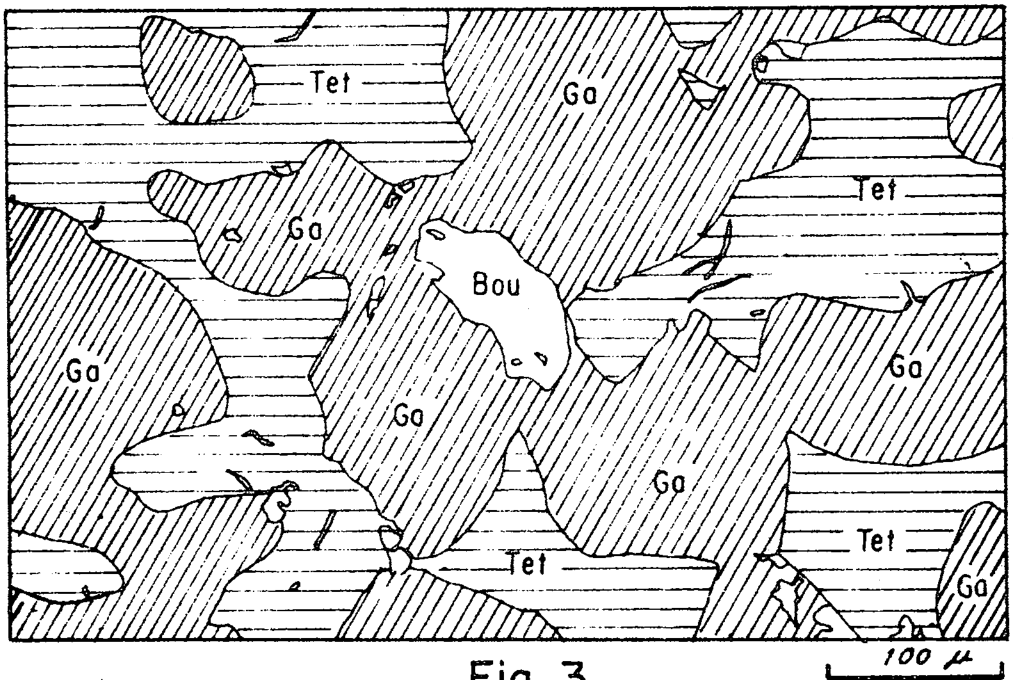

Fig. 3

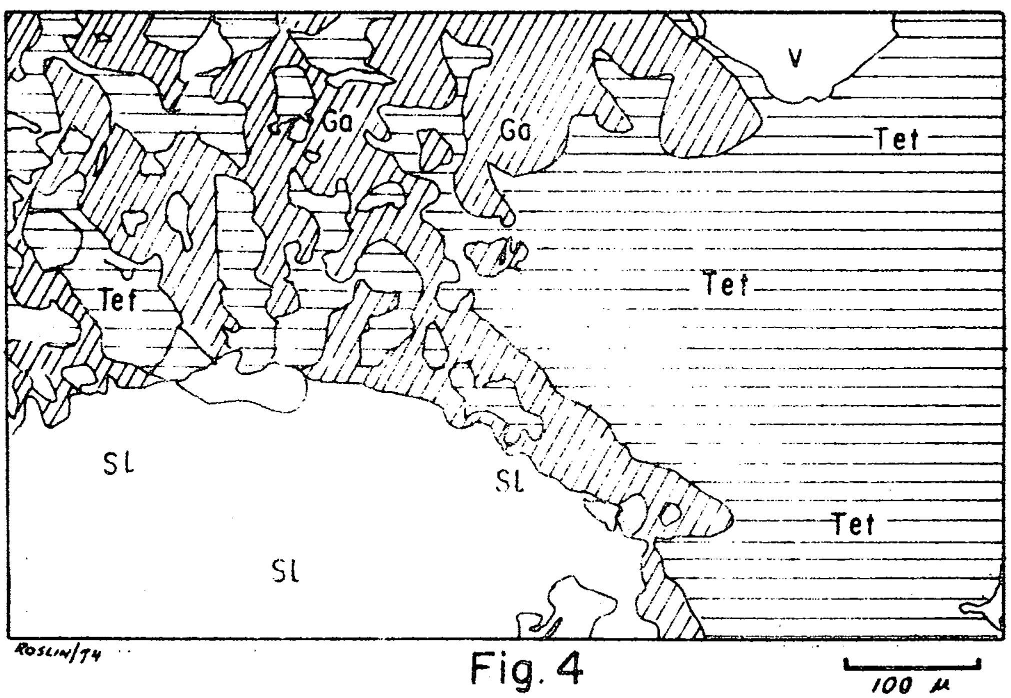

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Fig. 4

MEETINGS OF THE SOCIETY

27 November 1974

Dr Rick Varne of the Department of Geology, University of Tasmania gave a talk on 'The geology of Macquarie Island and its relationship to oceanic crust' to about 30 members of the Society. Dr Varne promised to send a summary of his talk for the Newsletter later.

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14 December 1974

The Ipoh Discussion Meeting was held in the new Conference Hall of the Geological Survey of Malaysia and was attended by about 60 members. The meeting was highly successful and this was due to the high standard of the 11 papers presented, the support and cooperation of the Survey particularly Encik S.K. Chung, the Director-General, and Encik S.K. Yong, and the Chairmen of the three sessions who handled the talks and discussions excellently. The speakers, the Chairmen of the sessions, Encik S.K. Chung, Encik S.K. Yong and also Dr T.E. Yancey who also organized the program should be thanked for making the Meeting so successful.

From amongst the papers presented, 2 papers need special mention. The keynote paper of the meeting by Dr C.S. Hutchison gave a fine summary of our present level of knowledge of the tectonic history of Peninsular Malaysia and pointed out that much more work is needed before we can claim to have a good knowledge of the tectonics of this region. The paper by Mr R.W. Murphy which was presented as the 7th Presidential Address was an exciting paper that presented sedimentological and structural classification of Tertiary basins of Southeast Asia.

Program and abstracts of the meeting are given in the following pages.

Ipoh Discussion Meeting Program and Abstracts

First Session

Chairman: Encik D. Santokh Singh
President, Geological Society of Malaysia

9.00 a.m.

Charles S. Hutchison, Jabatan Geologi, Universiti Malaya

An overview of the Tectonic History of the Malay Peninsula

The Malay Peninsula may be rationally subdivided into three distinct tectonic regions: 1) The continental core: all country west of and including the Main Range. 2) The Central Basin and 3) The eastern stable volcano-plutonic arc. The line of separation between regions 1 and 2 is a major deep seated tectonic line - The Bentong-Raub ophiolite line. Activity along this line cannot yet be precisely dated, and more work is needed in this fascinating region. It was active in the Paleozoic and the direction of tectonic transport appears to have been towards the west.

In the western "continental core" region the case for a lower Paleozoic deformation, so ably argued by Koopmans (1965), no longer seems valid because of increasing valuable paleontological studies on the Langkawi Islands. The first major deformation now should be considered as post Middle Permian. The existence of the well established Devonian unconformity is now also being questioned, but there is evidence that its continued existence is at least safe in the far west of Langkawi.

The study of the plutonic and their associated volcanic rocks is valuable in elucidating the tectonic history of the region. The eastern region is characterised by Permian and Triassic acid to intermediate volcanic and pyroclastic rocks and numerous granite to granodiorite plutons which give a Permian to Triassic radiometric age. Present studies of the mineralogy of these plutonic rocks indicate that they were emplaced at high levels, and hence are closely correlated with the synchronous surface volcanism.

Isotope studies by Bignell and Snelling (in press) indicate that these plutonic rocks are unlikely to have been derived from an established continental basement. The associated Paleozoic rocks are generally isoclinally folded and metamorphosed to the greenschist facies, except in a few regions, for example around Sungei Lembing. More than one deformation has been identified, but always with near concordant fold axis. We can regard this region as a Permo-Triassic volcano-plutonic arc which is preserved almost in its original configuration because of its extremely high degree of stability through the Mesozoic and Cenozoic. Hence I do not believe that the Murau and other Mesozoic conglomerates on its eastern margins are related to the conglomerates along its western margin (Tembeling Formation). These were formed along the sides of the stable arc and need not be synchronous and were unlikely to ever have been a continuous part of one formation.

The Main Range and all the granites of the Western region are dramatically different from those of the east. They are all deep seated and their mineralogy indicates slow cooling at considerable depth. The majority of radiometric ages are Triassic, with a few scattered Permian. Since the Triassic therefore a thick cover of sedimentary rocks has been removed from the western region. In other words this region has been actively uplifting, unlike the eastern region. We can only speculate as to what the formations were that had been removed. Was there any basis for Van Bemmelen's nappe theory?

The Central basin was actively subsiding through the Paleozoic to Mesozoic and it is the region with the highest grades of metamorphism now exposed as localized uplift along a line from the Taku Schist through Benta to Mount Ophir.

A tectonic synthesis of the Malay Peninsula which will withstand the test of time is not yet available, but any synthesis will have to recognise the tripartite nature of the Peninsula with contrasting sedimentary and tectonic histories in each of the regions.

9.25 a.m.

H.D. Tjia, Jabatan Kajibumi, Universiti Kebangsaan, Kuala Lumpur

Low-angle thrust faulting and superimposed deformations, Kuala Dungun area, Trengganu

This structural investigation records superimposed deformations upon Carboniferous(?) metasediments in the Kuala Dungun area, and the recognition of a second system of large, low-angle thrustfaults in West Malaysia, that is next to the Kisap thrust known from the Langkawi Islands.

The rocks that are exposed along the coast and in roadcuts of the Kuala Dungun area consist of phyllite to phyllitic schist intercalated with metarenite-metalutite-strata; occasionally impregnated by quartz and intruded by one dolerite dyke and several aplite dykes. The metasediments have been correlated with Carboniferous counterparts elsewhere in Trangganu State, whereas the intrusions of quartz, aplite and dolerite were probably emplaced during the Triassic-Jurassic orogenesis that strongly affected West Malaysian rocks. Structures of the metasediments include overturned to recumbent folds, strike-slip faulting, normal faulting, and a system of large, low-angle thrustfaults. Fold axes and crenulation trends indicate three groups of structural strikes. The first group trends almost northwest, a second group strikes east, and the third group strikes within the north-northwest and north sector.

The strikes of the first group parallel the regional structural grain on the peninsula. Therefore, this group of structures has been interpreted to represent the effects of the Triassic-Jurassic orogeny. In the Kuala Dungun area this deformation succeeded in developing folds recumbent towards west-southwest and a system of large, low-angle thrustfaults into the same direction. The second group of structural strikes represent an older deformation phase that also resulted in folds recumbent towards south. Granite ages elsewhere in the state suggest the older deformation to have occured during the Permian. The third group of structural trends has been interpreted as re-oriented strikes of the Triassic-Jurassic structures through thrust movements.

A few steeply to vertically inclined, more or less east-west striking faults reacted to the Triassic-Jurassic deformation by left lateral motion. One of the horizontal offsets amounts to 500 meters.

Absence of marker horizons has prevented the determination of the amount of horizontal transport by thrusting.

9.50 a.m.

Krishnan Dharmarajan, Jabatan Geologi, Universiti Malaya, Kuala Lumpur

A new structural interpretation of the formations of the Foothills Range near Bentong, Pahang

In the Bentong district of Pahang, between the granite of the Main Range and the low-lying area further east, is a chain of hills that form the Foothills Range. This range consists of metasedimentary and sedimentary rocks with basic and ultrabasic intrusions, all of them trending south-southeast. The stratigraphy of the area is made up of three distinct lithologic units which conforms to that of areas north of Bentong. In the northern areas the formations in the Foothills Range are steeply dipping to the east to form an overall homoclinal structure. In the Bentong area it has been believed that this overall structure applies also. But recent work by the writer shows that the structure there is not simple. A new structure consisting of nearly isoclinal anticline and synclinal folds is proposed. This structure accounts for the repetition of certain lithologic types and for the first time explains the localisation of the ultrabasic bodies as being on the broken crest of the anticline.

10.15 a.m.

T.E. Yancey, Jabatan Geologi, Universiti Malaya, Kuala Lumpur

Evidence against a Devonian conformity and against a mid-Paleozoic orogeny in Kedah & Perlis, Malaysia

The currently accepted concepts of a Devonian unconformity and a mid-Paleozoic folding phase in northwest Malaya are shown to be incorrect. At the best exposed locality of the supposed Devonian unconformity, in the Langkawi Islands, the interval from Lower Devonian strata to Upper Devonian strata is continuous, and the horizon of the "unconformity" is conformable.

Remapping in the type area of the mid-Paleozoic orogenic phase shows that the deformed rocks were wrongly dated, and includes strata of Ordovician to Carboniferous age. Most of the structures described in support of the folding phase are in strata of the Carboniferous Singa Formation. The age of the Langkawi folding phase is probably post-lower Permian and pre-lower Triassic.

Devonian strata containing common tentaculitid-monograptid and bivalve-brachiopod-trilobite faunas are fairly widespread in the Langkawi Islands and Kedah and Perlis states in northwest Malaya. These have previously been wrongly dated as Silurian or Carboniferous in age.

10.45a.m. Coffee Break

Second Session

Chairman: Encik S.K. Chung
Director-General
Jabatan Penyiasatan Kajibumi Malaysia

11.15 a.m.

R.W. Murphy, Exxon Exploration Inc., Singapore

Tertiary basins of South-east Asia
(7th Presidential Address)

Tertiary to recent basins of four main types underlie 75% of Southeast Asia's 10 million sq. km. Structural style is related to: (1) basement composition; (2) petrotectonic assemblages involved; (3) relative balance between extensional, compressional, and transcurrent forces; (4) availability of preexisting fabric; (5) susceptibility to impact of changes in plate motions; and (6) sedimentary diapirism developed in overpressured clastic wedges.

Shelfal basins have continental crust on all flanks. Examples are north, central, and south Burma, central and south Sumatra, Gulf of Thailand, Sunda, west and east Java, Billiton, and Barito. Plate-margin activity is not obviously reflected in shelfal basins develop basement-controlled tectonic patterns except where sedimentary diapirism overprints flowage structures at shallow levels in deep-basin areas.

Continental-margin basins have continental crust on one flank and oceanic on the other. Examples include the Gulf of Martaban, Sunda outer-arc basins, Mekong, Brunei, and East Kalimantan basins. These basins mirror principal movement changes in adjacent plates, enabling fairly satisfactory tying of internal unconformities to changes in spreading direction and rate. The 10-m.y. and 26-m.y. events are particularly widespread. Outer-arc basins (continental-margin basins associated with island arcs) filled mainly by volcanosedimentary input from andesitic inner volcanic arcs and also by subduction accretion from buoyant inner trench wall wedges with fan-shaped internal structure. Structural style results from interplay of compressional and transcurrent movements.

Archipelagic island-arc basins are intraoceanic arc basin complexes. Philippine examples include the Cagayan Valley, the Central Luzon trough. Agusan-Davao, and Cotabato. They form between intricate subparallel arc-trench systems with strong vertical mobility and relatively stable map-view configuration. Structural style is exceedingly complex.

Small ocean basins form by interarc spreading or by trapping of older oceanic crust behind newly risen intraoceanic island arcs. Examples include the Andaman Sea, South-China Sea, Southeast Sulu Sea, Celebes Sea, and Banda Sea.

Transitional types of basins are known and some basins change category during evolution.

12.00 p.m.

H.D. Tjia, Jabatan Kajibumi, Universiti Kebangsaan, Kuala Lumpur

Sense of tectonic transport in intensely deformed Trusmadi and Crocker sediments, Ranau-Tenompok area, Sabah

In the Ranau-Tenompok area to the south and southeast of Mount Kinabalu, Eocene to Aquitanian Trusmadi and Crocker flysch sediments have been intensely deformed into flasered strata, low-angle reverse to overthrust faults, and overturned to recumbent folds. Three main fault zones, the Kadamaian, Mensaban and Ranau faults, divide the map area into a western, northern, eastern and central domain. The linear Mensaban and Ranau faults are probably normal faults with or without lateral slip components. The Kadamaian fault zone, whose character is still uncertain, marks an important boundary between the structurally simple region of western Sabah and the complex, deformed central part of Sabah.

Within the central domain are exposed at least four units of sedimentary packets each of which is bounded by low-angle reverse faults that locally indicate overthrusting towards northeast and north. The southern unit appears to represent the axial zone of diastrophism and is demarcated by faults on which thrusting occurred towards northeast and southwest in the north and in the south, respectively.

The close association of flasered Trusmadi and Crocker sediments with metabasite in the Wariu and so called "Chert-spilite" formations in the Ranau-Tenompok-Kinabalu area suggests that this assemblage is comparable with mélange of subduction zones.

The diastrophic history of the area is documented by deformed metabasite of (?) Jurassic or older age, lower Tertiary geosynclinal sedimentation of Trusmadi and Crocker flysch strata, middle Miocene orogeny that produced the thrust and overthrust faults and recumbent folds, late orogenic intrusion of the Kinabalu silicic pluton during Late Miocene, general uplift and normal faulting along the Mensaban and Ranau faults that started in Plio-Pleistocene time and have continued to the present day.

12.25 p.m.

N.S. Haile, Jabatan Geologi, Universiti Malaya, Kuala Lumpur

An unusual unconformity of radiolarian chert on schist and gneiss west of Pangkajene, southwest arm, Sulawesi (Celebes)

A sequence of chert and sandstone is exposed in Sungai Dera (a tributary of Sungai Paring) about 22 km east of Pangkajene, SW arm, Sulawesi. At the exposure mentioned, slightly folded red (strictly, "brownish grey") radiolarian chert is seen overlying brecciated metamorphic rocks, along a undulating, approximately horizontal plane of unconformity. About 7m stratigraphic thickness of the chert is seen. The chert is very regularly bedded, in beds about 10cm thick, which appear to show a kind of grading, with clastic material (fine quartz, mud, and white mica) more abundant near the base of the bed. Specimens examined show up to 60 percent Radiolaria, probably Cretaceous in age. Near the base of the chert sequence, medium-grained sandstones up to 0.3 m thick are interbedded with the chert. Some show grading, but none show lamination. The sandstones are litharenites, with a high proportion (up to 35 percent) of grains of mica schists, muscovite, and altered ultrabasic rocks. The chert is intruded by a basic dyke.

I believe the contact to be an unconformity, and not a tectonic contact because:

i) The appearance of the undulating contact surface looks like an unconformity;

ii) The flat-lying, gently folded sequence of cherts, with sandstone beds common near the base, absent higher up, suggests a normal basal sequence;

iii) The sandstones above the metamorphic rocks contain clasts clearly derived from the metamorphic rocks (e.g. schist, garnet).

The underlying metamorphic rocks are greenish grey, and brecciated. They include epidote-quartz-plagioclase-calcite gneiss and mica schist.

The interest of the exposure lies in the interbedding of rather coarse sandstone with the chert, suggesting deposition by some form of mass flow, and the unconformity on metamorphic rocks. There appear to be no published references to cherts resting on rocks other than marine sediments, pillow lavas, gabbros, or ultrabasic rocks. The full significance of the contact is not likely to become clear without more extensive mapping.

1.00 p.m.   Lunch

Third Session

Chairman: Prof. H.D. Tjia
Ketua, Jabatan Kajibumi
Universiti Kebangsaan

2.00 p.m.

J.C.M. de Coo, Jabatan Kajibumi, Universiti Kebangsaan, Kuala Lumpur

Carbonate sedimentation of a mobile Triassic basin edge (NW Malaysia): preliminary report

Five rock types resulting from five distinct sedimentary environments are distinguished in the Triassic Kodiang limestone, in north Kedah.

1) Laminated crystalline limestones: algal stromatolites probably deposited in a shallow marine environment.

2) Intraformational (limestone) breccias: unstable slope(?) conditions.

3) Black nodular lime mudstones with chert, alternating with black siliceous and slightly carbonaceous shales: deeper water basin conditions.

4) Graded bedded (allodapic) limestones: turbidites.

5) Limestone conglomerates: pebbly lime "mudstones" deposited on a slope, accompanied by large sedimentary slumping.

The carbonate sediments of the Kodiang limestone were deposited partly on a quiet stable shelf, partly on an unstable slope, and partly in the deeper water of a miogeosynclinal furrow. The instability of the area of deposition indicates the approaching large diastropic events of the Late Triassic Thai-Malay Orogeny.

2.25 p.m.

P.C. Aw, Jabatan Penyiasatan Kajibumi, Kelantan, Malaysia

Textures of the border zone and their implication on the origin of the Bukit Ulu Lalat batholith of South Kelantan

The Bukit Ulu Lalat batholith whose border zone exhibits certain features which may either be interpreted as of magmatic or metasomatic origin, is described. The batholith is emplaced in a low-grade metasedimentary-pyroclastic sequence of Permian to Triassic age. This sequence is folded, in part isoclinally, with the general fold-axis trending N-S. A discontinuous contact-aureole of albite-epidote amphibolite facies is formed around the batholith.

The batholith, medium to coarse-grained, is mainly adamellitic in composition with granodiorite and granite occur locally. Minor microgranitic dykes and apophyses/enclaves occur randomly. The core of the batholith is massive and of typical granitic rock in terms of colour, texture and mineralogical composition. However, along the border zone, the granitic rock is generally mesocractic, and, in part, foliated. Hornfels enclaves are common. The contacts of the granitic rock with the hornfelsic country rocks are sharp, without chill zone and either discordant or concordant. In places, hornfels grades into mica schist or micro-granitic rock. Elsewhere, diffuse hornfelsic streaks, foliation, and alignment of the feldspar megacrysts in the mesocratic granitic rock are sub-parallel to the laminations of the hornfels.

Despite the fact that most of the textures are subject to alternative interpretations, from the available field evidence, it is tentatively concluded that the Bukit Ulu Lalat batholith is of intrusive magmatic origin.

2.50 p.m.

N.S. Haile, Jabatan Geologi, Universiti Malaya, Kuala Lumpur

Are the Kuantan dolerite dykes and extrusive basalt related to each other or to the Segamat basalt? Palaeomagnetic evidence.

Dolerite dykes, and extrusive basalt, in the Kuantan area are petrographically and chemically similar, and were postulated by F.H. Fitch to be of the same age. Basalt at Segamat, 160 km SSW of Kuantan, has been considered to be Late Cainozoic by various authors, and related a single hypothetical subduction system.

Fourteen handsamples from five dolerite dykes cutting granite at Kuantan show, after cleaning, a mean direction of remanent magnetism of declination 332^o, inclination 40^o. This corresponds to a palaeo-latitude of 24^o, and a palaeomagnetic pole 57^{o}N, 51^{o}E.

Nine samples of basalts from Kuantan show a mean declination of 177^o, inclination 12^o, that is, they are magnetized along the direction of the present field but in a reversed sense.

K/Ar age estimates by J.D. Bignell give (from one dolerite) 111 $\pm$ 4 m.y. and (from one basalt) 1.6 $\pm$ 2 m.y. The palaeomagnetic results are consistent with the radiometric results showing a widely differing age between the basalts and dolerites. An age of 1.6 m.y. for the basalts would place them in the Matuyama Reversed Epoch, and their reversed magnetism is consistent with this.

The direction of remanent magnetism of the Segamat Basalts (Declination 131^o, Inclination -34^o; palaeomagnetic pole, latitude 39^{o}N, longitude 35^{o}E) is quite different from that of the Kuantan basalts, and close but not identical to that of the dolerites, but all except two of the Segamat basalts tested are reversely magnetized. This is consistent with Bignell's age of 62 m.y. minimum, from a K/Ar determination on the Segamat Basalts. Reversed magnetic zones before 60 m.y. occur in the Palaeocene, and Maestrichtian (up to 70 m.y.) but the Upper Cretaceous was entirely normal, except for a short reversed zone at about 79 m.y.

It is concluded:

1. The Kuantan basalts (K/Ar age 1.6 ± 2 m.y.) are Late Cainozoic, probably early Pleistocene, and were extruded during the Matuyama Reversed Epoch.

2. The Kuantan dolerites are Early Cretaceous (K/Ar age 110 ± 4 m.y.), and are not directly related to the Kuantan basalts

3. The Segamat basalts (K/Ar age 62 m.y. minimum) are probably Palaeocene or Cretaceous, and are not contemporaneous with the Kuantan basalts

Summary of palaeomagnetic results

Rock unit	N	D	I	R	k	α_{95}
Kuantan basalts	9	177	12	7.655	5.9	23.0
Kuantan dolerites	14	332	40	13.732	48.5	5.7
Segamat basalts	11	131	-34 1)	10.415	17	11.3

1) Reversed direction; equivalent to normal direction of D = 311, I = 34.

N, number of samples; D, declination east of true north;
I, inclination, positive downwards, negative upwards;
R, result out of N unit vectors; k, precision parameter;
α_{95}, radius of circle of 95 percent confidence about the mean.

3.15 p.m.

Syed Sheikh Almashoor, Jabatan Kajibumi, Universiti Kebangsaan, Kuala Lumpur

The tuff of Gunung Jerai, Kedah

Field and laboratory investigation of the "quartz porphyry" of Gunung Jerai showed that it is, in fact, tuff. The tuff is mappable and it is, therefore, upgraded as a member of the Jerai formation. The tuff member consists of two thick beds and a few thin ones which intercalate in the quartzite member of the Jerai formation.

The tuff is found to be chemically similar to the tuff in the Grik area located about 100 km to the southeast of Gunung Jerai. By lithostratigraphic correlation with the Grik area, the Jerai formation is found to be probably of Ordovician age.

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

Editorial

Although it has been the adopted policy of the Society to publish papers in Bahasa Malaysia (Malay) so far none has been published either in the Newsletter or in the Bulletin. To date, only a news item in Bahasa on the Universiti Kebangsaan Malaysia has been published in the Newsletter (No. 27). The lack of contributions in Bahasa may be due to the lack of sufficient encouragement and suitable dictionaries of geological terms in Bahasa which are now available, albeit 'unofficially'. In this Newsletter a paper in Bahasa is published and it is hoped that this will serve to encourage more papers to be written in Bahasa particularly from geologists who are proficient in Bahasa and also those who have received their geological education in Bahasa.

Circum Pacific Plutonism Conference

The organizers of the UNESCO-funded Circum Pacific Plutonism Project have accepted the Society's invitation to hold a conference connected with the Project in Kuala Lumpur next year. The main theme of the conference will be on "Circum Pacific Plutonism and associated mineralisation" and possibly the conference will be held in November. It is believed that many of the members of the Society associated with the mining industry in South-east Asia will be very interested in this conference and all members will be informed of any development through the Newsletters or special circulars.

Stratigraphic Nomenclature Sub-Committee

Recently the sub-committee received from the International Sub-commission on Stratigraphic Classification (ISSC) its Circular 47, which includes a copy of the final draft of the International Stratigraphic Guide and calls for comments on this Guide. This draft has been compiled by an editorial committee of 10 set up after the International Geological Congress in Canada in 1972, and is now submitted to members of the ISSC for approval and comments. The Guide is highly significant because it attempts to incorporate the views of geologists all over the world and forge a stratigraphic guide that can be used all over the earth. The ISSC requests that comments reach them by the end of this year (1974), and then a final copy will be made, and printed and distributed shortly thereafter,

Since the sub-committee received this only a few weeks before the dateline for submitting comments, it was immediately sent out to subcommittee members, and all sub-committee members have submitted views, which was now being forwarded to the ISSC. In addition, comments on the Guide have been solicited from some institutions who are not members of the GSM sub-committee. At the present time, any other persons or institutions who wish to examine the Guide may do so by borrowing it from the GSM sub-committee on Strat. Nomenclature.

The Guide is quite long (148 p.), and has 8 long and very complete chapters. The first chapter is Introduction, Chapter 2 is on Principles, and Chapter 3, is on Definitions and Procedures. Chapter 4 is on Stratotypes, then Chapter 5 on Lithostratigraphic units, Chapter 6 on Biostratigraphic units, and Chapter 7 on Chronostratigraphic units. Chapter 8 is a summary and evaluation of relationships between these units. The greatest difference over older guides and codes is that biostratigraphic units are limited to zonal-type units, and standard subdivisions of the geologic time scale such as stage, series and system are completely separated into the distinctly different category of chronostratigraphic units. The chronostratigraphic units have pure time equivalents called geochronologic units, similar to the distinctions used in older codes. The dangers of confusion on these concepts is minimized by very clear and detailed explanations of the concepts. Much of the clarity is due to constant discussion of the problems between geologists over the last 2-3 years, both within the ISSC and in the outside literature. The International Guide is now coming to bear fruit and hopefully will be adopted by most geologists.

(TEY)

Exchange of Publications

The Council has agreed to exchange the Society's publications with the following:

(a) Librarian
Teylers Stichting
P.O. Box 333
Haarlem, Holland

(b) Institute of Geology of Foreign Countries
2nd Novotikhvinskaya, 12/22
Moscow, USSR

Purchase of a Slide Projector

The Council has approved the purchase of a Rollei P37 autofocus slide projector for use during talks and meetings.

Subscriptions 1975/76

In spite of the high cost of running the Society this year and very likely even higher next year, the Council has decided not to raise the subscription rates of members next year. Several societies have raised their members' dues recently to cope with the inflation and it is believed that members of the Society will be delighted to learn that our Society is not following suit. Any increase in members' dues will contribute to the inflation which may already be tormenting many of our members. To cope with the inflation the Society has been and will be as always frugal and prudent with the use of funds. One way in which members can help to increase the Society's funds will be for them to try their best to recruit new members to the Society. The more members we have the less will be the chances of the subscriptions being increased. It is hoped that members will do their best to make the membership list in the next Newsletter as long as the one shown below.

Membership

The following applicants were lelected.

Full members

V. Arthivitanas
Siam Barite Co. Ltd.
935-941 Ramai Road
Patumwan, Bangkok, Thailand

N.L. Banks
MXS/1 Sarawak Shell Bhd.
Lutong
Sarawak

J.H. Bennie
c/o UNDP
P.O. Box 650
Rangoon, Burma

J.N. Bubb
Esso Exploration Malaysia Inc.
P.O. Box 857
Kuala Lumpur

P. Burri
Sarawak Shell Bhd.
Lutong
Sarawak

S. Dhebhasit
Thailand Exploration & Mining Co. Ltd.
P.O. Box 37, Phuket
Thailand

D.E. Francis
Esso Exploration Malaysia Inc.
P.O. Box 857
Kuala Lumpur

R.F. Goninon
Faber Merlin Ltd.
11th Floor Dusit Thani Building
946 Rama IV Rd., Bangkok, Thailand

B.W. Hester
Australian Inland Expl. Ltd.
Box 100, West Perth,
W.A. 6005, Australia

Kamarul Ariffin Abdullah
P.O. Box 67
Ipoh
Perak

W.V. Kramer
234F, Faber House, 6th Floor
236 Orchard Road
Singapore 9

W.W. Lynn
Rua Urbano Santos 76 Urca
Rio de Janeiro
Brazil

T.S. Mackay
P.O. Box 2159
Texas City, Texas 77590
U.S.A.

G.A. McLellum
Endeavour Oil Co. N.L.
232 Victoria Parade
East Melbourne, Australia

P. Merki
Sarawak Shell Bhd.
Lutong
Sarawak

P.J.C. Nagtegaal
Sarawak Shell Bhd
Lutong
Sarawak

G.A. Nelson
Thailand Explo. & Mining Co.
6th Floor Bank of Ayudthya Bldg.
Ploenchit & Wireless,
Bangkok, Thailand

H.J. Nijhuis
Sarawak Shell Bhd.
Lutong
Sarawak
East Malaysia

D.J. Patrick
Texaco Inc.
Producing Eastern Hemisphere
P.O. Box 430, Bellaire
Texas 77401, U.S.A.

B.L. Reed
U.S. Geol. Survey
1209 Orca Street
Anchorage
Alaska 99502, U.S.A.

A.L. Scholtens
White Yun, Sukumvit Yl Soi 4
Bangkok, Thailand

V. Sripatanawat
241/4 Soi Sarasin, Rajdamri Road
Bangkok, Thailand

R.G. Taylor
Geology Department
James Cook University
Townsville, Queensland
Australia

Than Htay
20 Pyithaya Avenue, Pyithaya P.O.
Bauktaw, Rangoon
Burma

R. Vajarapong
Associated Consultants Co. Ltd.
448/2 Petchburi Road
Bangkok 2, Thailand

H. van Wees
P.T. Broken Hill Proprietary Indonesia
Kelapa Kampit
Belitung, Indonesia

Umar Yahya
PN Timah
Jalan Gatot Subroto
Jakarta Selatan
INDONESIA

Associte member

Kisanga Kabongelo
Kisanga Directeur General
Adjoint, Symetain Kalima
Kivu, Zaire

C. Phornprapha
1362-68 Bantad Thong Road
Bangkok, Thailand

N O T I C E

International Remote Sensing Symposium and Training Program

World Mining will be holding the above-mentioned Symposium/ Training Program probably in the autumn of 1975 in London, England. At the Symposium the use and interpretation of ERTS imagery and high altitude aerial photographs as an aid to mineral exploration, for mined area reclamation, forest management and related subjects will be discussed. There will also be a training program for participants who will be supervised by NASA principal investigators and other skilled scientists. For further information write as soon as possible to:

World Mining Symposium Controller
500 Howard Street
San Francisco, California 94105
U.S.A.

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