PP 173/12/86 ISSN 0126-5539

PERSATUAN GEOLOGI MALAYSIA

WARTA GEOLOGI

NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MALAYSIA

Jil. 13, No. 2 (Vol. 13, No. 2) Mar-Apr 1987

KANDUNGAN (CONTENTS)

DIKELUARKAN DWIBULANAN
ISSUED BIMONTHLY

PERSATUAN GEOLOGI MALAYSIA
(GEOLOGICAL SOCIETY OF MALAYSIA)

Majlis (Council) 1987/88

Pegawai-pegawai (Officers)

Presiden (President)	:	Hamzah Mohamad, Jabatan Geologi, Universiti Kebangsaan Malaysia, 43600 UKM, Bangi.
Naib Presiden (Vice-President)	:	Ahmad Said, Petronas, P.O. Box 12444, 50778 Kuala Lumpur.
Setiausaha Kehormat (Honorary Secretary)	:	S. Paramananthan, Jabatan Sains Tanah, Universiti Pertanian Malaysia, 43400 UPM, Serdang.
Penolong Setiausaha Kehormat (Honorary Assistant Secretary)	:	Ibrahim Komoo, Jabatan Geologi, Universiti Kebangsaan Malaysia, 43600 UKM, Bangi.
Bendahari Kehormat (Honorary Treasurer)	:	Ahmad Tajuddin Ibrahim, Jabatan Geologi, Universiti Malaya, 59100 Kuala Lumpur.
Pengarang Kehormat (Honorary Editor)	:	Teh Guan Hoe, Jabatan Geologi, Universiti Malaya, 59100 Kuala Lumpur.
Presiden Yang Dahulu (Immediate Past President)	:	John Kuna Raj, Jabatan Geologi, Universiti Malaya, 59100 Kuala Lumpur.
Ahli-ahli Majlis 1987-89 (Councillors 1987-89)	:	Khee Kok Kean, Esso Production Malaysia Inc., P.O. Box 10857, 50728 Kuala Lumpur.
		Wan Fuad Wan Hassan, Jabatan Geologi, Universiti Kebangsaan Malaysia, 43600 UKM, Bangi.
		Idris Mohamad, Jabatan Geologi, Universiti Malaya, 59100 Kuala Lumpur.
		Fateh Chand, Geological Survey Malaysia, P.O. Box 11110, 50736 Kuala Lumpur.
Ahli-ahli Majlis, 1987-88 (Councillors, 1987-88)	:	Azhar Hj. Hussin, Jabatan Geologi, Universiti Malaya, 59100 Kuala Lumpur.
		Albert Loh, Malaysia Mining Corporation, P.O. Box 10300, 50710 Kuala Lumpur.
		Chin Lik Suan, Ahli Kajibumi (Persendirian), 13 Lorong SS1/11A, 47300 Petaling Jaya.
		Tay Say Ann, Petronas-Carigali, P.O. Box 12407, Kuala Lumpur.
Juruodit Kehormat (Honorary Auditor)	:	Peter Chew

******

Published by the Geological Society of Malaysia, Department of Geology, University of Malaya, 59100 Kuala Lumpur (Tel. 03-7577036)

Printed by Art Printing Works Sdn. Bhd., 29 Jalan Riong, 59100 Kuala Lumpur.

CATATAN GEOLOGI
(GEOLOGICAL NOTES)

A PROMINENT FAULT ACROSS THE MALAYSIA-THAI BOUNDARY; PRELIMINARY REPORT

Syed Sheikh Almashoor & H.D. Tjia, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor

Harmonizing our independent laboratory and field exercises has resulted in establishing the presence of a yet unidentified fault which transcends the Malaysia-Thailand border.

A blown-up Landsat false-colour print that covers parts of southern Thailand, Kedah and Perak shows a prominent 4-km wide zone of tonal and topographic lineaments that extend from the middle reaches of Mae Nam Pattani (Pattani River), Thailand, in 165° direction parallel Sg. Kenarong, then along the north and middle parts of the Temenggor Reservoir and probably terminates at Sg. Sara in the south (Figures 1 and 2). This zone may extend farther towards SSE beyond the limits of the Landsat image. Across its width two to four lineament strands can be distinguished; the longest continuous strand reaches 10 km (at the Malaysia-Thailand border) and averages 5 km in length. Near the trace of the particular lineament zone are other parallel-striking linear features that have also been accentuated on Fig. 2. The SSE-trending lineament seems to have been displaced right-laterally for a short distance by a north-striking lineament that runs along a major portion of the Temenggor Reservoir.

The lineament zone transects the East-West highway near kilometre-post 184 towards Kota Bharu (or 208 km towards Ipoh), where it is represented over a 100-m width by three, 1 to 1.5 metre wide fault zones in quartz-phyllite/schist. Within this width are numerous sigmoidal quartz bodies. The three subparallel faults strike northerly and dip very steeply towards east and west. The general foliation of the phyllite/schist is between 170/75 and 190/75. Near one of the faults left-lateral drag is indicated. The sigmoidal quartz in plan view also indicates left-slip motion. Fault-plane striations pitch 22 degrees and these were subsequently superimposed by downdip striae resulting from normal faulting. This superimposition of striae has masked fault-plane sense-indicators that were associated with the lateral movements. The fault drag and shape of quartz-sigmoid mentioned earlier, however, clearly indicate left-lateral motion. This was succeeded by normal movements on at least one of the fault zones.

The small difference (not more than 10 degrees) between the strikes of the three faults and the trend of the regional lineament is believed to represent a local deviation. We interpret the lineament as representing a prominent, left-lateral strike-slip fault zone and further propose to name it the Ruok fault zone after a small tributary of Sg. Perak. A comprehensive account of the fault is being prepared.

Acknowledgements

Puan Haidar Ludin drafted Figure 1.

******

Manuscript received 27 November 1986.

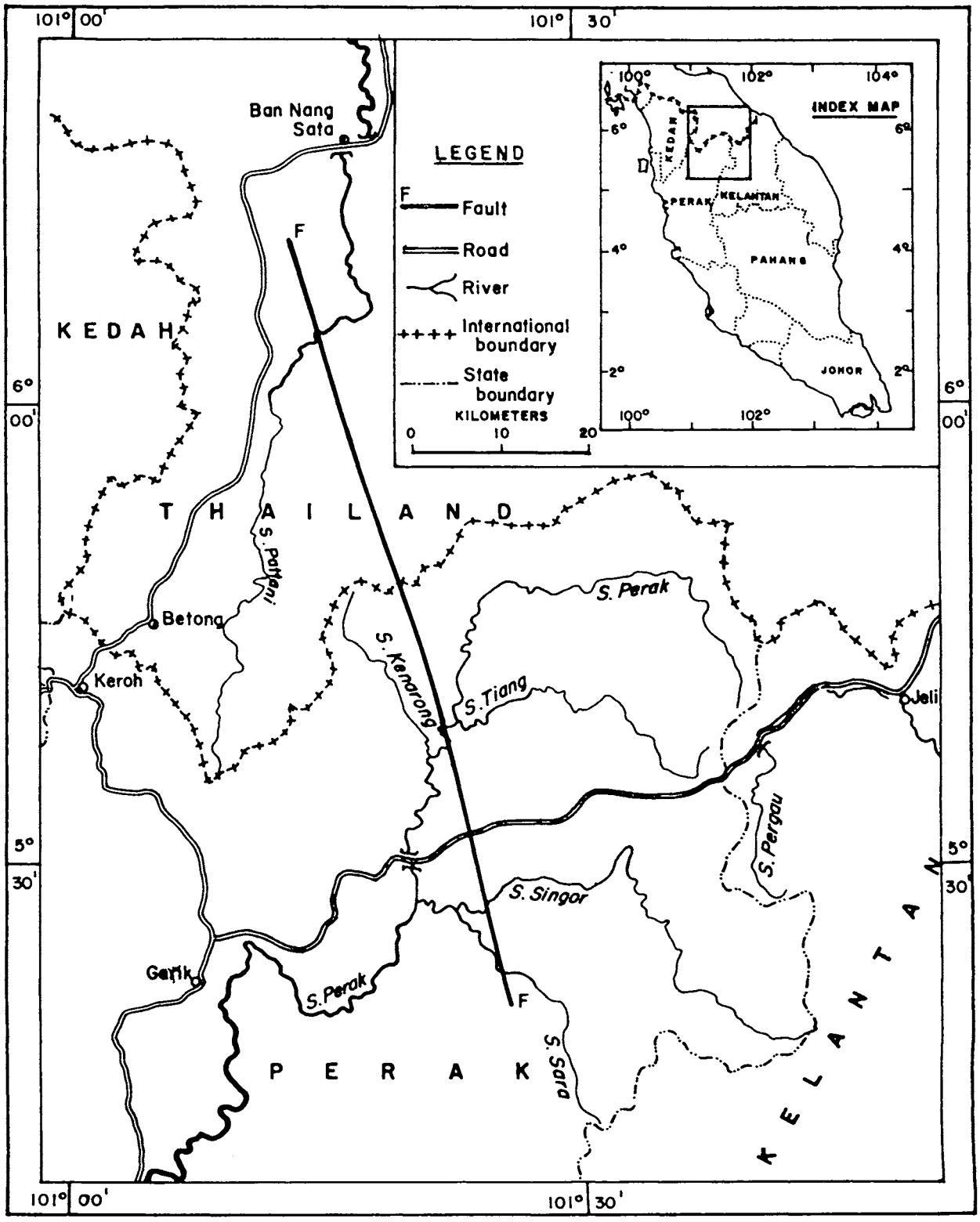


Figure 1. Location of the newly identified fault zone.

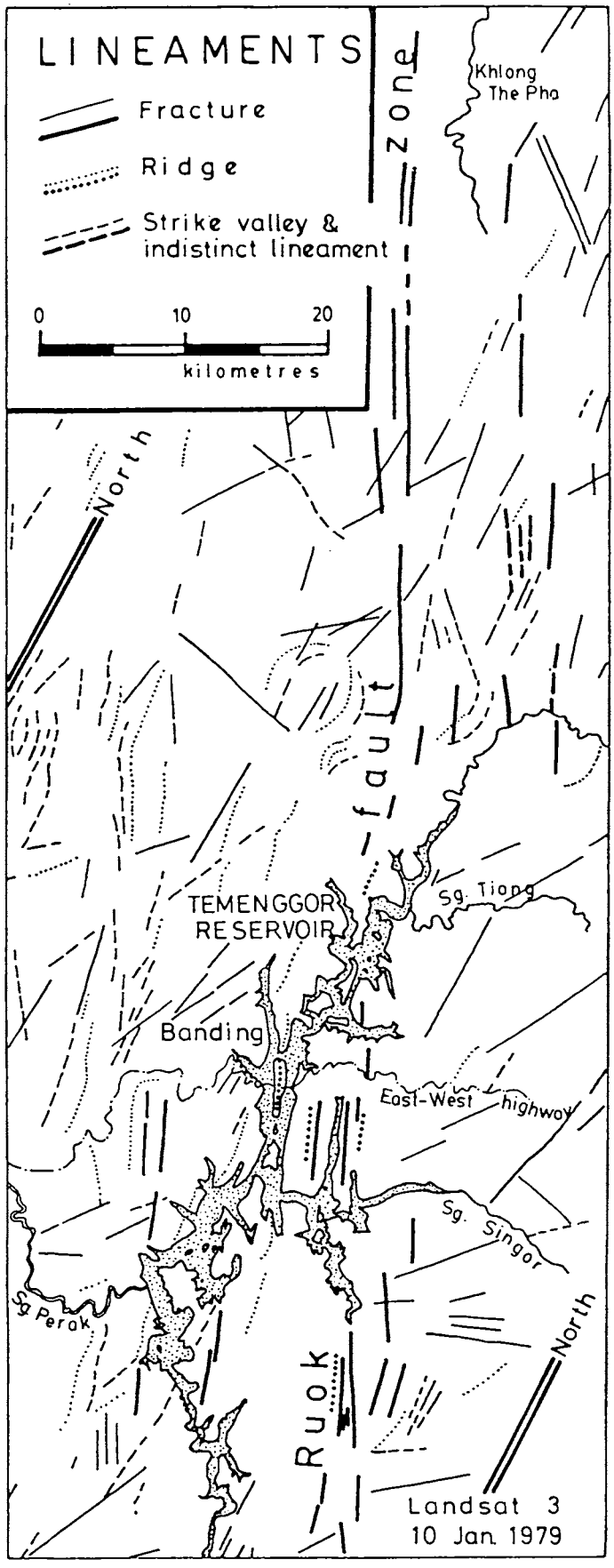
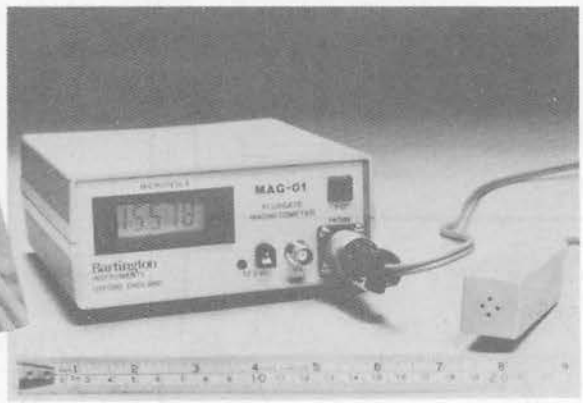


Figure 2. Fragment of the Landsat image mentioned in this article. Note that the central portion of the Temenggor Reservoir is parallel to the proposed Ruok fault zone. Other lineaments parallel to the Ruok fault but located outside the zone are also shown by bold lines.

MAG-01
A COMPACT HIGH PERFORMANCE SINGLE-AXIS FLUXGATE MAGNETOMETER

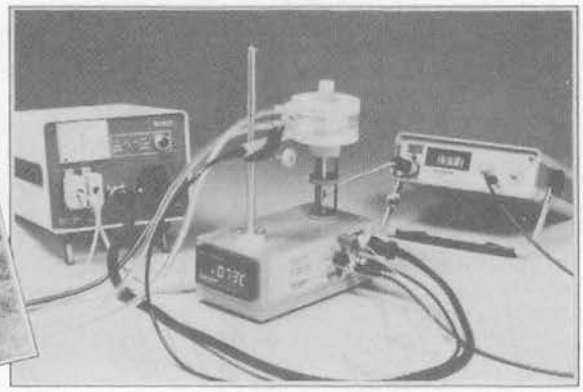


- AUTO RANGING: wide range 1-200,000nT
- EXCELLENT TEMPERATURE STABILITY
- INTERNAL RECHARGEABLE BATTERIES (non-magnetic)
- ADJUSTABLE ALIGNMENT
- SUPERB LINEARITY: 0.005%
- ACCURATE CALIBRATION
- LOW NOISE ANALOG OUTPUT
- THEODOLITE MOUNTING KIT
- WEATHERPROOF
- **PRICE £2200** complete with meter, probe, connecting cable, power supply battery charger, operation manual

Bartington instruments Ltd.
Spendlove Centre, Enstone Road, Charlbury,
Oxford. OX7 3PQ. ENGLAND
Tel: +44·608·810657 Telex: 837883 SPEND-G

Agents in: USA · AUSTRALIA · CHINA · JAPAN WEST GERMANY · SPAIN · GREECE · MALAYSIA

BARTINGTON MODEL M.S.2.
MAGNETIC SUSCEPTIBILITY SYSTEM



- **DIGITAL :** 4 digit L.C.D., push button or computer control for rapid results
- **ACCURATE :** sensors calibrated to H_2O standard, factory set
- **SENSITIVE :** measures down to 10^{-7} c.g.s.
- **DUAL FREQUENCY SENSORS :** granulometry/erosion studies
- **CORE LOGGING SENSORS :** 6 sizes for high resolution measurements of whole cores with diameters 40 - 130 mm.
- **SUSCEPTIBILITY/ TEMPERATURE EQUIPMENT :** for **X/T** measurements from −200°C to +900°C
- **FIELD SURVEY EQUIPMENT :** range of sensors
- **INTERNAL BATTERIES :** rechargeable from a.c. line or vehicle dashboard
- **RS 232 INTERFACE + ANALOG OPTION**

Bartington instruments Ltd.

Spendlove Centre, Enstone Road, Charlbury,
Oxford. OX7 3PQ. ENGLAND
Tel: +44·608·810657 Telex: 837883 SPEND-G

MALAYSIAN AGENT:
Sul Supplies (MALAYSIA) SDN. BHD.
No. 71A Jalan Lazat Satu, Taman Gembira, P.O. Box 38,
Pejabat Pos Jalan Kelang Lama, 58700 KUALA LUMPUR. MALAYSIA.
Tel: 03 - 7826255/7826711 Telex: SUL MA 37148

WARPED REFOLDED FOLD IN UPPER PALAEOZOIC METASEDIMENTS AT TANJUNG BALAU, JOHORE

H.D. Tjia, Department of Geology, Universiti Kebangsaan Malaysia, 43600 Bangi

All along the east coast of Johore - particularly at the headlands - Upper Palaeozoic metasediments outcrop, sometimes forming extensive strips up to a kilometre long and a hundred metres wide. The outcrops may be low cliffs, but more often are abrasion surfaces in the present intertidal zone or those of slightly higher, past sea-levels. The rocks are usually thick to massive-bedded meta-arenite (often quartzitic) interbedded with thick or thin bands of dark to light coloured phyllite and other types of meta-argillite. In the well-bedded sequences, complicated structures are suggested by local contortions of strata, sometimes by the occurrence of small scale superimposed folds, and by the common presence of mylonite zones parallel and transverse to bedding.

At Tanjung Balau (Fig. 1) a medium scale body of deformed rocks exhibits the structural style in exemplary fashion (Figs. 2A, B & C). The outcrop is an 11-m long, North-striking open, asymmetrical antiform, its east and west limbs dipping 75 and 50 degrees, respectively. The antiformal axis, F, is warped about an axis (F_3) striking in 70° direction. In other words, the F_2 axis undulates along its strike and possesses a general north-ward plunge of the order of 10 degrees (Fig. 2A, north is towards the left). At the south end of the antiform is exposed the cross section on Figs. 2B and 2C. In this section is seen a medium size recumbent fold plunging 47 degrees north (F_1 axis). The sequence of deformations exhibited by the outcrop is as follows. The quartzitic strata were first flexurally folded about F_1 axis probably into an isoclinal recumbent fold. Co-axial refolding about F_2 axis produced the open, asymmetrical antiform that plunges north. Warping about F_3 axis resulted in the present outcrop. The quartz dyke strikes 350°, dips 53 degrees east and postdates the antiform. There is insufficient field evidence to decide if the dyke also postdates warping.

The base of this particular outcrop stands slightly below high tide but most of the structure is above that level. Other interesting exposures were also seen in the immediate vicinity and are being studied. It would be worthwhile to set aside this relatively small cape from being developed (and the highly instructive outcrops from being destroyed).

******

Manuscript received 28 November 1986.

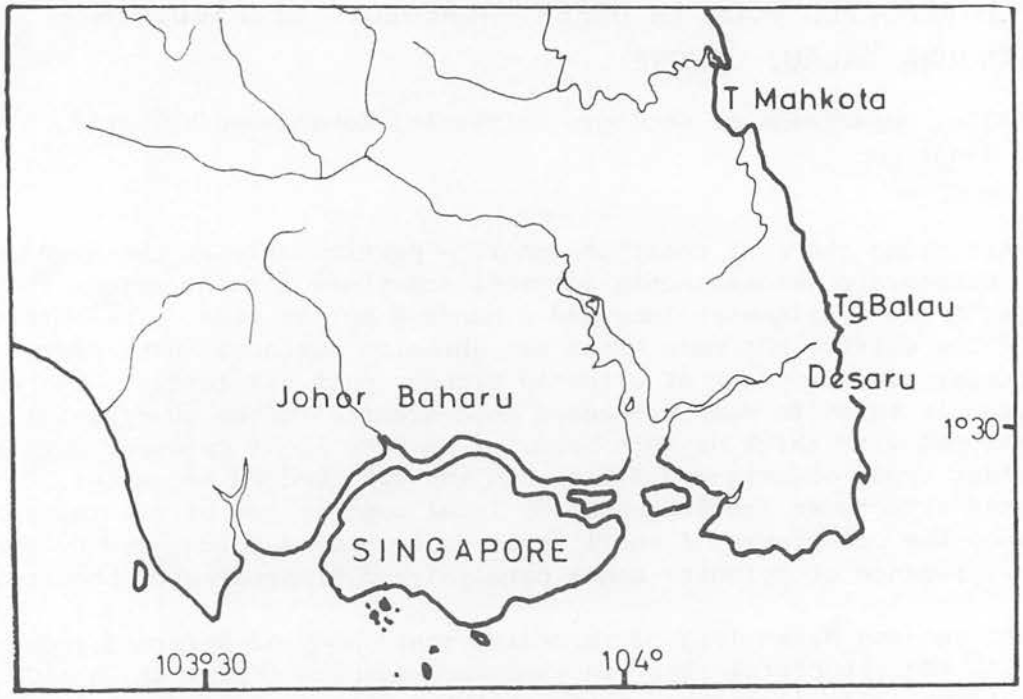


Fig. 1. Index map of Tanjung Balau on the east coast of Johore.

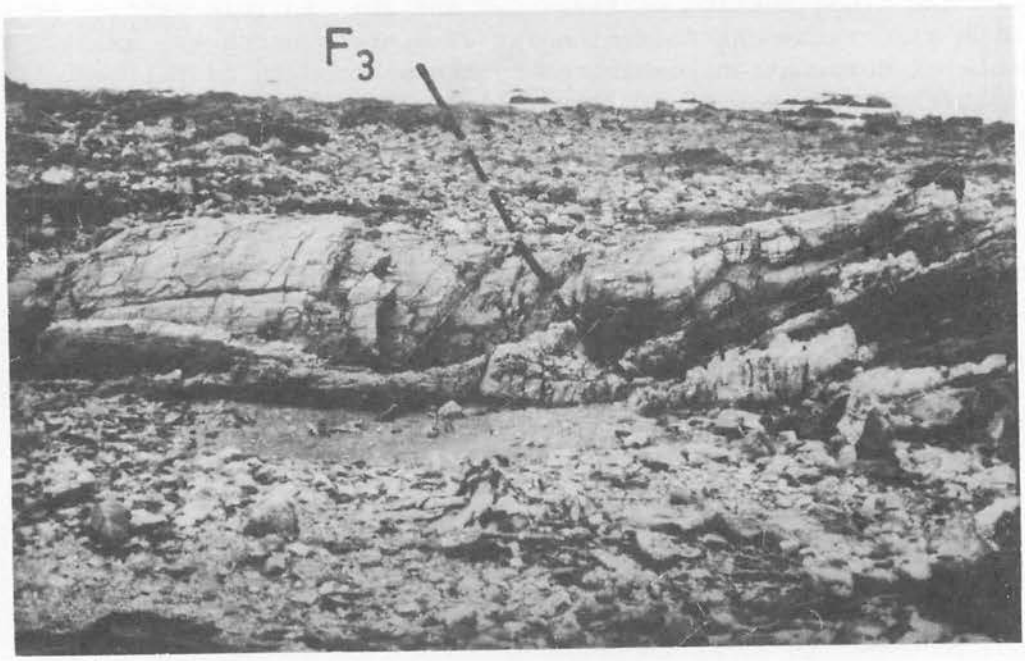


Fig. 2A. View from west of the antiform. F_3 is the 70°-striking warp axis.

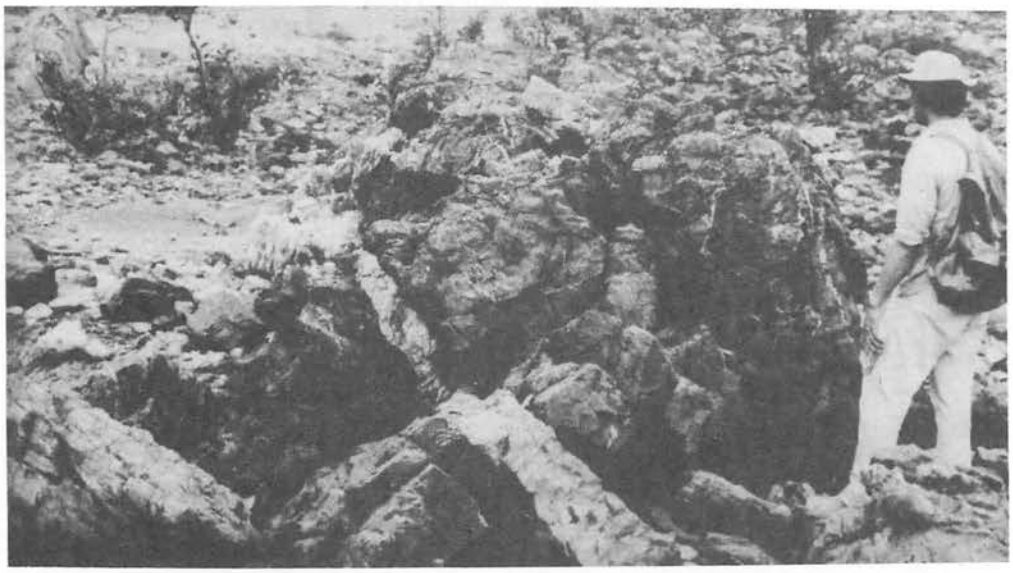


Fig. 2B. South end of the antiform where a recumbent refolded fold is transected by a 25-cm wide quartz dyke.

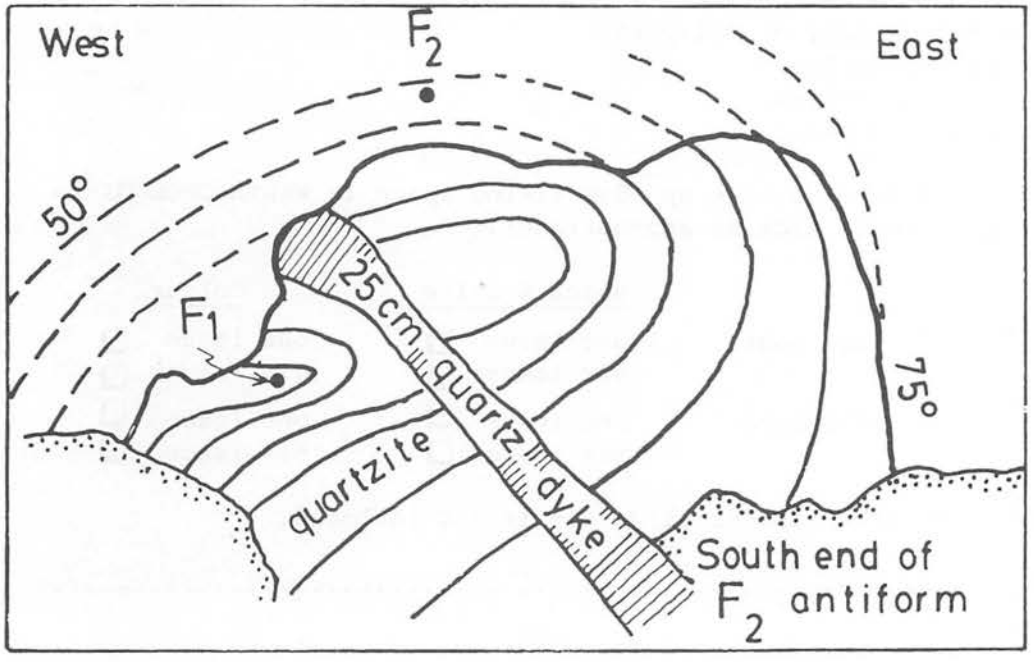


Fig. 2C. Sketch of Fig. 2B. The dashed lines represent parts of the layers that were eroded away near this end of the antiform but are intact near the other end (see Fig. 2A, left side). Attitude of fold axes are F_1 = 0/47 and F_2 = 0/10-15.

WARTA GEOLOGI - NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MALAYSIA

ADVERTISING SPACE ORDER FORM

Format of WARTA GEOLOGI: 20 cm x 28 cm

Rates:	Black & White	Colour
Inside full page per issue	M$300	M$600
Inside half page per issue	M$200	M$500
Inside full page for 6 issues	M$1600	M$3400
Inside half page for 6 issues	M$1000	M$2800

Artwork and positive films or slides (for colour or black & white) should be supplied by the advertiser.

Please send the completed form below together with remittance payable to 'Geological Society of Malaysia' to:

Editor,
Geological Society of Malaysia,
c/o Dept. of Geology,
University of Malaya,
59100 Kuala Lumpur, Malaysia.

For further information, please ring 03-7577036

The Editor,
Geological Society of Malaysia,
c/o Dept. of Geology,
University of Malaya,
59100 Kuala Lumpur.

I/We* would like to take up advertising space in WARTA GEOLOGI in the form (please tick as appropriate).

	Black & White	Colour
Inside full page	one issue ☐	one issue ☐
	six issues ☐	six issues ☐
Inside half page	one issue ☐	one issue ☐
	six issues ☐	six issues ☐

Artwork/Positive film or slide* is/is not inclosed.

Company .....

Address .....

.....

Enclosed cheque/money order/bank draft ..... for M$ .....

Person to be contacted ..... Tel.....

Designation ..... Signature .....

PEDAWAN FORMATION OF THE PENRISSEN AREA, SARAWAK: A REVISION OF ITS UPPER AGE LIMIT

Nuraiteng Tee Abdullah & Kushairi Hj. Abang, Dept. of Geoology, University of Malaya, Kuala Lumpur

Abstract

The Pedawan Formation in the Penrissen Area (in the vicinity of Tepoi), West Sarawak, contain abundant planktonic foraminifera of Upper Santonian age (Marginotruncana coronata, Marginotruncana angusticarenata and Dicarinella carinata). To date, no planktonic foraminifera of post Upper Santonian age have been reported from this formation. Based on this, the upper age limit of the Pedawan Formation should be revised from Maastrichtian to Upper Santonian.

Abstrak

Formasi Pedawan dikawasan Penrissen (berhampiran Tepoi), Sarawak Barat, mengandungi banyak foraminifera plankton yang berumur Santonian Atas (Marginotruncana coronata, Marginotruncana angusticarenata dan Dicarinella carinata). Selama ini, foraminifera plankton yang lebih muda daripada Santonian Atas belum dilapurkan daripada formasi ini. Berdasarkan ini, had atas untuk Formasi Pedawan perlu diubah daripada Maastrichtian ke Santonian Atas.

Introduction

The Pedawan Formation in the Tebedu Area (Fig. 1b) was mapped by one of us (Kushari Hj. Abang, unpubl. thesis, 1987). Several outcrops containing Upper Cretaceous planktonic foraminifera were encountered. Of particular significance ot this paper is station 23, an outcrop located near Tepoi (Fig. 1b). In this station, abundant planktonic foraminifera were found in several of the mudstone beds.

General description of station 23 (Fig. 2)

Outcrop (station) 23 is composed of interbeds of calcareous mudstone and siltstone. The mudstone beds are indurated, dark grey in colour, massive, with bed thickness ranging from 20 - 60 cm, and do not show internal sedimentary features. In contrast, the siltstone beds have bed thickness ranging from 4 - 15 cm and generally exhibit cross-lamination or wavy lamination.

Method of study

4 samples from the mudstone beds were collected, starting from the base to the top of the outcrop. The samples were then sectioned and studied under the light microscope. Microfossil content was determined and their respective stratigraphic ranges were plotted (Table 1).

Results

All the 4 samples are characterised by the presence of planktonic foraminifera. Three diagnostic species of planktonic foraminifera, *Marginotruncana angusticarenata*, *Marginotruncana coronata* and *Dicarinella carinata*, were identified. The presence of *Dicarinella carinata* (a particular good zonal indicator) and its association with the other two species in the mudstone samples indicate an Upper Santonian age (P. Silva & Boersma, 1977; Wonders, 1979).

Discussion

The Pedawan Formation in the Penrissen Area (Fig. 1a) was reported to range from Upper Jurassic to Upper Cretaceous (Turonian-Maastrichtian) based on the presence of radiolaria, *Orbitolina lenticularis* and *Globotruncana* spp. (Wilford, 1965).

The present study indicate that the upper age limit of the Pedawan Formation should be revised. The reported Turonian-Maastrichtian age was based on samples collected about 2 miles south of Pedawan (Wilford, 1965; sample numbers S12873-4, S12892, S12895-6, S13565). Published faunal content of these samples indicate the co-occurrence of *Marginotruncana coronata* and *Globotruncana tricanata* in several samples. Based on the current accepted published global stratigraphic ranges of planktonic foraminifera (Postuma, 1971; P. Silva & Boersma, 1977; Wonders, 1979) the ranges of *Marginotruncana coronata* and *Globotruncana tricarinata* do not overlap. We have compared the faunal content of our samples with Wilford's published data (the authors have no access to the actual samples). The microfossil common to both our samples is *Marginotruncana coronata*. *Globotruncana tricarinata* is absent from our samples; instead abundant specimens of *Marginotruncana angusticarenata* are present. Of significance is the presence of *Dicarinella carinata* in all our samples containing *Marginotruncana coronata*. This indicates that the age of our samples is Upper Santonian. Based on the incompatible stratigraphic ranges of *Marginotruncana coronata* and *Globotruncana tricarinata* and the faunal association of our samples (i.e. *M. coronata* is always present together with *M. angusticarenata* and *Dicarinella carinata*), we suspect forms identified as *Globotruncana tricarinata* in Wilford's samples could have been *Marginotruncana angusticarenata*. The presence of *Dicarinella concavata* in one of Wilford's sample (S13565) further indicates that the age of that sample is at least Lower Santonian (slightly older than the age obtained from the present samples). Palynological study of the Pedawan Formation in the Penrissen Area indicate an age range from Cenomanian to Senonian (Muller, 1968). Apart from the present work, no subsequent paleontological work on planktonic foraminifera from the Pedawan Formation has been carried out. Therefore, we conclude that to date, no diagnostic post Upper Santonian planktonic formainifera have been found in the Pedawan Formation of the Penrissen Area.

Based on the current accepted published global stratigraphic ranges of planktonic foraminifera (Postuma, 1971; P. Silva & Boersma, 1977; Wonders, 1979) the ranges of *Marginotruncana coronata* and *Globotruncana tricarinata* do not overlap. We suspect forms identified as *Globotruncana tricarinata* were actually *Marginotruncana angusticarenata*. Abundant specimens of the latter species are found inthe present study to be associated with *Marginotruncana coronata*. The presence of *Dicari-*

nella concavata in one of the sample (S13565) further indicates that the age of the Pedawan Formation in the Pedawan Area is at least Lower Santonian (slightly older than the age obtained from the present study area). Palynological study of the Pedawan Formation in the Penrissen Area indicates an age range from Cenomanian to Senonian (Muller, 1968). Apart from the present work, no subsequent paleontological work on planktonic foraminifera from the Pedawan Formation has been carried out. Therefore based on Wilford's previous work and the present work, to date, no diagnostic post Upper Santonian planktonic foraminifera have been found in the Pedawan Formation of the Penrissen Area.

Systematics

Order	Foraminiferida Echwald, 1830
Superfamily	Globigerinacea Carpenter, Parker and Jones, 1862
Family	Flobotruncanidae Brotzen, 1942.

Genus *Marginotruncana* Hofker, 1956

Marginotruncana angusticarenata (Gandolfi, 1942).
(Pl. 1, Fig. 3)

Globotruncana linnei var. *angusticarenata* Gandolfi, 1942; Riv. Ital. diPaleontologia; p. 127-, fig. 40, nos. 3a-c; table 4, figs. 17, 30.

Marginotruncana angusticarenata Pessagno, 1967; Paleont. Amer., v. 5, no. 37, p. 300-301, pl. 98, figs. 5, 9-11.

Globotruncana angusticarenata Postuma, 1971; Manual of Planktonic Foraminifera, p. 16-17.

Thin-section description

Test trochospirally coiled; unequally biconvex, the dorsal side being more convex. Chambers angular-truncate with 2, moderately spaced. peripheral keels. Umbilicus wide. Surface of test smooth.

Range: Middle Turonian - basal Early Campanian.

Marginotruncana coronata (Bolli, 1944)
(Pl. 1, Figs. 1-2)

Globotruncana lapparanti coronata Bolli, 1944; Eclog. Geol. Helv., v. 37, p. 233, fig. 1, nos. 21-22; pl. 9, figs. 14, 15.

Flobotruncana cf. *coronata* Lehmann, 1962; Notes Serv. Geol. Maroc. t. 21, no. 156, text-fig. 2, no. m; pl. 4, fig. 3; pl. 5, fig. 3; pl. 8, figs. 2-3.

Marginotruncana coronata Pessagno, 1967; Paleont. Amer., v. 5; no. 37, p. 305-306, pl. 65, figs. 11-13; pl. 100, fig. 6.

Globotruncana coronata Postuma, 1971; Manual of Planktonic Foraminifera, p. 32-33.

Thin-section description

Test a low trochospire, characterised by having a large, compressed,

nearly biconvex or lenticular shape. Chambers of the earlier whorls globigerine-like; all later chambers angular-truncate and double keeled. Peripheral keels are relatively well spaced but with a tendency to become closer on the later chambers of the final whorl. Fusion of the two keels on the final chamber has been reported but was not observed here.

Range: Middle Turonian - Late Santonian (possibly basal Early Campanian)

Dicarinella carinata (Dalbiez, 1955)
(Pl. 1, figs. 4-6)

Globotruncana (Globotruncana) ventricosa carinata Dalbiez, 1955; Micropaleont., v. 1, no. 2, p. 168-169, text-figs. 8a-d.

Globotruncana concavata *Globotruncana carinata* Lehmann, 1962; Notes Serv. Geol. Maroc, t. 21, no. 156, text-figs. 2q-r; text 1, fig. 3s, pl. 6, figs. 4b.

Marginotruncana concavata Pessagno, 1967; Paleont. Amer., v. 5, no. 37, p. 304-305, pl. 58, figs. 3-6; pl. 99, figs. 1,3; pl. 95, fig. 7.

Globotruncana carinata Postuma, 1971; Manual of Planktonic Foraminifera, p. 24-25.

Marginotruncana carinata Wonders, 1979; Proc. Kon. Ned. Akad. Weten., Sers. B, v. 82(2), pl. 9, figs. 4-5.

Thin-section description

Test trochospirally coiled, plano-convex. Dorsal side slightly concave with a gently raised central cone formed by the earlier whorls; ventral side strongly convex. Chambers of the earlier whorls globular but becoming partly truncate in the later part of the penultimate whorl. Chambers of the final whorl nearly angular conical in shape, with two distinct but relatively closely-spaced peripheral keels and a peri-umbilical keel along the imbilical shoulders. Umbilicus wide and deep.

Range: Late Santonian.

Acknowledgement

We thank Dr. Azhar Hj. Hussin for his critical comments on the stratigraphy of the study area. We also thank Mr. Lee Kok Eng for preparing the photographs.

References

Bolli, H.M., 1944. Zur stratigraphie der Oberen Kreide in den hoheren helvetischen Decken. *Ecologae Geol. Helv.*, v. 37, 217-328.

Dalbiez, F., 1955. The genus *Globotruncana* in Tunisia. *Micropaleontology*, v. 1, no. 2, 161-171.

Gandolfi, R., 1942. Ricerche micropaleontologiche e stratigrafiche sulla Scaglia e sul Flysch Cretacici dei Dintorni di Balerna. *Riv. Ital. Paleont.*, ann. 48, mem. 4, 160 p.

Kushairi Hj. Abang, 1987. *Geology of the Tebedu Area, West Sarawak.* Unpubl. B.Sc. thesis, University of Malaya.

Lehman, R., 1962. Etude des Globotruncanides du Cretace Superieur de la Province de Tarfaya (Maroc Occidental). *Notes Serv. Geol. Maroc,* t. 21, no. 156.

Muller, J., 1968. Palynology of the Pedawan and Plateau Sandstone Formations (Cretaceous - Eocene) in Sarawak, Malaysia. *Micropaleontology,* v. 14, no. 1, 1-37.

Pessagno, E.A. Jr., 1967. Upper Cretaceous planktonic foraminifera from the western Gulf Coastal Plain. *Paleontographica Americana,* v. 5, no. 37, 443 p.

Postuma, J.A., 1971. *Manual of Planktonic Foraminifera.* Elsevier Publishing Co., Amsterdam, London, N.Y., 250 p.

Silva, I.P., and Boersma, A., 1977. Cretaceous planktonic foraminifers-DSDP Leg 39 (South Atlantic). *Ini. Reps. DSDP VXXXIX,* Supko *et al.,* (eds), 615-641.

Wonders, A.A.H., 1979. Middle and Late Cretaceous pelagic sediments of the Umbrian Sequence in the Central Appennines. *Proc. Kon. Ned. Akad. Weten.,* Ser. B, v. 82(2), 171-205.

Wilford, G.E., 1965. Penrissen Area, West Sarawak, Malaysia. *Report 2, Geol. Surv. Borneo Region,* Malaysia.

******

Manuscript received 26 December 1986.

Table 1. Distribution of planktonic foraminifera in Station 23.

micro-fossil / samples	*M. coronata*	*M. angusti-carenata*	*D. carinata*
SO5/16	x	x	x
TP1	x		x
S4/25		x	x
TP8	x	x	x

Abbreviation: *M.* - *Marginotruncana*
D. - *Dicarinella*

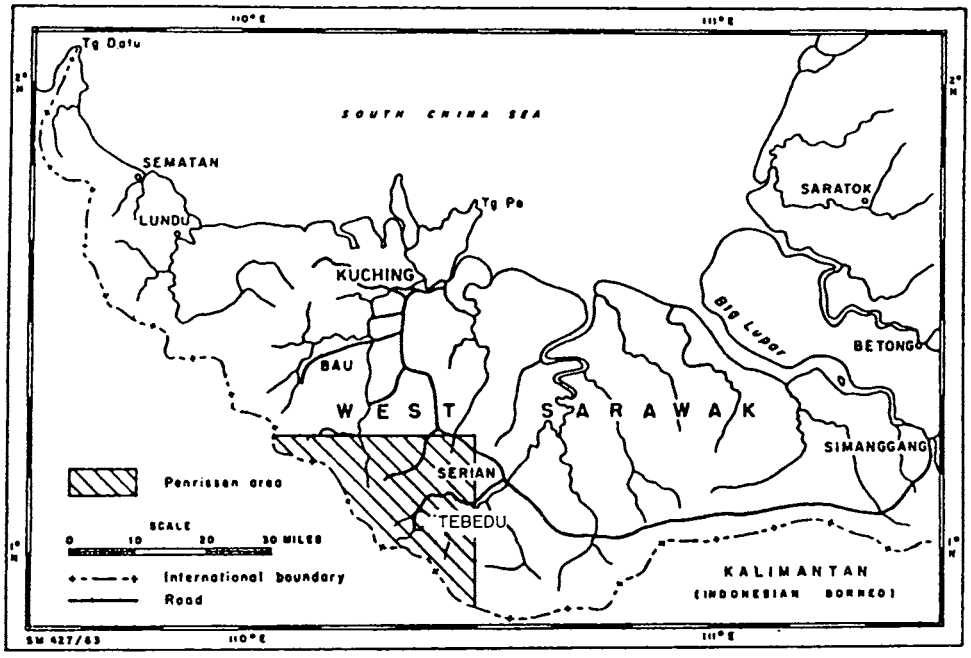


Fig. 1a. Location of the Penrissen Area (after Wilford, 1965).

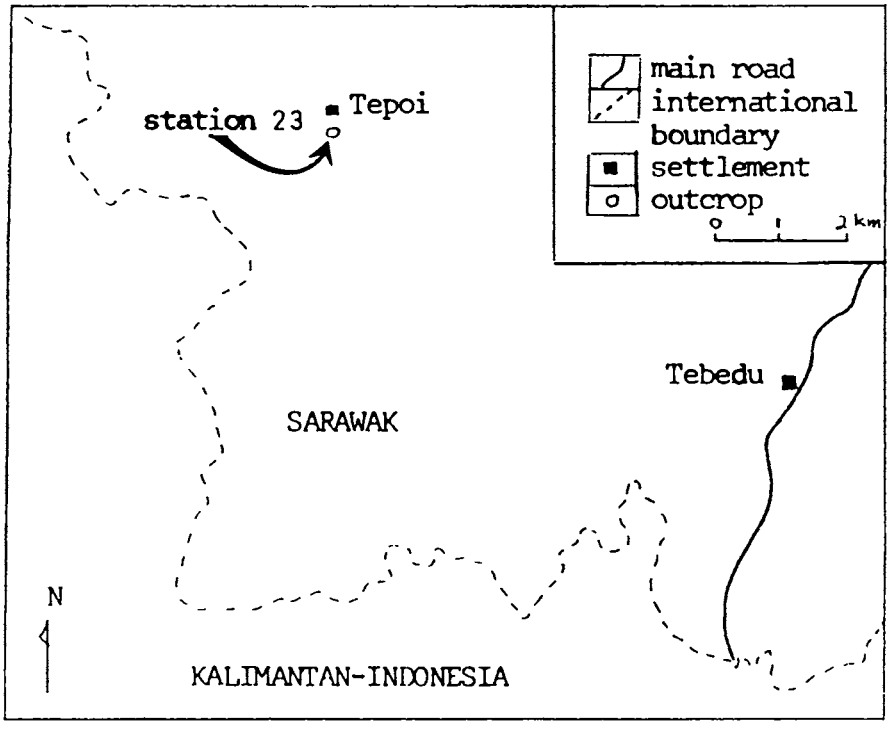
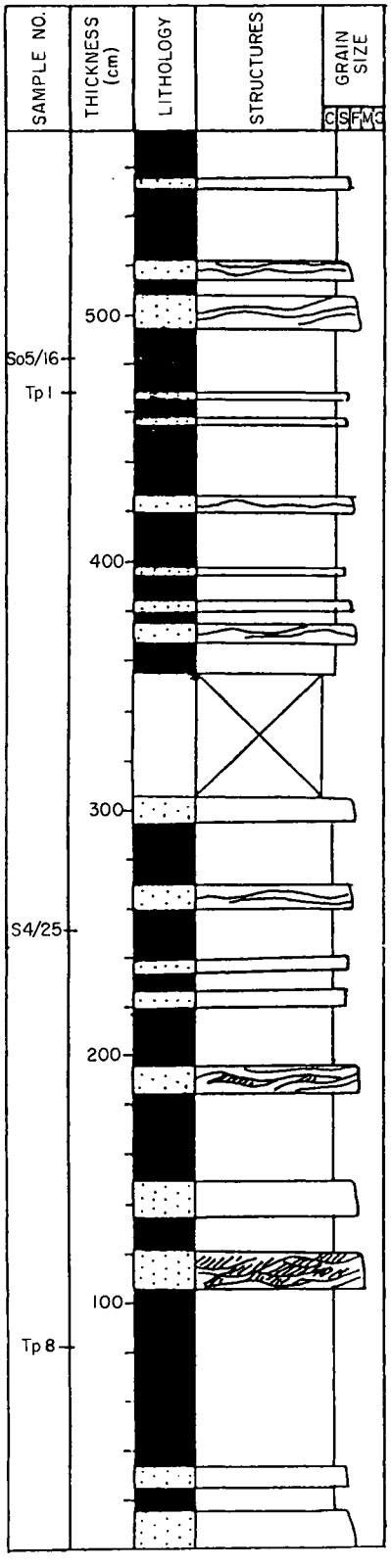


Fig. 1b. Location of Station 23 (after Kushairi, 1987).



(after Kushairi, 1986/87)

Symbols

cross-lamination

wavy lamination

Fig. 2. Stratigraphic sequence of the Pedawan Formation in Outcrop 23.

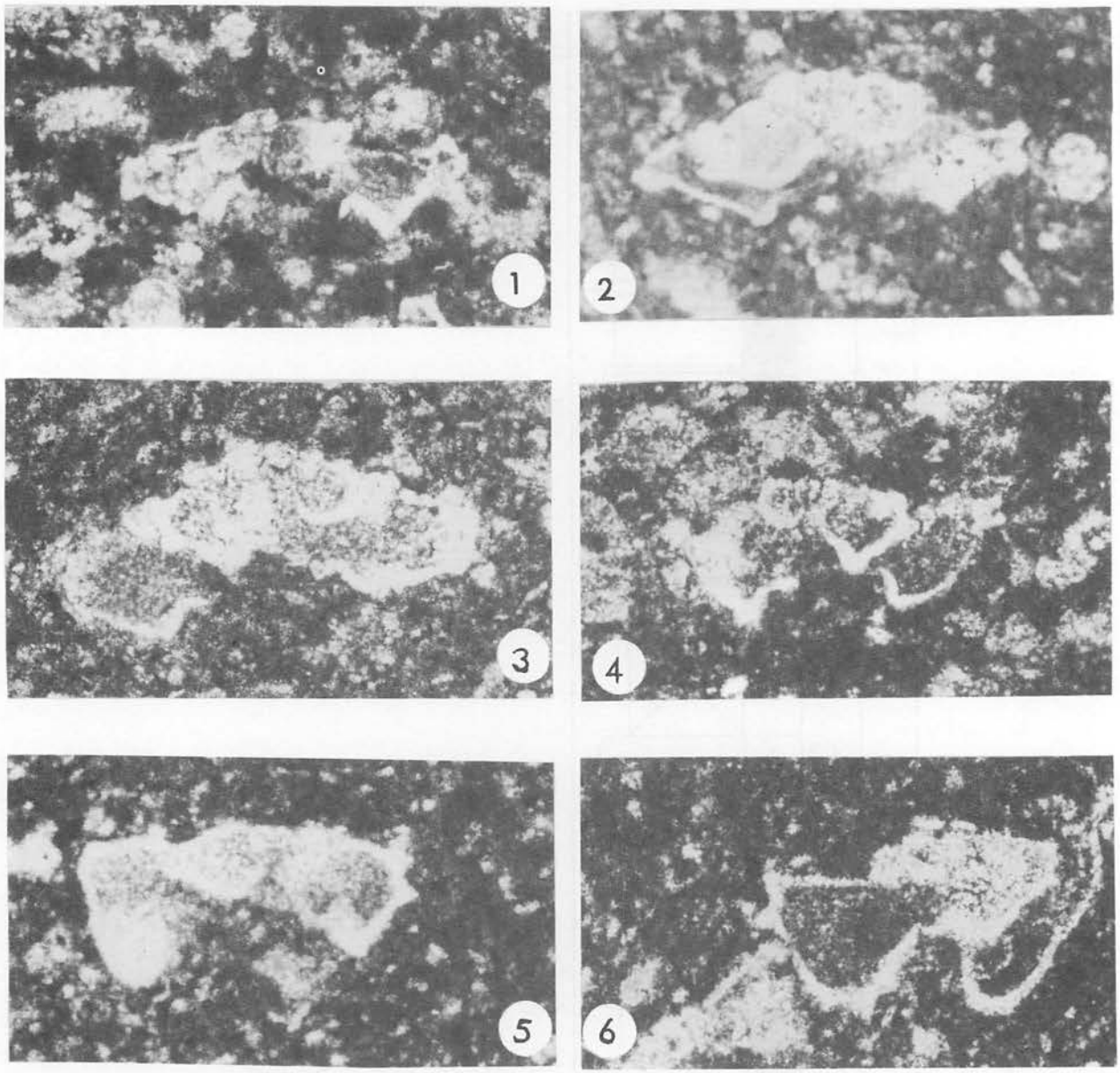


Plate 1.

Figs. 1 - 2 *Marginotruncana coronata*
Sample SO5/16

Fig. 3 *Marginotruncana angusticarinata*
Sample SO5/16

Figs. 4 - 6 *Dicarinella carinata*
4 - Sample SO5/16
5 - Sample S4/25
6 - Sample P8

All samples are from Pedawan Formation, Station 23, Tepoi. X 100

PERTEMUAN PERSATUAN
(MEETINGS OF THE SOCIETY)

PERSIDANGAN TAHUNAN GEOLOGI 1987 - LAPORAN
(ANNUAL GEOLOGICAL CONFERENCE 1987 - REPORT)

Persidangan Tahunan Geologi 1987 telah dianjurkan bersama oleh Persatuan Geologi Malaysia dan Jabatan Geologi, Universiti Kebangsaan Malaysia. Persidangan ini telah dirasmikan oleh Prof. Dr. Jalani Sukaimi, Timbalan Naib Canselor (Akademik dan Penyelidikan), Universiti Kebangsaan Malaysia. Sambutan ahli dan tetamu undangan sangat menggalakkan. Dekan Fakulti Sains Fizis dan Gunaan UKM, Dekan Fakulti Kejuruteraan UKM, Timbalan Pengarah Jabatan Kajibumi Malaysia, dan beberapa orang Ketua Jabatan bersama-sama lebih 80 orang peserta telah bersama meraikan upacara Pembukaan Rasmi Persidangan pada kali ini.

Dalam ucapan Perasmian Prof. Jalani telah membangkitkan beberapa isu yang amat wajar dipertimbangkan oleh Persatuan. Di antaranya, beliau telah menimbulkan pandangan mengenai betapa pentingnya hubungan kerjasama di antara Pusat Pengajian Tinggi dan Jabatan Penyiasatan Kajibumi Malaysia dieratkan lagi. Hubungan kerjasama boleh dalam bentuk pertukaran kakitangan, kerjasama penyelidikan atau pun penubuhan sebuah Jawatankuasa bersama yang dapat membincangkan isu dan masalah geologi semasa. Selain itu, beliau ada menyentuh mengenai arah penyelidikan geologi. Menurut beliau, ahli geologi tempatan harus peka terhadap perkembangan negara, oleh itu bentuk penyelidikan geologi seeloknya boleh menyumbang kepada perkembangan ini.

Persidangan geologi yang telah berlangsung pada kali ini telah mendapat sambutan di luar dugaan. Sebanyak 40 kertas kerja yang mewakili berbagai bidang geologi telah dibentangkan, 3 daripadanya merupakan Kertas Utama yang telah disampaikan oleh Prof. C.S. Hutchison, dan Prof. Madya Dr. K.R. Chakraborty dari Universiti Malaya, dan En. Aw Peck Chin dari Jabatan Penyiasatan Kajibumi Malaysia. Senarai program lengkap dan abstrak daripada kertas kerja dilampirkan bersama. Jumlah peserta biasa juga meningkat, sejumlah 45 ahli telah mendaftar menjadikan jumlah peserta keseluruhannya seramai 85 orang.

Walaupun masa yang diperuntukkan bagi setiap pembentang kertas kerja singkat tetapi nampaknya setiap pengerusi persidangan mampu mengawal sidangnya sambil membuka peluang kepada soal-jawab. Saling hubung seperti ini pasti dapat mengeratkan lagi pengenalan sesama ahli dan mudah-mudahan beberapa bentuk kerjasama penyelidikan atau sosial telah mula terjalin yang pasti dapat membawa faedah bukan sahaja kepada ahli, tetapi dapat memperkukuhkan lagi Persatuan Geologi Malaysia.

Bagi pihak Majlis, saya ingin merakamkan jutaan terima kasih kepada beberapa pihak dan individu yang telah mencurahkan banyak tenaga dan masa bagi menjayakan Persidangan Tahunan Geologi 1987 ini. Perlu diakui tanpa sumbangan mereka yang terlibat, persidangan ini tidak mungkin mencapai kejayaan cemerlang. Pertama, saya ingin mengucapkan terima kasih kepada Ahli Jawatankuasa Penganjur yang tidak jemu-jemu memberikan buah fikiran dan tenaga sehingga segala program yang dirancang telah berjalan dengan teratur.

Terima kasih seterusnya kepada Jawatankuasa Teknik yang diketuai oleh Dr. Uyop Said dan dianggotai oleh kakitangan am Jabatan Geologi UKM. Tanpa 'anggota di belakang tirai' ini, persidangan tidak mungkin dapat mencapai kejayaan. Kepada pembentang kertas kerja, saya ingin mengucapkan setinggi terima kasih kerana sudi meluangkan masa menyediakan bahan dan pembentangannya. Terima kasih juga kepada Pengerusi Sesi yang telah memastikan perjalanan persidangan mengikut programnya.

Kesempatan ini juga ingin diambil untuk mengucapkan penghargaan khas kepada dua buah Institusi yang telah banyak membantu, sama ada kewangan atau moral untuk kejayaan persidangan ini. Pertama, Universiti Kebangsaan Malaysia yang telah bermurah hati membenarkan penggunaan segala kemudahan persidangan, dan membiayai jamuan pembukaan, makan tengahari dan jamuan satay. Kedua, Jabatan Penyiasatan Kajibumi yang buat pertama kali memberikan sokongan moral yang padu dengan begitu bersedia menyumbang banyak kertas kerja termasuk sebuah Kertas Utama. Kepada semua pihak yang terlibat sekali lagi diucapkan berbanyak terima kasih.

Akhir kata, saya ingin menyarankan kepada Majlis Persatuan Geologi Malaysia agar persidangan tahunan 1988 dirancangkan lebih awal supaya Jawatankuasa Penganjur mampu menyediakan kertas kerja penuh semasa persidangan. Selamat berjumpa kembali di 'Persidangan Tahunan 1988'.

Ibrahim Komoo
Pengerusi Persidangan

*****

UCAPAN PENUTUP PERSIDANGAN TAHUNAN GEOLOGI 1987 OLEH DR. HAMZAH MOHAMAD, PRESIDEN PERSATUAN GEOLOGI MALAYSIA (CLOSING ADDRESS BY THE PRESIDENT OF THE GEOLOGICAL SOCIETY OF MALAYSIA AT THE ANNUAL GEOLOGICAL CONFERENCE 1987)

Terima kasih Tuan Pengerusi Majlis.
Para hadirin sekalian,

Terlebih dahulu saya ingin mengucapkan berbanyak terima kasih kepada Jawatankuasa Penganjur yang telah sudi mengundang saya memberikan sepatah dua kata dan selanjutnya menutup Persidangan ini dengan rasminya.

Bersyukur kita kepada Allah kerana dengan izinnya jua persidangan geologi tahun ini telah sampai ke hujungnya, dengan tiada menemui sebarang masalah yang besar. Begitu juga Mesyuarat Tahunan. Dalam dua hari ini kita telah menyaksikan 40 kertas dibentangkan dengan penuh semangat, yang mana tiga daripadanya merupakan kertas utama yang dibentangkan oleh ahli-ahli kita yang penuh berpengalaman dalam bidang yang mereka perkatakan.

Sekali pandang sahaja kita sebagai ahli geologi pasti berpuas hati melihatkan luasnya skop yang diberikan oleh persidangan ini. Ini bersesuaian dengan bertambahnya bilangan ahli dan kepakaran masing-masing, juga kerana bertambah luasnya kegiatan penyelidikan di man-mana sahaja dewasa ini.

Pakar-pakar geotektonik telah membawa berbagai idea mengenai letak Semenanjung ini, juga Borneo Timur dalam sejarah perkembangan muka bumi seperti yang kita lihat sekarang. Berbagai bukti dikemukakan, dan pada kali ini kita dihinggapi deman 'dropstone' yang saya rasa akan berlanjutan hingga ke persidangan tahunan akan datang, malah mungkin ke seluruh dekat inipun.

Sedang ahli-ahli geotektonik kita memikirkan masa lalu, ahli-ahli geologi kejuruteraan dalam persidangan ini terus dengan kebimbangan mereka mengenai keselamatan dan keperluan hidup manusia sejagat dalam konteks pembangunan. Sejumlah kertas telah dibentangkan mengenai kegagalan cerun, pembinaan empangan, dan pencarian air bawah tanah - dengan bantuan teknik-teknik geofizik yang semakin maju. Sebagaimana biasa, ahli-ahli geologi eknonomi kita sentiasa membentangkan data baru penjelajahan mineral, dan secara tidak langsung memberikan maklumat-maklumat teknik lebih ekonomi dalam usaha menakluki kekayaan bumi ini. Saya juga mendapati terdapat sejumlah kertas-kertas geologi am, yang tidak syak memberikan maklumat baru mengenai geologi Semenanjung dalam berbagai aspek. Kita juga bergembira kerana pada kali ini terselit beberapa kertas kedudukan, termasuk mengenai organisasi dan penyelidikan semasa Jabatan Penyiasatan Kajibumi, yang saya rasa merupakan maklumat yang amat diperlukan bagi memulakan kerjasama erat penyelidikan Jabatan berkenaan - Universiti tempatan yang disebut-sebut semalam.

Tuan-tuan/Puan-puan,

Matlamat sesuatu persidangan, selain daripada forum membentangkan maklumat baru, ialah forum menyelesaikan masalah dan pertelingkahan. Tidak syak lagi semakin banyak yang kita kerjakan semakin banyak pula tersingkap keganjilan-keganjilan. Ini pada satu sudut adalah amat baik sebagai penggerak kepada lebih banyak kerja-kerja lanjutan, tetapi ada bahayanya. Bilamana penyelidikan dijalankan dengan membelakangkan etika akademik dan sifat kritis seorang saintis, maka kita akan menghadapi zaman gelap, iaitu kerja berbalik, yang amat merugikan. Kita harus menyedari dalam bidang sains, amat sedikit berlaku keadaan hasil kajian terus membatalkan kesimpulan kajian sebelumnya. Ini tidaklah terkecuali kepada bidang geologi. Apa yang sering terjadi ialah kajian baru berbentuk menambah keterangan dan maklumat, atau cuma memberikan suatu alternatif lain, yang tidak selalunya berbeza jauh.

Inilah cabaran yang dihadapi oleh saintis geologi Malaysia hari ini. Iaitu kembali kepada disiplin ahli sains yang tradisi dan tinggi. Saya ingin mencadangkan, jika dipersetujui, diadakan semacam badan di mana-mana, mungkin di dalam Persatuan ini, yang mengandungi pakar-pakar. Pakar-pakar ini tertugas mengkoordinasikan penyelidikan supaya tidak berlaku duplikasi, dan lebih penting ianya berarah, iaitu 'problem solving oriented'. Dengan cara ini dapatlah disalurkan segala tenaga pakar yang kita ada, dan sesuatu pertelingkahan dapat diselesaikan dengan cara yang lebih bersistem.

Tuan-tuan/Puan-puan,

Dalam keghairahan kita menyelami bidang kepakaran masing-masing, tidak wajarlah kita melupai hakikat bahawa kita adalah geologis Malaysia, yang sudah tentunya dibendung oleh sistem di sekeliling kita dan kita harus peka terhadap perkara-perkara yang berlaku di sekeliling kita. Dalam dua hari ini kita telah melihat perubahan besar yang tidak pernah berlaku di Malaysia sebelum ini, iaitu pembentangan sebilangan kertas saintifik, iaitu sains geologi, dalam Bahasa Malaysia. Apa yang menarik perhatian kita ialah isi kertas-kertas tersebut, yang tidak ada beza kualitinya dengan kertas-kertas yang dibentangkan di dalam Bahasa Inggeris, selain dari bahasa penyampaiannya. Pada hemat saya, inilah bukti awal kemampuan bahasa tersebut dalam sains geologi.

Sama ada tuan/puan sedari atau tidak, mulai daripada sekarang atau paling lewat lO tahun yang akan datang, orang-orang seperti Tajul Anuar Jamaluddin inilah yang akan masuk ke pasaran kerja dan memegang peranan

yang penting-penting. Mereka adalah hasil daripada sistem pelajaran negeri ini, yang berteraskan Bahasa Malaysia. Tidak seperti setengah daripada kita, mereka ini menerima ilmu yang sama mutunya dalam Bahasa ini, dan wajarlah kemampuan mereka diukur daripada hasil kerjaya dalam bahasa yang boleh dikuasainya dengan baik, bukan daripada aspek kebolehan bertutur dalam Bahasa Inggeris sahaja.

Pada hemat saya pelajar dewasa ini, apabila masuk ke Universiti tersepit di tengah segala macam kekurangan. Yang paling jelas sekali ialah kekurangan buku-buku dalam Bahasa Malaysia. Beberapa tahun yang lalu, kajian yang saya lakukan menunjukkan, jika satu kursus geologi memerlukan sebuah sahajapun, kita memerlukan kira-kira lima puluh buah buku. Pada masa ini, jumlah buku tulisan asal yang sudah dan hampir terbit ialah 10 buah sahaja, ditambah oleh 13 judul terjemahan.

Memandangkan ketiadamampuan tenaga di pusat-pusat pengajian tinggi melaksanakan tugas berat ini, saya rasa sudah tiba masanya persatuan mendekatkan diri dengan masalah ini, sebagai usaha awal mempekakan diri kepada sekelilingan kita. Saya tahu sejumlah ahli kita mempunyai potensi dalam penulisan dan penterjemahan buku, mungkin salurannya sahaja yang belum terbina.

Biarlah saya tamatkan di sini sahaja. Dalam sesuatu kegiatan, apatah lagi sebesar dan semeriah persidangan tahunan ini, sejumlah tenaga telah dicurahkan, baik oleh orang yang nampak atau oleh orang-orang yang berada di sebalik tabir, yang selalunya lebih ramai. Melangnya tiadakan dapat saya sebutkan satu persatu.

Bagi pihak persatuan saya ingin mengucapkan setinggi-tinggi ucapan terima kasih kepada Penganjur Persidangan ini, yang dikepalai oleh Dr. Ibrahim Komoo. Jawatankuasa ini mengandungi Jawatankuasa Kecil Teknik dikepalai oleh Dr. Uyop Said, yang di dalamnya terkandung sejumlah kakitangan pentadbiran dan makmal Jabatan ini, yang kebanyakannya berada di belakang tabir. Kepada mereka diucapkan terima kasih. Saya ingin menyatakan penghargaan yang tinggi kepada semua pembentang kertas kerja, kerana tanpa kesediaan mereka mengambil bahagian, maka kita tidak akan berkumpul di sini hari ini. Perjalanan persidangan telah berjalan begitu lancar sekali dengan adanya kerjasama Pengerusi-pengerusi Sesi, kepada mereka diucapkan terima kasih. Penghargaan juga dirakamkan kepada ahli-ahli yang sudi menghadiri persidangan dua hari ini, termasuk pelajar-pelajar. Kita amat memahami 'demam peperiksaan' sudah mengenai mereka, tetapi mereka masih tidak dapat menolak untuk mendengar 'deman dropstone' kita.

Saya juga ingin memanjangkan penghargaan Persatuan kepada badan-badan yang sama ada secara langsung atau tidak telah memberikan bantuan menjayakan persidangan ini, terutamanya Jabatan Geologi, Universiti Malaya dan Jabatan Penyiasatan Kajibumi Malaysia.

Kepada ahli-ahli kita di Jabatan Penyiasatan Kajibumi saya berpesan 'jaga-jaga, mungkin tahun hadapan kita 'landing' di Ipoh pula'.

Akhir sekali saya mengucapkan dan mendoakan kepulangan yang selamat semua peserta ke tempat kediaman masing-masing.

Dengan menyebut kalimah bismillah., saya dengan rasminya menutup persidangan ini. Terima kasih.

*****

PERSIDANGAN TAHUNAN GEOLOGI 1987
(GEOLOGICAL ANNUAL CONFERENCE 1987)

Program

Isnin, 30hb. Mac. 1987

8.00 a.m. - 8.30 a.m.	:	Pendaftaran lewat
8.30 a.m. - 8.40 a.m.	:	Ucapan Aluan oleh Presiden Persatuan Geologi Malaysia
8.40 a.m. - 9.00 a.m.	:	Pembukaan Resmi - Ucapan oleh Prof. Dr. Jalani Sukaimi, TNC, Universiti Kebangsaan Malaysia
9.00 a.m. - 9.20 a.m.	:	Jamuan Ringan
9.20 a.m. - 9.50 a.m.	:	Kertas Utama 1 oleh K.R. Chakraborty: Tectono-magmatic evolution of the Peninsular Malaysia - some observation and comments (Pengerusi: Prof. H.D. Tjia)

Sesi I (Geologi Am, Stratigrafi & Paleontologi) (Pengerusi: Prof. H.D. Tjia)

9.50 a.m. - 10.10 a.m.	:	I. Metcalfe: Gondwana, Tethys and Peninsular Malaysia
10.10 a.m. - 10.30 a.m.	:	K.R. Chakraborty & I. Metcalfe: Occurrence of diamictite in the Raub area - its possible extensions and tectonic implications
10.30 a.m. - 10.50 a.m.	:	K.R. Chakraborty, G.H. Teh & C.A. Foss: Geology of the Bahau Area - tectonic implications
10.50 a.m. - 11.10 a.m.	:	Ann Yasmin Nordin: Sedimentology of the 'Passage beds' of the Cuping Formation in the Bt. Temiang - Bt. Tengku Lembu Ridge, Perlis
11.10 a.m. - 11.30 a.m.	:	Zakaria Hussain : Geologi dan stratigrafi di kawasan Labis, Johor

Sesi II (Geologi Kejuruteraan) (Pengerusi: Dr. Ahmad Tajuddin)

11.30 a.m. - 11.50 a.m.	:	Abdul Ghani Rafek & Ibrahim Komoo: Survei kegagalan cerun di lebuh raya Timur-Barat, Kelantan
11.50 a.m. - 12.10 p.m.	:	Tan Boon Kong: Damsite investigation in the Bentong area, Pahang
12.10 p.m. - 12.30 p.m.	:	Sain Suratman: Geotechnical investigation at Batu Dam, Kuala Lumpur
12.30 p.m. - 12.50 p.m.	:	Jamaludin Othman, Dzazali Ayub & Sukri Ghazali: Seismic refraction survey for the Chenderoh Dam rehabilitation study
12.50 p.m. - 2.00 p.m.	:	Makan Tengahari

Sesi III (Geologi Am, Stratigrafi & Paleontologi) (Pengerusi: Dr. Wan Fuad Wan Hassan)

2.00 p.m. - 2.20 p.m.	:	Syed Sheikh Almashoor & Mat Arifin Ismail: The depositional setting of the Lawin Basin deposits, Perak
2.20 p.m. - 2.50 p.m.	:	Wahid A. Rahman: Batuan berusia Perm di bahagian Barat dan Baratlaut Johor
2.50 p.m. - 3.10 p.m.	:	Uzaymee Mohd. Yusof: Igneous petrography and geochemistry of the Bukit Payong-Penghulu diman area, Terengganu

3.10 p.m. - 3.30 p.m. : H.G. Lim: Carbonate sedimentology of Gua Sai, Pahang

Sesi IV (Geokimia & Geologi Ekonomi) (Pengerusi: Dr. Syed Sheikh Almashoor)

3.30 p.m. - 3.50 p.m. : Wan Fuad Wan Hassan: Some characteristics of heavy detrital mineral grains from Peninsular Malaysia

3.50 p.m. - 4.10 p.m. : Teoh Lay Hock: A preliminary assessment of the mineral potential in the proposed Nenggiri Dam reservoir area, Kelantan

4.10 p.m. - 4.30 p.m. : Abdul Khalik Hj. Wood, Zaini Hamzah & Daud Mohamad: Teknik analisis pengaktifan neutron (NAA) dalam kajian geologi

4.30 p.m. - 4.50 p.m. : G.H. Teh: The Cu-Fe-Sn-S system at 600^{o}C and its significance

4.50 p.m. - 5.10 p.m. : G.H. Teh, & R.W. Hutchinson: Volcanogenic barite, Fe and Mn oxide and massive sulphide mineralisation at Cini area, Pahang

5.10 p.m. - 5.30 p.m. : Teh petang

5.30 p.m. - 6.30 p.m. : AGM, Jabatan Geologi, UKM

6.30 p.m. - 7.00 p.m. : Jamuan satay

Selasa, 31hb. Mac. 1987

9.00 a.m. - 9.30 a.m. : Kertas Utama II oleh Aw Peck Chin: Geological Survey of Malaysia - organization, progress and current activities
(Pengerusi: Prof. C.S. Hutchison)

Sesi V (Geologi Am, Stratigrafi & Paleontologi) (Pengerusi: Prof. C.S. Hutchsion)

9.30 a.m. - 9.50 a.m. : Ahmad Jantan: Depositional environment of the Paloh bed sequence near Paloh, Johor

9.50 a.m. - 10.10 a.m. : Ahmad Jantan, Basir Jasin, Ibrahim Abdullah, Abd. Rahim Samsudin & Uyop Said: Fasies model of the Triassic Semanggol Formation sequence at Pedu Dam, Kedah

10.10 a.m. - 10.30 a.m. : Basir Jasin, Ahmad Jantan, Ibrahim Abdullah, Abd. Rahim Samsudin & Uyop Said: Some new features of Semanggol Formation observed at Bt. Barak, Kuala Nerang, Kedah

10.30 a.m. - 10.50 a.m. : Mohd. Shafeea Leman: Fauna Trias di sekitar Kuala Lipis, Pahang

10.50 a.m. - 11.10 a.m. : Teh pagi

Sesi VI (Geologi Am, Stratigrafi & Paleontologi) (Pengerusi: Dr. Hamzah Mohamad)

11.10 a.m. - 11.30 a.m. : H.D. Tjia & Anizan Isahak: Permian glacigenic deposits at Salak Tinggi, Selangor

11.30 a.m. - 11.50 a.m. : Ibrahim Abdullah: Perkembangan struktur berskala kecil dalam batuan Ahli Gersik, Formasi Setul, Pulau Tuba, Kepulauan Langkawi

11.50 a.m. - 12.10 a.m. : Zaiton Harun: Struktur dalam zon ricih di kawasan Genting Sempah, Selangor

12.10 a.m. - 12.30 a.m. : Tajul Anuar Jamaluddin: Struktur sedimen di kawasan Tamparuli, Sabah - implikasinya terhadap sekitaran pengendapan

12.30 a.m. - 12.50 p.m. : Askury A. Kadir: Petrology and petrochemistry of the granites in the Gunung Ledang area, Johor

12.50 p.m. - 2.00 p.m. : Makan Tengahari

2.00 p.m. - 2.30 p.m. : Kertas Utama III oleh Prof. C.S. Hutchison: The preliminary model for the stratigraphic-tectonic evolution of Eastern Borneo (Pengerusi: Dr. Abdul Ghani Rafek)

Sesi VII (Geofizik & Hidrogeologi) (Pengerusi: Dr. Abdul Ghani Rafek)

2.30 p.m. - 2.50 p.m. : Daud Mohamad, Roslan Mohd. Ali & Wan Zakaria: A study of groundwater hydrology with environmental isotope in Kedah - Perlis area

2.50 p.m. - 3.10 p.m. : Muhammed Sayyadul Arafin & C.Y. Lee: Diagnostic resistivity sounding curves of karstic aquifers in the Cuping Limestone

3.10 p.m. - 3.30 p.m. : Tan Eng Heng & Mahan Singh: Groundwater supply study in Northern Kelantan

3.30 p.m. - 3.50 p.m. : Abdul Rahim Samsudin: Keputusan beberapa rentisan graviti di selatan Semenanjung Malaysia

3.50 p.m. - 4.10 p.m. : C.A. Foss: Geophysical mapping of bedrock beneath the coastal plains of Kedah and Perlis

4.10 p.m. - 4.30 p.m. : C.A. Foss: Algorithms for optimising 2-D gravity and magnetic modelling

4.30 p.m. - 4.40 p.m. : Teh petang

Sesi VIII (Geologi Am & Pelbagai) (Pengerusi: Dr. Ibrahim Komoo)

4.40 p.m. - 5.00 p.m. : Hamzah Mohamad: Pendekatan mineralogi terbitan dalam kajian profil luluhawa granit di kawasan tropika

5.00 p.m. - 5.20 p.m. : Nik Ramli Nik Hassan: Research needs in Petroleum Geology in Malaysia

5.20 p.m. - 5.40 p.m. : Ramly Khairuddin & E.V. Gangadharam: Potential for application of trace element studies in Petroleum Geology in Malaysia

5.40 p.m. - 6.00 p.m. : Seet Chin Peng: River bank infiltration as a source of water supply in Felda Lepar Hilir, Pahang

6.00 p.m. - 6.10 p.m. : Majlis penutup oleh Presiden Persatuan Geologi Malaysia.

*****

PERSIDANGAN TAHUNAN GEOLOGI 1987
(Annual Geological Conference 1987)

PERSIDANGAN TAHUNAN GEOLOGI 1987
(Annual Geological Conference 1987)

PERSIDANGAN TAHUNAN GEOLOGI 1987

Keterangan foto-foto

1. Pengerusi Persidangan Dr. Ibrahim Komoo memulakan program persidangan.
2. Ucapan aluan oleh Presiden Persatuan Geologi Malaysia, Dr. John Kuna Raj.
3. Prof. Dr. Jalani Sukaimi dan ahli-ahli Jawatan Kuasa Penganjur.
4. Prof. Dr. Jalani Sukaimi dengan ucapan beliau.
5. Peserta-peserta di hadapan dewan.
6. Peserta-peserta di belakang dewan.
7. Dr. K.R. Chakraborty dengan kertaskerja utama beliau.
8. Zakaria Hussain dengan kertaskerjanya.
9. Ann Yasmin Nordin dengan "passage beds".
10. Dr. Abdul Ghani Rafek dengan survei kegagalan cerun.
11. Saim Suratman dengan kertaskerjanya.
12. Dr. I. Metcalfe tentang "Gondwana Tethys dan Semenanjung Malaysia".
13. Para pembentang kertas pada masa perbincangan.
14. Syed Sheikh Almashoor tentang mendapan lembang Lawin.
15. Dr. G.H. Teh tentang pemineralan di kawasan Cini.
16. Wahid A. Rahman sedang menunjukkan batuan berusia Perm di Johor.
17. Dr. C.A. Foss tentang graviti 2-D.
18. Jamaludin Othman tentang survei biasan seismik.
19. Dr. Azhar Hussin dengan kertaskerja H.G. Lim.
20. Dr. Ahmad Jantan tentang Formasi Semanggol.
21. Teoh Lay Hock dengan kertaskerjanya.
22. Seet Chin Peng tentang bekalan air di Felda Lepar Hilir.
23. Prof. H.D. Tjia tentang mendapan glasigenik.
24. Dr. Ibrahim Abdullah tentang Formasi Setul.
25. Teh pagi.
26. Dr. Hamzah Mohamad dengan kertaskerja beliau.
27. Dr. Wan Fuad tentang butir-butir mineral detritus berat.
28. Tajul Anuar Jamaluddin tentang struktur sedimen di Tamparuli.
29. Muhammed Sayyadul Arafin dengan kertaskerjanya.
30. Roslan Mohd. Ali tentang hidrologi airtanah di Perlis-Kedah.
31. Teh petang.
32. Mohd. Shafeea Leman tentang fauna Trias.
33. Dr. Nik Ramli Nik Hassan dengan kertaskerja beliau.
34. Tan Boon Kong tentang penyiasatan tapak empangan.
35. Ramly Khairuddin tentang kajian unsur surih.
36. Prof. C.S. Hutchison dengan kertaskerja utama beliau.
37. Zaini Hamzah menerangkan teknik analisis pengaktifan neutron.
38. Askury A. Kadir tentang granit Gunung Ledang.
39. Dr. Abd. Rahim Samsudin dengan kertaskerja berkongsi beliau.
40. Aw Peck Chin dengan kertaskerja utama beliau.
41. Basir Jasin dengan kertaskerja berkongsinya.
42. Zaiton Harun tentang zon ricih di Genting Sempah.
43. Pegawai-pegawai majlis Persatuan Geologi Malaysia dengan Mesyuarat Agong Tahunan 1987.

******

ANNUAL CONFERENCE 1987 - ABSTRACTS OF PAPERS

Tectonomagmatic evolution of Peninsular Malaysia: some observations and comments

K.R. Chakraborty, Dept. of Geology, University of Malaya

In the past decade, a number of models pertaining to the tectonomagmatic evolution of Peninsular Malaysia have been published. The basic theme of most of these models is the closure of an ocean basin through eastward subduction resulting in the Late Triassic collision of two continental blocks (eastern and western blocks of Peninsular Malaysia). Such tectonic schemes regard the Triassic sediments as part of an accretionary wedge and the Main Range granitoids as collision related consequent upon crustal thickening. Many geological observations, however, cannot be reconciled with such models.

The magmatism in the central belt does not find any ready explanation in the published schemes. If the Main Range granite (of Late Triassic age) is collision related, then the timing of the collision must be earlier than the Late Triassic since there would be a time gap between the crustal thickening episode and granite magmatism. This is because the rate of crustal thickening during collision is faster in comparison with the establishment of a steady state geotherm.

There are several lines of evidence (spatial disposition and structural style of the Palaeozoic and Triassic sediments, occurrence of olistostrome type diamictites of probable Permian/Early Triassic age along the Bentong - Raub line) to suggest that the eastern and western blocks were amalgamated probably during the Carboniferous - Lower Permian time and that the Triassic sedimentation occurred in post-amalgamation rift basins. The rifting and central belt magmatism seem to be related.

If the Carboniferous/Lower Permian amalgamation time is correct, then the Late Triassic granites may not be directly collision related. The absence of horizontal structures of the like found in typical overthrust belts of collision zones implies a very oblique collision and hence significant crustal thickening, a pre-requisite for collisional granite magmatism, can also be discounted. In view of this and taking note of the rift setting of the Triassic sediments, it seems likely that the Main Range and other Late Triassic granitoids are the products of remobilized crusts with steep thermal gradients. Higher heat production due to higher concentration of heat producing elements and pressure release in a tensional setting are probably responsible for the steep thermal gradients.

*****

Gondwana, Tethys and Peninsular Malaysia

I. Metcalfe, Jabatan Geologi, Universiti Kebangsaan Malaysia

Peninsular Malaysia comprises two tectonostratigraphic terranes bounded by the approximately north-south trending Bentong - Raub suture. The western part of the Peninsula, together with the Shan State of Burma, northwest Thailand, Peninsular Burma and Thailand and northwest Sumatra, forms the elongate tectonic block of Sibumasu. Stratigraphical, palaeon

tological and palaeomagnetic evidence suggest that Sibumasu had its origin in the southern hemisphere on the northwest Australian margin on Gondwana. The rifting of Sibumasu from Gondwana probably occurred in late Lower Permian times and amalgamation with Laurasia had occurred by the late Triassic at the latest. Much recent debate has centred on the timing of rifting of Sibumasu and other Southeast Asian blocks from Gondwana, their subsequent travel northwards across the Tethys ocean and their collision with Eurasia. The rifting of Sibumasu from Gondwana has been suggested by various authors to have occurred in the Late Devonian - Early Carboniferous, Early Permian, Late Permian - Early Triassic and Jurassic. Its collision with Eurasia has been suggested to have occurred in the Early Carboniferous, Middle - Late Permian, Late Triassic and Jurassic. As evidenced by these wide ranges of opinions, much geological groundwork is still required to constrain these timings.

The Malay Peninsula east of the 'Bentong - Raub line' formed part of 'Cathaysialand' during the Permian and amalgamation with the western part of the Peninsula (Sibumasu) has traditionally been taken as Late Triassic - Early Jurassic. However, an earlier suturing, either in the late Permian - Early Triassic or even in the Carboniferous is also possible. Much more detailed stratigraphical, palaeontological, palaeomagnetic and structural work is required to resolve the tectonic evolution of Peninsular Malaysia and results of ongoing and future research (which will be briefly discussed) have direct implications on any regional Eastern Tethyan palaeotectonic/palaeogeographic reconstructions.

*****

Occurrence of sheared diamictite in the Raub area, its possible extensions and tectonic implications

K.R. Chakraborty, Jabatan Geologi, Universiti Malaya and
I. Metcalfe, Jabatan Geologi, Universiti Kebangsaan Malaysia

Sheared diamictite has recently been discovered along the Krau Satu road and at Taman Indrapura, South of Raub town. These diamictites comprise angular to subrounded clasts of various sizes (a few milimetres to several metres) and lithologies (predominantly limestone, sandstone, tuff, mudstone and acidic volcanics) set in a muddy matrix.

Diamictites have also been recorded in several places between Raub and Bentong and near Karak, but in these localities they lack limestone clasts and precise age control but contain, in addition, conglomerate clasts.

In many exposures individual clasts show well preserved primary sedimentary structures including graded bedding, load casts and small scale cross bedding. While some clasts show evidence of deformation such as stretching and development of cleavage, many are internally undeformed due to rigid body rotation. The muddy matrix in these diamictites are variably sheared and cleaved and the shear planes and cleavages are commonly parallel to bedding though in places they have been observed to cut across the bedding.

Some limestone clasts are fossiliferous and yield conodonts and fusulinids of Permian (probably Guadalupian) age. This suggests that the diamictites cannot be older than early Late Permian and because of other geological considerations are most likely to be late Permian and/or early Triassic in age.

The occurrence of these diamictites define a relatively narrow zone along what has been referred to as the Bentong - Raub Line and are here regarded as being of regional tectonic significance. It is of interest to note that diamictites also occur near Genting Sempah and may form part of the same unit.

Currently available data on the diamictites do not allow a clear cut recognition as to wheterh they represent a tectonic melange of a sheared olistostrome. However, on grounds of Palaeozoic - Mesozoic stratigraphic and structural relationships, an interpretation of the diamictites as an olistostrome seems more probable.

*****

Geology of the Bahau area: tectonic implications

K.R. Chakraborty, G.H. Teh & C.A. Foss, Jabatan Geologi, Universiti Malaya

The Bahau area lies on or near to the Bentong - Raub line (occurrence of serpentinite, chert and schists) and hence bears directly on certain problems crucial to the understanding of the palaeotectonic evolution of the Malay Peninsula.

The timing of the fusion between the eastern and western blocks of the Malay Peninsula has been postulated in several published works to be Late Triassic. However, the geological evidence from the Bahau area (such as absence of strong penetrative deformation in the Carbon-Permian and Triassic sediments, occurrence of serpentinite bodies within only the older Palaeozoic rocks, etc.) suggests that the fusion episode probably occurred before Carbo-Permian time.

The Carbon-Permian shallow marine deposits (with a significant volume of conglomerates in the Bahau area) probably mark the initiation of post-collisional basin formation which became the dominant tectonic feature during the Triassic.

It is of interest to note also that a thin bedded turbidite sequence similar to the Semantan formation has recently been observed to rest unconformably on isoclinally folded Jelai limestone which may be older than the Carbo-Permian sediments.

*****

Fauna Trias di sekitar Kuala Lipis, Pahang

Mohd. Shafeea Leman, Jabatan Geologi, Universiti Kebangsaan Malaysia

Geologi kawasan sekitar Kuala Lipis hampir keseluruhannya dibentuk oleh jujukan batu pasir dan enapan turbidit bertuf yang berusia Trias. Sekurang-kurangnya lapan lokaliti utama fosil dengan lebih daripada dua puluh lima spesies telah dijumpai di dalan unit batu lumpur dan batu pasir bertuf.

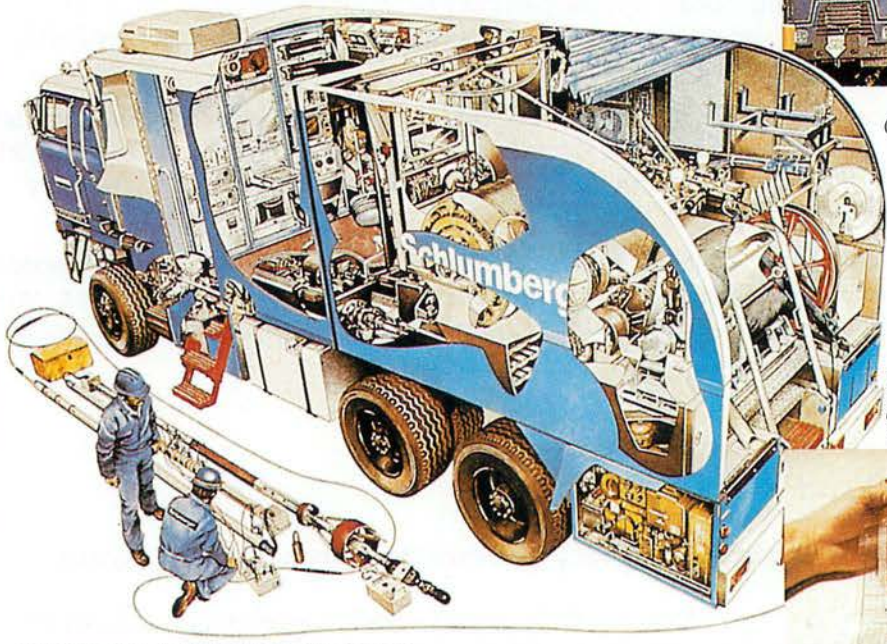
Moluska pelesipod dan sefalopod merupakan dua fauna yang paling banyak dan paling berpelbagai dijumpai di kawasan ini. Kumpulan fosil sampingan lain termasuklah gastropod, brakiopod dan krinoid, disamping sedikit tinggalan flora. Kehadiran beberapa spesies penting seperti ?Paraceratites trinodosus (Anisian), Daonella pahangensis (Ladinian), Hoernessia chobaiensis, Cassianella malayensis, Pteria pahangensis,

Schlumberger: services throughout Malaysia.

Schlumberger, the eyes of the oil industry, has provided services since the discovery of oil in Miri, Sarawak, several decades ago. Its commitment to high technology continues to provide the most cost effective results.

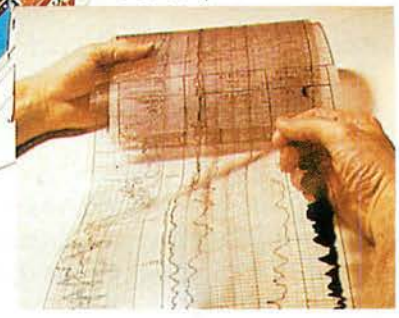
Schlumberger engineer at work with the Cyber Service Unit system inside a wireline logging Unit

Cyber Service Unit on location.



Schlumberger crew checking a logging tool.

Cyberlook, an interpreted log prepared at the wellsite by the CSU computer.



Schlumberger

3rd Floor, Wisma Bunga Raya, 152 Jalan Ampang, 50450 Kuala Lumpur.
Tel: 2485533/2485621/2485947. Telex: SCHLUM MA 31335. Cable: SCHLUMEAD.

Wellog (Malaysia): making full use of data.

Wellog (Malaysia), located in Kuala Lumpur, staffed with specialists, develops the answers with your experts.

It provides a full range of data processing services:

- *Open Hole Log Evaluation*
- *Key Well Study*
- *Reservoir Description Services*
- *Cased Hole Reservoir Analysis*
- *Production Flow Analysis*
- *Well Seismic Processing*
- *Facies Analysis*
- *Dipmeter Processing*
- *Permeability Evaluation*

Our specialists evaluating a set of logging data.

Wellog (Malaysia) Sdn. Bhd.

3rd Floor, Wisma Bunga Raya,
152 Jalan Ampang, 50450 Kuala Lumpur.
Tel: 2434622/2434776/2434890.
Telex: SCHLUM MA 31335.
Cable: SCHLUMEAD.

Costatoria quinquicostata dan Costaria pahangensis (? Karnian) dan asosiasinya menunjukkan bahawa fauna ini mempunyai julat usia daripada Trias Tengah (?Anisian) hingga Trias Akhir (? Karnian).

*****

Geologi dan stratigrafi di kawasan Labis, Johor

Zakaria Hussain, Jabatan Penyiasatan Kajibumi Malaysia

Pemetaan geologi secara bersistem pada skala 1:63360 di kawasan Labis telah dijalankan dalan tahun 1983-1986 yang meliputi keluasan sekitar 1215 km persegi. Stratigrafi kawasan ini menunjukkan batuan-batuan yang berusia dari Perm Atas hingga Resen. Formasi Lop merupakan batuan yang tertua sekali, terdiri daripada selang lapis sabak, filit, metabatu lodak, metabatu pasir dan sedikit metakonglomerat. Terdapat juga tuf hablur, tuf hablur litik dan aglomerat yang mengalami metamorfisme yang rendah. Usia Formasi Lop ditentukan dengan terdapatnya fosil-fosil devikatup yang berusia Perm Atas. Formasi ini dipercayai dienapkan di sekitaran pantai yang cetek. Volkano Sedeli dipercayai terletak secara selaras di atas Formasi Lop, dan terdiri daripada batuan piroklast asid yang mengalami metamorfisme lemah. Formasi Gemas yang berusia Trias Tengah hingga Taias Atas terletak secara tak selaras di atas batuan volkano Sedeli. Formasi Gemas pula terdiri daripada terutamanya tuf hablur dan selang lapis syal, syal bertuf, tuf litik serta sedikit aglomerat, batu lodak dan batu pasir. Granit Gunung Bekok yang dianggarkan berusia Trias Atas telah merejah batuan yang lebih tua, dan terdiri daripada kebanyakannya granit biotit berbutiran sederhana ke kasar dengan sedikit granit biotit sangat kasar berporfiri, granodiorit, monzodiorit kuarza dan diorit kuarza. Formas Paloh yang berusia Jura Atas hingga Kapur Bawah berada secara takselaras di atas batuan yang lebih tua. Formasi ini merupakan batuan endapan daratan yang terdiri daripada selang lapis batu pasir padat, batu pasir berperlapisan silang, syal, batu lodak, batu lumpur dan konglomerat.

Kebanyakannya berwarna kemerahan. Batu rejahan minor yang terdiri daripada mikrogranodiorit Chaah dan mikrogranit Pagoh dijangka berusia Kapur Atas. Aluvium resen yang merupakan endapan permukaan yang tidak terkonsolidasi terdiri daripada pasir, lodak dan tanah liat mengisi lembah-lembah sungai dan paya.

*****

Survei kegagalan cerun, Lebuh Raya Timor-Barat, Perak-Kelantan

Abdul Ghani Rafek & Ibrahim Komoo, Jabatan Geologi, Universiti Kebangsaan Malaysia

Survei kegagalan cerun telah dilakukan di sepanjang Lebuh Raya Timur-Barat untuk mengelaskan jenis kegagalan, jenis bahan yang terlibat serta faktor utama penyebab kegagalan cerun. Bahagian lebuh raya dari Jeli ke Sri Banding diutamakan dalam survei ini.

Batuan metasediment berusia Paleozoik Bawah yang direjah oleh pluton batuan granit tersingkap di kawasan kajian. Filit, skis kuarza-mika dan kuarzit merupakan metasediment yang utama, sementara skis amfibol sebagai kekanta di dalamnya. Kebanyakan granit di kawasan ini berbutir kasar dan sedikit berporfiri. Terdapat juga granit berbutir sederhana dan halus.

Kegagalan cerun yang berlaku dengan kekerapan yang tinggi sekali ialah gelinciran tanah. Gelinciran tanah terdapat dalam bahan luluhawa granit, metasediment dan juga bahan tambakan. Tanah yang gagal berupa bahan terluluhawa bergred IV, V dan VI. Satah gelinciran didapati seringkali terletak di antara lapisan gred IV dan V. Ada juga satah gelinciran yang terletak di antara lapisan gred III dan IV, khususnya dalam batuan metasediment. Teknik tambakan yang kurang sempurna nampaknya penyebab utama kegagalan cerun tambakan.

Kegagalan cerun batuan mengambil tempat kedua mengikut kekerapan, dan berlaku pada kedua-dua jenis batuan utama. Orientasi ketakselanjaran merupakan penyebab utama jenis kegagalan ini, diikuti oleh pelonggaran jasad batuan akibat luluhawa, bahan pengisi ketakselanjaran dan kehadiran air.

Bahan terluluhawa yang peroi serta air laluan menyebabkan kegagalan hakisan. Bahan gred V menimbulkan masalah kegagalan hakisan yang utama.

*****

Damsite investigations in the Bentong area, Pahang Darul Makmur

Tan Boon Kong, Jabatan Geologi, Universiti Kebangsaan Malaysia

This paper presents the results of damsite investigations carried out recently in the Bentong area, Pahang Darul Makmur.

Three damsites were investigated, namely:

1. *The Upper Sungai Perting Dam*
2. *The Lower Sungai Perting Main Dam, and*
3. *The Lower Sungai Perting Saddle Dam.*

Each of the three damsites mentioned above were investigated by 3 boreholes drilled to at least 6 metres into the bedrock. Besides taking soil samples for standard laboratory tests, field tests were also conducted and these include the Standard Penetration Test (SPT), Borehole Permeability Tests for the soil, and Packer Test for the bedrock.

The Upper Sungai Perting Damsite is underlain by granite occurring at depth ranging from 0 m (river exposure) to 21.0 m at the left abutment. Permeability of bedrock can be as low as 0 cm/sec (massive bedrock or tight joints). Residual granite soils consist mainly of clayey sand and sand.

The Lower Sungai Perting Main Dam and Saddle Dam are underlain by graphitic schist occurring at depths of 9.0 m to greater than 60 m. The schist bedrock is highly foliated, fractured and brecciated, giving rise to high permeability values generally of the order of 0.1 to 1.0 cm/sec. Permeability values of the residual schist soils are even higher, and are generally of the order of 1.0 to 10 cm/sec. Residual schist soils are predominantly clayey silt.

Based on geologic considerations, the Upper Sungai Perting Dam appears to be a better site than the Lower Sungai Perting Scheme.

*****

Geotechnical instrumentation at Batu Dam, Kuala Lumpur

Saim Suratman, Jabatan Penyiasatan Kajibumi Malaysia

The construction programme of Batu Dam was started in July 1984 and expected to be completed in the middle of 1987. The dam and its various structures (embankment, outlet works, spillway, etc.) are founded on the decomposed to fresh Hawthornden schist of Silurian age. The major part of the downstream embankment is founded on a gravel layer.

Various types of instruments namely vibrating-wire piezometers, inclinometer, porous-tube piezometers, measurement points and seepage weirs are installed at Batu Dam to monitor the performance of the dam embankment, foundation, abutments and structures during construction and after completion of the dam.

*****

Seismic refraction survey for the Chenderoh Dam rehabilitation study

Jamaludin bin Othman, Dzazali Haji Ayub & Sukri bin Ghazali, Jabatan Penyiasatan Kajibumi Malaysia

The rehabilation study of the Chenderoh Dam has been carried out by Shawinigan Consultatns Inc. (Canada) on behalf of Lembaga Letrik Negara (LLN) to increase the production of hydro-electric power. Part of the study involves investigating the feasibility of deepening the downstream section of the river to obtain a smoother flow which would increase the efficiency of the turbines. A knowledge of the bedrock profile together with its physical characteristics (strength) is useful in the assessment of the type and cost of excavation required. The process of excavation normally involves ripping and/or blasting.

A seismic refraction survey across the Perak River was therefore undertaken to study the profile and quality of the bedrock. This is the first time that such a survey has been carried out by the Geological Survey of Malaysia. To make measurements across the river, the normal field technique had to be modified. This involved fixing shot points at 5 m interval, up to 40 shots per line across the river, and planting three geophones on each bank. The results of the survey indicated that the rock mass is non-rippable. The cost of excavation by blasting is prohibitively high for the consultants to undertake the task of deepening the river channel.

*****

The depositional setting of the Lawin Basin deposits

Syed Sheikh Almashoor & Mat Arifin Ismail, Jabatan Geologi, Universiti Kebangsaan Malaysia

A mapping exercise carried out in the Lawin area, Perak has revealed that Jone's (1970) Tertiary Lawin Basin Deposits underlie an area of approximately 22 ½ square kilometers, or about five times larger than that reported by him. The Lawin Basin Deposits consist of various mixture of sand, pebbles, cobbles and boulder in the lower sections and granite outwash in the upper parts.

The Deposits crop out as an elliptical body within the Bok Bak fault zone. The long axis nearly parallels the Bok Bak fault-strike. The sediments are believed to be genetically related to the Bok Bak fault.

*****

Batuan berusia Perm di bahagian barat dan barat laut Johor

Wahid Abdul Rahman, Jabatan Penyiasatan Kajibumi Malaysia

Batuan berusia Perm di bahagian barat dan barat laut Johor telah ditemui semasa kerja-kerja pemetaan geologi dilakukan di kawasan pemetaan Syit 123 (Yong Peng), Syit 116 (Labis) dan Syit 106 (Bata Anam). Sebelum daripada ini belum ada laporan ataupun penerbitan yang menyatakan kewujudan batuan berusia Perm di kawasan yang dimaksudkan. Batuan berusia Perm di negeri Johor sememangnya telah diketahui tersebar dengan begitu meluas di bahagian timur Johor khususnya ke sebelah timur jasad granit tengah Johor. Dengan penemuan ini telah melebarkan lagi sebaran batuan berusia Perm di negeri Johor khususnya de kawasan di sebelah barat jasad granit tengah Johor. Pengenalan usia Perm untuk kumpulan batuan ini berpandukan kepada kandungan fosil yang terkandung di dalam batuan berkenaan. Antara fosil-fosil-fosil yang telah ditemui dan dikenalipasti ialah Pachyphloia sp., Solenomorpha sp., Siphogrammysia cf. kasanensis, Agathiceras, Leptodus dan Retimarginifera. Batuan utama di sini terdiri daripada sedimen, piroklas dan aliran lava. Sebahagian besar daripadanya telah termetamorf dengan darjah metamorfisme yang berbeza-beza daripada rendah ke sederhana.

*****

Igneous petrography and geochemistry of the Bukit Payong - Penghulu Diman area, Terengganu

Uzaymee Mohd. Yusof, Jabatan Geologi, Universiti Malaya

The Bt. Payong - Penghulu Diman area, Terengganu consists mainly of metamorphic, gabbroic, granitic, acid and basic hypabyssal rocks and alluvial deposits.

The gabbroic rocks in the study area include olivine gabbro and hornblende gabbro. The gabbroic rocks are believed to predate or are almost contemperanous with the granitic rocks.

The granitic rocks in the study area include olivine gabbro and hornblende gabbro. The gabbroic rocks are believed to predate or are almost contemporaneous with the granitic rocks.

The granitic rocks in the study area are divided into 4 units, namely:

1. *Hornblende-biotite granodiorite*
2. *Biotite-hornblende adamellite*
3. *Biotite adamellite*
4. *Pink biotite granite*

Unit 1 is homogeneous, medium grained, equigranular and is characterised mineralogically by the presence of primary biotite and hornblende. Unit 2 is generally homogeneous, medium to coarse grained, equigranular and is characterised mineralogically by the presence of primary biotite

and high modal hornblende. Unit 3, is homogeneous, medium grained and is characterised mineralogically by the presence of primary biotite. Unit 4 is homogeneous, medium to coarse grained, equigranular to weakly porphyritic and is characterised mineralogically by the presence of primary biotite and pink alkali feldspar. The granitoids in the area range in age from Permian to Triassic (Bignell and Snelling, 1977, Liew, 1983).

The basic hypabyssal rocks in the area are further divided into 3 main types namely:

1. *Porphyritic basaltic dykes*
2. *Microgabbroic dykes*
3. *Anorthositic microgabbroic dykes*

The basic hypabyssal rocks were dated as Jurassic (Bignell, 1972).

The acidic hypabyssal rock in the area occur as microporphyritic rhyolitic dykes and is believed to be contemporaneous in age with the basic hypabyssal rocks.

Geochemically the gabbroic rocks fall inthe Shoshonite and strongly alkaline regions. The granitoids in the study area, show a calc-alkaline trend and fall within the compositional field of I-type granitoids. The narrow range of D.I. value in the granitoids strongly suggest that the granoitoids are derived from a similar magma, differentiated and evolved into different granitoids. The hypabyssal rocks in the study area fall within the calc-alkaline to high calc-alkaline region and high-alumina basalt to sub-alkaline. The hypabyssal rocks could probably be the parental magma for the granitoids in the area.

*****

Petrology and petrochemistry of the granites in the Gunung Ledang area, Johore

Askury Abd. Kadir, Jabatan Penyiasatan Kajihumi Malaysia

The Gunung Ledang pluton, a northeast trending elliptically shaped body covers an area of about 100 sq. km. It can be broadly divided into two types, viz: the predominant Ledang-type (medium-grained, quigranular pink granite) and the minor Bekoh-type (microgranite). Generally, the Bekoh-type occurs as enclaves ranging in size from several m to 100 m in diameter within the Ledang -type. It is believed that these two types were emplaced during the same episode with slight differences in their histories of crystallization, assimilation and enrichment of residuals.

The chemical variation diagrams show that this pluton can be termed as oversaturated (acidic) granite with relatively high silica contents (73.8 - 77.1%) and high differentiation indices (88 - 94). It can be classified as an S-type granite with characteristically high values for normative corundum, ALMO, SiO_2 and Sr ratio, thus indicating that the pluton may have been formed by the process of partial melting or anatexis of metasedimentary rocks.

The pluton is epizonal in nature based on the major and trace elements, the contact metamorphic aureole and the colour of the rock itself (pink). Age determinations done by the previous workers suggested that this pluton was emplaced during the Late Cretaceous.

*****

Some characteristics of heavy detrital mineral grains from Peninsular Malaysia

Wan Fuad Wan Hassan, Jabatan Geologi, Universiti Kebangsaan Malaysia

Over a hundred samples of alluvial tin concentrates taken from various tin-fields of Peninsular Malaysia have been examined, and the results of the observations are hereby presented.

In terms of mineralogical associations, concentrates from known pegmatitic areas show an abundance of columbite-tantalite, pyrometasomatic concentrates with magnetite, and the hydrothermal cassiterites with a variety of minerals from sulphides to oxides. The forms and shapes of individual mineral grains tend to show variation and they are also related to the types of tin deposit. Cassiterite in particular shows a variety of forms. In addition to the common tetragonal form, pegmatitic cassiterite from Semiling and Bakri has peculiar 'squat bipyramidal' and 'elongated wedge-terminated' shapes, whereas those from the east coast have 'wood tin' forms.

The characteristics of the heavy detrital minerals are useful guides that could be used to characterise the various tin-fields of Peninsular Malaysia, in view of the difficulty in obtaining fresh primary ore samples due to the tropical weathering conditions.

*****

A preliminary assessment of the mineral potential in the proposed Nenggiri Dam reservoir area, Kelantan

Teoh Lay Hock, Jabatan Penyiasatan Kajibumi Malaysia

Penentuan awal mengenai potensi mineral dilakukan di kawasan cadangan kolam air Empangan Nenggiri melalui percontohan sedimen, bahan konsentrat, air sungai dan juga batuan.

Sejumlah 36 anomali disempadankan, empat daripadanya diberikan keutamaan 1 (memerlukan kajian susulan segera), lima keutamaan 2 (memerlukan kajian susulan kemudiannya), 18 keutamaan 3 (kajian susulan mungkin boleh dijalankan). Anomali-anomali lain diberikan keutamaan 4 (tidak memerlukan kajian susulan).

Anomali yang menunjukkan potensi yang terbaik ialah satu anomali Au-U yang berpusat berdekatan Kuala Sungai Rela. Pemineralan emas berkemungkinan berkaitan dengan rejahan diorit. Percontohan bahan konsentrat sungai yang lebih dekat, penggerimitan cubaan, diikuti dengan percontohan tanah, jika perlu, dicadangkan. Untuk tiga anomali keutamaan 1 yang lain pula, dicadangkan keluasan mereka ditentukan terlebih dahulu.

*****

Teknik analisis pengaktifan neutron (NAA) dalam kajian geologi

Abdul Khalik Hj. Wood, Zaini Hamzah & Daud Mohamad, Unit Tenaga Nuklear

Analisis pengaktifan neutron (Neutron Activation Analysis) merupakan teknik analisis yang telah banyak digunakan dalam kajian geologi. Kegunaannya yang meluas adalah disebabkan oleh kepekaannya, kebolehsuaian (adapta-

bility) terhadap jenis-jenis sampel dan kebolehannya memberikan maklumat unsur yang banyak serentak. Rawatan kimia tidak perlu bagi teknik ini, oleh itu masalah gangguan bahan kimia terhadap analisis tidak timbul. Pemilihan masa penyinaran dan penyejukan yang sesuai boleh mengurangkan gangguan daripada unsur-unsur yang mengganggu (interference elements).

Kertas kerja ini akan membincangkan mengenai teknik analisis pengaktifan neutron, kemudahan teknik ini di Unit Tenaga Nuklear, penganalisisan beberapa contoh SRM dari USGS dan IAEA dan kemungkinan penggunaannya dalam kajian geologi.

*****

The Cu-Fe-Sn-S system at 600^{o}C and its geologic significance

G.H. Teh, Jabatan Geologi, Universiti Malaya

The Cu-Fe-Sn-S system is one of the many geologically important systems.

The quaternary phases stable at 600^{o}C include stannite (Cu_2FeSnS_4), stannoidite ($Cu_8Fe_3Sn_2S_{12}$) and rhodostannite ($Cu_2FeSn_3S_8$) which are all in equilibrium with liquid sulphur. Stannite is also stable with both stannoidite and rhodostannite at 600^{o}C.

Stannoidite forms extensive solid solution with the Cu-rich end of the intermediate solid solution (i.s.s.) and is connected by tie lines to bornite (Cu_5FeS_4), Cu_4SnS_4, Cu_2SnS_3, pyrite (FeS_2) and the Cu-rich half of the Cu-Sn-S melt.

Rhodostannite is stable at 600^{o}C with pyrite, pyrrhotite, berndtite, ottemannite and herzenbergite.

The ternary phases stable at this temperature include Cu_2SnS_3, Cu_4SnS_4, $Cu_2Sn_3S_8$, the Cu-Sn-S ternary liquid, intermediate solid solution (i.s.s.) and the bornite solid solution.

The binary phases existing at 600^{o}C include pyrite (FeS_2), pyrrhotite solid solution ($Fe_{1-x}S$), herzenbergite (SnS), ottemannite (Sn_2S_3), and berndtite (SnS_2) and the chalcocite-digenite solid solution.

*****

Volcanogenic barite, Fe and Mn oxide and massive sulphide mineralization at Cini area, Pahang Darul Makmur

G.H. Teh, Jabatan Geologi, Universiti Malaya & R.W. Hutchinson, Department of Geology, Colorado School of Mines, Golden, Co., USA.

This paper represents a preliminary report on the volcanogenic barite-Fe & Mn oxide-massive sulphide mineralization at Bukit Botol, Cini, Pahang Darul Makmur.

Ferruginous bedded barite underlies a hanging wall of metasediments and is in turn underlain stratigraphically by bedded, manganese-rich iron oxides, mainly hematite, probably as martitized magnetite. The dark ferruginous barite is cut by veinlets of coarse crystalline barite, probably remobilised by a very local lateral secretion process or metamorphism.

Footwall metasediments underlie the manganese-iron rich unit and this is in turn underlain deeper in the succession by tuff and associated massive, banded sulphide mineralization. This consists of massive pyrite on top, followed by pyrite-quartz-sphalerite, pyrite-pyrrhotite-chalcopyrite and stratigraphically lower are alternating layers of pyrite-quartz mineralization.

The lower massive sulphides are cut by a network of disseminated stringers of chalcopyrite, bornite and supergene covellite and this is in turn underlain by intense silification.

*****

Depositional environment of the Paloh bed sequence near Paloh, Johor

Ahmad Jantan, Jabatan Geologi, Universiti Kebangsaan Malaysia

A small hill, ½ km to the south of Paloh town, Johor, trimmed for the purpose of a housing project, exposes an excellent, about 160 m thick upward-coarsening sequence which begins from structureless mudstone at the bottom, grading up into mudstone with thin (about 2 cm to 5 cm thick) parallel - laminated very fine-grained sandstone, silty mudstone with thin (about 5 cm thick) parallel and cross-laminated very fine-grained sandstone, into siltstone with thicker (up to 30 cm thick) cross-laminated fine-grained sandstone. This is cut by erosive-based, over 2 m thick, channelised, small-scale trough cross-bedded sandstone bodies. A clay bed, rootleted in the lower part and rich in plant remains in the upper part, topped the sequence.

This sequence is interpreted as representing prograded and abandoned mouth-bar sequence.

*****

Facies model of the Triassic Semanggol Formation sequence at Pedu Dam, Kedah

Ahmad Jantan, Basir Jasin, Ibrahim Abdullah, Abdul Rahim Samsudin & Uypo Said, Jabatan Geologi, Universiti Kebangsaan Malaysia

A winding disused road leading up to an abandoned quarry in the vicinity of Pedu Dam area, Kedah, patchilly exposed two thick, coarsening and thickening upward sequence representative of the configuration of prograding submarine fan complex. Progradation, abandonment and switching of sublobes, and possibly switching of a fan complex could be demonstrated.

Erosively cut, stacked-up, channel-shaped, poorly sorted, matrix-supported granule to cobble conglomerate bodies eroding into very thickly bedded, graded to massive sandstone beds indicate a mid-fan situation.

Groove and flute casts have not been seen at the bases of turbidite sandstone beds and suggest that scouring of the substratum by the sediment-laden turbidity currents is minimal.

Slump-folds and channels axis suggest a east-northeast to north-northeast palaeoslope.

*****

Some new features of Semanggol Formation observed at Bukit Barak, Kuala Nerang, Kedah

Basir Jasin, Ahmad Jantan, Ibrahim Abullah, Abdul Rahim Samsudin & Uyop Said, Jabatan Geologi, Universiti Kebangsaan Malaysia

An earth quarry at Bukit Barak, Kedah, exhibits several interesting features of the Semanggol Formation. Burton (1973) subdivided the formation into three members, namely from bottom to top, the Chert Member, the Rhythmite Member and the Conglomerate Member. The outcrop shows sheared zones and faults, including a major thrust, cutting across the hill and brought the two members adjacent to one another. A section on the west flank of the hill (Section A) is about 30 m thick and belongs to the Chert Member. It consists of over 5 m of thinly bedded siliceous shales, about 20 m of variously interbedded chert, calcareous chert and siliceous limestone, and about 5 m of siliceous shales with very thin interbeds of muddy limestone and limestone lenticles. Calcispheres occurrence in the limestones indicate a pelagic origin; and together with the micritic nature of the limestone interbeds and lenticles, suggest a deep water environment for the sequence. The other section (Section B) is about 60 m thick and belongs to the Rhythmite Member. It consists predominantly of siliceous rhythmite with occassional, 5 cm to 15 cm thick, turbidite sandstone in the lower part and several channelised units, 0.5 m to 2 m thick, infilled with sands in the middle part. The sands contain impressions of fragments of bivalves, brachiopods, crinoid stems, corals and bryozoa which were apparently derived from the shelf areas. The calcareous fragments were brought down to the deep basin areas and underwent dissolution. This suggest an environment of deposition just below Calcite Compensation Dept.

*****

Sedimentology of the 'Passage Beds' of the Chuping Formation in the Bt. Temiang - Bt. Tengku Lembu Ridge, Perlis

Ann Yasmin Nordin, Jabatan Geologi, Universiti Malaya

The 'Passage Beds' is a popular term given by past workers to the transition of beds from the Kubang Pasu Formation into the Chuping Formation in Perlis.

The 'Passage Beds' reflect an interesting gradual facies change from a predominantly clastic environment to one of pure limestone. This paper attempts to investigate the probable conditions and environmental controls that were present during that time (Carboniferous-Permian) which could have account for the change.

The transition is investigated through several aspects; mainly through sedimentary field rrlationships, petrography and its faunal association.

*****

Permian glacigenic deposits at Salak Tinggi, Selangor

H.D. Tjia & Anizan Isahak, Jabatan Geologi, Universiti Kebangsaan Malaysia

In the vicinity of the Sepang District Office, Salak Tinggi, outcrops a well-bedded Permian sereis (Agathiceras sp.; Abdullah Sani Haji Hashim, 1986) of mainly white phyllite with thin metasandstone interbeds, thicker metasandstone layers, and several metres-thick diamictite horizons. The series is folded into a large, 340° - striking, west-verging overturned anticline that contain smaller folds of similar style. The diamictite horizons may consist of irregularly disrupted beds (arenaceous and argillaceous); of up to several meters long, irregular clasts of medium to coarse-grained metasandstone and phyllite; and of rounded to subangular pebbles to boulders of metasandstone, quartz/metaquartzite, rare crenulated schist in an argillaceous or arenaceous groundmass. Some of the larger fragments were folded or deformed into contorted shapes. Around the pebbles-boulders may be seen laminations forming sag structures, which together with the presence of pebbly mudstone suggest the clasts to be dropstones. The medium to coarse-grained metasandstone beds and fragments contain subhedral 2-3 mm large grains of (now weathered) feldspar, implying that chemical weathering was insignificant during the time of deposition.

The Late Palaeozoic age of the metasediments, the presence of diamict horizons, non-weathered and non-abraded feldspar, dropstones (especially in the pebbly mudstone), occasional slide marks in association with well-bedded sediments suggest to us that the Salak Tinggi deposits were most probably formed in the vicinity of Gondwanaland in a marine environment that was sufficiently shallow to allow larger icebergs to develop ice-push structures (disrupted bedding, contortions and local folds) in the bottom sediments. We also suggest that the Salak Tinggi Singa Formation (Langkawi islands), the Bohorok Formation (Northern Sumatra), and the Phuket Group (Southern Thailand).

*****

Perkembangan struktur berskala kecil dalam batuan Ahli Gersik Formasi Setul di Pulau Tuba, Kepulauan Langkawi

Ibrahim Abdullah, Jabatan Geologi, Universiti Kebangsaan Malaysia

Kajian pada struktur-struktur berskala kecil mendapati batuan Ahli Gersik Formasi Setul di kawasan Pulau Tuba telah mengalami tiga kali canggaan yang masing-masing dapat dikaitkan dengan tiga fasa perlipatan. Canggaan pertama yang menerbitkan lipatan isoklin hingga rebah dengan paksi menunjam ke arah hampir utara, telah menyebabkan terbentuknya struktur-struktur lain seperti 'boudinage', lipatan minor, ira sabak dan ira retakan. Pada peringkat akhir fasa canggaan pertama terbentuk telerang kuarza yang selari dengan satah ira sabak. Canggaan kedua yang menyebabkan pembentukan lipatan tak simetri dengan paksi menunjam ke arah hampir 80° turut mempengaruhi pembentukan struktur di sini. Struktur seperti lipatan pada telerang kuarza, lipatan minor, ira kerdut, jalur kercau dan jalur ricih terbentuk semasa canggaan tersebut. Pada peringkat akhir canggaan kedua ini terbentuk lagi telerang kuarza yang memotong ira sabak dan juga telerang yang terbentuk semasa canggaan yang pertama. Canggaan yang ketiga menyebabkan paksi lipatan minor generasi pertama dan

kedua turut terlipat semula dengan arah paksi juga hampir ke utara. Pada fasa canggaan ini juga sekali lagi terbentuk ira kerdut, lipatan pada telerang kuarza dan jalur ricih dengan kedudukan yang berbeza daripada yang terbentuk semasa canggaan yang kedua.

*****

Struktur dalam zon ricih di kawasan Genting Sempah, Selangor

Zaiton Harun, Jabatan Geologi, Universiti Kebangsaan Malaysia

Di km 35 lebuh raya Kuala Lumpur - Karak tersingkap suatu zon ricih sepanjang lebih 100 m. Zon ricih ini merupakan sebahagian daripada jalur singkapan Genting Sempah. Zon ini terapit oleh Rijang Gombak di bahagian timur dan oleh Skis Selut di baratnya. Kedua-dua Rijang Gombak dan Skis Selut berumur Paleozoik. Batuan zon ricih ini terdiri daripada milonit, filonit, lutit yang mengandungi klasta-klasta kuarza, skis kuarza, skis kuarza-mika, skis grafit, filit, rijang, metaargilit, beberapa jenis batu pasir, baut lumpur dan konglomerat. Secara umum batuan Paleozoik ini menjurus ke arah barat laut dan miring ke timur laut. Jujukan struktur yang terdapat di sini ialah mendatan, lipatan rebah yang berkaitan dengan sesar sungkup songsang ke arah barat, lipatan condong yang berkaitan dengan sesar jurus dan sesar normal yang menempati satah-satah sesar yang telah sedia ada.

*****

Struktur di sedimen kawasan Tamparuli, Sabah: implikasinya terhadap sekitaran pengendapan

Tajul Anuar Jamaluddin, Jabatan Geologi, Universiti Kebangsaan Malaysia

Kajian yang telah dijalankan ke atas jujukan sedimen Formasi Crocker (Collenette, 1958) di Tamparuli, Sabah menunjukkan bahawa kawasan tersebut melimpah dengan berbagai-bagai jenis struktur primer. Struktur primer yang ditemui dikelaskan kepada enam kumpulan yang utama; (a) struktur linear perlapisan, (b) struktur satah perlapisan, (c) struktur hakisan, (d) struktur canggaan dan gangguan semasa pengendapan, (e) struktur penokokan, dan (f) struktur organik/biogen.

Sebahagian besar daripada struktur primer yang ditemui jelas mewakili sedimen jujukan turbidit fasies flysch bersekitaran pengendapan laut dalam. Bagaimanapun kehadiran struktur-struktur seperti kesan riak beralunan, lapisan riak bertindihan bebola lumpur, rekahan lumpur, fosil serpihan kayu, lapisan nipis lignit, fosil surihan fasies Skolithos (Skolithos, Scoyenia, dan ?Thallassinoides), mengimplikasi sekitaran samudera cetek berair tenang hingga daratan.

*****

Sedimentologi of the Gua Sai limestone, Kuala Lipis, Pahang

Lim Heng Gaul, Jabatan Geologi, Universiti Malaya

Gua Sai limestone, located 5 miles towards the northeast of Kuala Lipis has been dated Carboniferous by previous workers. Recent studies on conodont palaeontology indicates that the Gua Sai limestone have been

formed in the Permian (per. comm. with Metcalfe, I.).

The microfacies identified in this limestone are:

1. *echinodermal-algal boundstone*
2. *bioturbated-peloidal grainstone*
3. *peloidal grainstone*
4. *graded oolitic-peloidal grainstone*
5. *fissure-filling dolomite*

The fissure-filling dolomite facies are syndepositional dolomites as fillers and occupy substantial pore spaces of the echinodermal-algal boundstone. This is later succeeded by shallowing upward sequence of the bioturbated-peloidal grainstone and the peloidal grainstone, the later two facies appear to be a lateral variation of the graded oolitic-peloidal grainstone facies.

The sequence of microfacies and the sedimentary structures of the Gua Sai limestone records the initial buildup of an algal mound in a relatively shallow and quiet environment within the photic zone. Dolomitization, shallow water (intertidal-upper subtidal) sedimentation and calichification indicates that the algal mound was later progressively subjected to a relatively high energy environment culminating in the emergence of the mound.

*****

A preliminary model for the stratigraphic-tectonic evolution of Eastern Borneo

C.S. Hutchison, Jabatan Geologi, Universiti Malaya

Eastern Borneo has been nucleated since Late Cretaceous time around the Miri Zone, whose basement like the Luconia Province with which it is continuous, appears to be a microcontinent rifted from Vietnam or South China.

The eastern margin of the Miri Zone is interpreted as an Atlantic-type continental margin, with downfaulted continental crust giving way eastwards to Late Cretaceous to Eocene oceanic lithosphere (Chert-Spilite Formation), of the same age as the ocean floor of the Celebes Sea marginal basin.

The NE-trending Rajang Group was deposited as a Late Cretaceous to Paleogene turbidite fan directly on this oceanic crust ('Crystalline Basement' and Chert-Spilite Formation).

Eastwards subduction of the oceanic basement resulted in the western and northern Sulawesi Volcanic Arc. Continuing subduction narrowed the marginal sea basin, causing growth of an accretionary prism and shoaling of the infilling flysch basin (Rajang Group) to locally give carbonate reefs through the Paleogene.

By Early Miocene time, the Rajang Group flysch basin had been compressed between the Miri Zone microcontinent and the Sulawesi arc-trench system into a fold-thrust collision orogenic zone. Ophiolite was obducted and it shed blocks of itself into extensive olistostrome deposits of the Dent and Segama Valley Areas.

Thrust tectonics, as the Miri Zone underthrust the Rajang Group,

resulted in Late Oligocene-Early Miocene granite intrusions in the Long Laai, and Late Miocene in the Mount Kinabalu area. The tin mineralization of the Long Laai plutons is interpreted as mobilized from the Miri Zone underthrust basement.

Aulacogen-like rift arms extended outwards from the opening Makassar Straits, and the rift system was filled by fluvio-deltaic sediments of the Tanjong Formation, which is oil, gas and coal-bearing in the Tarakan Basin, but unexplored for oil in Sabah, although its coal deposits are well known at Silimpopon.

*****

A study of groundwater hydrology in Kedah-Perlis area with environmental isotopes

Daud Mohamad, Roslan Mohd. Ali & Wan Zakaria Wan Mohd. Tahir, Unit Tenaga Nuklear, Bangi

In this paper, the results of an environmental isotope hydrological study from thirty-nine sampling sites in the Kedah-Perlis area are discussed.

a) *The groundwater in the study area shows a narrow range of variation; -7.69 to -5.06% for ^{18}O and -49.4 to -35.5% for ^{2}H. Based on $\delta D - \delta O$ plot, the waters in the area could be divided into two groups (a) southern part, with more negative values of ^{18}O and ^{2}H, and (b) northern part with a generally enriched stable isotope concentrations. This suggests that the waters in the area belong to two different catchments, indicating two water regimes.*

b) *Isotopic results indicate the occurrence of two types of waters, namely that has been recharaged from the highland, and local recharge in the southern part.*

c) *The groundwater of the area probably originates from two sources, i.e. coastal and highland sources, based on T and ^{18}O distribution.*

d) *The isotopic composition of some groundwaters has been affected by evaporation, as exemplified by samples from localities 13 and 38.*

e) *Tritium content in the groundwater varies from 0.3 to 7.1 TU. Such feature shows that this groundwater comprises of recent, mixture and old water components.*

*****

Diagnostic resistivity sounding curves of karstic aquifers in the Chuping limestone

Mohammed Sayyadul Arifin, Pusat Pengajian Kejuruteraan Sumber Bahan & Mineral, & C.Y. Lee, Pusat Pengajian Fizik, Universiti Sains Malaysia

The DC resistivity method has been used extensively in recent years to identify and locate karstic aquifers in Perlis. It is generally believed that this method has not been successful in finding such aquifers in the state. One reason for the failure is that the thickness of the karstic zone and its resistivity contrast with adjacent layers are not large enough to be detected by this method. The second reason is that the depth

of investigation was probably insignificant to detect any water-bearing fractured or cavity zone in the limestone at depth.

While the above statement may be true for the Setul limestone and other formations in Perlis, it is not quite true for the Chuping limestone. Resistivity sounding data from the Chuping limestone area are four-layer curves. The minima of these curves are related to water-bearing fratured limestone. It is interesting to note that all these sounding cruves are very similar in shape, and in some cases, in the magnitudes of apparent resistivity. The lithologic logs at or near these soundings show more or less similar subsurface conditions. Interpretation of the available resistivity and borehold data indicates that the fractured zone in the Chuping limestone runs along the north-south direction.

*****

Groundwater supply studies in Northern Kelantan

Tan Eng Heng & Mahan Singh, Syed Muhammad, Hooi & Binnie Sdn. Bhd.

Hydrological investigation was undertaken to evaluate the groundwater resources that would meet or contribute to the water supply needs of Northern Kelantan. A total of 24 exploration wells and two production wells were drilled at localities where the aquifer was most likely to be productive. Based on the results, the shallow aquifer is favoured for development because it has good quality water, gets recharged readily and wells are shallow giving rise to low construction and pumping cost. The 3rd aquifer has water of acceptable salinity (10 - 65 mg/1) and based on existing literature it is also favoured for development at selected localities.

It is proposed to utilize both these aquifers to provide water supplies of up to 172 Ml/d to the year 2000 for Kota Karu and Bachok districts. For the district of Tumpat, the shallow aquifer at Wakaf Batu will be able to meet the projected total water requirement of 22.8 Ml/d to the year 2000. Well-fields proposed in the vicinity of Kg. S. Petai and Gong Kedak may prove adquate to meet demand of 10 Ml/d the year 2010 for Pasir Puteh district.

*****

Keputusan beberapa rentisan graviti di selatan Semenanjung Malaysia

Abdul Rahim bin Hj. Samsudin, Jabatan Geologi, Universiti Kebangsaan Malaysia

Enam rentisan graviti telah dilakukan ke atas beberapa singkapan batuan di selatan Semenanjung Malaysia. Profil graviti yang diperolehi jelas menunjukkan nilai anomali minimum di kawasan granit. Bentuk dan kedalaman jasad granit telah diperolehi dengan melakukan pemodelan dua-metra. Teknik pemodelan ini menggunakan program graviti dua-metra yang telah diubahsuai dan dilakukan dengan pertolongan mikrokomputer. Implikasi model yang diperolehi terhadap struktur kerak bumi Semenanjung Malaysia turut diperbincangkan.

*****

Geophysical mapping of bedrock beneath the coastal plains of Kedah and Perlis

C.A. Foss, Jabatan Geologi, Universiti Malaya

A gravity map and some detailed gravity profiles are presented of an area between Alor Star and Kangar. These results are used to illustrate the applicability of the gravity method to map bedrock fractures under extensive alluvial cover. Particular attention is paid to resolution as a function of measurement distribution. The gravity results are augmented by some seismic refraction and V.L.F. data, and the advantages of incorporating these methods into an integrated geophysical technique is discussed.

*****

Algorithms for optimising 2-D gravity and magnetic modelling

C.A. Foss, Jabatan Geologi, Universiti Malaya

A program is described which performs rapid and efficient computation 2-D model fields for comparison with measured gravity or magnetic profiles. The novel features of the program are mostly located in an editing procedure which recalculates the model fields as changes are made to the models in an iterative approach to producing a best-fil model. Various algorithms are dedicated to reducing memory requirements, increasing computational speed, or providing greater ease of altering the model parameters. The editing procedure and its interactive design with the graphics display makes the modelling process more convenient, faster, and capable of dealing with more complex geological models.

*****

Pendekatan mineralogi terbitan dalam kajian profil luluhawa granite kawasan tropika

Hamzah Mohamad, Jabatan Geologi, Universiti Kebangsaan Malaysia

Secara mineralogi, pertambahan darjah luluhawa di dalam sesuatu profil granit dapat ditunjukkan oleh kenaikan kadar (mika lempung + mineral lempung + klorit) terhadap (feldspar + mika). Parameter Niggli (al-alk) didapati boleh digunakan untuk menunjukkan perubahan relatif ini. Ini ialah kerana (al-alk) mewakili alumina batuan yang terkandung di dalamnya (mika lempung + mineral lempung + klorit) sahaja, iaitu selepas diambil kira alumina di dalam feldspar dan mika. Oleh itu (al-alk) boleh digunakan sebagai indeks semi kuantitatif jumlah (mika lempung + mineral lempung + klorit). Penerbitan indeks (al-alk) cuma memerlukan peratus berat Al_2O_3, K_2O, *dan* Na_2O. *Beberapa profil luluhawa granit di lebuh raya Kuala Lumpur - Karak dan satu di Kuala Pilah telah menunjukkan perubahan jelas (al-alk) daripada batuan induk ke permukaan. Nilai (al-alk) juga boleh dijadikan indeks umum kekuatan batuan, tertakluk kepada faktor-faktor lain seperti mikroretakan. Kepentingannya dalam pemilihan tapak pembinaan akan bertambah apabila (al-alk) dapat dikaitkan dengan gred luluhawa mengikut pandangan geologi kejuruteraan, dan dengan beberapa parameter asas geologi kejuruteraan, misalnya kekuatan mampatan sepaksi. Kelemahan pendekatan ini ialah apabila sesuatu profil mempunyai illit, bukan gibsit*

dan kaolinit, dengan jumlah yang besar. Dalam hal ini penafsiran (al-alk) terdedah kepada beberapa ralat.

*****

Research needs in petroleum geology in Malaysia

Nik Ramli Nik Hassan, Makmal Petronas

Petroleum exploration has to be sustained in order to maintain a balance between the depletion of hydrocarbon resources and the energy needs of developed and developing countries. A means of reducing exploration risk is to actively proceed with research which may be either directly or indirectly related to petroleum exploration. Local universities have an important part to play in contributing towards the advancement of knowledge in petroleum geology.

Several examples are provided which will give an insight into the kinds of research which can be carried out in an effort to improve our knowledge on the petroleum geology of Malaysia.

*****

Potential for application of trace element studies in petroleum geology in Malaysia

Ramly Khairuddin, Makmal Petronas & E.V. Gangadharam, Jabatan Geologi, Universiti Malaya

Trace elements present in crude oils could come from the source materials or acquired subsequently during migration of oil to reservoirs. Trace element abundance patterns of crude oils could be used with advantage for crude-to-crude correlations and crude-to-source rock correlations. Trace elements in formation waters can throw light on the pathways of oil migration. Finally, the oil-bearing rock formations could themselves be characterised by trace element studies to clarify under favourable conditions their environment of deposition.

Elsewhere in the world trace element studies have been used in petroleum geology, and a few case histories are described to illustrate the above applications.

For the first time in Malaysia, systematic trace element studies are being initiated on crude oils in the first instance. Results of preliminary experiments in the use of neutron activation analysis and inductively-coupled plasma spectrometry methodologies are described.

Specific areas of petroleum geology in Malaysia where trace element studies could be useful are discussed.

*****

River bank infiltration as a source of water supply in Felda Lepar Hilir, Pahang

Seet Chin Peng, Jabatan Penyiasatan Kajibumi Malaysia

Felda Lepar Hilir was found to have a potential site for developing a

water supply scheme using river bank infiltrated water. This source of water would be free of suspended sediments, thus reducing the cost of water treatment. The amount of water required is 6800 cu m per day. It was decided to test a well field system using wells with single bore.

The site is covered by a sequence of unconsolidated sediments 7 m to 14 m thick and underlain by sedimentary rocks comprising sandstone and conglomerate. A sand and gravel aquifer was identified, which varies in thickness from 2 m to 9 m, but averaging 4 m.

A total of 8 wells were constructed. Pumping tests were carried out to determine the aquifer parameters, to ascertain that the wells are capable of producing the required amount of water and to determine to what extent the iron content of the groundwater can be reduced by bank infiltration. The pumping tests conducted consisted of a step-drawdown test for each completed well, a 72-hour constant discharge test on one of the wells and the simultaneous pumping of 3 wells for 288 hours.

Accurate determination of the aquifer parameters cannot be carried out due to the influence of the river, the large variation in aquifer thickness and its limited lateral extent. However a value of 250 m/day had been estimated for the hydraulic conductivity, giving a range of transmissivity values from 750 m/day.

The well field system has been shown to be more than capable of supplying the required amount of water throughout the season. On the present demand, only 6 out of the 8 wells need to be pumped for 15 hours at a total output of 455 cu m per hour. The remaining 2 wells can be used as 'stand-by' wells but they should be operated from time to time to maintain the pumps. If an increased demand is required, the number of hours of pumping can be extended or all the wells can be pumped.

The iron content of the groundwater can be reduced significantly by bank infiltration. When all the wells are being pumped simultaneously at high discharge rates for long duration, the iron content in all the wells should be reduced to a level comparative to that of the river water. Judging from the present data, the average iron content shouldbe in the region of 5 ppm. For this to occur, the amount of river recharge required is estimated to be twice that of the groundmwater.

*****

BERITA-BERITA PERSATUAN
(NEWS OF THE SOCIETY)

KUMPULAN KERJA (WORKING GROUPS)

The Council has agreed to the setting up of the following Working Groups and the nomination of the Organising Chairman to start off each group.

Engineering Geology/Hydrology	-	Ibrahim Komoo
Economic Geology	-	Wan Fuad
Stratigraphy/Sedimentology	-	Azhar Hussin
Petroleum Geology	-	Nik Ramli
Structural Geology/Tectonics	-	K.R. Chakraborty

These Working Groups are formed with the aim of encouraging research in the different fields of geology and will provide forums for discussion and exchange of ideas and knowledge for the benefit of Members. They will also serve to initiate seminars, technical talks, field trips and the like on the different aspects of geology.

*****

INSTITUTE OF PROFESSIONAL GEOLOGISTS MALAYSIA - PROTEM COMMITTEE

In response to a letter regarding the absence of East Malaysia representatives to the proposed protem committee (see Warta Geologi, Vol. 13, No. 1), the Council agreed to the appointment of Mr. Lim Peng Siong (Sabah Geological Survey) and Mr. Chen Shick Pei (Sarawak Geological Survey) to the committee.

*****

WAKIL KAWASAN PERSATUAN

The Council has appointed the following members to serve as the Society's area representatives:

Ipoh	:	Aw Peck Chin
Penang	:	Leong Lap Sau
Kota Bharu	:	Teoh Lay Hock
Sabah	:	Lim Peng Siong
Sarawak	:	Chen Shick Pei

*****

KEAHLIAN (MEMBERSHIP)

The following applications for membership were approved:

Full Members

1. Michael C. Friederich, Utah International, 510-C Herndon Parkway, Herndon, Va. 22070, USA
2. Mhd. Rodzi Abd. Hamid, CIMA, Bukit Ketri, 02450 Chuping, Perlis
3. Chen Shick Pei, Geological Survey of Malaysia, P.O. Box 560, 93658 Kuching, Sarawak
4. Muhammad Barzani Gasim, Jabatan Sains Bumi, UKM Sabah Campus, Beg berkunci 62, 88996 Kota Kinabalu, Sabah
5. Mohammad Jamaal Hoesni, Petronas Laboratory, Lot 1026, PKNS Industrial Area, 54200 Hulu Kelang

Student Member

1. Anil Kumar Muralidharan, Jabatan Geologi, Universiti Malaya, Kuala Lumpur

Institutional Member

1. Perpustakaan Cabang, UKM Kampus Sabah, Beg Berkunci 62, 88996 Kota Kinabalu, Sabah.

*****

PERTAMBAHAN BARU PERPUSTAKAAN (NEW LIBRARY ADDITIONS)

The Society has received the following publications:

1. Bulletin of Statistics relating to the mining industry of Malaysia 1984
2. Institution of Mining & Metallurgy Transactions, Section A, vol. 96, Jan. & April 1987
3. Memoirs of the Ehime University, vol. x, no. 3, 1986
4. Bulletin, American Museum of Natural History, vol. 183, article 1, 1986
5. American Museum Novitates, nos. 2845 & 2857, 1986
6. Oklahoma Geology Notes, vol. 46, nos. 4-6, 1986
7. Journal of the Faculty of Science, The University of Tokyo, vol. 21, no. 3, 1986
8. Palynology of Upper Permian and Lower Triassic strata of Fuyuan District, Eastern Yunnan by Ouyang Shu. 1985
9. Cretaceous and early Tertiary sporo-pollen assemblages from the Sanshui Basin, Guangdong Province by Song Zhichen, et al.
10. Palaeontological abstracts, no. 4, 1986
11. Bulletin of Nanjing Institute of Geology & Palaeontology Academia Sinica, no. 8, 1984
12. Geological literature of USSR. Bibliographic yearbook for 1982 year, vols. 1 & 2, 1986 and for 1983 year, vols. 1 & 2, 1987
13. AGID news, no. 51, 1987
14. Scripta Geologica, nos. 81 & 82, 1986

*****

BERITA-BERITA LAIN
(OTHER NEWS)

7TH OFFSHORE SOUTHEAST ASIA - PRELIMINARY CONFERENCE PROGRAMME

The Asian Petroleum Show & Conference, 2-5 February 1988, World Trade Centre Singapore

Sponsored by: Society of Petroleum Engineers
Southeast Asia Petroleum Exploration Society
Society of Naval Architects & Marine Engineers of Singapore

Selected items in the programme

Keynote Session

'Outlook and Opportunities for the Petroleum Industry in Southeast Asia'

Speakers:

Mr. Abdul Rachman Ramly, President Director, Pertamina
Mr. D.K. McIvor, Director and Senior Vice-President, Exxon Corporation
Dato Murad Hashim, Senior Vice-President (Downstream), Petronas
Mr. Peter D. Gaffney, Senior Partner, Gaffney, Cline & Associates.

Tuesday, 2 February 1988

Hall B: Session 2: Geophysics, 10.30 - 12.30
Chairmen: John McLean-Hodgson, Marathon Petroleum Exploration Ltd.
Bhagwan Sahay, Oil and Natural Gas Commission

Paper Number

88101 Highlights of 3D Seismic Surveys, Offshore Sarawak: H.J.E. Schmidt, Sarawak Shell Bhd. (Malaysia)

88102 Depositional Environments and Hydrocarbon Distribution and Their Expression on 3D Seismic Data at Tabu, Guntong and Palas Fields: H.M. Noor, M.I. Ismail and C.H. Sim, Esso Production Malaysia Inc. (Malaysia

88103 The Impact of Modern Seismic in an Old Field: A.M. Kamis, Brunei Shell Petroleum Co. Sdn. Bhd. (Brunei) and W.R. van der Vlugt, retired, Shell Intl. Petroleum Co. (The Netherlands)

88104 Optimum Deconvolution for Seismic Inversion Purposes: S. Munadi, Lemigas and L. Nutt, Schlumberger Overseas S.A. (Indonesia)

88105 VSP Guided Preprocessing and Inversion of Surface Seismic: R. Gir, Schlumberger Overseas S.A. (Malaysia)

Hall B: Session 4: Structural Geology, 14.00 - 17.00
Chairmen: Roger Eubank, OMS Orient Consulting Ltd.
Jean-Marie Despretz, Petrofina S.A.

Paper Number

88113 Hydrocarbon Potential of Intracratonic Rift Basins: S.J. Derksen and J. McLean-Hodgson, Marathon Petroleum Exploration Ltd (Singapore)

88114 Structure of Sedimentary Basins in Eastern Asia: J. Letouzey, Inst. Francais du Petrole, and L. Sage, B.E.I.C.I.P. (France)

88115 Seismic Evidence for Structural Style in the Offshore Kerema Area Papua New Guinea: Application for Petroleum Exploration: A. Slater and H.R. Balkwill, Petro-Canada Resources (Canada)

88116 Styles of Compressional Wrench Faulting Taranak, Basin, New Zealand: G. Bulte, Petrocorp New Zealand (New Zealand)

88117 On the synchronism of Extensional Subsidence of South China Sea Basin and Compressional Uplift of Qinghai-Xizang Plateau: Y. Li, Inst. of Geology (People's Republic of China)

88118 A Paleogene Depositional Model for Exploration: D.N. Hayes and G.J. Jeffery, Hadson Petroleum Intl. Ltd. (USA), and H.K. Seong, Korea Petroleum Development Corp. (Korea)

Alternate

88119 Western Continental Margin of India and Hydrocarbon Potential of Deep-sea Basins: S.K. Biswas and N.K. Singh, Oil & Natural Gas Commission (India)

Wednesday, 3 February 1988

Hall B: Session 8: Exploration - Regional Studies, 14.00 - 17.00
Chairmen: Brian Hopkins, BHP Petroleum Pty. Ltd.
Martin White, Woodside Offshore Petroleum

Paper Number

88141 Geology and Petroleum Prospects of Seychelles: S.N. Khanna and G.E. Pillay, Seychelles Natl. Oil Co. Ltd. (Seychelles)

88142 Exploration History and Status of Hydrocarbon Exploration of Cauvery Basin with Particular Reference to Occurrence of Oil & Gas and Their Relationship to Depositional System in Paleogene and Crustaceous: P.K. Chandra and S. Venkataraman, Oil & Natural Gas Commission (India)

88143 Geology and Hydrocarbon Prospects of the Surma Basin, Bangladesh: M.A. Maroof Khan, M. Ismail and Manzur Ahmad, Bangladesh Oil, Gas & Mineral Corp. (Bangladesh)

88144 Petroleum Exploration in the South Western Plain of Taiwan, The Republic of China: C.H. Liou and C.Y. Hsu, Chinese Petroleum Corp. (Republic of China)

88145 First Foreign Onshore Petroleum Exploration Project in China: R.J. Mollah, CSR Orient Oil Ptd. Ltd. (People's Republic of China)

88146 Far East Oilfields: Comparative Economics: M. Stenner, Wood MacKenzie (UK)

Alternate

88147 An Oil and Gas Supply and Economics Model for Indonesia: W. Partowidagdo, Inst. of Technology Bandung (Indonesia) and E.L. Dougherty, U. of Southern California (USA)

Thursday, 4 February 1988

Session 10: General Exploration, 09.30 - 12.30
Chairmen: William C. Ade, Seis-Strat Services
Cheah Tik Wah, Promet Pte. Ltd.

Paper Number

88156 The Geology of the Arun Field Miocene Reef Complex: M. Abdullah,

Mobil Oil Indonesia (Indonesia) and C.F. Jordan Jr. Mobil R & D Corp (USA)

88157 Chemistry of Oilfield Waters in South East Asia and Their Application to Petroleum Exploration: P. Cockcroft, Key Resource Analysts Ltd., and K. Robinson, P.T. Corelab Indonesia (Indonesia)

88158 Characteristics of J Sandstone (Tapis Formation) Reservoirs in the Southeastern Part of the Malay Basin, Offshore West Malaysia: N. Ramli, Petronas (Malaysia)

88159 Computer Aided Exploration: Principles and Examples of Use of Geological and Geochemical Models: P.Y. Chenet and M. Latreille, B.E.I.C.I.P (France)

88160 Log Response in a Pyrite-Cemented Sandstone Reservoir: A Case Study from Offshore North Western Australia: R.V. Halyburton and A.L. Locke, BHP Petroleum Pty. Ltd. (Australia)

88161 Direct Observation and Interpretation of *In-Situ* Borehole Images using the Formation Microscanner with Comparison to Cores: J. Roestenburg, Schlumberger Overseas S.A. (Indonesia)

Registration

At Hyatt Hotel, Scotts Road. 0900 - 1200 & 1300 - 1700
28th January - 1st February 1988
At World Trade Centre Singapore. 0900 - 1800
1st February - 5th February 1988

Registration Cost

Singapore $25 for a 4-day ticket, Singapore $10 for one day ticket. (Valide all conference sessions & exhibition)

Delegates' Reception

Hyatt Hotel, Magnolia/Vanda rooms.
Tuesday 2nd February 1988, 1900 - 2200 hours
Open to all conference speakers, chairman, delegates and exhibition staff, including wives.

Opening Hours

Tuesday 2nd, Wednesday, 3rd, Thursday 4th February, 0900 - 1800
Friday 5th February 1988, 0900 - 1600 hour

Proceedings

Complete sets of proceedings will be available from the Registration Centre, during registration hours.
Price: S$120.00

All enquires to: Offshore Southeast Asia 88 c/o Singapore Exhibition Services Pte. Ltd., 11 Dhoby Ghaut 15-09 Cathay Building, Singapore 0922. Tel: 3384747; Tlx: RS 23597/28733 SINGEX; Fax: (65) 3395651.

******

A SHORT TERM COURSE ON MINERALOGICAL AND TECHNOLOGICAL ASPECTS OF PROCESSING OF GOLD AND OTHER PRECIOUS METALS

February 4 - 7, 1988, Ipoh, Perak
Organised by the Universiti Sains Malaysia, School of Materials and Mineral Resources Engineering.

Topic

Mineralogical and technological aspects of processing of gold and other precious metals.

Introduction

The surge in gold prices has stimulated and increaed aggressive exploration programmes to both reactivate old mines and search new areas for discovery and recovery throughout the whole world. Gold's industrial demand should continue to increase in all areas of high technology manufacturing, in addition to jewelleries, because of its unique chemical, physical and mechanical properties and fairly stable prices in the international market.

It is, therefore, imperative that the professionals and paraprofessionals, working in gold exploration, mining, processing, should have a clear understanding of the mineralogical and technological aspects of extraction of gold and other precious metals from their difficult-to-process ores (i.e. low grade, high grade and refractory type) and tailings at a profit. They should also keep abreast with the latest developments in the field o gold processing.

This course, first of its kind in Southeast Asia, has been designed for the gold mining and processing personnel to acquire and update their knowledge and implement them into the industry in order to achieve the maximum recovery at the minimum cost.

Objectives

The aim is to provide opportunities for individual and group learning, through group discussion of most topics pertinent to the duties of a gold processing teams, to recognise and appraise the relative problems, the possible solutions and the options available. The basic objectives are:-

1. To advance specialist knowledge not normally available in courses or gained as part of normal employment.
2. To cultivate detailed understanding of chemical, mineralogical and technological aspects of gold extraction from various ores.
3. To aid an insight into the problems and restraints of starting a new gold processing plant.
4. To promote an understanding of the choices of right type of ores (alluvial, sulphide and finer placer gold) and tailings.
5. To further detailed knowledge on the latest advacement in gold extraction techniques.

Methods

The course involves the following main aspects:

a. Lectures followed by discussion
b. Problem solving by syndicate work
c. Case histories - personal presentation by all participants
d. Some laboratory exercises on microscopic examination of minerals.

Participants

To establish the basis for a successful course, participants are to be selected on the basis of the experience and current position in their organisations. This course will interest those working in gold mining and processing such as geologists, prospectors, miners, metallurgists, senior staff in Government Agencies and staffs of Universities and Polytechnics. Proficiency in English is required since the program will be conducted in English. The maximum number of candidates for the course will be 30.

Course content

The course content is organized into a logical sequence of topics as follows:

1. Introduction to the course
2. The mineralogical, textural and chemical nature of precious metal ores with regard to the extraction techniques
3. Gold ore mineralogy and its relevance to mineral processing
4. Processing of gold - Retrospect and Prospect
5. Physico-chemical principles of gold cyanidation
6. Gold precipitation and smelting of precipitates
7. Carbon in pulp Technology (Gold absorption on activated carbon, elution, reactivation of carbon, and electrolysis)
8. Washing circuits and Materials balance
9. Developments of various flowsheet for gold extraction
   a) Flowsheet-1- General, Dredging, Jigging, Sluicing and Almalgamation
   b) Flowsheet-II- Gravity Concentration, Cyanidation and Precipitation or C.I.P.
   c) Flowsheet-III- Flotation, Roasting and Cyanidation
   d) Flowsheet-IV- Flotation, Chemical Oxidation or Biochemical Oxidation and Cyanidation
10. Test Procedures
11. Test Results and choice of right Flowsheets for right type of ores
12. Calculation of gold and gold balance for the recovery of gold from the Lailings dump
13. Processing, problems and practices of refractory types of gold ores
14. Heap leaching, C.I.P. and C.I.L. Processes
15. Extraction of Silver
16. Recovery of Platinum
17. Some Miscellaneous Practices
18. Recent developments in the processing of gold
19. Precious metal industries of Southeast Asia.

The Faculty

The faulty will comprise mainly of distinguished academics, managers and consultants working in USM, local mining, public and private organisations. The faculty members from the School of Materials and Mineral Resources Engineering, who will design and present the course, have extensive research, teaching and consulting experiences.

General information

a) Course Fee is M$400/- per participant. This covers tuition, program materials, coffee on meeting days and a closing banquet.

The course are non-residential. Participants from abroad needing hotel accommodation may write to the program coordinator for assistance.

b) Class size: Participation in the course is limited to not more than 30 participants and will be based on a first-come-first served basis.

c) Closing Date: The closing date for registration is 31st December 1987.

d) Payment: Applicants should make their cheques payable the Bendahari, Universiti Sains Malaysia, Ipoh, Perak by 31st December 1987.

Registration

Attendance for this course is by prior registration only.

Enquiries and further information may be obtained from Mr. V.N. Misra, Program Coordinator, School of Materials and Mineral Resources Engineering, Universiti Sains Malaysia, Kampus Cawangan Perak, Jalan Bandaraya, 30000 Ipoh, Perak, Malaysia.
Ph. (60)-5-503131 extn. 2322.

******

KURSUS-KURSUS LATIHAN & BENGKEL-BENGKEL (TRAINING COURSES & WORKSHOPS)

1988

February 1988
METALLOGENY (Quito, Ecuador). Annual 3-week training course for Latin Americans organized by Central University of Quito, the Autonomous University of Madrid (Spain), and Unesco. Language: Spanish. For Information: Director, Curso Internacional de Metalogenia, Escuela de Geologia, Minas y Petroleos, Division de Post-grado, Universidad Central, Apartado Postal 8779, Quito, Ecuador.

February 1988 - March 1988
GEOCHEMICAL PROSPECTING TECHNIQUES (Tervuren, Belgium). Annual course sponsored by the Royal Museum of Central Africa and UNDP. Language: French. For information: Musee royal de l'Afrique centrale, Steenveg op Leuven, 13, B-1980 Tervuren, Belgium.

February 1988 - June 1988
MINERAL EXPLORATION (Leoben, Austria). Diploma course organized annually by the University of Mining and Metallurgy in Leoben and sponsored by Unesco. Language: English. For information: University for Mining and Metallurgy, Post-graduate course on mineral exploration, Montanuniversitat, Leoben, A-8700, Austria.

March 1988
REMOTE SENSING APPLIED TO HYDROGEOLOGY (Bogota, Colombia). Special course from IGAC. For information: Subdirection de Docencia e Investigacion del IGAC, Apartado Aereo 53754 y 6721, Bogota 2, Colombia, South America.

March 1988 - November 1988
PHOTOINTERPRETATION APPLIED TO GEOLOGY AND GEOTECHNICS (Bogota, Colombia). Annual post-graduate diploma courses organized by the Government of Colombia, Centro Interamericano de Fotointerpretacion, International Institute for Aerial Survey and Earth Sciences and Unesco. Language: Spanish. For information: Academic Secretariat of the CIAF, Apartado Aereo 53754, Bogota 2, Colombia.

March 1988 - April 1988
MINERAL EXPLORATION (Paris, France). A 4-week annual course organized by the Ecole Nationale Superieure des Mines and sponsored by Unesco. Language: French. For information: Prof. H. Pelissonnier, Ecole des Mines, 60 Bd Saint Michel, 75272 Paris, Cedex 06, France.

June 1988
SEDIMENT TECHNOLOGY (Ankara, Turkey). An annual four-week Unesco-sponsored postgraduate course. For information: Dr. Ergun Demiroz, DSI Teknik Arastirma ve Kalite Kontrol, Dairesi Baskanligi, 06100 Ankara, Turkey.

June 1988 - August 1988
TECHNIQUES OF HYDROLOGIC INVESTIGATIONS (Washington, D.C. and Denver, Colorado, USA). Annual training course for international participants. For information: Office of International Hydrology, Water Resources Division, U.S. Geological Survey, 470 National Center, Reston, Virginia 22092, USA.

July 1988 - August 1988
SUMMER COURSE ON EARTH SCIENCES: CRYSTALLOGRAPHY, MINERALOGY, METALLOGENY (Madrid, Spain). Annual course organized by the Department of Geology and Geochemistry of the Universidad Autonoma de Madrid and sponsored by Unesco. Language: Spanish. For information: Prof. T. Monseur, Departamento de Geologia y Geoquimica, Facultad de Ciencias, Universidad Autonoma de Madrid, Canto Blanco, Madrid 34, Spain.

September 1988 - July 1989
PETROLEUM EXPLORATION GEOLOGY (Headington, Oxford, UK). An annual diploma course designed by Oxford Polytechnic to prepare post-graduate geologists for the duties of geologists in oil exploration teams. For information: M. Hoggins, Department of Geology and Physical Sciences, Oxford Polytechnic, Headington, Oxford OX3 OBP, U.K.

September 1988 - August 1989
MINERAL EXPLORATION AND EXPLORATION GEOPHYSICS (Delft, The Netherlands). Annual diploma courses organized by the International Institute for Aerial Survey and Earth Sciences and sponsored by Unesco. Language: English. For information: Student Registration Office, ITC (ME), P.O. Box 6, 7500 AA Enschede, The Netherlands.

October 1988 - November 1988
TECTONICS, SEISMOLOGY AND SEISMIC RISK ASSESSMENTS (Potsda, East Germany). One-month training course organized annually by East German Academy of Sciences in collaboration with Unesco. Language: English. For information; Prof. Dr. H. Kautzleben, Director, Central Earth's Physics Institute, Academy of Sciences of the German Democratic Republic, Telegraphenberg, DDR-500 Postdam, German Democratic Republic.

October 1988 - July 1989
ENGINEERING HYDROLOGY (Galway, Ireland). Annual diploma and post-graduate courses organized by the Department of Engineering Hydrology, University College Galway, Ireland. Sponsored by Unesco-IHP and the World Meteorological Organization. For information: Prof. J.E. Nash, Department of Engineering Hydrology, University College Galway, Galway, Ireland.

October 1988 - September 1989
HYDRAULIC ENGINEERING AND HYDROLOGY (Delft, The Netherlands). Diploma courses organized annually by the International Institute for Hydraulic and Environmental Engineering and sponsored by Unesco for professionals from developing countries. Language: English. For information: International Institute for Hydraulic and Environmental Engineering (IHE), Oude Delft 95, P.O. Box 3015, 2601 DA Delft, The Netherlands.

October 1988 - September 1990
FUNDAMENTAL AND APPLIED QUATERNARY GEOLOGY (Brussels, Belgium). Annually organized training course leading to a Master's degree in Quaternary Geology by the Vrije Universiteit Brussel (IFAQ) and sponsored by Unesco. Language: English. For information: Prof. Dr. R. Paepe, Director of IFAQ, Kwartairgeologie, Vrije Universiteit Brussel, Pleinlaan 2, B-1050, Brussels, Belgium.

October 1988 - September 1990
GEOLOGICAL EXPLORATION METHODS (Nottingham, U.K.). Two-year M.Sc. course starting every other year with emphasis on applied methodology, date acquisition and interpretations. For information: Dr. M.A. Lovell, Department of Geology, University of Nottingham NG7 2RD, U.K.

KALENDAR (CALENDAR)

1987

November 9-18, 1987
HYDROTHERMAL SYSTEMS (4th IUGS Workshop on Mineral Deposit Modelling), Santiago, Chile. (Charles G. Cunningham, U.S. Geological Survey, 913 National Center, Reston, Va. 22092, USA).

December 7-10, 1987
PETROGENESIS AND MINERALIZATION OF GRANITOIDS (International Symposium), Guangzhou, P.R. China. Language: English. (International Symposium on Petrogenesis and Mineralization of Granitoids, c/o Institute of Geochemistry, Academia Sinica, Guiyang, Guizhou Province, People's Republic of China).

December 7-11, 1987
SOUTHEAST ASIAN GEOTECHNICAL CONFERENCE (9th), Bangkok, Thailand. Language: English. (The Hon. Secretary, 9th SEAGC, c/o GTE Division, Asian Institute of Technology, P.O. Box 2754, Bangkok 10501, Thailand).

December 7-19, 1987
PRECAMBRIAN METALLOGENY RELATED TO TECTONICS AND COMPUTERIZED MINERAL RESOURCE ASSESSMENT METHODS APPLIED TO METALLOGENIC PROVINCES (International Conference), Arusha, Tanzania. Co-sponsored by IGCP-247, COGEODATA and Geological Society of Africa. (Dr. E. Malisa, University of Dar-es-Salaam, Department of Geology, P.O. Box 35052, Dar-es-Salaam, Tanzania).

1988

January 6-8, 1988
CARE - '88 (Conference on Applied Rock Engineering), Newcastle upon Tyne, U.K. (Conference Office, IMM, 44 Portland Place, London W1N 4BR, U.K.).

February 2-5, 1988
OFFSHORE S.E. ASIA (7th Conference and Exhibition), Singapore. (D.H. Morgan, SEAPEX Program Committee, Southeast Asia Petroleum Exploration Society, P.O. Box 423, Tanglin P.O., Singapore 9124).

February 24-27, 1988
ASIA/PACIFIC MINING (Conference), Bangkok, Thailand. (Asia/Pacific Mining Conference Secretariat, c/o Cahners Exposition Group, 1 Maritime Square 12-03 World Trade Centre, Singapore 0409).

March 8-11, 1988
ASIAN MINING '88 (3rd International Conference and Exhibition), Kuala Lumpur, Malaysia. (The Conference Office, The Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, U.K.).

March 17-18, 1988
CLAY DIAGENESIS IN HYDROCARBON RESERVOIRS AND SHALES (4th Cambridge Meeting, Mineral Diagenesis), Cambridge, U.K. (Dr. C.V. Jeans, Dept. of Applied Biology, Pembroke Street, Cambridge CB2 3DX, U.K.).

March 20-23, 1988
AAPG/SEPM (Annual Meeting), Houston, Texas, USA. (Convention Department AAPG, Box 979, Tulsa, Ok. 74101, USA).

March 21-23, 1988
THE NEOGENE OF THE KARAKORAM AND HIMALAYA (Conference), Leicester, U.K. (E. Derbyshire, Dept. of Geography, University of Leicester, Leicester LE1 7RH, U.K.).

March 23-25, 1988
OCEAN DRILLING PROGRAM (GAC-MAC-CSPG Special Session), St. John's, Newfoundland, Canada. (Paul T. Robinson, Centre for Marine Geology, Dalhousie University, Halifax, N.S., Canada B3H 3J5).

March 28-30, 1988
MOBILITY AND CONCENTRATION OF BASE METALS IN SEDIMENTARY COVER ROCKS (International Colloquium), Paris-Orleans, France. (J.F. Sureau, Bureau de Recherches Geologiques et Minieres, B.P. 6009, 45060 Orleans Cedex, France).

April 6-8, 1988
THE CADOMIAN OROGENY (Meeting), Oxford, U.K., Co-sponsored by IGCP-233, (R. D'Lemos, Dept. of Geology, Oxford Polytechnic, Headington, Oxford OX3 OBP, U.K.).

April 7-9, 1988
EXPERIMENTAL MINERALOGY, PETROLOGY AND GEOCHEMISTRY (2rd International Symposium), Bochum, F.R.G. Co-sponsored in part by IUGS. (Bochum Symposium, Institut fur Mineralogie, Ruhr-Universitat, Postfach 10 21 48, D-4630 Bochum 1, F.R.G.).

April 10-15, 1988
LANDSLIDES (5th International Symposium), Lausanne, Switzerland. (Ch. Bonnard, Case Postale 83, CH-1015 Lausanne 15, Switzerland).

April 18-21, 1988
TUNNELLING '88 (5th International Symposium), London, U.K. (The Conference Office, Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, U.K.).

April 24-27, 1988
INDUSTRIAL MINERALS (International Congress), Boston, USA. (Barry Harris, Metal Bulletin Conferences Ltd., Park House, Park Terrace, Worcester Park, Surrey KT4 7HY, England, U.K.

May 11-12, 1988
CLASSIC PETROLEUM PROVINCES (Geological Society Meeting), London, U.K. (Dr. J.S. Brooks, 10 Langside Drive, Newlands, Glasgow G43 2EE, Scotland, U.K.).

May 11-20, 1988
INTERNATIONAL COMMITTEE FOR THE STUDY OF BAUXITE, ALUMINA AND ALUMINIUM (6th International ICSOBA Congress), Sao Paulo, Brazil. (A.J. Melfi, Inst. Astronomico et Geofisico, Univ. Sao Paulo, C.P. 30.267, Sao Paulo 01051, Brazil).

May 16-20, 1988
BICENTENNIAL GOLD '88 (Conference), Melbourne, Australia. Co-sponsored by Society of Economic Geologists. (Dr. R.R. Keays, Department of Geology, University of Melbourne, Parkville, Vic. 3052, Australia).

May 16-20, 1988
AMERICAN GEOPHYSICAL UNION (Spring Meeting), Baltimore, Maryland, USA. (AGU Meetings, 2000 Florida Avenue NW, Washington, D.C. 20009, USA.).

May 16-20, 1988
HYDROLOGICAL PROCESSES AND WATER MANAGEMENT IN URBAN AREAS (IAHS/IUGG-IAH/IUGS-Unesco Meeting), Duisburg, F.R.G. (Dr. E. Romijn, Provincial Waterboard of Gelderland, Markstraat 1, P.O. Box 9090, 6800 GX Arnhem, The Netherlands).

May 22-25, 1988
GAC/MAC/CSPG (Annual Meeting), St. John's, Newfoundland, Canada. (J.M. Fleming, Department of Mines and Energy, P.O. Box 4750, St. John's Newfoundland, Canada A1C 5T7).

May 29 - June 3, 1988
WATER FOR WORLD DEVELOPMENT (6th IWRA World Congress), Ottawa, Canada. Languages: English, Franch, and Spanish. (P.J. Reynolds, University of Ottawa, 631 King Edward Av., Ottawa, ON, Canada K1N 6N5).

May 30 - June 3, 1988
INTERACTION BETWEEN GROUNDWATER AND SURFACE WATER (International Symposium), Lund, Sweden. (Prof. Dr. G. Lindh, Lund Inst. of Technology, S-22007 Lund, Sweden).

May 31 - June 4, 1988
SEISMIC ANISOTROPY IN THE EARTH'S CRUST (AGU Chapman Conference), Berkeley, Calif., USA. (AGU Meetings, 2000 Florida Av, NW., Washington, D.C. 20009, USA).

June 1-5, 1988
CASE HISTORIES IN GEOTECHNICAL ENGINEERING (2nd International Conference and GSA Penrose Conference), St. Louis, Missouri, USA. (Shamsher Prakash, Room 308, Department of Civil Engineering, University of Missouri, Rolla, MO 65401, USA).

June 5-10, 1988
ENERGY '88 (2nd International Congress), Tiberias, Israel. Language: English. (Miriam Malz Exhibition Services Ltd., 30 Hey B'iyar Street, 62988 Tel-Aviv, Israel).

June 21-24, 1988
FLUID FLOW, HEAT TRANSFER AND MASS TRANSPORT IN FRACTURED ROCKS (4th Canadian/American Conference), Banff, Alberta, Canada. (Dr. Claude M. Sauveplane, ARC, P.O. Box 8330, Station F, Edmonton, Alberta, Canada T6H 5X2).

July 9-15, 1988
MINERALS AND EXPLORATION AT THE CROSSROADS (Annual Conference Australasian Institute of Mining and Metallurgh), Sydney, NSW, Australia. (Bicentenary Conference, c/o The Aus IMM, P.O. Box 122, Parkville, Victoria 3052, Australia).

July 10-15, 1988
LANDSLIDES (5th International Symposium), Lausanne, Switzerland. (C. Bonnard, P.O. Box 83, CH-1015, Lausanne 15, Switzerland).

July 11-16, 1988
GEOCHEMICAL EVOLUTION OF THE CONTINENTAL CRUST (IAGC Conference), Sao Paulo, Brazil. Language: English. (Dr. A.J. Melfi, Institute of Astronomy and Geophysics, University of Sao Paulo, C.P. 30627, Sao Paulo 01000, Brazil).

July 18-20, 1988
RADIOLARIA (International Conference), Marburg, F.R.G. (Prof. Dr. R. Schmidt-Effing, Interrad - Conference, Department of Geosciences, Philipps Universitat, Lahnberge, D-3550 Marburg, Federal Republic of Germany; or Dr. J.R. Blueford, U.S. Geological Survey, 345 Middlefield Road, MS 144, Menlo Park, Ca. 94025, USA).

July 18-22, 1988
GONDWANA (7th International Symposium), Sao Paulo, Brazil. Co-sponsored by IUGS (A.C. Rocha-Campos, Instituto de Geosciencias, Universidade de Sao Paulo, C.P. 20899, Sao Paulo, SP, Brazil).

July 25-29, 1988
FOSSIL CNIDARIA (5th International Symposium), Brisbane, Australia. (Dr. J.S. Jell, Department of Geology and Mineralogy, University of Queensland, St. Lucia, Queensland 4067, Australia).

July 25-29, 1988
OSTRACODA AND GLOBAL EVENTS (10th International Symposium), Aberystwyth, Wales, U.K. (Dr. R.C. Whatley, Micropalaeontology Division, Department of Geology, University College of Wales, Aberystwyth, Dyfed SY23 3DB, Wales, U.K.)

July 30 - August 4, 1988
SEDIMENTOLOGY RELATED TO MINERAL DEPOSITS (IAS International Symposium), Beijing, P.R. China. Co-sponsored by IGCP 219 and 226. Language: English. (Dr. Wang Shousong, IAS International Symposium, c/o Institute of Geology, Academia Sinica, P.O. Box 634, Beijing, P.R. China).

August 1988
GEOLOGICAL MAPS OF THE WORLD (3rd Exhibition), Edinburgh, Scotland. (Mr. D.H. Land, Hon. Secretary, Edinburgh Geological Society, c/o British Geological Survey, Murchison House, West Mains Road, Edinburgh EH9 3LA, Scotland, UK).

August 9-12, 1988
ORDOVICIAN SYSTEM (5th International Symposium), St. John's, Newfoundland, IUGS Subcommission on Ordovician Stratigraphy and IGCP 216. (Dr. C.R. Barnes, ISOS, Department of Earth Sciences, Memorial University, St. John's, Newfoundland, Canada A1B 3X5).

August 14-19, 1988
THE ORIGIN AND EVOLUTION OF ANORTHOSITES AND ASSOCIATED ROCKS (GSA Penrose Conference), Chugwater, Wyoming, USA. (B. Ronald Frost, Department of Geology, University of Wyoming, P.O. Box 3006 University Station, Laramie, WY 82071, USA).

August 28 - September 2, 1988
INTERNATIONAL PALYNOLOGICAL CONGRESS (7th), Brisbane, Australia. (Dr. John Rigby, Conventions Department, P.O. Box 489, G.P.O., Sydney, NSW 2001, Australia).

August 28 - September 2, 1988
CLAY (AIPEA 9th International Conference), Strasbourg, France. (Dr. Helene Paquet, 9th International Clay Conference, Institut de Geologie, 1 rue Blessig, F-67084 Strasbourg Cedex, France).

August 29 - September 2, 1988
GEOCHEMISTRY AND COSMOCHEMISTRY (European Association of Geochemistry International Congress), Paris, France. (Pr. C.J. Allegre, Laboratoire de Geochimie et Cosmochimie, 4 place Jussleu, Tous 14-15, 3 eme etage, 75252 Paris Cedex, France).

September 5-9, 1988
PETROLOGY AND GEOCHEMISTRY OF GRANULITES AND RELATED ROCKS (International Workshop), Clermont-Ferrand, France. (Drs. D. Vielzeuf and Ph. Vidal, Departement de Geologie, 5 rue Kessler, 63038 Clermont-Ferrand, France).

September 5-9, 1988
FISSION TRACK DATING (6th International Congress), Besancon, France. (Laboratoire de Microanalyses nucleaires, UER Sciences et Techniques, La Bouloie, Route de Gray, 25030 Besancon Cedex, France).

September 5-9, 1988
GEOSTATISTICS (3rd International Congress), Avignon, France. Languages: English and French. (Geostat Congress 1988, Centre de Geostatistique, 35 rue Saint-Honore, 77305 Fontainebleau, France).

September 5-10, 1988
FAN DELTAS (International Workshop), Calabria, Italy. Sponsored by IAS. (Dr. Albina Colella, Dipartimento di Scienze della Terra, Universita della Calabria, 87030 Castiglione Cosentino SC. (CS), Italy).

September 6-10, 1988
GEOCHEMISTRY AND MINERALIZATION OF PROTEROZOIC MOBILE BELTS (International Symposium), Beijing, P.R. China. Partly co-sponsored by IGCP-217 and IGCP National Committee of China. Languages: English and Chinese. (Prof. Sun Dazhong, Tianjin Institute of Geology and Mineral Resources, CAGS, No. 4, 8th Road, Dazhigu, Tianjin 300170, P.R. China).

September 7-10, 1988
ASIAN MARINE GEOLOGY (International Conference), Shanghai, P.R. China. Co-sponsored by IUGS Commission for Marine Geology. (Prof. Wang Pinxian, Department of Marine Geology, Tongji University, Shanghai 200092, P.R. China).

September 19-23, 1988
ENGINEERING GEOLOGY AS RELATED TO THE STUDY, PRESERVATION OF ANCIENT WORKS, MONUMENTS AND HISTORICAL SITES (IAEG International Symposium), Athens, Greece. Languages: English, French, and Greek. (Greek Committee of Engineering Geology, 1988 Symposium Secretariat, P.O. Box 19140, GR-117 10 Athens, Greece).

September 20-22, 1988
BARITE (Symposium), Kutna Hora, Czechoslovakia. (Geological Survey /UUG/Symposium Barite, Malostranske nam. 19, 118 21 Praha 1, Czechoslovakia).

September 20-23, 1988
METAMORPHISM AND CRUSTAL EVOLUTION (International Symposium), Changehun, P.R. China. Languages: English and Chinese. (Yan Hongquan, Changchun College of Geology, Changchun, Jilin, P.R. China).

September 25-28, 1988
MEDITERRANEAN BASINS (AAPG European Geological Conference & Exhibition), Cl1ce, France. (AAPG Convention Department, Box 979, Tulsa, Ok 74101, USA).

September 26-29, 1988
THE APPLICATION OF GEOLOGY IN THE DEVELOPING COUNTRIES (International Conference), Nottingham, U.K. Co-sponsored by AGID. (Conference Secretariat, Dept. of Geology, University of Nottingham, Nottingham, NG7 2RD, U.K.).

October 1988
COAL RESEARCH (International Conference), Tokyo, Japan. (Dr. W.G. Jensen, International Committee for Coal Research, Bte 11, B-1150 Brussels, Belgium).

October 1-3, 1988
NEOTECTONICS (INQUA Colloquium), Orleans, France. (J. Fourniguet, BRGM/SGN, B.P. 6009, 45060 Orleans Cedex 2, France.

October 11-17, 1988
GEOLOGY '88, CHINA (International Exhibition), Beijing, P.R. China. (M.C. Morley-Hall, SHK International Services Ltd., 3/F Prince Rupert House, 64 Queen Street, London EC4R 1AD, England, UK).

October 12, 1988
HYDROTHERMAL PROCESSES IN VOLCANIC TERRANES (Joint Meetings: Geological Society of London and Mineralogical Society of Great Britain), Cardiff, Wales, U.K. (Dr. R.E. Bevins, Department of Geology, National Museum of Wales, Cardiff CF1 3NP, UK).

October 23-28, 1988
MINE WATER (3rd International Congress), Melbourne, Australia. (Australasian Institute of Mining and Metallurgy, P.O. Box 122, Parkville, Victoria 3052, Australia).

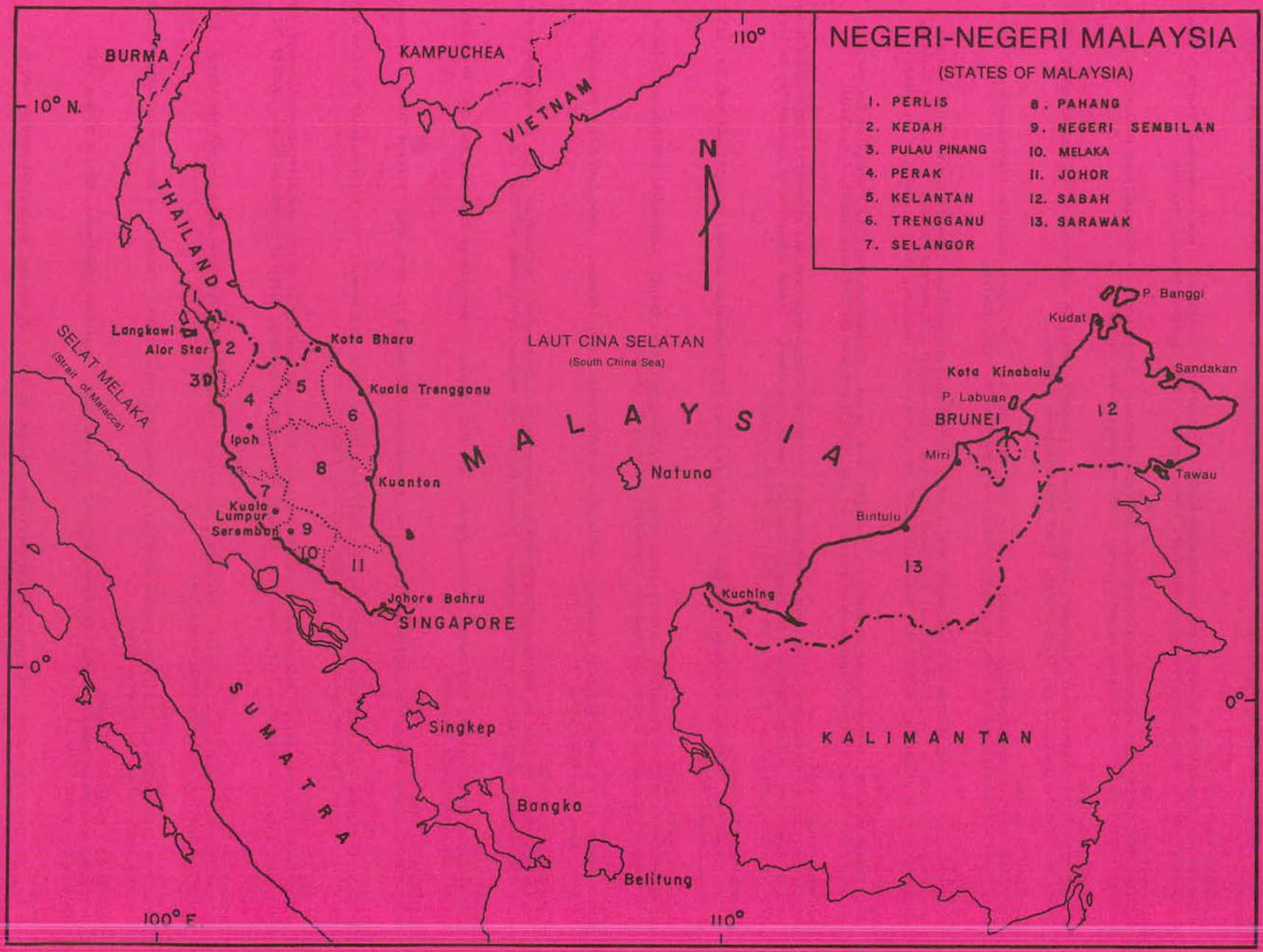
October 30 - November 3, 1988
SOCIETY OF EXPLORATION GEOPHYSICISTS (Annual Meeting), Anaheim, California, USA. (Society of Exploration Geophysicists, P.O. Box 3098, Tulsa, Ok. 74101, USA).

October 31 - November 3, 1988
GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Denver, Colorado, USA. (Meetings Department, GSA, P.O. Box 9140, Boulder, Co. 80301, USA).

November 1988
GLOBAL GEOSCIENCE TRANSECTS (ICL Symposium and Workshops), Belem, Brazil. (J. Monger, Geological Survey, 100 W. Pender Street, Vancouver, B.C., Canada V6B 1R8).

November 10-14, 1988
EXPLORATION AND DEVELOPMENT OF GEOTHERMAL RESOURCES (Meeting), Kumamotu and Beppu, Japan. (Geothermal Research Society, c/o Geological Survey of Japan, 1-1-3 Higashi, Yatabe, Tsukuba, Ibaraki 305, Japan).

November 21-24, 1988
SILVER-EXPLORATION, MINING AND TREATMENT (Conference), Mexico City. (IMM Conference Office, 44 Portland Place, London W1N 4BR, U.K.).


NEGERI-NEGERI MALAYSIA
(STATES OF MALAYSIA)
1. PERLIS
2. KEDAH
3. PULAU PINANG
4. PERAK
5. KELANTAN
6. TRENGGANU
7. SELANGOR
8. PAHANG
9. NEGERI SEMBILAN
10. MELAKA
11. JOHOR
12. SABAH
13. SARAWAK
BURMA
KAMPUCHEA
VIETNAM
THAILAND
10° N.
110°
N
LAUT CINA SELATAN
(South China Sea)
SELAT MELAKA
(Strait of Malacca)
Langkawi
Alor Star
Kota Bharu
Kuala Trengganu
Ipoh
Kuala Lumpur
Seremban
Kuanton
Natuna
MALAYSIA
Johore Bahru
SINGAPORE
SUMATRA
Singkep
Bangka
Belitung
0°
100° E
110°
P. Banggi
Kudat
Kota Kinabalu
Sandakan
P. Labuan
BRUNEI
Miri
Tawau
Bintulu
Kuching
KALIMANTAN