

# WARTA GEOLOGI

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ISSUED BIMONTHLY BY THE  
 GEOLOGICAL SOCIETY OF MALAYSIA,  
 c/o Jabatan Geologi, Universiti Malaya, Kuala Lumpur, Malaysia.



PERSATUAN GEOLOGI MALAYSIA  
(GEOLOGICAL SOCIETY OF MALAYSIA)

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Tujuan Persatuan Geologi Malaysia adalah untuk memajukan sains bumi, terutamanya di Malaysia dan tempat-tempat berhapiran. Sesiapa yang ingin menjadi ahli Persatuan sila dapatkan borang-borang daripada Setiausaha Kehormat.

The aim of the Geological Society of Malaysia is to promote the advancement of geological sciences particularly in Malaysia and nearby areas. Anyone interested in becoming a member of the Society should obtain the necessary forms from the Hon. Secretary.

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Some Bahasa Malaysia (Malay) geographical terms

Bukit (Bt)	- hill	Kuala (K)	- mouth of river
Genting (Gtg)	- pass	Pulau (P)	- island
Gunung (G)	- mountain	Sungai (S)	- river
Jalan (Jln)	- road, street	Tanjung (Tg)	- cape
Kampung (Kg)	- village	Teluk (T)	- bay

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## G E O L O G I C A L   N O T E S

## Unexpected rock types in Central Kedah

P.H. Stauffer & N.S. Haile, Jabatan Geologi, Universiti Malaya, Kuala Lumpur.

A recent excavation off the road between Rkok Sena and Kuala Nerang, Kedah, has revealed a variety of sedimentary and igneous rocks which suggest that the stratigraphy and structure of that part of central Kedah are more complicated than heretofore thought.

The excavation is a large borrow-pit or earth quarry located a few hundred metres north of the Kuala Nerang road at Mile 10½ from Alor Setar. The exposure involves an area at least 100 x 100 metres, though some parts are covered by rubble and others have been left standing as ridges, up to 10 metres high.

The geologic features visible in the exposure are indicated on the sketch map (Fig. 1), which is drawn from one made in the field. Distances on the map are estimated, but the attitudes shown and some reference directions were determined with a compass.

At the eastern edge of the exposure is quartzose sandstone, with scattered rounded pebbles and small-scale cross bedding, dipping vertically to very steeply eastward. Topside is to the east (this is the only portion in which the topside was determined). Underlying this is reddish mudstone and shale which contains small plant impression, minute imprints suggestive of fish scales, and also tiny (1 mm) cubic cavities, which show no iron-staining around them and may possibly be molds of salt crystals. To the west of the mudstone is a thin sequence of bedded chert in which what appear to be Radiolaria are visible. The cherts dip nearly vertically, though westward, and are locally folded into small open folds with axes plunging 80° west.

The central 'valley' of the excavation, and the face of the ridge to the west of it, are underlain by a reddish mottled soft material of surprisingly low density which appears to be a thoroughly weathered igneous rock. It shows a network of small veins of fibrous, asbestos-like character, and we suspected the original rock may have been serpentinite. A crushed and washed sample, however, yielded some fine anhedral quartz and some probable ilmenite; a borax bead test for chromite by Encik Yeap Ee Beng was negative. The parent rock may be a partly serpentinitized intermediate rock, or perhaps have a complex origin, as a fault breccia or such.

To the west of the igneous rock appears another near-vertical thin sequence of chert (possibly a repetition), and then a quite extensive area of red shale, cut by a fault, to the west of which the beds are gently dipping and of variable strike. Locally in this shale also appear the cubic molds, somewhat larger here, up to several millimetres. From their form alone these could represent former pyrites, but the shale appears to be red throughout and may therefore be an originally oxidized sediment, a most unlikely setting for pyrite.

To the northwest, the shale appears to be replaced (not overlain) by laterite. Adjoining the laterite is more shale and mudstone, but there including black and white colourings as well as red, with some pyritic mudstone and local mineralization, probably hematite. The weathered surfaces here often show a bright red ochre.

This exposure was noticed by us in the course of a brief reconnaissance, accompanied by Encik K.T. Yap of the University of Malaya and Miss S. Arpornsuwan of Prince of Songkla University in Hat Yai, Thailand, following a field trip in the same area with Year 3 students of the University of Malaya. The exposures traditionally visited in the supposedly simple homoclinal succession from west of Pokok Sena to east of Kuala Nerang are now old and weathered, and we hoped to find better and fresher ones.

However, the main rock types seen in this exposure - red mudstones, radiolarian(?) chert, and a possibly basic or ultrabasic igneous rock - do not seem to fit in the lithologies expected here. The site is mapped as part of the Kubang Pasu Formation, a clastic sedimentary unit composed of marine shales, mudstones, and sandstones (Gobbett, 1973, p. 68). Chert in central Perlis, considered by Gobbett as part of the Kubang Pasu, recorded by Scrivenor (1931, p. 80) as containing fusulinids was regarded by him as probably silicified limestone. It does not seem to resemble the bedded chert here described.

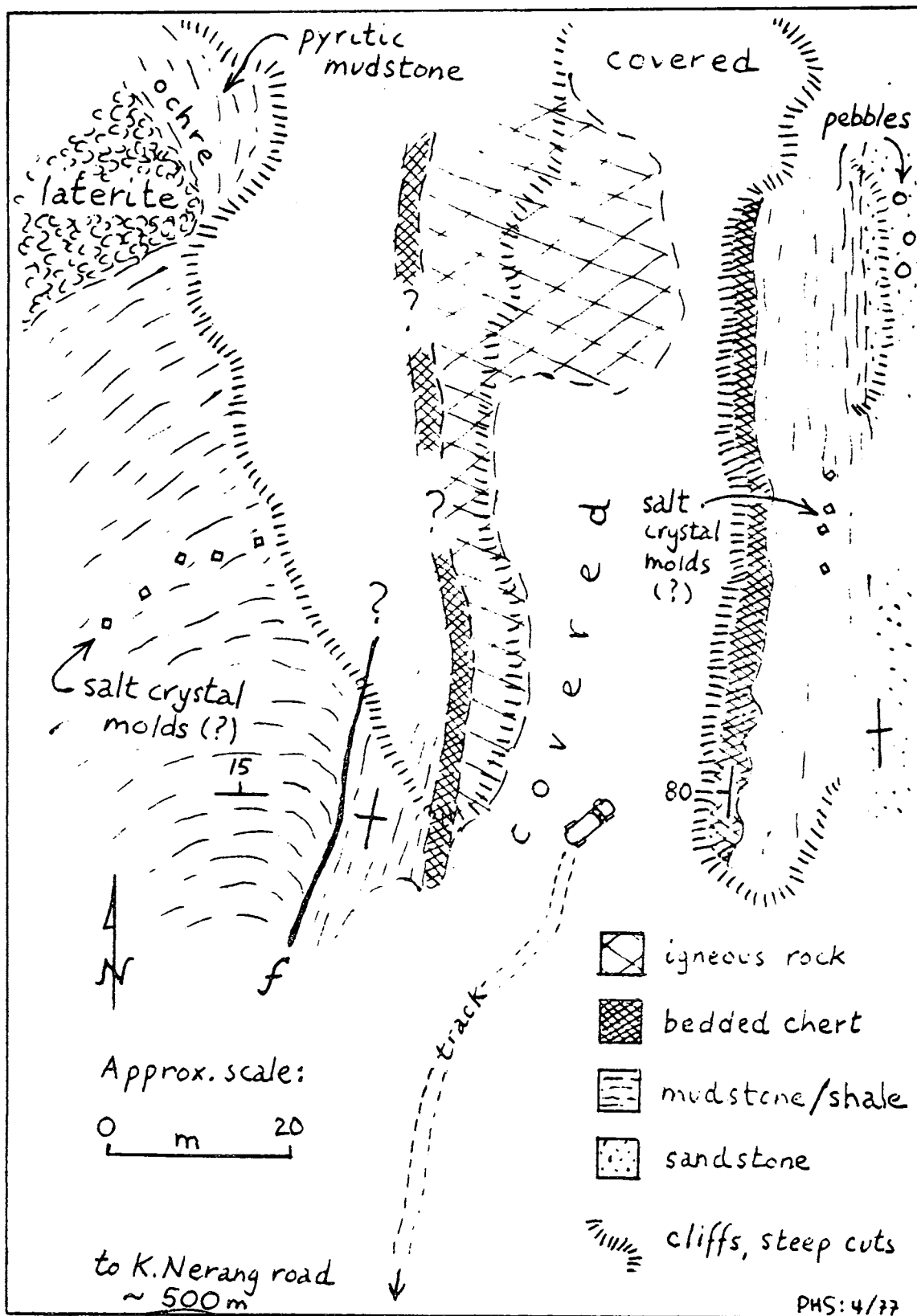
We suggest the exposures at Mile 10½ indicate greater stratigraphic and/or structural complexity in the area and pose questions well worth pursuing in further field studies. It may be more than coincidence that the site lies approximately on the extrapolated trace of the Bok Bak Fault (Burton, 1965; Gobbett & Tjia, 1973, p. 318).

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Fig. 1: Geologic sketch map of exposure near Mile 10½, Kuala Nerang road. Features such as salt crystal molds (?) and pebbles not to scale.



Banda Sea volcanic arc: some comments on the Rb, Sr and cordierite contents.

Charles S. Hutchison, Jabatan Geologi, Universiti Malaya, Kuala Lumpur.

### Abstract

Unusually high Rb/Sr ratios in the volcanic rocks and cordierite in a rhyolite at Tanjong Illipoi indicate a strong continental crustal influence in the source of the volcanic rocks of Wetar. Romang also has Rb/Sr ratios which are slightly higher than those of the active volcanic arc. This extinct, eroded and uplifted portion of the volcanic arc, lying to the north of Timor, is suggested to have a relationship with the continental Australian Plate.

Cordierite in rocks of Ambon implies a continental crustal basement in the northern part of the Banda Arc.

### Introduction

In October 1975 visits were made to the Banda Sea volcanic islands of Wetar, Romang, Damar, Teon, Nila and thence around the arc to Ambon (Fig. 1). A continuing programme of petrological and geochemical research is under way, and this note is based on some data already obtained.

The volcanic arc sector to the north of Timor has long been wholly extinct. The islands have been deeply eroded and have lost their volcanic form. They have also been considerably uplifted, so that reef limestones obscure most the coastal outcrops and extend well inland to a considerable elevation. This is in direct contrast to the active fumerolic volcanic islands of Damar, Teon and Nila, which still maintain a volcanic form with no uplift and no reef limestone above sea level.

The volcanic arc may be traced continuously from Java, through Flores, to the Banda Sea. However, within this arc the sector from Alor through Wetar to Romang has long been extinct. The most easterly active volcano of the Java-Flores arc is Sirung on south Pantar island, with recorded activity as recently as 1947 (Neumann van Padang, 1951). East of the extinct sector, the islands of Damar, Teon and Nila are dormant but in an active fumerolic state. On the 16th October, 1975, I climbed up and into the crater of Wurlali volcano on Damar island, which is in a very active solfatara stage, with extensive sulphur deposits and active emission of toxic gas. A fresh black glassy basalt with phenocrysts of biotite and feldspar forms a very recent cone within the crater. Although no inhabitant of the island can remember any volcanic activity, it is presumed that this small cone must be very young because of its fresh unweathered and unvegetated character. The volcano of Lawor Kaura on Nila island is also in a solfatara stage, but the inha-

bitants were able to recall an impressive ashfall over most of the island several years ago which destroyed most of their banana plantations. A disaster of this nature could cause a migration of the population because banana is the only staple of the volcanic islanders.

Within the extinct sector, active volcanism has apparently been translated far to the north, where two submarine volcanoes of the Emperor of China and Nieuwerkerk had reported activity in 1927 (Neumann Van Padang, 1951). There is also the volcanic island of Gunung Api north of Wetar which is also in a solfataric stage.

Wetar is outstandingly different from other islands in this arc because of its abundance of light grey rhyolite and dacite (De Jong, 1941).

### Analytical method

The whole rock samples were first crushed, then pulverised in a Tema Mill, then finely ground in a mechanical agate mortar. About 4 g of each sample was thoroughly mixed in a Wig-L-Bug mixing mill with exactly 10% of chromatographic cellulose as binder. Each specimen was then pressed into a boric acid rimmed and backed disc after the method of Hutchison (1974, Chapter 10.1). X-ray spectrometry was carried out using the Rb and Sr K wavelenghts diffracted by a LiF crystal, using a scintillation counter and W tube at 52KV and 22 mA, counting for 10 seconds on the peak positions and background positions at  $\pm 0.5^\circ$  for Rb and  $\pm 0.8^\circ$  for Sr. The pulse height analyser was set to centralize the energy peak within the window, set at  $2\frac{1}{2}$  times the full width at half maximum on preparations containing major amounts of Rb and Sr respectively. Since all the samples are of intermediate volcanic rocks, no matrix corrections were made and the peak minus average background counts were arithmetically compared with a standard andesite AGV-1. By taking the values of AGV-1 at Sr 800 and Rb 110 ppm, a direct comparison of other two standards BR 2265 and BCR-1 gave acceptable values of Sr 1190 and 310 respectively and Rb 50 and 60 respectively.

### Results

The results of the analyses are given in Table 1. Other analyses are in progress from the remaining islands of the Banda Sea. In addition, whole rock major element analyses are under way and other trace element analyses are planned.

A summary of the data of Whitford (1975) mainly from Java, but also including some analyses from Sumatra, Bali, Sumbawa and Lombok, is given at the foot of Table 1.

The combined data of this paper and of Whitford (1975) are plotted on Fig. 2, showing Rb versus Sr contents in ppm and the Rb/Sr ratios.

### Cordierite

Cordierite occurs in the sanidine-albite rhyolite of Tanjong Illipoi, Wetar. Heering (1941) was not able to confirm cordierite with certainty because the suspected mineral was always pseudomorphed. With this in mind I worked on the outcrop with as heavy a hammer as was available for as long as necessary to obtain the freshest possible specimen. Professor N.S. Haile also was of great help by providing some of his cored rock specimens which he had obtained for Palaeomagnetic studies. In this way some very fresh rock yielded good cordierite phenocrysts which I have been able to prove on the departmental Scanning electron microscope (S4-10) using the Link Systems energy dispersive spectrometer. Cordierite is therefore now confirmed on Wetar, and Heering (1941) brought our attention to the occurrence of this mineral also on Ambon and Seram. He was sure that the cordierite is an early formed mineral because it is frequently enclosed within sanidine.

The cordierite-bearing rocks of the Banda Sea islands of Ambon, Seram and Wetar have been generally classified as "ambonite" by Verbeek (1905) and the term became internationally known through the listing of Johannsen (1939).

Verbeek had difficulty in confirming the cordierite in the Ambon granite with certainty because of its frequent pinitization. In October 1975 I collected a specimen of granite from Ambon (Universiti Malaya number 8715). A polished thin section showed easily identifiable cordierite and gave the following microprobe analysis on our Link Systems energy dispersive microanalyser:

MgO	7.42%
Al <sub>2</sub> O <sub>3</sub>	33.13
SiO <sub>2</sub>	50.86
FeO	8.43
	<hr/>
	99.84, which may be recalculated as a

cordierite formula of  $Al_3(Mg_{1.12}Fe_{0.71})_{1.83}(Si_{5.13}Al_{0.94}O_{18})$ .

Peter Jezek (Smithsonian Institution, personal comm.) has confirmed from microprobe analyses that most of the volcanic rocks of Ambon contain numerous small crystals of cordierite.

### Discussion

After allowance is made for the dependence of Sr and Rb contents upon the whole rock SiO<sub>2</sub> content and also upon the depth to the underlying Benioff zone at the time of magmatism (Hutchison, 1976), it may be concluded that the Rb/Sr ratios which characterize rocks of an



uncomplicated volcanic island arc should be less than 0.4. This is well displayed in Fig. 2 in which the majority of rocks from Nila, Teon, Damar, Lombok, Sumbawa, Bali, Java and Sumatra all have Rb/Sr ratios less than 0.4, and many have a considerably smaller ratio, usually within the range of 0.01 to 0.35.

Rb/Sr ratios greater than 1.0 may with certainty be attributed to rocks which have been derived from continental sialic basement. The Lake Toba ignimbrite (Whitford, 1975) has been shown to be of continental crust derivation because of its high  $^{87}\text{Sr}/^{86}\text{Sr}$  ratio of 0.7139, as compared with the low ratios of the normal volcanic rocks of the rest of the arc, which have an average ratio of 0.7043. This distinct nature of the Lake Toba rocks is also shown by the Rb/Sr ratio of 1.24 (Table 1, Fig. 2).

It must similarly be concluded that the rocks of Wetar (Table 1, Fig. 2) must have their parentage in continental crust. The rocks from Romang belong to a category of uncertainty. Their Rb/Sr ratios range from 0.25 to 0.44 (Table 1). On the whole they may be normal island arc calc-alkaline rocks, but their slightly higher Rb/Sr ratios may be taken to indicate some influence from continental basement.

Cocker (1976) has concluded that cordierite-bearing granitoids and volcanic rocks are derived from continental crust. The presence of cordierite in the rhyolite of Wetar would therefore seem to suggest derivation from or contamination with continental crust, for island arc calc-alkaline rocks are with the exception of Wetar, Ambon and Ceram, devoid of garnet and/or cordierite (Cocker, Univ. of Alberta, personal comm.).

The abundance of granite on Ambon would suggest that this part of the Banda Arc is not entirely volcanic and may have a continental crustal basement. This is further suggested by the almost universal presence of quartz and cordierite in the volcanic rocks of Ambon (Kuenen, 1949).

The continuity of the volcanic arc through Wetar suggests that the southern Banda arc may have initially been uncomplicated. It is suggested that the complexity around Timor must be due to underthrusting of the Australian Plate and that there may be a possibility of some of the rocks on Wetar being derived from continental crustal basement of the underthrust Australian Plate. Romang is more volcanic arc in nature, but its slightly higher Rb/Sr ratios may also have resulted from the influence of the Australian Plate.

#### Acknowledgement

I am most grateful to Mr. H. Hartono of the Direktorat Geologi, Bandung, for the opportunity to visit and study the Banda Sea.

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Table 1: Rubidium and Strontium contents of Banda Sea volcanic rocks

Island	Specimen number	Field name	Rb ppm	Sr ppm	Rb/Sr
DAMAR (Active)	8728	andesite	160	620	0.26
	8729	andesite	120	580	0.21
	8730	andesite	100	540	0.19
	8731	andesite	130	560	0.23
	8732	andesite	130	560	0.23
	8811	andesite	140	530	0.26
	8813	andesite	150	680	0.22
	8814	andesite	150	660	0.23
	8815	andesite	140	680	0.21
	8816	andesite	150	560	0.27
	8817	andesite	130	600	0.22
	Average for Damar		125	597	0.21
TEON (Active)	8820	andesite	120	590	0.20
	8821	andesite	90	630	0.14
	Average for Teon		105	610	0.17
NILA (Active)	8823	andesite	140	450	0.31
	8826	andesite	150	430	0.35
	8827	andesite	140	490	0.29
	8829	andesite	130	480	0.27
	Average for Nila		140	463	0.30
ROMANG (Extinct)	8734	andesite	160	640	0.25
	8802	andesite	220	500	0.44
	8803	andesite	180	590	0.31
	8804	andesite	240	570	0.42
	8805	andesite	140	560	0.25
	8806	tuff	430	1080	0.40
	8809	andesite	180	500	0.36
	Average for Romang		221	634	0.35
WETAR (Extinct)	8736	basalt sill	350	80	4.38
	8737	basalt dyke	50	190	0.26
	8738	rhyolite	460	80	5.75
	8794	basalt dyke	90	100	0.90
	8796	rhyolite	90	140	0.64
	8797	basalt sill	150	50	3.00
	8798	andesite	150	100	1.50
	8799	granite	50	160	0.31

Island	Specimen number	Field name	Rb ppm	Sr ppm	Rb/Sr
	8800	basalt dyke	100	50	2.00
	8801	gabbro	80	140	0.57
Average for Wetar			157	109	1.44

All analyses relative to AGV-1 taken as Rb 110, Sr 800, BR 2265 taken as Rb 50, Sr 1190 and BCR-1 taken as Rb 60 and Sr 310 ppm.

Average and number of analyses	Rb ppm	Sr ppm	Rb/Sr
Java (67)	63	478	0.13
G. Merapi, Sumatra (3)	71	377	0.19
Bali (6)	35	434	0.09
Sumbawa (3)	66	703	0.09
Lake Toba, Sumatra (1)	144	116	1.24
Lombok (2)	37	435	0.10

(From Whitford, 1975)

Fig. 1: Sketch map of the Banda Sea showing the active solfataric volcanoes and the extinct portion of the arc in relation to Timor

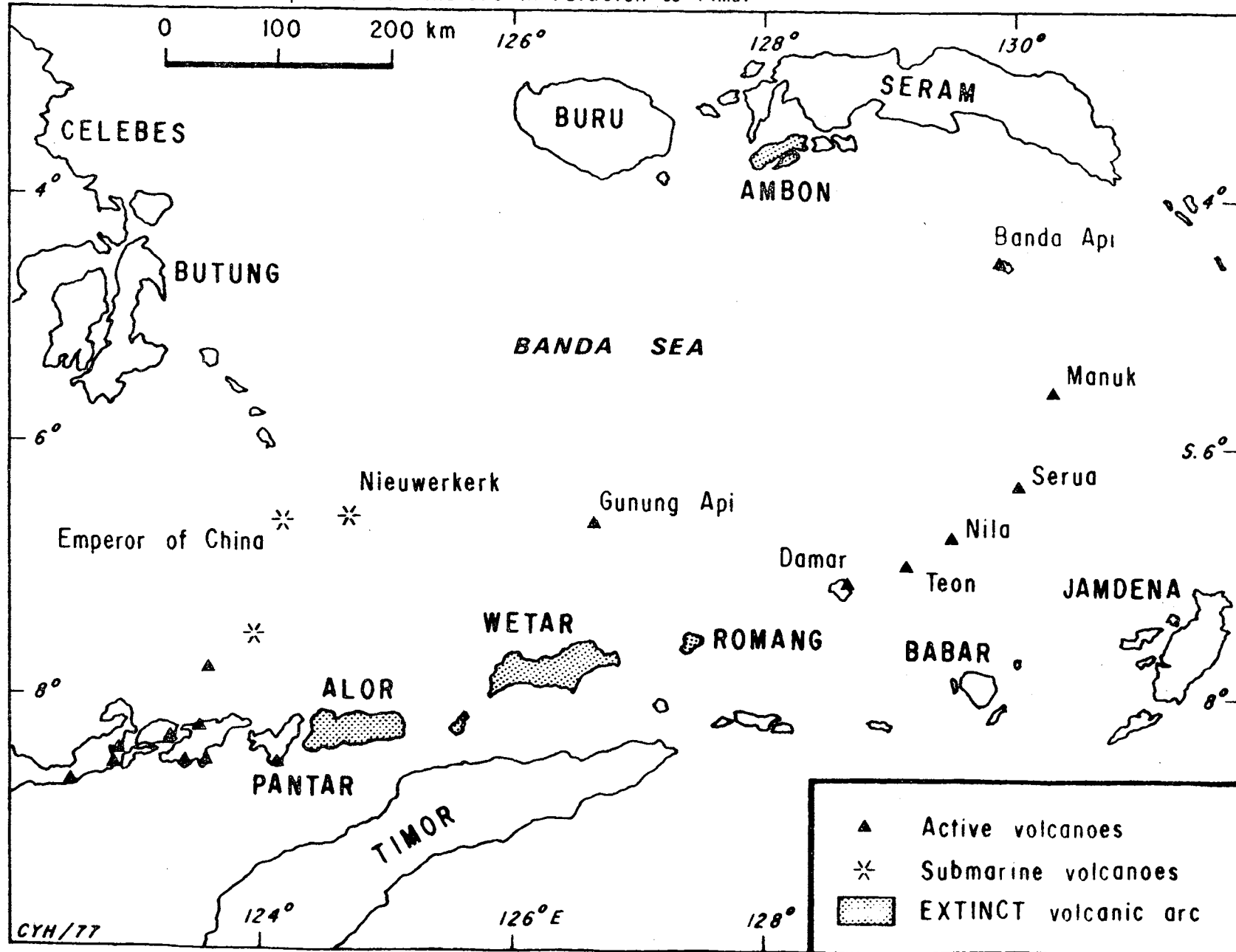
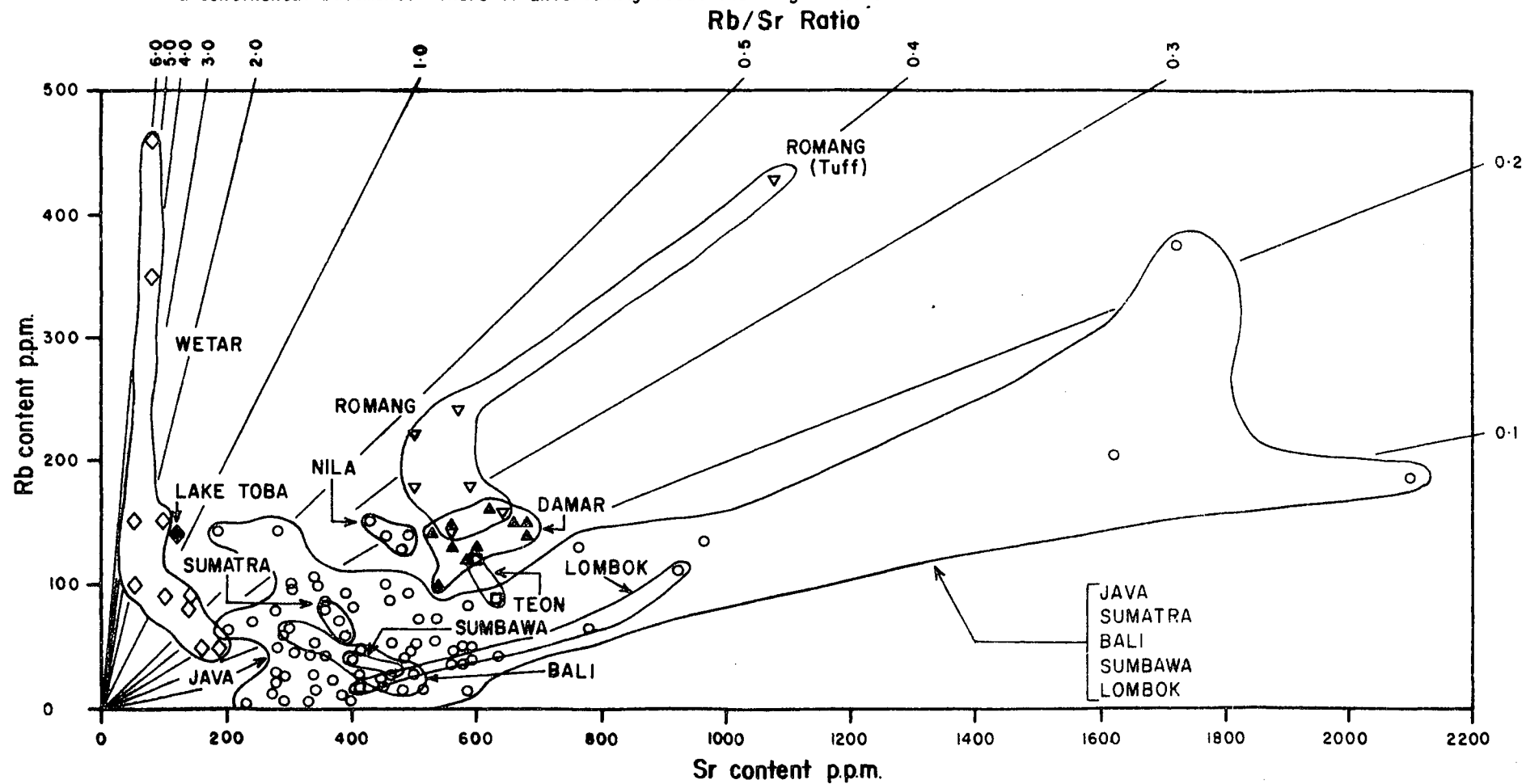


Fig. 2: Rb versus Sr contents in ppm for the Indonesian volcanoes, based on the data of this study and from Whitford (1975). The Sr rich samples from Java are from Gunung Muriah, which overlies a deep Benioff zone contour. Rb/Sr ratios less than 0.4 are associated with calc-alkaline rocks of an uncomplicated island arc. Ratios greater than 1.0 suggest derivation from a continental basement. There is uncertainty about the range 0.4 to 1.0.



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

Annual General Meeting

The eleventh Annual General Meeting held at the Lecture Hall, Department of Geology, University of Malaya at 1700 hours on the 25th March 1977, was attended by 21 members and was chaired by the outgoing President, Mr. W.K. Lee. The various reports were discussed. It was suggested that the Society should clear some stocks of past publications through the offering of special package offers to members and also that the bulletin series should be evolved into a journal to cater for geologists in the Asian region.

The new President outlined the new projects for the coming year which include a symposium on the geology of tin deposits and a training course. The meeting was adjourned at 1830 hours.

A.S.

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## O. Von Knorring: In Pursuit of Pegmatites.

Dr. O. Von Knorring addressed about 30 members and guests of the Society on the above-mentioned topic at 5.00 p.m. on 9 March 1977 in the Department of Geology, Universiti Kebangsaan. Dr. Knorring is a Reader at the Department of Earth Sciences, University of Leeds and he is currently in Kuala Lumpur as the External Examiner in Geology at Universiti Kebangsaan.

In his talk he discussed the chemistry of the rare-earth elements found in minerals associated with pegmatites. Some species of these minerals are of gem quality. He illustrated his talk with slides taken during his visits to East Africa. A brief geology of the East African region was also discussed.

ASG

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Mahillah Bibi b. Rafek: Microfossils especially conodonts.

Dr. Mahillah gave a general account on the different types of microfossils before focusing her attention on conodonts. She discussed briefly the techniques of separating conodonts from the host rocks using formic acid and acetic acid. Dr. Mahillah had recently collected some Malaysian rocks and hopes to find some conodonts in the residue left after acid treatment. Prior to her visit, Dr. Mahillah has been working on conodonts from Muschelkalk of Germany for her Doctorate degree.

Studies carried out on conodonts here revealed a great deal of information on conodonts especially with regards to their evolution and have established them as valuable tools in stratigraphy. The conodont assemblage can also give an indication of the environment of deposition. In general conodonts are more commonly found in deep or fairly deep water sediments.

In spite of the numerous studies carried out on conodonts in recent years, the questions as to what conodonts really are still remain a controversial topic among conodont researchers. Evidence uncovered recently appear to support the presence of some living tissue providing the framework within which the conodonts grew from.

The talk was attended by about 40 members.

BKT

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NEWS OF THE SOCIETY

Geology of Tin Deposits: An International Symposium and Training Course

The response to the first circular sent off in March has been very encouraging. Many replies have been received concerning participation and to date 8 papers have been offered (Malaysia 3, Australia 2, HongKong 1, Burma 2). It is expected that more papers will be forthcoming later.

Several replies have been received from geoscientists from Asean countries, USA, Australia and Japan expressing interest to attend the tin training course.

TTK



### Bulletin Sales

To clear some stock, and generate cash for the Society, the Council has decided to provide members the bumper sale offer of:

- Bulletins 1-7 including the Field Guide - M\$20.00 Student members
- M\$30.00 Other members.

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### Geotechnical Seminar

A suggestion was made during the recent AGM for the Society to arrange a field trip to the road exposures of the Karak Highway, presently under construction and to provide a forum for discussion on geotechnical aspects of the construction. The Council has accepted this suggestion and intends to organise a seminar not only on geotechnical aspects of road construction but also of dam-sites, stability of mine slopes and building foundations, etc. For further information and on your ideas of how to make this proposed seminar interesting and stimulative please write to Mr. John Kunaraj, Geological Society of Malaysia, Geology Department, University of Malaya, Kuala Lumpur, 22-11, Malaysia.

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### Field Trip to Pulau Redang, Trengganu

The Society will try to organize a 5-day field trip to Pulau Redang sometime between 14 August and 4 September 1977 if there are sufficient number of members interested in participating. Please give your name to the Hon. Secretary before mid-June if you are interested.

To cut down expenditure, the number of members able to participate must just be sufficient to fully occupy one boat or two boats. Members will have to assemble in Kuala Trengganu for the trip and the party will also disperse at Kuala Trengganu after the trip. The cost of the trip is uncertain. It is unlikely to be more than \$50 (transport and food) per participant.

Pulau Redang is about 30 miles north of Kuala Trengganu and about 20 miles from the Trengganu coast. The island is made up mainly of granitoids and layered rocks such as conglomerates, sandstones and siltstones. During the trip there will be opportunities to examine thermal metamorphic effects of granitoids and tonalitic rocks on adjacent sediments and early basic sheets (now garnetiferous), late basic sheets with chilled boundaries, mylonite zones in the plutonics, contact relation between different granitoids, gigantic conglomerate boudins with crushed and shattered pebbles, sedimentary structures such as slump and sandstone dykes (?), recent carbonate rocks, etc. There will also be plenty of opportunities for those keen in swimming, (we know of some secluded and exclusive spots), diving (see the beautiful coral reefs but look out for sea-urchins) or collecting sea-shells on the sea-shore.

TTK

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Plaque for the Mace of the Society

Members are invited to submit a design for the proposed pewter plaque for the Mace of the Geological Society of Malaysia.

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Membership

The following have been elected to membership:

Full Membership

P.J. Hamilton  
Geology Research Center  
Eastern Washington State College  
Cheney, Washington, USA.

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Penang, Malaysia.

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45 Tesbarnrungson Tai  
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 Kuala Lumpur, Malaysia.

Mamat @ Mukhtar Ibrahim  
 Jabatan Penyiiasatan Kajibumi  
 Bangunan Ukor  
 Jalan Gurney  
 Kuala Lumpur, Malaysia.

Mohd. Hussain Abdul Rahman  
 Jabatan Penyiiasatan Kajibumi  
 Bangunan Ukor  
 Jalan Gurney  
 Kuala Lumpur, Malaysia.

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Addresses of members

The addresses of the members listed below are wanted. It will be greatly appreciated if readers can supply us with the addresses of the members listed.

Choi Chee Chye  
 T. Crawford  
 B.L. Culp  
 D.E. Francis  
 Gan Kim Shin  
 A. Grepin  
 F. van Leempoel

A.D. McLeod  
 R. McLeod  
 P.J.C. Nagtegaal  
 L.B. Williams, Jr.  
 B.R. Yates  
 Yee Swee Lin.

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Change of Address

The following changes of addresses have been notified to the Society:

James C. Johnston  
 2006 Orchard Towers  
 400 Orchard Road  
 Singapore 9.

Foo Khong Yee  
 Geological Survey  
 P.O. Box 1015  
 Ipoh, Perak, Malaysia.

Rudy A. Vooyo  
 c/- AGIP Nucleare Aust. P/L  
 P.O. Box 1261  
 Alice Springs, N.T. 5750  
 Australia.

John H. Dayvault  
 P.O. Box 32061  
 Oklahoma City, Okla. 73132  
 USA.

Tony J.T. Tan  
 Dept. of Geology  
 University of Calgary  
 2920 24 Ave. N.W.  
 Calgary, Alberta, Canada T2N 1N4.

Dr. Sandra M. Barr  
 Dept. of Geology  
 Acadia University  
 Wolfville, Nova Scotia  
 Canada BOP 1X0.

Karl W. Stauffer  
 11 Mt. Burney Ct.  
 San Rafael, Ca. 94903  
 USA.

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### Subscription Reminder

It appears that there are still several members who have not paid up their 1977/78 subscriptions. These members are reminded to do so as soon as possible.

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### O T H E R   N E W S

### South-east Asia Geological Conference

The Council on behalf of the Society has agreed to give co-operation to the Geological Society of Thailand on their proposed SEA geological conference to be held in Pattaya in November 1978.

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### 11th Commonwealth Mining & Metallurgical Congress

The Institution of Mining and Metallurgy will hold the Eleventh Commonwealth Mining and Metallurgical Congress in Hong Kong from 6 to 12 May, 1978. It is expected that some 60 papers will be presented mainly on the general theme of geostatistics in mine evaluation, geology and planning.

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### International Conference on Oil

The Canadian Society of Petroleum Geologists will be organising an international conference in Calgary, Alberta, Canada on the 26-28 June, 1978 on the theme "The Facts and Principles of World Oil Occurrence". Invited papers in English will be presented and field trips will be arranged to the Alberta Foothills, Athabasca Tar Sands, Mackenzie Delta and the Arctic Islands.

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### AAPG

The American Association of Petroleum Geologists is seeking new members. Its major objective is the advancement of geology, particularly as it relates to petroleum and natural gas and other sedimentary minerals. Membership services are wide ranging and include specialised technical and regional divisions. An example of its technical programme is its coming symposium in Sioux Falls, South Dakota, on October 30 - November 2, 1977 on "The view from outer space, and its applications to energy and mineral resource exploration on earth". Members interested in the AAPG should write to AAPG, P.O. Box 979, Tulsa, Oklahoma 74101, USA.

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### Abstracts from Other Publications

The April issue of Berita Direktorat Geologi Geosurvey Newsletter quoted Prof. H.D. Tjia's comment on the Prof. van Bemmelen's Undation Theory as follows:

"In one case I agree with the Undation Theory: the explanation of epidermic gravity sliding to, perhaps dermal gravity sliding. There are some examples found in the neighbourhood of Kuala Lumpur which are still being investigated.

This may be a new recovering of scale to perhaps nappe-structure".

It noted that this is a preliminary statement as Tjia has to know first how van Bemmelen's book will be set up.

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### New Journals

Natural Resources Forum will be published quarterly on behalf of the United Nations by P. Reidel Publishing Company, Dordrecht, Holland. This journal is devoted to the study of economic, scientific, technological and policy aspects of energy, minerals and water resources development.

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### Review: Segama Memoir

The Geological Survey of Malaysia continue their publishing of basic geological information with a welcome addition: a completely revised edition of the Memoir 4 on the Upper Segama Valley and Darvel Bay Area\*. The first issue of this, by F.H. Fitch, was published in

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\* K.M. Leong: The Geology and Mineral Resources of the Upper Segama and Darvel Bay Area, Sabah, Malaysia. Geological Survey of Malaysia Memoir 4 (Revised). Government Printing Office, Kuching, Sarawak, 1974. Obtainable from Geological Survey Department, Kuching, Sarawak. Pp. xxi, 354, 63 figures, 45 tables, 123 plates, separate coloured map, scale 1:125,000. Price: M\$15.00.

1955. This memoir bears the date 1974, but apparently was actually issued in 1977; if so, an unfortunate inaccuracy.

The area has been completely re-mapped by K.M. Leong, who took over the project from N.P.Y. Wong in 1968. The Segama Valley geology is exceedingly complex, and as the author remarks, perhaps the key area for unravelling the pre-Tertiary of Sabah. The interior is also uninhabited, and difficult of access, requiring lengthy trips in longboats or on foot.

The area includes Crystalline Basement, including amphibolite, gneiss, schist, and acid intrusive rocks, which are Early Triassic and/or older, the Madai-Baturong Limestone, now thought to be Early Cretaceous, and the Chert-Spilite Formation of Late Cretaceous to Early Tertiary age. Cainozoic rocks include marine sediments with tuffs, tuffites, and cherts, and diamictite (bouldery mudstone), probably slump deposits. Gabbros and peridotites abound. Late Cainozoic basalts and porphyries occur. Almost all these formations are problematical and many have been the subject of debate and controversy.

In his interpretation of the metamorphic rocks (Crystalline Basement) Leong does not agree with the views of Fitch, or those of Hutchison and Dhonau, and returns to the original idea of Reinhard and Wenk, namely, that the schists are the oldest rocks and are overlain unconformably by the Chert-Spilite Formation. Two new units, the Madai-Baturong Limestone (probably Lower Cretaceous, the oldest fossiliferous formation in Sabah) and the Langusan Beds (Oligocene or early Miocene) are introduced.

Leong found that Quaternary lavas are less extensive inland than Fitch shows. In particular, Orchid Plateau, mapped by Fitch as flat-lying Quaternary lava overlying banded diorite, is regarded by Leong as an erosional feature in Crystalline Basement (which was actually Fitch's original interpretation, based on air photographs). However, detailed discussion of this puzzling feature is one of the problems the author has had to leave to future geologists, or perhaps for himself in another publication.

Widespread alluvial gold, and occurrences of copper, silver, chromite and molybdenite are known, but no deposits have yet been proved approaching economic size. The survey included a widespread geochemical reconnaissance, which located several areas with anomalous copper and nickel. A chapter on engineering geology gives information about constructional materials, water supply, and slope stability.

The author emphasizes that the mapping is only on a reconnaissance scale, and considerable areas were not traversed; and the Director, Mr. S.K. Chung, points out in his preface the numerous problems where future mapping or research efforts could be concentrated.

The value of the memoir lies especially in its strictly factual basis, with abundant citing of specimen numbers of rocks and fossils, which will enable future workers to start by reference to specimens available in the survey museum collection.

In so extremely complex and controversial an area, such a descriptive and factual approach, with a minimum of interpretive theory, is, to my mind, undoubtedly the wisest one for a memoir of this kind. The author's heroic self-denial in this respect is shown by the fact that "Plate Tectonics" is mentioned only once - in the statement "The pre-Tertiary events may have to be re-interpreted in the context of 'Plate Tectonics'".

This is undoubtedly true. The chapter on geologic history assumes a "fixist" view, whereas it is quite possible that the Segama area represents a jumble of elements brought from a distance and plastered together in confusing promiscuity. However, there is so little constraint in the form of adequate age-determinations on the Crystalline Basement, or evidence as to directions of large scale horizontal motions, if indeed, these have occurred, that speculation along these lines is unlikely to lead to an advance in knowledge. The next steps in understanding will probably involve regional geophysical surveys, many more radiometric dates, and perhaps detailed mapping of some key areas. Palaeomagnetic studies could also be fruitful.

The memoir contains 354 pages, with 63 text figures, 45 tables, and 123 photographs, mostly excellent. The splendid coloured map on 1:125,000 scale is admirably clear (with numbers on all the formations so that recognition does not depend on colour alone), accurately drafted, and the colours are well chosen, bright, but light enough not to obscure underlying detail. For M\$15.00 this has to be one of the best bargains in geological literature!

NSH

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