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CATATAN GEOLOGI (GEOLOGICAL NOTES)

A CARBONIFEROUS SHALLOW MARINE FAUNA FROM BUKIT BUCU, BATU RAKIT, TERENGGANU

M.B. Idris & S.M. Zaki, Dept. of Geology, University of Malaya, Kuala Lumpur

Abstrak

Turutan batuan sedimen di Bukit Bucu, Batu Rakit, Terengganu telah menghasilkan fauna Karbon Atas terdiri daripada trilobit, brakiopod, krinoid, bryozoa dan kerang. Invertebrat-invertebrat marine tohor ini telah juga di lapurkan di Kelantan, Pahang Darul Makmur dan Thailand.

Abstract

The sedimentary sequence at Bukit Bucu, Batu Rakit, Terengganu yielded an Upper Carboniferous fauna of trilobites, brachiopods, bryozoans, crinoids and bivalves. These shallow marine invertebrates have also been reported from Kelantan, Pahang Darul Makmur and Thailand.

Introduction

Exposures of sedimentary rocks at Bukit Bucu have been known to yield fossil brachiopods. However, recent visits to the area have also yielded trilobites, bryozoans, crinoids and bivalves. The age of these successions have been assigned vaguely as 'Permian to Triassic and possibly some Carboniferous' by MacDonald (1967). In the light of current findings, a more definite age is ascertained.

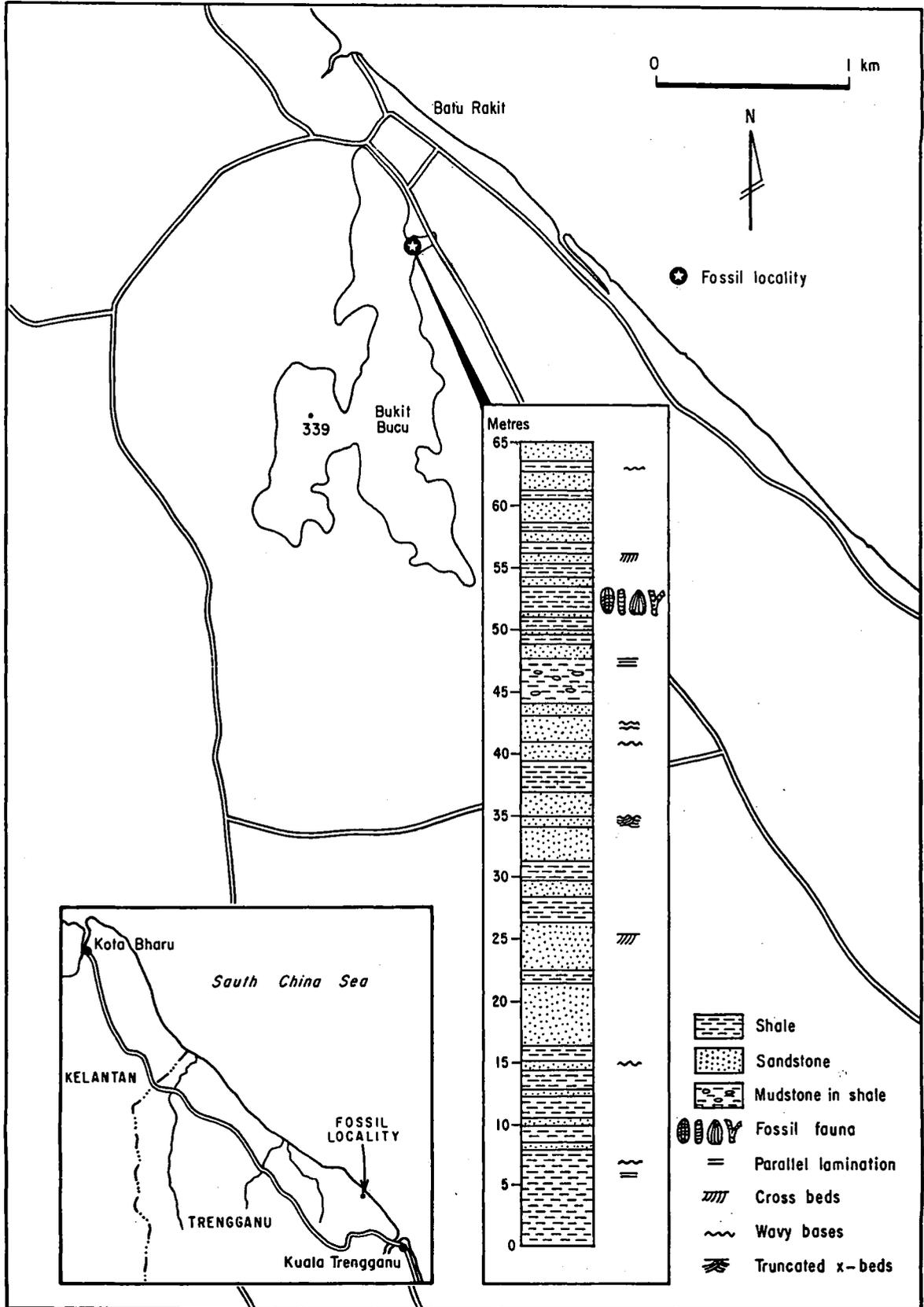
Fossil Locality

Bukit Bucu rises prominently some 100 m above sea-level, on the northern coast of Terengganu, close to Batu Rakit town (Map 1). The fossils were found in a shale horizon on the north-eastern face of the hill, which lies near to the main metalled road.

Stratigraphy

A generalised lithostratigraphic log of the fossil locality is shown in the inset. The sequence consists of alternating layers of sandstone, siltstone and shale. It is about 65 m thick and the fossil bearing stratum is at the 53 m level. A few of the sandstone beds exhibit cross-beddings and there is presence of mud clasts in a shale horizon at level 45 m. The rocks here have suffered low grade metamorphism as evidenced by slaty cleavages and some of them can be referred to as slates.

Prior to the present study, there was a dearth of information on this area. The strata have been assigned to an informal Arenaceous unit by MacDonald (1967), which he reported to be of Permian to Triassic with probably some Carboniferous age. Since then, the actual stratigra-



Map 1. Location of Bukit Bucu and stratigraphic log at the fossil locality.

phic position of the horizons at Bukit Bucu have not received any attention.

Palaeontology

The fauna discovered at Bukit Bucu is listed below and illustrated in Plate 1. The specimens are deposited in the Department of Geology, University of Malaya, Kuala Lumpur.

Bivalve

Edmondia sp.

Brachiopod

Brachythyrina strangwaysi

Chonetinella sp.

Bryozoa

Fenestella retiformes

Crinoid

'*Poterocinus*' (stems)

Trilobite

Paladin ophistops

Discussion

Although the genus *Paladin* is known to straddle the Carboniferous Period universally and possibly extend to early Permian in North America, *P. ophistops* has only been reported from Upper Carboniferous (Kobayashi & Hamada, 1979). This was recorded from the Haui Luang Shale in Thailand and a similar brachiopod fauna was described.

At home, closer to Batu Rakit, Yanagida & Aw (1979) have reported a brachiopod fauna which includes *B. strangwaysi* and *Chonetinella* sp. from close to the base of the Aring Formation in Kelantan. However, there is a marked contrast in lithology as the Aring Formation is widely interspersed with pyroclastics and volcanics, a feature not observed at Bukit Bucu. This clearly warrants a necessity of establishing a different stratigraphic unit which we are assessing.

The sequence at Bukit Bucu can also be correlated with the Namurian Panching Limestone, further south in Pahang Darul Makmur on the basis of similar fauna. The trilobite *Paladin* sp. recorded in the Panching Limestone (Metcalf, Idris & Tan, 1979) is in face *P. ophistops*. This we have ascertained after assessing the said specimen. Thus, the correlations of these Upper Carboniferous sequences is shown in Table 1.

Table 1. Upper Carboniferous sequences of Malaysia & Thailand

Kobayashi & Hamada (1979)	Yanagida & Aw (1979)	Metcalf, <i>et al.</i> (1979)	This work
Huai Luang Shale	basal Aring Formation	Panching Limestone	Bukit Bucu, Batu Rakit

PLATE 1

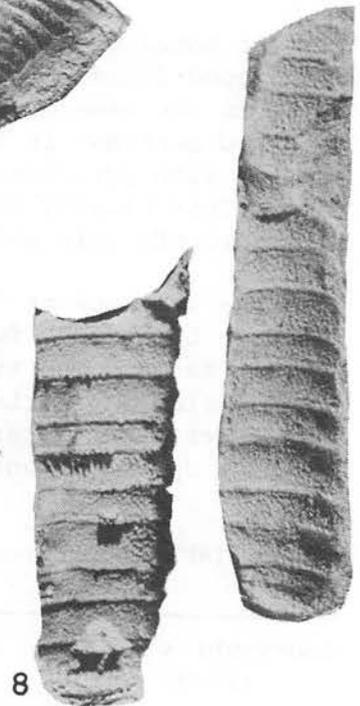
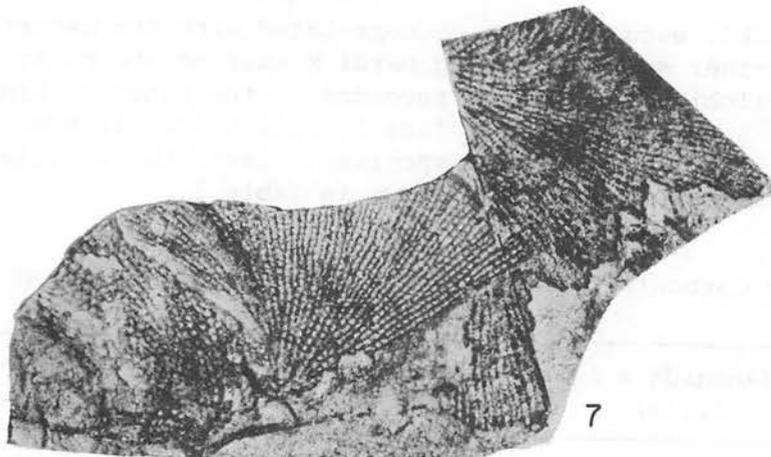
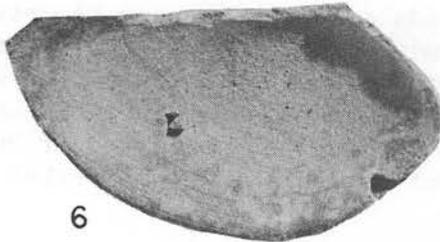
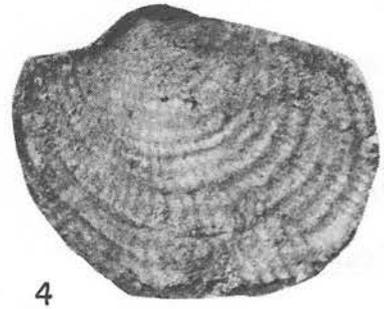
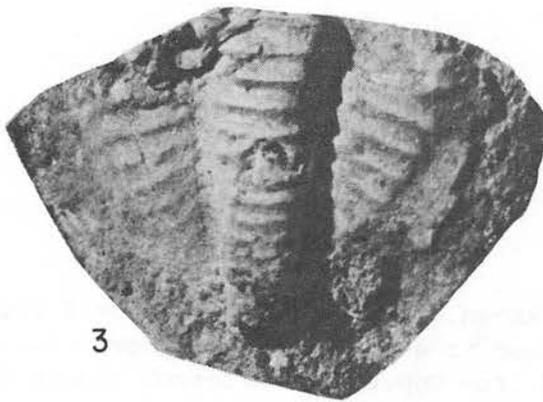
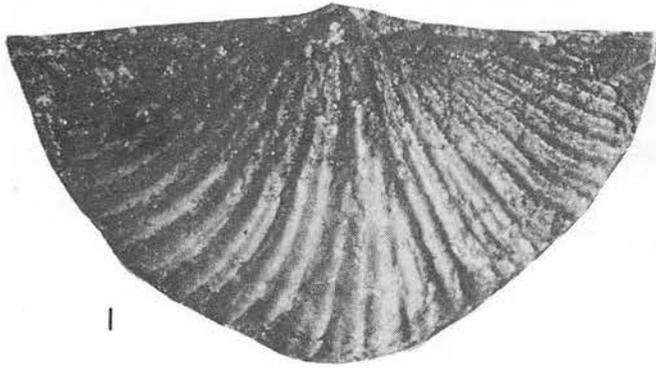


Plate 1.

- Fig. 1 *Brachythyryna strangwaysi* (4X) UM 10241
2, 4 *Chonetinella* sp. (3X) UM 10242, UM 10244
3, 5 *Paladin veeravurusi* (4.5X and 3X respectively)
UM 10243, UM 10245
6 *Edmondia* sp. (3X) UM 10246
7 *Fenestella retiformes* (2X) UM 10247
8, 9 '*Poteroocrinus*' sp. (3X and 3.5X respectively)
UM 10248, UM 10249

With respect to the location of Bukit Bucu, being on the east coast and the slight degrees of metamorphism of its rocks, these beds can loosely be correlated with the Carbo-Permian strongly deformed sequences of phyllites, slates and quartzites that stretches from the south in Johore to the north in Terengganu. Fossil plants of Carboniferous age have been reported from these successions and in contrast, the beds at Bukit Bucu are only slightly folded.

The palaeoenvironment of Bukit Bucu is undoubtedly shallow marine as evidenced by the faunal assemblage. The lithology is also consistently of shallow marine character.

Acknowledgements

We would like to record our appreciations to Messrs Lee Kok Eng, Mohd. Isa and Ching Yu Hay for photography and drafting aspects.

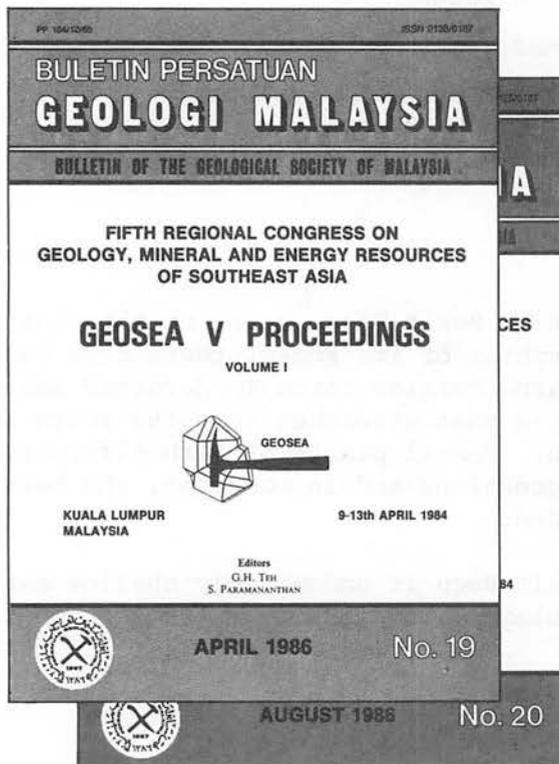
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GEOLOGICAL SOCIETY OF MALAYSIA

GEOSEA V PROCEEDINGS

VOLUMES I & II
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Some of the articles appearing include:-

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THE CLASSIFICATION AND NOMENCLATURE FOR POROUS CLASTIC ROCKS

Sriyanee De Silva, Dept. of Geology, St. Peter's College, Oxford OX1 2DL, England

Abstrak

Suatu sistem pengelasan and penamaan batupasir berdasarkan kepada satu gambarajah ternar, didirikan untuk membantu analisa petrografik batupasir yang poros. Pengelasan ini ditakrifkan oleh tiga parameter yang penting - kandungan klast, matriks dan keporosan. Dua istilah diperkenalkan, poro-arenite dan poro-wacke. Kedua-dua poro-arenite dan poro-wacke boleh dikelaskan dengan lebih terperinci mengikut pengelasan Dott (1964).

Abstract

A system of classification and nomenclature based on a ternary diagram was designed to aid petrographic analysis of porous arenites. The classification is defined by three parameters - the percentages of the clasts, matrix and porosity. Two terms are proposed, namely, poro-arenite and poro-wacke. The poro-arenite and poro-wacke can be further classified by their mineralogical components after Dott (1964).

The classification of porous clastic rocks is always the most difficult part of sedimentary petrography since the voids present represent an unknown parameter. However, in the interest of scientific promulgation, nomenclature allows the future recognition of similar, if not identical phenomena. Hence, it is with this in mind that the following classification is proposed.

The classification is defined by the three most prominent features in a sedimentary rock -

- i) detrital (clastic) component which is represented by quartz, feldspar, lithic fragments, bioclasts/fossils, heavy minerals and carbonaceous material. This precludes anything less than 30 microns.
- ii) matrix which is composed of all fine material less than 30 microns (Pettijohn *et al.*, 1972). No distinction is made as to the origin of the matrix, whether it be allogenic or authigenic. Cements are also included here, because it is found within the interstices. It should be noted that pervasive cementation is rare in porous rocks.
- iii) the porosity of the rock, which is defined as being the ratio of the aggregate volume of interstices in a rock to its total volume. This includes all types of porosity which are the result of primary or secondary sedimentary processes.

These features are used as end-members of a ternary diagram. Figure 1 illustrates the diagram. The problems of demarcation are addressed below.

1. Detritus - Porosity line

Scheidegger (in Pettijohn *et al.*, 1972, p. 94) concludes that porosity is independent of size but not of packing. Rhombohedral packing,

considered the tightest, has a porosity of 25.9%. The loosest has a porosity of 87.5%. These values present the theoretical limits of maximum and minimum porosity in an equigranular, uniformly spherical rock with no cement or matrix. Variation in grain size and morphology serves to occlude porosity. 40% initial porosity for wind or water deposited sediments (Hayes, 1979) is a more realistic value for the uppermost limit. Hence, 87.5% will mark the maximum theoretical limit while 40% will denote the normal upper limit of porosity in a detrital rock.

2. Detritus - Matrix line

The demarcation of this line is based on the classification of detrital rocks by Dott (1964), Pettijohn, *et al.* (1972), in which a rock containing more than 15% matrix is called a wacke and more than 75% a mudstone. Therefore, 15% will be the limit for arenites and 75% for mudstones. Wackes will be contained within these limits.

3. Matrix - Porosity line

This has been delineated based on the relationship of porosity to the burial history of argillaceous rocks (Greensmith, 1978). The occlusion of porosity is related to the chemical changes of the clay minerals during diagenesis.

Simple terms are introduced to allow for a more comprehensive classification (see Fig. 1). Terms which are normally used, such as arenite, shale, argillite, etc. are maintained in their original context. In addition, two other terms are introduced.

1. Poro-arenite
2. Poro-wacke.

Porosity-arenite

The prefix 'poro' is taken from the Greek word *poros* meaning passage to indicate the presence of pores. The porosity-arenite can be classified further using Dott's classification to reflect its mineralogical content. That is, by making up the detrital components up to 100%. Hence, if a sublitharenite (by virtue of its composition of quartz, feldspar and lithic components) contained a porosity of 20% then the rock will be called a porosity-sublitharenite.

Porosity-wacke

The prefix is used in the same way as above. The wackes can be defined with greater precision in a similar fashion, in concordance to its mineralogical composition. Therefore, a porous quartz wacke can be called a porosity-quartz wacke.

This classification can be used with data procured petrographically as well as other methods and it does provide porous rocks with a name.

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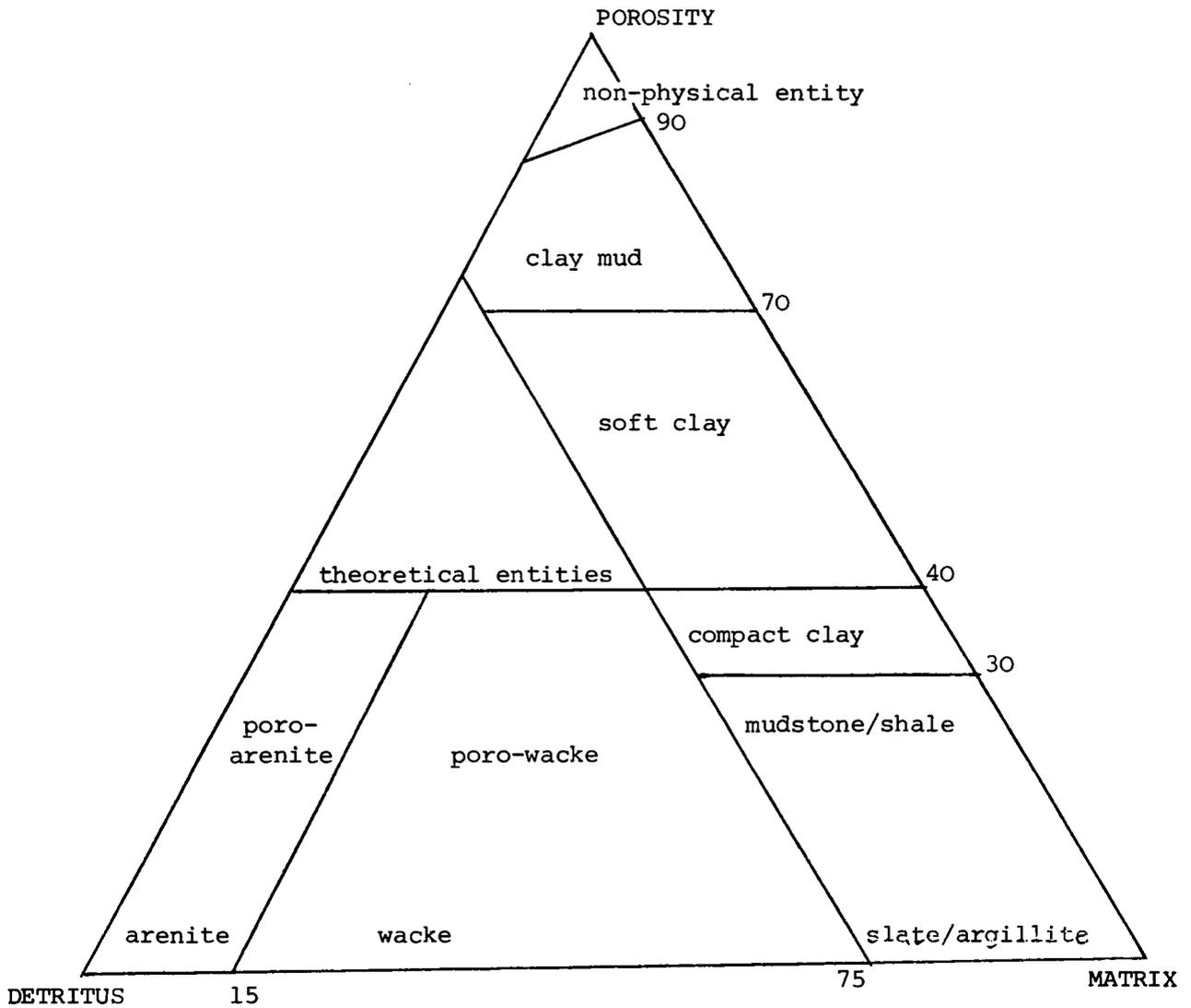


Fig. 1. Ternary diagram for the classification of porous rocks.

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THE SABAH MELANGE - A STRATIGRAPHIC UNIT?

(Letter to the Editor)

Robert B. Tate, New House Farm, Hatton, Warrington, U.K.

Sanudin Hj. Tahir and Tan Teong Hing have highlighted recently the unsatisfactory nature of the Chert-Spilite Formation in the stratigraphy of Sabah (*Warta Geologi*, Vol. 12, No. 2), and their suggestion that the stratigraphical relationships of the Formation should be re-examined is welcome.

Their suggestion, however, that the Wariu, Ayer and Kuamut Formations be grouped together as one mappable body to be termed "Sabah Melange" is premature. Chaotic rocks in those Formations show distinctive phreatic mineralisation and low temperature metamorphism which is not evident in other chaotic rocks in Sabah and it is believed that most of the chaotic sequences in the Wariu, Ayer and Kuamut Formations are the products of mud volcanism or have been caused by subterranean explosives forces which have disrupted overlying sediments, particularly the Kuamut Formation (cf. "Broken" Kuamut Formation, Memoir 4 (Revised) Leong, 1974). Thus, in addition to gravity tectonics, there is also an upward component to be added to the already confused stratigraphic scenario. There may be chaotic assemblages of several genetically different origins in Sabah of which melange, olistostrome and the products of mud volcanism are three possibilities (McManus & Tate, 1986).

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PERTEMUAN PERSATUAN (MEETINGS OF THE SOCIETY)

CERAMAH TEKNIK (TECHNICAL TALK)

Martin Oosterom: The geochemistry of the granitoids and related ore deposits in the Hercynian Belt of Western Europe

Laporan (Report)

Dr. Martin Oosterom, a geochemist with the Earth Sciences Institute, Utrecht, gave the above talk to members of the Society on 2 December 1986 at the Geology Department, University of Malaya, Kuala Lumpur.

Dr. Oosterom, who has worked extensively on alluvial tin and bauxite in Belitung and tungsten and uranium deposits in Europe, began his talk by giving a brief geology of Europe, in particular the tin occurrences at Cornwall and the Erzgebirge and the Sn/W occurrences of the Iberian Peninsular.

He mentioned that now uranium is of great importance in the Hercynian Belt with areas having 5-10 ppm U while the Massif Central possesses 10-15% of the world's uranium reserves.

Dr. Oosterom then went on to show the geochemical patterns of the Hercynian granites where trends of the elemental distribution show both increase and decrease with evolution.

He then focused on the Panasquiera Sn/W deposit to elaborate on multielement evolution within granites.

G.H. Teh



Martin Oosterom

PETROLEUM GEOLOGY SEMINAR 1986 - REPORT

The Geological Society of Malaysia held its Petroleum Geology Seminar '86 at the Ming Court Hotel in Kuala Lumpur on the 8th and 9th of December 1986. YB Dato' Abdul Ajib bin Ahmad, Minister in the Prime Minister's Department declared open the Seminar.

Despite a cautious start in the early stages of planning, due to the economic situation and low oil prices, the solid response in participation, technical papers and financial support, helped to crystallise the successful 'Petroleum Geology Seminar '86', a worthy tenth in the series of such annual seminars first introduced in 1977.

About 200 participants attended the Seminar this year and strong representation poured in from Petronas, Petronas Carigali Sdn. Bhd., SHELL and EPMI, Overseas Petroleum & Investment Corp. (OPIC), foreign and local oil and services companies as well as local universities.

A total of 16 excellent technical papers were presented at this Seminar by professionals from various oil, consultancy and service companies. Various aspects of the geology having direct bearing on petroleum geology of the region were presented and discussed in these papers.

The Seminar was solidly supported by a large number of foreign and local oil companies as well as petroleum related service companies despite the present economic situation. We were fortunate to have Schlumberger Overseas S.A. hosting a poolside cocktail on 8th December for participants of the Seminar.

In his welcoming address, the President of the Geological Society of Malaysia commented on the ever growing importance of the Seminar in this region as evidenced by the ever increasing trend of participants and good technical papers at the Annual Petroleum Geology Seminar over the past 10 years.

YB Dato' Abdul Ajib bin Ahmad in his opening address likened the tremendous growth of the Society's Petroleum Geology Seminar to that of the Petroleum Industry in Malaysia. However, he warned that since oil and gas are non-renewable resources, efforts should be stepped up to find more oil to replace depleted reserves in Malaysia where large areas still exist with good potential for oil and gas discoveries with new data and increasingly sophisticated technology.

It is hoped that papers presented at the Society's Petroleum Geology Seminars will continue to be published in the Society's Special Bulletins on Petroleum Geology so as to disseminate useful literature on Petroleum Geology in the region which is so important in designing future exploration programmes.

G.H. Teh

WELCOMING ADDRESS BY THE PRESIDENT OF THE GEOLOGICAL SOCIETY OF MALAYSIA AT THE PETROLEUM GEOLOGY SEMINAR '86

Yang Berhormat Dato' Abdul Ajib bin Ahmad, Menteri di Jabatan Perdana Menteri, Yang Berbahagian Datuk Haru Ariffin, Tuan-Tuan dan Puan-Puan,

On behalf of the Geological Society of Malaysia, I bid you all a very warm welcome to our Annual Petroleum Geology Seminar. This is the tenth of such Seminars organized by the Society with the first one having been held in 1977. Participation in these Seminars by geoscientists from Government, Academia and Industry has always been encouraging and has been increasing over the years with some 150 or so participants attending the earlier Seminars, while some 180 to 200 participants have been attending the more recently held Seminars. The number of papers presented at these Seminars has also been increasing over the years, with only one-day Seminars having been organized for the first 3 years while two-day Seminars have had to be held over the last 6 years. This growth of the Annual Petroleum Geology Seminars in terms of increasing participation and increasing numbers of papers presented is perhaps best appreciated by former Chairmen of Organizing Committees for these Seminars, in particular Dr. Mohamad Ayob who was responsible for the organization of the first Annual Petroleum Geology Seminar in 1977. This year's Petroleum Geology Seminar has also seen a tremendous response to the initial call for papers and what was originally intended to be a one-day Seminar has had to be transformed into a two-day Seminar. At this juncture, I would like to extend my thanks to the members of this year's Organizing Committee, in particular its' Chairman, Mr. Ahmad Said who has spent much time and effort in not only soliciting papers and donations but also in ensuring the smooth running of the Seminar.

The Petroleum Geology Seminar is one of the more important, if not the most important, annual activity organized by the Geological Society of Malaysia and it is always gratifying to note the tremendous response both to participation in, and support for, the Seminar. In this respect, the Geological Society of Malaysia is indebted to the various Petroleum and Service Companies, and other Organizations, who have always been forthcoming with generous contributions towards the organization of the Petroleum Seminars. This year's Petroleum Seminar is also no different for it has received generous donations from several Petroleum and Service Companies, and other Organizations. A list of the donors for this year's Seminar is provided in the Programme and I take this opportunity, on behalf of the Geological Society of Malaysia, to thank each and everyone of them for their contributions and support. This support of Industry is very well appreciated by the Society for it enables the Society to carry out effectively its primary objective of promoting the advancement of the geological sciences in Malaysia and nearby areas. It is thus sincerely hoped that the generous support of the Petroleum and Service Companies, and other Organizations, will continue unabated in the future.

The main objective of the Annual Petroleum Geology Seminar is the bringing together of both local and foreign geoscientists, and others, involved in Petroleum Geology in general to discuss and exchange ideas, and to share experiences and knowledge. In connection with this, the Geological Society of Malaysia was able last year to publish a Special Bulletin dealing exclusively with topics of interest in Petroleum Geology. This Special Bulletin contained papers presented at Petroleum Geology Seminars organized by the Society prior to 1985 and was well received by

geoscientists and others involved in the exploration for, and development of, oil and gas reserves. It is rather unfortunate, however, that due to technical reasons the Society was unable to publish another Special Bulletin on Petroleum Geology in time for this year's Seminar. This Special Bulletin would have contained several of the papers presented at the 1985 Petroleum Geology Seminar. Dissemination of ideas and knowledge forms an important pre-requisite for the advancement of any science and this the Geological Society of Malaysia believes as evidenced by its several publications. It is thus hoped that the papers presented at last year's, and this year's, Petroleum Geology Seminars will be able to be submitted to the Society for consideration for publication.

In closing, I would like to wish all participants a meaningful and fruitful two-day Seminar. I also wish to thank Yang Berhormat Dato' Abdul Ajib bin Ahmad for kindly consenting to declare open this year's Petroleum Geology Seminar.

OPENING ADDRESS BY YANG BERHORMAT DATO' ABDUL AJIB BIN AHMAD, MENTERI DI JABATAN PERDANA MENTERI ON THE OCCASION OF THE OPENING CEREMONY OF THE PETROLEUM GEOLOGY SEMINAR '86

Mr. Chairman, Ladies and Gentlemen,

It gives me great pleasure to be present here today at the opening of this 10th Petroleum Geology Seminar. I would like to take this opportunity to congratulate the Geological Society of Malaysia for having reached the milestone of successfully organizing this Seminar over the past 10 years.

I believe the past seminars have not only contributed to our knowledge of petroleum geology but have also helped to establish closer links between oil and service companies and Government and Academic Institutions. I am confident that the Geological Society of Malaysia will continue to play this important role in fostering the greater understanding of the petroleum geology of Malaysia and the latest exploration techniques available.

Ten years is not too long a time and cover this period we have seen the tremendous growth of the petroleum industry in Malaysia.

- * Ten years ago we were producing 165,000 BBLs of oil per day - today we are producing three times as much - around 500,000 barrels per day.
- * Ten years ago Malaysia's remaining reserves of oil were 1.2 billion barrels - today our remaining reserves are 3 billion barrels - more than double the amount even taking into account produced reserves.
- * Ten years ago, no gas was being exported - today we export close to 6 million tons of LNG a year from Sarawak.
- * Ten years ago, not a drop of oil was being produced offshore Terengganu - today this area contributes half our daily production.

All this serves to highlight the importance of the petroleum industry to Malaysia today. Petroleum is a large revenue earner for Malaysia, accounting for about 30% of total Federal Government revenue and it is essential that the industry continues its pace of development to ensure maximum economic benefits for the country.

However, everyone knows that oil and gas are non-renewable resources. Our daily production of petroleum continually reduces our reserves. It is estimated that at current production rates, our oil reserves will last another 17 years or so. And as domestic consumption increases, we could be net importers of oil by the time the 20th Petroleum Geology Seminar is held!

It is therefore imperative that we step up the efforts to find more oil to replace depleted reserves, taking into account the long lead time need to find and develop new reserves. As you all are aware, in most parts of the world, oil is getting more difficult to find and oil field sizes are not getting any bigger. In Malaysia, we are very fortunate that large areas still exist with good potential for oil and gas discoveries. And this is where the petroleum geologists will continue to play their key role in establishing further new reserves of oil and gas.

Over the past years, our geologists have gained a good understanding of the variety of geological settings in our sedimentary basins but I am sure more ideas can be developed with new data and increasingly sophisticated technology. There are large areas still to be explored, ranging from deep jungle to the deep waters of the South China Sea.

The technology is available to explore in all these areas. However exploration is a risky and expensive business and although many developing countries can now carry out their own exploration programmes, the more positive role will continue to be played by the foreign oil companies with available risk capital. It costs an average of 10 million Ringgit to drill an exploration well in Malaysia and the costs of an exploration venture in Malaysia by a foreign oil company can range in monetary terms from 30 to 150 million Ringgit. Malaysia has always welcomed foreign participation in the development of its petroleum industry. Historically, the foreign companies have played the key role in developing the nation's petroleum resources. Today, however, low and unstable oil prices have affected the cashflows of oil companies and have increased the risks in petroleum investments. There have been sharp cutbacks in exploration and development expenditures worldwide and exploration investments are being evaluated more critically. The Government thus recognizes the importance of creating an environment conducive to foreign investments and has always strived to provide incentives for foreign investors. To encourage oil exploration for instance, the Government last year announced the relaxation of the terms of the production-sharing contracts, which allow speedier recovery of investment costs and a larger share of profits for investors. There has been a positive response from oil companies to this move and we expect several new companies to commence operations in Malaysia next year, injecting not only risk capital but also new ideas in petroleum exploration, for Malaysia, investment in exploration is not only critical for establishing new reserves but is also the key to the generation of other investment opportunities in the service and downstream sector. Participation by various foreign oil companies will also provide ample opportunities for Malaysian geologists and geophysicists to upgrade their skills.

Although the oil business is currently going through a bad patch, it should be remembered that petroleum exploration is a long-term strategy that is not halted or continued depending on the prevailing oil price. It can be safely said that depressed oil prices will not always be with us and oil prices will rise again over the next few years. I am glad that the oil companies share our optimism and that there has been no drastic slowdown of exploration activity in Malaysia.

However, in these difficult times, there is even a greater need for innovative and thoughtful application of various petroleum exploration methods. For our petroleum geologists, whose primary roles really are the discovery of economic oil and gas deposits, the challenge is not only to sharpen their geological skills but also to gain a better appreciation of the economics of the business they are in. This includes gaining more knowledge of the vast and growing array of operational and engineering techniques available today.

Innovation and economics will play more key roles in the oil and gas business and the geologists should always be adequately prepared to meet the challenges of the future.

To this end, the need for sharing experiences and knowledge is even more critical today and I am very pleased to note that at this seminar, papers are not only being presented by oil companies on the geology of our areas, but there are papers also on the latest seismic and well evaluation techniques by the service companies, who continually strive to make life easier for the geologists! I am sure that with exploration over the next few years being planned to be carried out also in the land and deepwater areas, the need for sophisticated services will increase and there will be ample opportunities for service companies to expand their roles and grow with the oil industry in Malaysia.

In conclusion, I wish you success in your discussions over the next two days and I take great pleasure in declaring this 10th Petroleum Geology Seminar open.

Thank you.

GEOLOGICAL SOCIETY OF MALAYSIA
PETROLEUM GEOLOGY SEMINAR 1986

PROGRAMME

TUESDAY, 9TH DECEMBER 1986

- 9.00 a.m. : Better Accuracy from Sidescan Records:
The Object-Chord Method
- Malcolm James (Racal Survey (Malaysia) Sdn. Bhd.)
- 9.40 a.m. : PTV-Modelling as a Predictive Tool in Hydrocarbon
Exploration with Examples from the Mid-Norwegian
Continental Shelf
- Odd R. Heum (STATOIL; Norway)
- 10.20 a.m. : **COFFEE BREAK *******
- 10.40 a.m. : Controls on the Development of a Modern Beach Ridge
System - Significance in Interpretation of Ancient Sequences
- Noor Azim Ibrahim (PETRONAS Laboratory Services Dept.)
- 11.20 a.m. : Multiple Streamers and Source in 3D Marine Seismic
Surveys, Offshore Sarawak -1986
- Vincent Kong (Sarawak Shell Berhad)
- 12.00 noon : A Geophysical Case History of Irong Barat Field
- Lye Yue Hong (Esso Production Malaysia Inc.)
- 12.40 p.m. : **LUNCH BREAK *******

- 2.00 p.m. : Tectonic Evolution and Structure Styles of Cenozoic Basins around Taiwan Area
- Frank Fu Wen Huang (Chinese Petroleum Corp.)
- 2.40 p.m. : Early Diagenesis of a Holocene Reefal Terrace Merak-Anyer Area, Northwest Java Island, Indonesia
- M. Cassoudebat, Said El latief, A. Fediaevsky
(TOTAL Compagnie Francaise Des Petroles)
- 3.20 p.m. : **COFFEE BREAK *******
- 3.40 p.m. : The Hydrocarbon Habitat of PETRONAS Carigali's Main Operating Areas in the Malay Basin
- Md. Nazri Ramli, Jamlus Yassin & Mansor Ahmad
(PETRONAS Carigali Sdn. Bhd.)
- 4.20 p.m. : LITHO/Dipmeter Synergy: A Geological Interpretation Technique
- G.G. Shanor (Schlumberger Overseas S.A.) and Ali Mohd Shariff (PETRONAS)
- 5.00 p.m. : **CLOSING REMARKS *******

MONDAY, 8TH DECEMBER 1986

- 8.00 a.m. : **REGISTRATION *******
- 8.40 a.m. : Arrival of invited guests
- 8.50 a.m. : Arrival of Yang Berhormat Dato' Abdul Ajib bin Ahmad, Menteri di Jabatan Perdana Menteri
- 9.00 a.m. : Welcoming Address by Dr. John Kuna Raj, President, Geological Society of Malaysia
- 9.10 a.m. : Opening Address by Yang Berhormat Dato' Abdul Ajib bin Ahmad, Menteri di Jabatan Perdana Menteri
- 9.30 a.m. : **COFFEE BREAK *******
- 10.00 a.m. : The History and Geology of Irong Barat Field
- Jawati Abu Naim (Esso Production Malaysia Inc.)
- 10.45 a.m. : Formation MicroScanner Services - A Tool to Define Fine-Scale Geological Features with a 'Core-Like' Image
- Ali R. Somturk (Schlumberger Overseas S.A.)
- 11.30 a.m. : Large Scale 3D Marine Seismic Exploration
- E.G. Selby (Geophysical Service International, Singapore)
- 12.15 p.m. : **LUNCH BREAK *******
- 1.45 p.m. : Advances in DipLog Data Processing for Stratigraphic Analysis
- Terrence H. Quinn (Dresser Atlas Far East)
- 2.30 p.m. : Oligocene to Early Miocene Alluvial Deltaic Systems Southeastern Part of the Malay Basin, Offshore West Malaysia
- Dr. Nik Ramli Nik Hassan (PETRONAS Laboratory Services Dept.)
- 3.15 p.m. : **COFFEE BREAK *******
- 3.30 p.m. : Petroliferous Basins of India with Special Reference to the Giant Bombay High Oil Field
- V.V. Sastri (PETRONAS Laboratory Services Dept.)
- 4.15 p.m. : The Geological Configuration of the Betty Field, Baram Delta Province, Offshore Sarawak
- H.D. Johnson, T. Kuud & J.H. Archer (Sarawak Shell Berhad)
- 6.00 p.m. : **COCKTAIL RECEPTION ***** (Poolside, Ming Court Hotel) hosted by Schlumberger Overseas S.A.**

PETROLEUM GEOLOGY SEMINAR '86 - ABSTRACTS OF PAPERS

The History and Geology of Irong Barat Field

Jawati Abu Naim, Esso Production Malaysia Inc., Kuala Lumpur.

Irong Barat field is the seventh field offshore Peninsular Malaysia, to be developed by Esso Production Malaysia Inc. The structure is a complexly faulted anticlinal feature at the westernmost end of the Tapis-Irong anticlinal trend. Eleven exploration wells were drilled in the field between February 1979 to February 1982 and fifteen development wells were drilled from the A Platform from September 1983 to October 1984. The field produces oil mainly from Middle Miocene Group H reservoirs.

Formation Microscanner Services - A Tool to define Fine-scale Geological Features with a 'Core-like' Image

Ali R. Somturk, Schlumberger Overseas S.A., Kuala Lumpur.

Fine-scale definition and description of formations is a valuable knowledge needed by geologists and engineers for better understanding of the reservoirs.

Formation MicroScanner tool is designed to provide in-situ description of the reservoir that could otherwise only be obtained by the expensive and more time-consuming procedure of full-bore coring. It is an extension of dipmeter technology in which scanning electrode arrays are used to provide a high sampling of the formation microresistivity in both vertical and azimuthal directions on the borehole surface. These two-dimensional data are then mapped to gray-scale or colour to produce a 'core-like' borehole wall image that allows fine-scale features to be described, through essentially the interpretation procedures as that used in the examination of core photographs.

Major applications of the tool are seen in fracture identification, analyzing thinly bedded formations, recognizing secondary porosity developments in carbonates and in defining sedimentary structures and depositional environments.

Litho⁺/Dipmeter Synergy: A Geological Interpretation Technique

G.G. Shanor, Schlumberger Overseas S.A., Kuala Lumpur and
Ali Mohd. Shariff, PETRONAS, Kuala Lumpur

Dipmeter results have been utilized effectively worldwide for the subsurface determination of dips encountered in the wellbore. As Dipmeter 'patterns' are interpreted with respect to their corresponding lithologies, a tandem display of LITHO⁺ and Dipmeter results provides a powerful tool for the interpretation of subsurface structure, depositional environments, unconformities, and porosity and permeability trends. Several examples, in both carbonate and siliciclastic sections are discussed which illustrate the benefits of the LITHO⁺/Dipmeter display.

Large Scale 3D Marine Seismic Exploration

E.G. Selby, Geophysical Services Inc. (GSI), Singapore

In recent years there has been a significant increase in the use of three dimensional seismic surveys. Because of the large volume of data which has to be collected and processed such surveys have been generally restricted in areal extent and therefore have been used primarily as a tool for field development rather than for exploration.

In some circumstances it is possible to design surveys which will lead to a full 3D migrated data volume without the need to collect significantly more data than is necessary for a detailed 2D survey.

Criteria for designing such surveys will be discussed together with details of collection and processing techniques. These methods will be illustrated using results from a survey which has been recently completed.

Advances in Diplog Data Processing for Stratigraphic Analysis

Terrence H. Quinn, Dresser Atlas Far East, Kuala Lumpur.

Detailed log-derived stratigraphic interpretation requires the use of high vertical resolution logging devices such as a dipmeter. The Dresser Atlas Strata Dip^R program, originally introduced in the early 1980's, is a computer program designed to give a detailed point-wise estimate of the orientation and depth of very fine formation laminae. Numerous improvements in the computational algorithms coupled with features such as the removal of the effects of structural dip and intelligent handling of floating pad data have resulted in a second generation product which is described in this paper.

The accuracy of the program's results was tested using synthetic data generated by a dip simulation program. The repeatability of the program (in fact of the entire data acquisition and processing system) is demonstrated by separate analyses of three independent runs over the same well interval. Two field examples demonstrate the value of this new program as an aid to stratigraphic analysis.

Oligocene to Early Miocene Alluvial Deltaic Systems Southeastern part of the Malay Basin, Offshore West Malaysia

Nik Ramli Nik Hassan, PETRONAS Laboratory Services Dept., Kuala Lumpur

The K sandstone member of the Pulai Formation is an important hydrocarbon bearing reservoir in the southeastern part of the Malay Basin. Depositional facies in the Lower K sandstone consist of braided stream sediments in the northeastern part of the area and fluvial and possibly deltaic sediments in the southern part of the area.

Palaeocurrent data and the association between braided stream sediments with an interpreted interfan deposit suggest that these braided streams may have been formed as a part of an alluvial fan deposit. The Upper K sandstone consists of deltaic sediments formed at the edge of a narrow seaway communicating the West Natuna Basin with the Malay Basin.

Petroliferous Basins of India with Special Reference to the Giant Bombay High Oil Field

V.V. Sastri, PETRONAS Laboratory Services Dept., Kuala Lumpur

There are 23 sedimentary basins in India, of varying priorities for petroleum exploration.

The pericratonic petroliferous basins are the resultant of mainly two global tectonic events: (1) the separation of India from Gondwanaland, and (2) the northerly movement of Indian block and collision with the Asian continental mainland. The intracratonic basins have a relatively low priority for oil exploration. The coastal basins which extend into the offshore, belong to the divergent margin category, with the exception of one i.e. the Andamans, which is of convergent margin type.

The giant Bombay High oil field is located on a wide continental shelf, to the west of Bombay city, which is believed to be the largest continental terrace in the world. This offshore basin was initiated during the break up of Gondwanaland during the Late Cretaceous. At the time of break up of Gondwanaland the sedimentary fill consists of Tertiary sediments which are at places more than 5000 meters thick. Three possible source rocks are suggested. The source shales contain more than 0.5% of organic matter. Four Miocene oil and gas bearing zones in the limestones and sandstones are identified - the main pay zone is the Middle Miocene L-III Limestone. Both the primary (intergranular) and secondary porosities are present. Post Miocene shales act as cap rocks. The Bombay High oil field is surrounded by a large number of satellite oil/gas fields. The structures are mostly in the form of drapes of sediments over paleohighs (of basalt) and also by faults. The Bombay High basin contains more than half of India's oil/gas reserves.

Geological Configuration of the Betty Field, Baram Delta Province, Offshore Sarawak

H.D. Johnson, T. Kuud & J.H. Archer, Sarawak Shell Bhd., Sarawak

The geological configuration of the Betty Field is typical of oil fields in the Baram Delta Province of offshore Sarawak: (1) structures result from the interaction of delta-related growth faulting and later Pliocene compressional folding, (2) reservoirs comprise Miocene shallow water sandstones and shales which accumulated during repeated phases of progradation and transgression of the wave-dominated Palaeo-Baram Delta, and (3) hydrocarbons occur in numerous vertically-stacked sands separated by sealing shales and trapped by a combination of fault seal and dip closure.

This paper discusses in more detail these aspects in relation to the Betty Field and relates them to the field's development strategy.

Structurally, the field is relatively simple, consisting of a NE-SW trending anticline which is bounded to the south by a major E-W trending growth fault (Betty growth fault). The anticline is a result of rollover associated with this growth faulting combined with Pliocene compressional folding along the NE-SW trending Bokor-Betty-Baronia anticlinal trend.

The Betty reservoirs occur within a ca. 2450 ft thick sequence

(between 7200-9650 ft ss) of Late Miocene, Upper Cycle V clastic deposits, which accumulated in a wave-/storm-dominated, inner neritic to nearshore/coastal environment within the Palaeo-Baram delta complex.

The sand bodies are characterized by composite (or amplified) coarse-ning upward/progradational sequences (ca. 160 ft) overlain by generally thinner, fining upward/retrogradational sequences (ca. 20-50 ft thick). The sand bodies are vertically heterogeneous but display high lateral continuity with excellent field-wide well log correlation, which is consistent with the inferred high wave-energy depositional setting.

Vertical heterogeneity is reflected in variations in the thickness and frequency of shale layers, and in the distribution of four distinctive reservoir facies of varying rock quality:

- 1) poorly stratified sandstone (porosity ca. 23%, permeability ca. 1200 md).
- 2) bioturbated sandstone (porosity ca. 22%, permeability ca. 500 md).
- 3) laminated sandstone (porosity 19%, permeability ca. 90 md).
- and
- 4) bioturbated heterolithic sandstone (porosity 17%, permeability ca. 50 md).

The Betty reservoirs are interpreted as representing the repeated build-out and gradual retreat of wave-/storm-dominated sand bodies (shore-face and/or shoreface-connected bars). They probably accumulated in a coastal to inner-shelf environment, which was marginal to the axial part of the Palaeo-Baram delta. Complete coastal progradation never occurred in this area in Upper Cycle V times with the environment remaining sub-littoral. The variations in sequence types reflect fluctuations in sediment supply and repeated base level changes, in which the latter was probably influenced by movements along the nearby Betty growth fault. The preservation of both progradation and retrogradational deposits, and the development of thick amplified sequences are both indicative of the high subsidence rates within the Baram Delta Province.

Hydrocarbons are trapped within at least twenty-one stacked sand bodies separated by sealing shales. The bulk of the hydrocarbons are encountered in a single structural block where trapping is a result of anticlinal dip closure and updip seal against the Betty growth fault. Only minor hydrocarbons are present in subsidiary fault blocks behind the Betty growth fault. Within the Betty structure oil-bearing reservoirs decrease in thickness and frequency with depth, while both associated primary gas caps and unassociated gas reservoirs increase in depth (down to 9500 ft ss). This reflects the thermal maturity profile of oil and gas migration in this area. Late expulsion and migration of gas has led to the preferential displacement of oil by gas in the structurally deep reservoirs.

Better Accuracy from Sidescan Records: The Object-Chord Method

Malcolm Jones, Racal Survey (Malaysia) Sdn. Bhd., Kuala Lumpur

Sidescan Sonar has become a widely used and often indispensable tool for seafloor engineering and survey activities in the oil industry. This acoustic technique has the ability to create a wide and continuous 'picture' of the 3-dimensional seafloor features and contours, and therefore permits quick and economical acquisition of seafloor information which is not readily available through other types of acoustic instrumentation.

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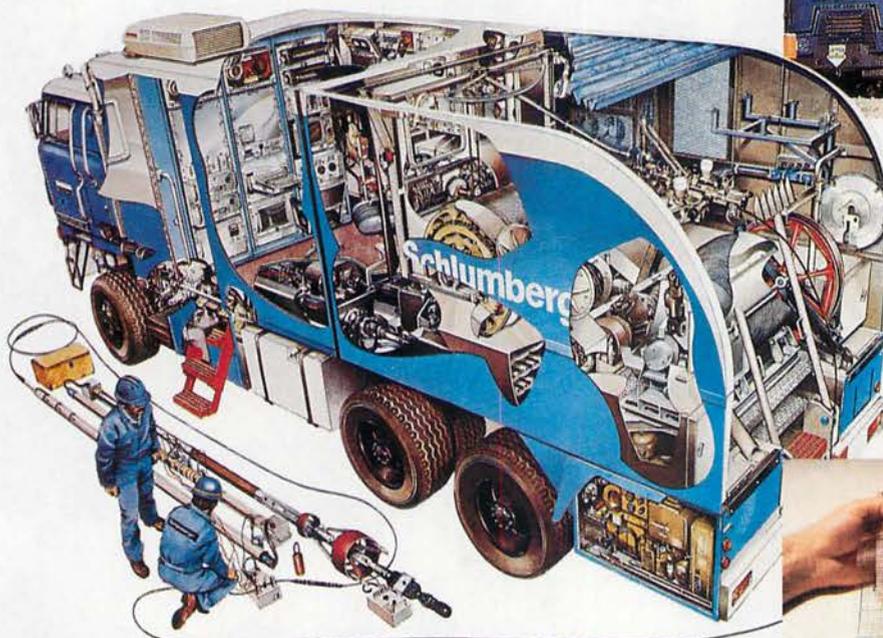
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Schlumberger engineer at work with the Cyber Service Unit system inside a wireline logging Unit

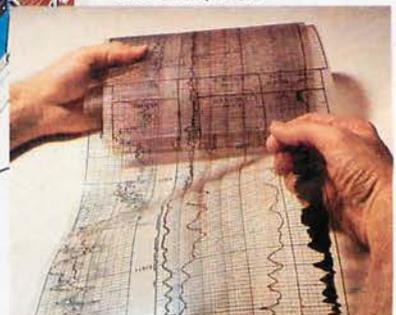


Cyber Service Unit on location.



Schlumberger crew checking a logging tool.

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



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GSM PETROLEUM GEOLOGY SEMINAR 1986

Captions to photographs

1. Early registrants at the Registration Desk.
2. "Nice to see you again". The crowded registration hall.
3. Registration goes on steadily.
4. Yang Berhormat Dato' Abdul Ajib bin Ahmad being introduced to members of the welcoming party on arrival.
5. Yang Berhormat Dato' Abdul Ajib bin Ahmad talking to GSM Council Members.
6. Organising Chairman, Ahmad Said, announcing the arrival of the guest-of-honour.
7. Dr. John Kuna Raj, President GSM, with his welcoming address.
8. Yang Berhormat Dato' Abdul Ajib with his Opening Address.
- 9 - 13. The large turnout at the Opening Ceremony.
- 14 - 16. A cup of tea/coffee and some discussions before the start of the technical sessions.
17. Vincent Kong of Sarawak Shell Bhd. on "Multiple Streamers and Source".
18. Malcolm James of Racal Survey on "The Object-chord Method".
19. Dr. Johnson of SHELL with a question from the floor.
20. Ted Selby of GSI on "3D Marine Seismic Exploration".
- 21, 22. The orderly rush for lunch.
23. D.E. Francis presenting the President with ESSO's contribution to the Seminar.
24. The President receiving SHELL's contribution from R.I. Young.
25. Noor Azim Ibrahim of PETRONAS Laboratory Services Dept. on a "Modern Beach Ridge System".
26. Md. Nazri Ramli of PETRONAS Carigali with a comment from the floor.
27. Frank Fu of CPC on "Cenozoic Basins around Taiwan".
- 28, 29. At the poolside cocktail hosted by Schlumberger Overseas S.A.
30. T. Kuud of SSB on the "Betty Field".
31. Active participation from the floor.
32. Ali Somturk of Schlumberger receiving his token of appreciation from Session Chairman, Dr. Nik Ramli.
33. V.V. Sastri of PETRONAS Laboratory Services Dept. being congratulated by the Session Chairman.
34. Session Chairman R.I. Young of SHELL discussing a point with Odd R. Huem of STATOIL.
35. A. Fediaevsky of TOTAL beaming with happiness as he receives his token from Session Chairman, Tony Lim of PETRONAS Carigali.
36. Terence Quinn being congratulated by D.E. Francis, the Session Chairman.
37. Lye Yue Hong of ESSO receiving his token from the Session Chairman.
38. A few final words and 'See you next year'.

The accuracy of mapped objects interpreted from this method has been limited by the fact that the fish is towed a distance from the vessel and its position is affected by different sea states and current conditions resulting in different feathering angles and layback distances.

Some present interpretation techniques do take into account the uncertain feathering angles of the fish, but they assume no errors in the layback distances. The object-chord method takes into account both the feathering angle and layback errors and in certain circumstances, due to good field practices, eliminates them, resulting in more accurate positions mapped.

PTV-Modelling as a Predictive Tool in Hydrocarbon Exploration with Examples from the Mid-Norwegian Continental Shelf

Odd R. Heum, STATOIL, Norway

Computerized PTV-modelling has been applied on several examples offshore Mid-Norway to demonstrate how the basic PTV-properties (pressure, temperature and hydrocarbon component distribution) may be critical for the hydrocarbon phase relation in a trap (oil vs. gas or condensates). The productive force of PTV tools in hydrocarbon exploration is tremendous. Hydrocarbon densities, phase relations, gas oil ratios, shrinkage, expansion factor, etc. can be calculated with great certainty with reliable input data. The multiple applications include general basin modelling, flash analysis, dew point analysis and boiling point analysis.

Controls on the Development of a Modern Beach Ridge System - Significance in Interpretation of Ancient Sequences

Noor Azim Ibrahim, PETRONAS Laboratory Services Dept., Kuala Lumpur.

The interpretation of subsurface stratigraphic and sedimentological information including 40 shallow vibra-cores and 19 bore holes, geomorphological analysis and ground penetrating impulse reflection radar have shown that the stratigraphy of the beach-ridge barrier is composed of two major lithosomes: (1) an earlier transgressive sequence; and (2) and a later regressive sequence with a landward transgressive component. Like other regressive barriers around the world, the regressive phase coincided with the Late Holocene stillstand of sea level. Its development is also controlled by antecedent topography and the presence of large sediment supply.

A SIR-7 impulse reflection radar has documented time line surfaces that have been inferred in previous studies of regressive systems such as along the Gulf Coast of America, in the Netherlands and in Australia. The radar record suggests that progradation of the regressive system occur sporadically. The development of the beach ridge begins during period of abundant sediment influx whereby the beach widens and builds seaward. This accretionary phase is punctuated by a period of low sediment supply when the beach erodes, leaving some cobble and gravels as sediment lag. Subsequence onshore movement of coarse-grained sediment steepens the beach profile forming a ridge. The influx of sediment is controlled by major storms.

A Geophysical Case History of the Irong Barat Field

Lye Yue Hong, Esso Production Malaysia Inc., Kuala Lumpur

The Irong Barat field is located at the western downfaulted end of the Tapis-Irong anticlinal trend. Faulting is extremely complicated with probably basement-involved wrenching and subsequent north-south compression.

Eleven exploration and delineation wells were drilled on the Irong Barat structure based on conventional 2D seismic. Because of structural and stratigraphic complexity encountered in these 12 wells, a 3D seismic survey was carried out over the whole field in 1984.

The 3D seismic data were interpreted using EPMI's ISIS 3D interpretation system. The interpreted 3D data show the Irong Barat structure to be even more complicated than previously mapped. However, it has shown a lot more of the structural configuration as well as yielding other geophysically significant information relating to lithofacies, hydrocarbon occurrence and the remaining potential of the field.

Tectonic Evolution and Structure Styles of Cenozoic Basins around Taiwan Area

Frank Fu Wen Huang, Chinese Petroleum Corp., Taiwan

The ocean margin island of Taiwan is a geodynamic body of young and complex build. It is the site of an ongoing arc-continent collision between the Eurasian plate and the Philippine-sea plate. The most manifest tectonic movements responsible for the deformation of this island arc are tephrogenic, collisional and wrenching. These movements played an important role in the Cenozoic tectonic evolution of Taiwan and formed various types of hydrocarbon accumulated geologic structures.

The Marginal-Pacific crust around Taiwan area was attenuated by rifting and developed north-northeast trending Cenozoic basins. These basins have various graben-horst structures and are bounded by large faults. Extensional structural styles have prevailed in Cenozoic basins in offshore Taiwan, with listric faults, and tilted blocks in the basement, and detached faults, growth faults, and rollover anticlines or drape fold in the cover rocks. However, in onshore Taiwan, with the collision of Luzon island arc, those basins show a strong response to the stress imposed upon the Cenozoic rocks by this Tertiary continent-arc collision. The collision remobilized the Mesozoic tectonized basement rocks and refolded them on various scales. Compressional and wrenching deformations are thus prevailed, with thrust faults, right-slip reverse faults and en-echelon arranged folds in the cover rocks.

The Cenozoic basins around Taiwan area have undergone different tectonics. In onshore areas the extensional structures have been changed into contractional structures. In offshore areas, those Cenozoic basins have extensional geologic structures until today.

Since there are different tectonic evolution types and different structural styles in different tectonic levels, these Cenozoic basins around Taiwan area have complicated hydrocarbon accumulations.

Multiple Streamers and Sources in 3D Marine Seismic Surveys,
Offshore Sarawak - 1986

Vincent Kong, Sarawak Shell Bhd., Sarawak

A 3D marine seismic survey generates up to ten times more data than conventional 2D surveys. In the Balingian Province, offshore Sarawak, most of the structures are geologically complicated and often intensely faulted. In order to adequately resolve these features a bin size of 25 x 25 m is required. If one considers a base programme of 10 x 10 km sq of 3D seismic survey, it would require some 60 days to complete the 4000 line-km programme. The fair weather window for offshore Sarawak extends from mid-March till mid-September, giving some 6 months of optimum survey period. When a number of 3D programmes are scheduled in one survey campaign it becomes necessary to find more cost effective methods of acquiring the data. Two options are available:

- 1) Reduction in data volume required by increasing the bin size.
- 2) Reduction in the multiplicity of the common depth point coverage.

Increasing the bin size would be detrimental to the spatial resolution of the dataset whereas it has been shown that 3D seismic surveys generally do not require as high a degree of CDP coverage as 2D surveys when migration is included in the data processing (KREY). The option of reduction in multiplicity is therefore preferred.

During the 1986 survey season, Sarawak Shell Berhad utilised the twin-streamers-twin-sources technique which acquired 4 seismic profiles at 25 m separation per ship's traverse. Three 3D surveys totalling 639 sq km were completed within a three and half months period. Some 39,000 km of data were acquired giving an average production rate of some 11,000 km per month.

The use of the twin-streamers-twin-sources technique raised two points of concern. One, of maintaining streamer separation parallelity and second, a possible compromise in data quality due to the large offset ratio between shot and receiver intervals. Monitor of streamers' shapes by the least square spline-fit method of data from the 12 compasses located at regular intervals along each streamer indicated that parallelity of separation was constant to a large extent. Preliminary data processing extracted in the 2D mode have shown good quality data acquired as compared to previous vintages at similar localities.

Known operational constraints common to seismic surveys in the region were alleviated by sufficient preparatory groundwork. The twin-streamers-twin-sources technique has proven its capability to 'condense' the time needed to obtain large volume of 3D data during the 1986 survey season.

Early Diagenesis of a Holocene Reefal Terrace Merak-Anyer Area
Northwest Java Island, Indonesia

M. Cassoudebat, Said El latief, A. Fediaevsky, TOTAL Compagnie
Francaise Des Petroles

The shoreline of the northwestern coast of Java Island is fringed by a terrace of holocene reefal deposits. These deposits are made of massive and finger coral biotherms and of coral debris accumulations. This show

early diagenetic phenomena as observed in the field and drill-core samples.

Three distinct zones corresponding to distinct hydrologic regimes with different prevailing diagenetic phenomena are observed. These are:

- . An inner zone adjacent to the coast, characterized by thin (? 1 m) fossil coral deposits. These cap holocene bay fill deposits. Corals are still aragonitic in spite of their age (7000-5800 years BP) and only a slight dissolution is observed in the vadose zone. Micritization and blocky sparitization are observed in the reefal terrace i.e. in the phreatic and the lowermost part of vadose zones, the blocky calcite, locally giving way to 'pisolites'.
- . A tidal flat and mangrove marsh located along the mouth of a small river and invaded by brackish waters at high tide. The aragonitic corals show a micritization of their surface and partly of their septae.
- . A coastal area, where the coral accumulations are the thickest (2 to 4.50 m) and partly observable as small outcrops. Micritization of the coral surface and traces of dissolution are observed in both phreatic and vadose zones. The micritic cement seems to require a quite permanently 'wet' condition (most probably an active marine phreatic zone).

Fine calcitic sparitization and blocky calcite occur in the vadose zone. Blocky calcite is also present within the bioclastic sands, above the reefal terrace. But there, a vadose origin is not proven, and a recent marine diagenetic environment is possible.

This study indicates that early diagenesis can strongly affect recent and near shore sediments. This observation underlines the importance of all unconformities, even minor ones, which can occur in carbonate reservoirs.

The reservoir characteristics of a carbonate sediment may be influenced by the diagenesis in its very early depositional history.

The Hydrocarbon Habitat of Petronas Carigali's Main Operating Areas in the Malay Basin

Md. Nazri Ramli, Jamrus Yassin & Mansor Ahmad, PETRONAS Carigali Sdn. Bhd., Kuala Lumpur

The popular hypothesis has been that sourcing of oil and gas in the Malay Basin was from deeply buried source beds. The observed distribution pattern of non-associated gas and oil with associated gas in structures of different geological ages was attributed to the timing of trap formation in relation to oil and gas generation phases. This model however, could not satisfactorily explain, in certain cases, the presence of substantial amounts of oil in younger structures while older ones were found to be gas bearing.

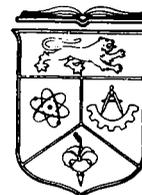
Recent geochemical studies by PETRONAS Carigali have revealed that intraformational sourcing is the likely process for hydrocarbon generation in PETRONAS Carigali's operating areas, even at relatively shallow depths (i.e. between 1100-1500 mss). This is due to the interplay of different source types and the varying geothermal gradients (4 to 6°C/100 m) resulting in the generation of crude oils of different maturity levels and distinct physical and chemical properties.

GSM COUNCIL 1987/88

The Chairman of the Nomination Committee, J.K. Raj, presented the list of Councillors for the 1987/88 Committee. This was accepted by the Council at its meeting on 31 October 1987. Since there were no other valid nominations, no election was necessary. The GSM Council for 1987/88 is as follows:

President:	Hamzah Mohamad, Universiti Kebangsaan Malaysia
Vice-President:	Ahmad Said, Petronas
Hon. Secretary:	S. Paramanathan, Universiti Pertanian Malaysia
Hon. Asst. Sec:	Ibrahim Komoo, Universiti Kebangsaan Malaysia
Treasurer:	Ahmad Tajuddin, Universiti Malaya
Editor:	Teh Guan Hoe, Universiti Malaya
Councillors:	Khee Kok Kean, Esso Production Malaysia Inc.
(1-year)	Wan Fuad Wan Hassan, Universiti Kebangsaan Malaysia
	Idris Mohamad, Universiti Malaya
	Fateh Chand, Geological Survey Malaysia
(2-year)	Azhar Hj. Hussin, Universiti Malaya
	Albert Loh, Malaysia Mining Corp.
	Chin Lik Suan
	Tai Say Ann, Petronas-Carigali

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ANNUAL GEOLOGICAL CONFERENCE 1987

Objektif Persidangan

Persidangan Tahunan Geologi ini bertujuan mengumpul ahli geologi tempatan, supaya dapat bergaul, bekenalan dan bertukar pendapat mengenai soal perkembangan geologi semasa.

Persidangan Tahunan ini juga bersempena dengan Mesyuarat Agung Tahunan Persatuan Geologi Malaysia supaya lebih ramai ahli dapat bersama di dalam majlis ini.

Thema

Perkembangan semasa dalam Geologi Malaysia.

Bahasa Persidangan

Persidangan akan dijalankan dengan menggunakan dwibahasa: BAHASA MALAYSIA atau BAHASA INGGERIS.

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Persidangan akan mempunyai empat sesi utama:

1. Geologi Am, Stratigrafi & Paleontologi.
2. Geokimia & Geologi Ekonomi.
3. Geologi Kejuruteraan & Geologi Sekitaran.
4. Geofizik Penerokaan & Hidrogeologi.

Pendaftaran

Peserta dinasihatkan melakukan pendaftaran awal untuk mengelakkan bayaran pendaftaran lewat.

	Bayaran Pendaftaran Awal	Bayaran Pendaftaran Lewat (selepas 15 Feb. 87)
Ahli	MR 30.00	MR 40.00
Ahli Pelajar	MR 10.00	MR 20.00
Bukan Ahli	MR 50.00	MR 60.00

Hanya pembentang akan dikecualikan bayaran pendaftaran.

Bayaran melalui cek terpalang atau draf bank boleh diterima. Tujukan bayaran kepada "Geological Society of Malaysia". Cek luar perlu melibatkan bayaran-bayaran bank.

Sila hantar bayaran pendaftaran bersama dengan Borang Pendaftaran yang terlampir kepada:

Bendahari
Persatuan Geologi Malaysia
Jabatan Geologi, Universiti Malaysia
59100 Kuala Lumpur, MALAYSIA

Panggilan Kertas

Peserta yang bercadang untuk membentangkan kertas kerja hendaklah menyerahkan Abstrak *sebelum* 20hb. JAN. 1987.

Keterangan Lanjut

Bakal peserta yang memerlukan keterangan lanjut harap dapat berhubung dengan:

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Pengerusi Persidangan
c/o JABATAN GEOLOGI
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Tel. 8250011 atau 7577036 (UM)

Objectives of Conference

The objective of the Conference is to serve as a venue for local geologists to mix and exchange views with fellow members on current developments in geology.

To enable members to attend the Annual General Meeting of the Geological Society of Malaysia held in conjunction with the Annual Conference.

Theme

Recent developments in Malaysian Geology.

Language of the Conference

The Conference will be conducted in Bahasa Malaysia or English.

Sessions

The Conference will be divided into four sessions:

1. General Geology, Stratigraphy & Palaeontology.
2. Geochemistry and Economic Geology.
3. Engineering and Environmental Geology.
4. Exploration Geophysics and Hydrogeology.

Registration

Members are advised to register early to avoid payment of late registration fees.

	Early Registration Fee	Late Registration Fees (after 15th Feb. 87)
Member	MR 30.00	MR 40.00
Student Member	MR 10.00	MR 20.00
Non-Member	MR 50.00	MR 60.00

Only speakers at the Seminar will be exempted from payment of registration fees.

Payment by crossed cheques, bank drafts or cashiers orders is acceptable and should be made payable to the Geological Society of Malaysia. Outstation cheques should include sufficient bank charges.

Please send registration fees together with the attached Registration Form to:

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Geological Society of Malaysia
c/o Department of Geology
University of Malaya
59100 Kuala Lumpur, MALAYSIA

Call for Papers

Those wishing to present papers should submit their abstracts *before* 20th. JAN. 1987.

Further Information

For further information please write to:

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BERITA-BERITA LAIN (OTHER NEWS)

3-D SEISMIC ACTIVITIES IN MALAYSIA

The first 3-D seismic survey was conducted in 1984 in Malaysia when Petronas Carigali Sdn. Bhd. and EPMI conducted their joint 3-D seismic survey over the Dulang field, offshore Peninsular Malaysia. During the same year, 3-D seismic surveys were also conducted over Irong Barat, D35, D18 and Samarang fields resulting in the acquisition of a total of some 15,600 km of data. The amount of 3-D seismic data acquired doubled to 34,500 km in 1985 and in 1986, increased to 43,800 km. This rapid increase in 3-D seismic data acquired over a span of just two years bears testimony to the rapidly increasing importance and significance of the 3-D seismic method, which unlike conventional 2-D seismic data, provides more accurate geological details of the subsurface. New 3-D seismic surveys are currently being planned for the Seligi field, D35 West, Bayan North and D45 structures (Fig. 1).

The 3-D method has been used effectively in pre-field development areas for proper delineation of the complex faulted structures, gas affected faulted crestal areas, reservoir trends, numerous channel features over J4, D35, D21, D18, Dulang and Guntong. Over producing fields such as Samarang and St. Joseph, the 3-D seismic method has also proven its usefulness in providing detailed data for more positive interpretation through improved structural definition and resolution of complex tilted fault-blocks. This has contributed to more effective drilling efforts in optimisation of drainage points from additional jackets. The 3-D method has also been used successfully to detail complex structures in undrilled prospects and areas, for example, over J10 (Fig. 2).

It is envisaged that the 3-D seismic method could be applied over abandoned oilfields (e.g. the Miri field) to further elucidate subtle hydro carbon-bearing traps, untested fault-blocks, deeper structures etc., which are unclear based on existing 2-D seismic data.

Advances in 3-D acquisition methods since 1984 have and will continue to increase data volumes at substantial cost and time savings.

With the enormous volume of high quality data from 3-D seismic surveys, seismic interpreters will require the aid of computer-based interactive 3-D seismic interpretation workstations. At present, more than 10 geophysical companies have developed computer-based interactive interpretation workstations. More sophisticated systems will continue to be developed and made available to the petroleum industry. Currently, in Malaysia, there are four operational workstations being used by our production sharing contractors.

Extracted from *Nada PETRONAS* Oct. 1986

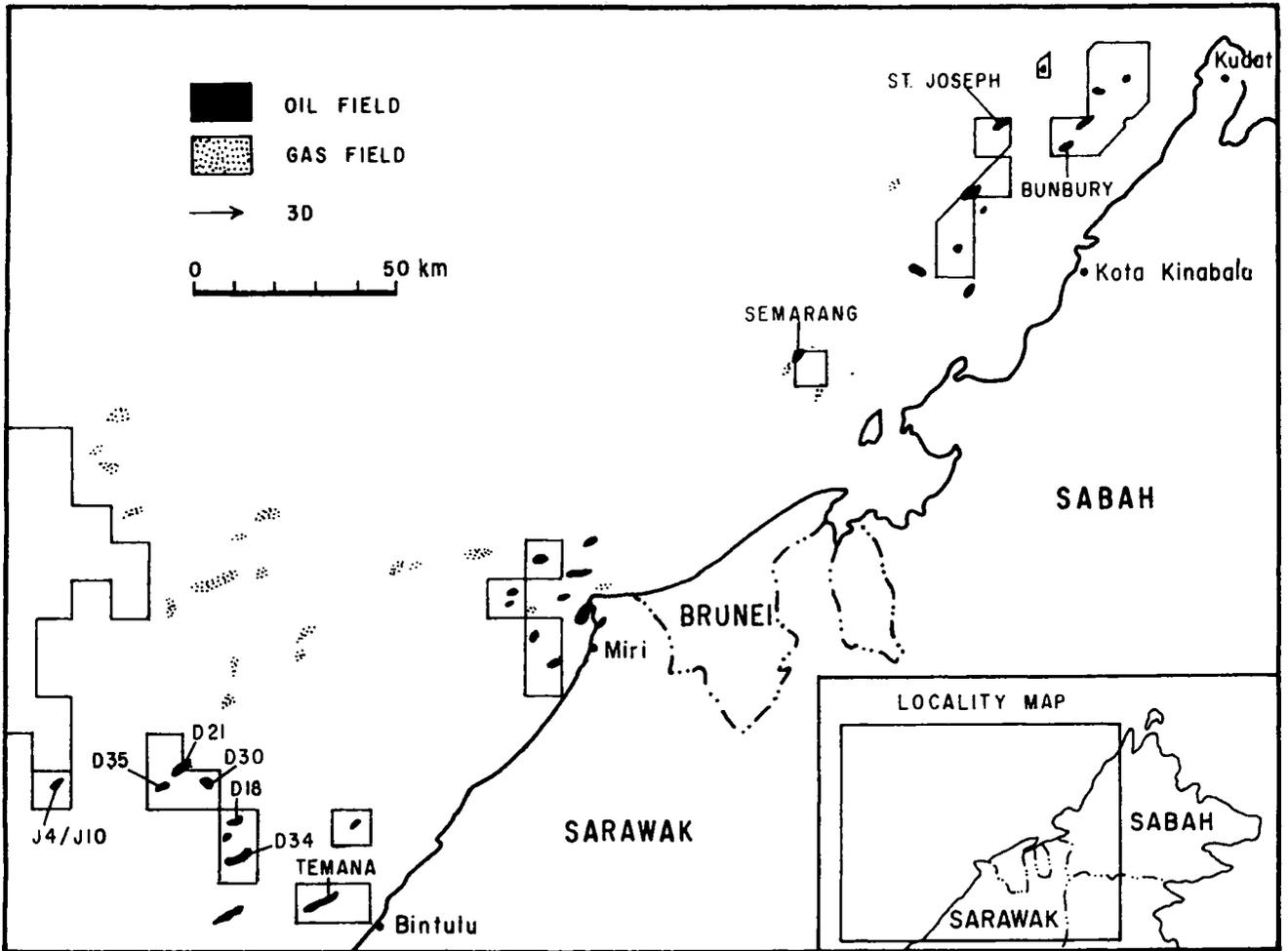


Fig. 1. 3-D seismic activity in East Malaysia

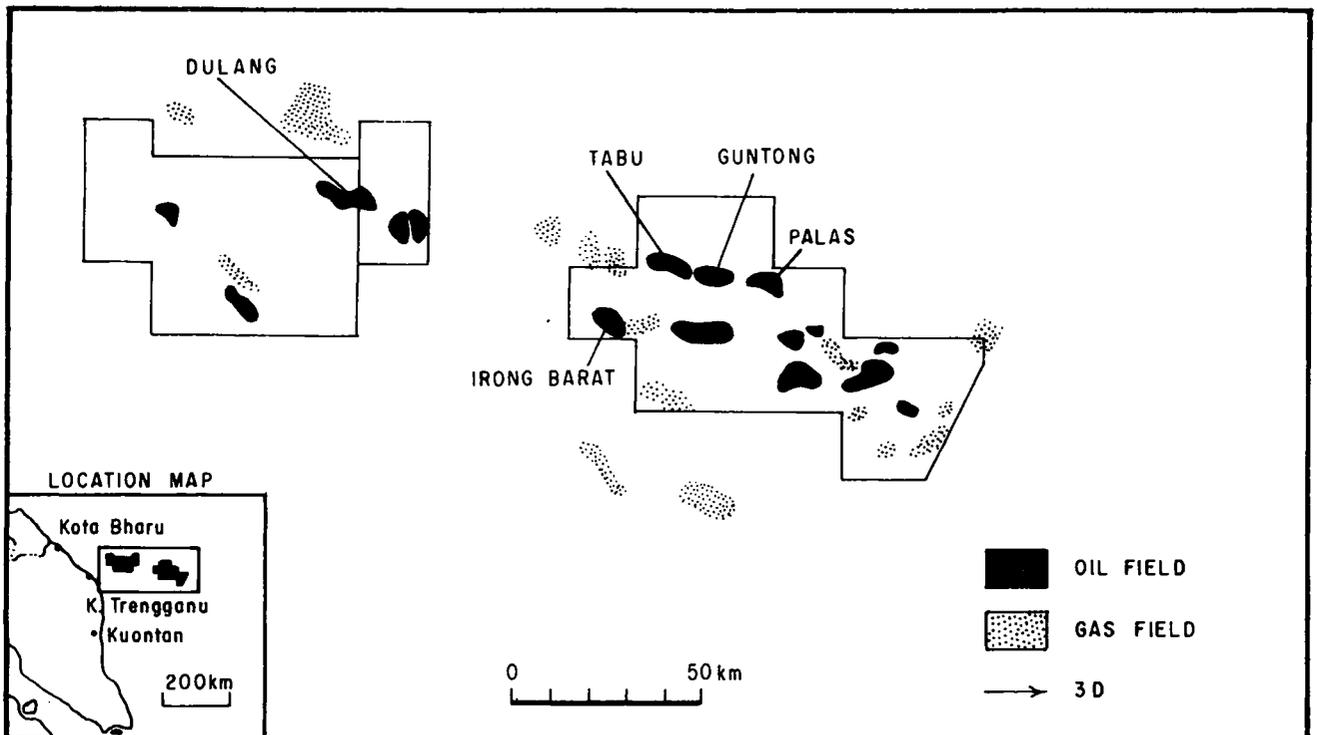


Fig. 2. 3-D seismic activity in Peninsular Malaysia

PUSAT PENGAJIAN KEJURUTERAAN BAHAN DAN SUMBER MINERAL YANG BARU DI KAMPUS CAWANGAN PERAK UNIVERSITI SAINS MALAYSIA

Kampus cawangan Universiti Sains Malaysia (USM) yang baru di Ipoh telah dibuka dengan rasminya oleh Duli Yang Maha Mulia Paduka Seri Sultan Perak pada 12 September 1986. Sempena perasmian ini telah diadakan hari terbuka dan pamiran aktiviti-aktiviti kampus ini kepada orang ramai selama dua hari.

Kampus cawangan sementara ini terdiri dari bangunan-bangunan pejabat Majlis Perbandaran Ipoh, yang lama kini mempunyai 346 orang pelajar dan 33 orang kakitangan akademik untuk kedua-dua Pusat Pengajian Kejuruteraan Bahan dan Sumber Mineral, dan Pusat Pengajian Kejuruteraan Elektrik dan Elektronik. Kampus tetap yang dirancangkan seluas 196-hektar terletak di bandar baru Seri Iskandar, 29 km dari Ipoh. Kampus tetap ini akan mempunyai dua pusat pengajian lagi iaitu Kejuruteraan Awam dan Kejuruteraan Mekanikal, dan bilangan pelajar maksima pada tahun 1990 ialah 1800 orang.

Menurut Naib Canselor USM Datuk Haji Musa Mohamad, pemilihan lokasi Kampus Cawangan Perak ini adalah berikutan dari terdapatnya kemudahan infrastruktur yang baik yang sedia ada di Ipoh untuk kursus-kursus Kejuruteraan. Perak mempunyai Institut Penyelidikan Galian, Makmal Penyiasatan Kajibumi, Pusat Penyelidikan dan Pembangunan Timah Asia Tenggara (SEATRAD), Politeknik Ungku Omar dan banyak foundri dan kerja-kerja kejuruteraan yang memberikan khidmatnya untuk industri perlombongan timah.

Kejuruteraan Sumber Mineral ialah salah satu dari dua kursus ijazah yang ditawarkan oleh Pusat Pengajian Kejuruteraan Bahan dan Sumber Mineral sejak tertubuhnya Pusat Pengajian tersebut di Kampus Perak pada bulan Mei 1986 lalu. Sebelum ini Ijazah Sarjana Muda Sains Gunaan (B. App. Sc.) dalam bidang Sains dan Teknologi Mineral telah ditawarkan mulai tahun 1972 di Pusat Pengajian Sains Gunaan di Kampus Induk USM di Pulau Pinang.

Objektif program empat tahun B.E (Sumber Mineral) ini ialah untuk mengeluarkan jurutera-jurutera yang benar-benar terlatih untuk industri sumber mineral. Siswazah-siswazah yang berjaya seharusnya sudah benar-benar sesuai untuk diambil bekerja di industri tempatan hasil dari latihan vokasional yang ditekankan dalam kursus ini. Program juga direkabentukkan untuk memenuhi keperluan Institut Jurutera Malaysia.

Program kursus ini telah distrukturkan supaya ia menekankan subjek-subjek sains dan kejuruteraan dalam tahun permulaan dan akan menjadi asas kepada kursus-kursus yang lebih vokasional di tahun-tahun akhir program. Kursus ini mengandungi aspek-aspek geologi, mendapan mineral ekonomik, eksplorasi dan penilaian mineral, pengukuran, geofizik, perlombongan dan pemprosesan mineral. Satu kursus dalam pengurusan juga diberikan disamping subjek-subjek kejuruteraan asas yang diajarkan termasuk kejuruteraan mekanikal dan elektrik.

Pendedahan kepada penggunaan komputer juga diberikan kepada pelajar-pelajar pada peringkat permulaan kursus ini.

Adalah diharapkan bahawa perhubungan yang erat dapat dijalin dengan pihak industri untuk mendapatkan maklumbalas mengenai perkembangan berhubung dengan sesuatu kursus, peluang mendapatkan projek-projek penyelidikan, dan untuk 'menentukan supaya kakitangan-kakitangan sedar dengan keadaan diluar yang sebenarnya'.

Daud Batchelor & K.K. Cheang

REPORT ON LANDPLAN III - A SOUTHEAST ASIAN SYMPOSIUM ON THE ROLE OF GEOLOGY IN URBAN DEVELOPMENT, 15-20 DECEMBER 1986, HONG KONG

The Landplan III Symposium was attended by about 150 participants, mostly from Asia, with some from Europe, USA and Australia.

The three guest speakers were: Prof. W.R. Dearman (University of Newcastle Upon Tyne, UK), Dr. M.J. Knight (University of New South Wales, Australia), and Mr. J.L. Neilson (Dept. of Industry, Technology and Resources, Australia). They led workshops and also spoke at the symposium on weathering profiles, waste disposal and geological mapping respectively. In addition, various personnels also helped in conducting the two-day workshops preceding the symposium, and they were drawn mainly from the Geotechnical Control Office (GCO) in Hong Kong.

About 100 papers were submitted to the symposium, out of which some 80 or so were presented during the four-day symposium. These papers covered a wide range of topics related to Engineering Geology, Environmental Geology and Landuse, etc., with many case studies coming from the Asian region.

The symposium also incorporated several site visits or technical excursions to construction sites or places of geological/geotechnical interest in Hong Kong, such as to construction sites for the MRT, slope stabilization works, and weathering profiles. There was also a fair-sized exhibition of posters and publications.

The dominant role and the numerous contributions by the Geotechnical Control Office in the workshop and the symposium is most outstanding, perhaps underlining the unique role of this organisation in tackling geotechnical problems (especially slopes and foundations) in highly urbanised Hong Kong. The unique set-up of GCO which incorporates Geological Survey and Engineering Geology/Rock Mechanics Sections within its fold (with over 100 engineers and geologists) is most impressive and should perhaps be emulated by some of the neighbouring countries, such as the Southeast Asian nations.

The Open Forum at the end of the symposium gave an opportunity for participants to raise various issues with regard to the symposium and the next Landplan symposium. Though no definite plans were formulated with respect to the next Landplan Symposium (when, where or by who?), a group of 3 persons representing the various disciplines in Landplan, namely Prof. Yudhbir (Geotechnical Engineer), Dr. Sampurno (Geologist) and Mr. Lokman (Planner), was formed and charged with looking into the follow-up actions that need to be taken after this symposium.

Finally, I would like to congratulate the Geological Society of Hong Kong, and the organising Committee (Dr. A.D. Burnett, Chairman; Dr. D.R. Workman, Secretary and others) for a well-organised and highly successful symposium. The proceedings of the symposium (scheduled for August 1987) would be most useful and informative for all geotechnical engineers and geologists working in this part of the world.

Tan Boon Kong

WORKSHOP/TRAINING COURSE ON GOLD EXPLORATION/PROSPECTING

AGID in cooperation with CIFEG and the University of Malaya will be organizing this course under the direction of Council Member Dr. Yeap Ee Beng. It will be held in Kuala Lumpur, Malaysia from 14-24 June 1987.

The program is designed to familiarize geoscientists in Southeast Asia with gold exploration. With the drop in tin prices there is a growing interest in gold in the region, and it is hoped that gold can replace tin to some extent as the dominant metal produced. There is already much interest in gold in the region, but since local geologists have concentrated mainly on tin there is limited technical knowledge on mining and exploration for gold.

The course will include a two-day seminar followed by a four-day training course and a four-day field trip to areas in Malaysia and southern Thailand. Lecturers from Malaysia and Thailand will be supplemented by specialists from Australia. Further information can be obtained from Dr. Yeap Ee Beng at the Department of Geology, University of Malaya, 59100 Kuala Lumpur, Malaysia.

NB: Dr. Yeap has informed the Editor that the Workshop/Training Course on Gold Exploration/Prospecting will now be held from 2-11 November 1987.

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1987

January 1987 - April 1987

DIGITAL IMAGE PROCESSING (Enschede, The Netherlands). Certificate courses on techniques for national resources surveys, organized annually by the International Institute of Aerial Surveys and Earth Sciences (ITC). Sponsored by Unesco. Language: English. For information: ITC Student Affairs Office, P.O. Box 6, 7500 AA Enschede, The Netherlands.

February 1987

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 1987 - March 1987

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

February 1987 - June 1987

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, Postgraduate course on mineral exploration, Montanuniversitat, Leoben, A-8700, Austria.

March 1987 - November 1987

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 1987 - April 1987

MINERAL EXPLORATION (Paris, France). A 4-week annual course organized annually 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.

Spring 1987

LOCAL BUILDING MATERIALS (Cameroun). One-week seminar for African practicing geologists to show the value of local construction materials. For information: International Center for Training and Exchanges in Geosciences, 103 rue de Lille, 75007 Paris, France.

April 1987 - July 1987

RURAL GROUNDWATER DEVELOPMENT (Loughborough, U.K.). A 10-week diploma course organized annually by WEDC. For information: WEDC, University of Technology, Loughborough, Leics, LE11 3TU, UK.

April 1987 - July 1987

ENVIRONMENTAL EVALUATION MANAGEMENT AND CONTROL (Liverpool, UK). Annual 12-week training course for administrators, consultants and professionals. For information: Dr. H.W. Pearson, Environmental Management Course, Dept. of Botany, University of Liverpool, P.O. Box 147, Liverpool L69 3BX, UK.

May 1987 - November 1987

GENERAL HYDROLOGY with emphasis on groundwater (Argentina). Post-graduate course organized every other year and sponsored by Unesco. Language: Spanish. For information: Comite Nacional para el Programa Hidrologico Internacional de la Republica Argentina, Av 9 de Julio 1925 - 15^o piso, 1332 Buenos Aires, Argentina.

May 1987 - June 1987

GEOPHYSICS APPLIED TO GEOTHERMAL PROSPECTION (Manizales, Colombia). Annual course organized for Latin Americans by the Latin American Organization for Energy with financial assistance from Unesco. Language: Spanish. For information: Organizacion Latinoamericana de Energia (OLADE), P.O. Box 119, Quito, Ecuador.

June 1987

MARINE GEOLOGY (Moss Landing, California, USA). 24-week course organized by the U.S. Geological Survey. For information: Training Section, Office of International Geology, U.S. Geological Survey, 917 National Center, Reston, VA 22092, USA.

June 1987 - August 1987

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 1987

GEOLOGICAL COMPARISON OF WEST AFRICA AND BRAZIL (Bahia, Brazil). Course organized by the Geological Society of Brazil for African and Brazilian investigators of the correlations and mineralizations of the two continents. For information: International Center for Training and Exchanges in Geosciences, 103 rue de Lille, 75007 Paris, France.

July 1987 - August 1987

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.

July 1987 - September 1987

VOLCANOLOGY (Quito, Ecuador). Annual 10-week course organized for Latin Americans by the Latin American Organization for Energy with financial assistance from Unesco. Language: Spanish. For information: Organizacion Latinoamericana de Energia (OLADE), P.O. Box 119, Quito, Ecuador.

August 1987 - June 1989

SOIL SCIENCE AND WATER MANAGEMENT (Wageningen, The Netherlands). A 2-year M.Sc. course organized by Agricultural University Wageningen. Course starts every other year. Language: English. For information: The Director of Studies of the M.Sc. Course in Soil Science and Water Management, P.O. Box 37, 6700 AA Wageningen, The Netherlands.

August 1987 - October 1987

REMOTE SENSING AND DIGITAL IMAGE ANALYSIS, International Workshop. (Sioux Falls, South Dakota, USA). Program of training workshops organized by the U.S. Geological Survey for non-U.S. scientists, engineers, and resources managers. For information: Training Section, Office of International Geology, U.S. Geological Survey, 917 National Center, Reston, VA 22092, USA.

August 1987 - October 1987

GEOCHEMICAL PROSPECTING METHODS (Prague, Czechoslovakia). Certificate course organized every second year by the Geological Survey of Czechoslovakia and sponsored by Unesco, IAGC and Czechoslovakia. Language: English. For information: GEOCHIM Unesco CSSR, Geological Survey of Prague, Malostranske nam. 19, 11821 Prague 1, Czechoslovakia.

September 1987 - October 1987

GROUNDWATER TRACING TECHNIQUES (Graz, Austria). Five-week course organized every other year by the Institute of Technical Geology, Petrography and Mineralogy and sponsored by Unesco. Language: English. For information: Institute of Technical Geology, Petrography and Mineralogy of the University of Technology, A-8010 Graz, Austria.

September 1987 - November 1987

DRILLING OF GEOTHERMAL WELLS (Mexicali, Mexico). Annual 12-week seminar organized for Latin Americans by the Latin American Organization for Energy with financial assistance from Unesco. Language: Spanish. For information: Organizacion Latinoamericana de Energia (OLADE), P.O. Box 199, Quito, Ecuador.

September 1987 - November 1987

GEOTHERMAL RESERVOIR ENGINEERING (Mexicali, Mexico). Annual 9-week course organized for Latin Americans by the Latin American Organization for Energy with financial assistance from Unesco. Language: Spanish. For information: Organizacion Latinoamericana de Energia (OLADE), P.O. Box 119, Quito, Ecuador.

September 1987 - November 1987

GEOTHERMAL ENERGY (Kyushu, Japan). Annual short course organized by the Government of Japan and sponsored by Unesco. Language: English. For information: Japan International Cooperation Agency (2nd Training Division, Training Affairs Dept.), P.O. Box 216, Shinjuku Mitsui Building, 2-1, Nishi-shinjuku, Shinkuku-ku, Tokyo, 160, Japan.

September 1987 - June 1988

REMOTE SENSING TRAINING (Toulouse, France). A diploma course with options for geoscientists sponsored by the French Aerospace Remote Sensing Development Organization (GDTA), BRGM, IFP and other French institutions. Language: French. For information: GDTA-Formation, 18 Avenue Edouard-Belin, 31055 Toulouse Cedex, France.

September 1987 - July 1988

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, Dept. of Geology and Physical Sciences, Oxford Polytechnic, Headington, Oxford OX3 0BP, UK.

September 1987 - August 1988

MINING 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: ITC (ME), P.O. Box 6, 7500 AA Enschede, The Netherlands.

October 1987 - November 1987

TECTONICS, SEISMOLOGY AND SEISMIC RISK ASSESSMENTS (Potsdam, 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 1500 Potsdam, German Democratic Republic.

October 1987 - July 1988

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

October 1987 - September 1988

WATER AND WASTE ENGINEERING FOR DEVELOPING COUNTRIES (Loughborough, England, UK). Twelve-month M.Sc. programme organized annually for engineers and scientists from developing countries by WEDC. For information: John Pickford, WEDC Group Leader, University of Technology, Loughborough, Leics. LE11 3TU, UK.

October 1987 - September 1988

HYDRAULIC ENGINEERING AND HYDROLOGY (Delft, The Netherlands). Diploma courses organized annually 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 1987 - September 1989

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.

KALENDAR (CALENDAR)

1987

March 10 - 14, 1987

ORIGIN AND EVOLUTION OF PLANETARY AND SATELLITE ATMOSPHERES (Conference), Tucson, Arizona, USA. (S.K. Atreya, University of Michigan, Space Research Building, Ann Arbor, MI 48109-2143, USA).

March 11 - 12, 1987

MINERAL RESOURCES RESEARCH IN THE USGS (3rd Annual McKelvey Forum), Denver, Colorado, USA. (Buhler and Abraham, Inc., 10102 McKinney Avenue, Silver Springs, Maryland 20902, USA)

March 16 - 20, 1987

GEOCHEMISTRY OF WATERS IN DEEP SEDIMENTARY BASINS (GSA Penrose Conference), Oxnard, California, USA. (L. Elms, Western Experience, 2369 Carriage Circle, Oceanisee, CA (2056, USA).

March 16 - 20, 1987

LUNARY AND PLANETARY SCIENCE (18th Conference) Houston, Texas, USA. (Lunar and Planetary Institute, 3303 NASA Road 1, Houston, Tx. 77052, USA).

March 18 - 19, 1987

EARLY TERTIARY VOLCANISM AND THE OPENING OF THE NE ATLANTIC (Meeting), London, U.K. (A.C. Morton, British Geological Society, Keyworth, Notts. NG12 5GG, UK).

March 23 - 24, 1987

EXTRACTIVE INDUSTRY GEOLOGY '87 (Meeting), Keele, Staffordshire, U.K. (Conference Office, IMM, 44 Portland Place, London W1N 4BR, UK).

March 23 - 26, 1987

SMALL MINE ECONOMICS AND DEVELOPMENT (Conference) London, U.K. (Small mine economics and development conference, International Mining, Cii House, 31 Theobalds Road, London WC1, UK).

March 23 - 28, 1987

GROUNDWATER MONITORING AND MANAGEMENT (International Symposium), Desden, G.D.R. Languages: English and Russian. (Dr. P. Losel, Institut fur Wasservirtschaft, Schnellerstrasse 140, DDR-1190 Berlin, German Democratic Republic).

March 26 - 27, 1987

THE PHYLOGENY AND CLASSIFICATION OF THE TETRAPODS (Special Meeting), London, U.K. (M. Benton, Department of Geology, The Queen's University of Belfast, Belfast, BT7 1NN, Northern Ireland).

March 29 - April 3, 1987

EROSION AND DEPOSITION WITH EMPHASIS ON SEMIARID AND ARID ENVIRONMENTS (Meeting), Jerusalem, Beersheba, Elat, Israel. Co-sponsored by INQUA. (Prof. A. Yair, Department of Physical Geography, Institute of Earth Sciences, Hebrew University, 91904 Jerusalem, Israel).

April 1987

GEOCHEMISTRY AND MONITORING IN REPRESENTATIVE BASINS (International Meeting), Prague, Czechoslovakia. (Dr. B. Molden, Geological Survey, Malostranskera 19, 11821 Prague 1, Czechoslovakia).

April 1 - 3, 1987

SEDIMENTOLOGY (8th IAH Regional Meeting), Tunis, Tunisia. (Pr. Ali M'Rabet, Faculte des Sciences de Tunis, Departement des Sciences de la Terre, Campus Universitaire, 1060 Tunis, Tunisia).

April 1 - 10, 1987

GEOTECHNICAL ENGINEERING AND HAZARD ASSESSMENT IN NEOTECTONIC TERRAINS (Sino-British Conference), Taiwan. (Dr. J. Rowbotham, Department of Geological Sciences, University College, Gower Skreet, London WC1E 6BT, UK).

April 2 - 3, 1987

MICROPALAEONTOLOGY, PALYNOLOGY AND PETROLEUM EXPLORATION, ON- AND OFFSHORE EUROPE (Meeting), Aberdeen, Scotland, U.K. (Geological Society, Burlington House, Piccadilly, London W1V 0JU, UK).

April 6 - 12, 1987

LATE QUATERNARY SEA LEVEL: THE MARINE AND TERRESTRIAL RECORD (GSA Penrose Conference), Ferry Reach, Bermuda. (J.L. Carew, Department of Geology, College of Charleston, Charleston, SC. 29424, USA).

April 6 - 10, 1987

HYDROLOGY IN PERSPECTIVE (International Symposium), Rome, Italy. Co-sponsored by Unesco, WMO, and IAHS. (International Association of Hydrological Sciences, GIBI s.a.s. Studio Congressi, Via Marco Besso, 40, 00111 Rome, Italy)

April 7 - 8, 1987

PHANEROZOIC IRONSTONES AND RELATED DEPOSITS (International Symposium), Sheffield, U.K. (Dr. G. Taylor, Dept. Science, Luton, CHE, Park Square, Luton LU1 3JU, UK).

April 7 - 10, 1987

DRILLEX 87 (International Exhibition and Conference on Drilling), Stoneleigh, Warwickshire, UK. (The Conference Office, The Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, UK).

April 10 - 11, 1987

RECONSTRUCTION AND CORRELATION OF THE PHANEROZOIC LACUSTRINE RECORD (IGCP-219 Workshop), Lake Luzern, Switzerland. (Dr. K. Keits, EAWAG-Geology, CH-8600 Dubendorf ZH, Switzerland).

- April 13 - 16, 1987
EUROPEAN UNION OF GEOSCIENCES (IV Biennial Conference), Strasbourg, France. (Prof. Dr. W. Lowrie, Inst. fur Geophysik, HPP P 5, ETH Honggerberg 8093 Zurich, Switzerland)
- April 13 - 16, 1987
ENVIRONMENTAL RECORDS FROM LACUSTRINE BASINS (IGCP-219 Symposium at EGU) Strasbourg, France. (Dr. K. Kelts, EAWAG-Geology, CH-8600 Dubendorf ZH, Switzerland).
- April 21 - 22, 1987
DELTAS: SITES AND TRAPS FOR FOSSIL FUELS (Geological Society Meeting), London, U.K. (Geological Society, Burlington House, Piccadilly, London W1V 0JU, UK).
- April 22 - 24, 1987
GEOLOGICAL KINEMATICS AND DYNAMICS, FROM MOLECULES TO MANTLE (International Meeting), Uppsala, Sweden. (The GKD Committee, Institute of Geology, Uppsala University, Box 555, S-751 22 Uppsala, Sweden).
- April 23 - 26, 1987
INTERNATIONAL GEOCHEMICAL EXPLORATION (12th Symposium) and METHODS OF GEOCHEMICAL PROSPECTING (4th Symposium), Orleans La Source, France. (The Organizing Committee, 12th IGES - 4th SMGP, BRGM, B.P. 6009, 45060 Orleans Cedex, France).
- April 26 - May 1, 1987
WORLD PETROLEUM CONGRESS (12th) Houston, Texas, USA. (12th WPC Association, c/o American Petroleum Institute, 1220 L Street NW, Washington, DC 20005, USA).
- April 27 - May 1, 1987
DRILLEX '87 (International Conference and Exhibition on Drilling - The Minerals Industry and Geotechnical Engineering), Stoneleigh, Warwickshire, U.K. (IMM, 44 Portland Place, London W1N 4BR, U.K.)
- April 27 - 29, 1987
LATE CENOZOIC PALEOENVIRONMENTS AND GEOLOGY OF THE ARTIC (Workshop), Spidsbergseter Fjellstue, Norway. (Dr. A. Elverhoi, Norwegian Polar Research Institute, P.O. Box 158, 1330 Oslo Lufthavn, Norway).
- April 28 - May 7, 1987
ZECHSTEIN: STRATIGRAPHY-PALEOGEOGRAPHY-GEOCHEMISTRY (International Symposium), Hannover/Kassel, F.R.G. (J. Lepper, Niedersachsisches Landesamt fur Bodenforschung, P.O. Box 51 01 53, D-3000 Hannover 51, F.R.G.)
- May 1987
EXPOSED CROSS SECTIONS OF THE CONTINENTAL CRUST (GSA Penrose Conference), southeastern Ontario, Canada. (D.M. Fountain, Dept. of Geology and Geophysics, University of Wyoming, Laramie, WY 82071, USA).
- May 3 - 8, 1987
THE CONSTRUCTION OF GEOLOGICAL CROSS SECTIONS: TECHNIQUES, ASSUMPTIONS AND METHODS (GSA Penrose Conference), New Paltz, New York, USA. (P.A. Geiser, Dept. of Geology and Geophysics, University of Connecticut, Storrs, CT 06268, USA).
- May 3 - 7, 1987
ENGINEERING GEOLOGICAL ENVIRONMENT IN MOUNTAINOUS AREAS (International Symposium), Beijing, P.R. China. (Geological Society of China, Ministry of Geology, Pai Wan Chung, Fuchengmenwai, Beijing, P.R. China)
- May 12 - 14, 1987
COASTAL SEDIMENTS '87 (Conference), New Orleans, Louisiana, USA. (Dr. N.C. Kraus, USAE Waterways Experiment Station, P.O. Box 631, Attn: WESCE-P, Vicksburg, MS 39180-0631, USA).
- May 15 - 17, 1987
HYDROLOGY, SEDIMENTOLOGY AND GEOMORPHOLOGICAL IMPLICATIONS OF FLOODS (Conference), Lancaster, U.K. (P.A. Carling, Freshwater Biological Association, The Ferry House, Far Sawrey, Ambleside, Cumbria LA22 0LP, UK).
- May 16 - 24, 1987
PALAEOECOLOGICAL - PALAEOHYDROLOGICAL STUDIES BASED ON STRATIGRAPHICAL RESEARCH IN LAKES AND MIRES AND FLUVIAL ENVIRONMENTS (IGCP-158 Symposium), Sweden. (B.E. Berglund, Dept. of Quaternary Geology, Tornav. 13, S-223 63 Lund, Sweden).
- May 18 - 22, 1987
GEOMATHEMATICS AND GEOSTATISTICS APPLIED TO SPACE- AND TIME-DEPENDENT DATA (International Conference and Course), Wroclaw, Poland. Sponsored by CODATA, IAMG, IUGS, and Unesco. (Dr. J.J. Royer, C.R.P.G., B.P. 20, 15 rue Nd des Pauvres, 54501 Vandoeuvres-les-Nancy Cedex, France).
- May 18 - 22, 1987
AMERICAN GEOPHYSICAL UNION (Spring Meeting), Baltimore, Maryland, U.S.A. (AGU Meetings, 2000 Florida Avenue NW, Washington, DC 20009, U.S.A.)
- May 21 - June 5, 1987
WORLD MINING CONGRESS (13th), Stockholm, Sweden. (Organizing Secretary, 13th World Mining Congress, University of Lulea, S-951 87 Lulea, Sweden)
- May 25 - 27, 1987
COASTAL LOWLANDS: GEOLOGY AND GEOTECHNOLOGY (International Symposium), The Hague, The Netherlands. (Dr. H.J.W.G. Schalke, P.O. Box 85947, 2508 CP The Hague, The Netherlands)
- May 25 - 27, 1987
GEOLOGICAL, MINERALOGICAL ASSOCIATIONS OF CANADA (Joint Annual Meeting), Saskatoon, Canada. (Dr. W.O. Kupsch, Department of Geological Sciences, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 0W0)

May 27 - 28, 1987

ALPINE TECTONICS (Geological Society, The Fermor Lecture Meeting), London, U.K. (Prof. M.P. Coward, Dept. of Geology, Royal School of Mines, Imperial College, Prince Consort Road, London SW7 2BP, UK).

May 28 - 30, 1987

PERMANENT SEISMOGRAPHIC OBSERVATORIES AND NETWORKS (Centennial Anniversary Symposium), Berkeley, California, U.S.A. (Prof. B.A. Bolt, Seismographic Stations, University of California, Berkeley, CA 94720, U.S.A.)

May 31 - June 5, 1987

WORLD MINING CONGRESS (13th), Stockholm, Sweden. (Organizing Secretary, 13th World Mining Congress, University of Lulea, S-951 87 Lulea, Sweden).

June 1987

INTERNATIONAL MINING AND EXPLORATION EXHIBITION '87 (Meeting), Sydney, Australia. (Thomson Exhibitions, 47 Chippen Street, Chippendale, NSW 2008, Australia)

June 3 - 6, 1987

PROTEROZOIC GEOCHEMISTRY (International Symposium), Lund, Sweden. Sponsored by IGCP-217. (Prof. R. Gorbatshev, Geological Institute, Lund University Solvegatan 13, S-223 62 Lund, Sweden).

June 7 - 10, 1987

AAPG and SEPM (Annual Meeting), Los Angeles, Calif., U.S.A. (AAPG Headquarters, Box 979, Tulsa, OK 74101, U.S.A.)

June 9 - 12, 1987

EUROPEAN ASSOCIATION OF EXPLORATION GEOPHYSICISTS (49th Annual Meeting and Technical Exhibition), Belgrade, Yugoslavia. (EAEG, Wassenaarseweg 22, 2596 CH The Hague, The Netherlands).

June 11 - 12, 1987

FAN-DELTA: SEDIMENTOLOGY AND TECTONIC SETTINGS (International Symposium), Bergen, Norway. Sponsored by Norsk Hydro, Univ. of Bergen and Norwegian Petroleum Society. (R.J. Steel, Norsk Hydro Research Centre, P.O. Box 4314, 5013 Bergen, Norway).

June 21 - 25, 1987

HYDROGEOLOGY (4th Canadian/American Conference), Banff, Alberta, Canada. (Dr. B. Hitchon, Alberta Research Council, P.O. Box 8330, Station F, Edmonton, Alberta, Canada T6H 5X2).

June 30 - July 6, 1987

CHEMISTRY OF THE EARTH AND THE UNIVERSE (IAGC 20th Anniversary Congress), Paris, France. (Dr. B. Hitchon, Alberta Research Council, P.O. Box 8330, Station F, Edmonton, Alberta, Canada T6H 5X2).

July 6 - 10, 1987

CRYPTOEXPLOSIONS AND CATASTROPHES IN THE GEOLOGICAL RECORD (International Workshop), Parys, South Africa. Co-sponsored by IUGS. (L.O. Nicolaysen, Geophysics Department, Witwatersrand University, Johannesburg, South Africa 2001).

July 6 - 11, 1987

CONTINENTAL AND OCEANIC LITHOSPHERE: SIMILARITIES AND DIFFERENCES (Workshop), London, U.K. (M.A. Menzies, Dept. of Geology, University of London, RHBNC, Egham, Surrey TW20 OEX, UK).

July 6 - 11, 1987

FOSSIL ALGAE (4th International Symposium), Cardiff, Wales, UK. (Dr. R. Riding, Dept. of Geology, University College, Cardiff CF1 1XL, Wales, UK).

July 6 - 12, 1987

SIXTH REGIONAL CONGRESS ON GEOLOGY, MINERAL AND HYDROCARBON RESOURCES OF SOUTHEAST ASIA (GEOSEA VI), Jakarta, Indonesia. (Rudy Phoa, Trend Energy, Five Pillars Office Park, P.O. Box 209, Jl. M.T. Haryono No. 58, Jakarta, Indonesia).

July 7 - 10, 1987

APPLIED MINERALOGY (3rd International Congress), Orleans, France. (P. Alain, ICAM 87, Laboratoire de Mineralogie Appliquee, Ecole Sup. de PEnergie et des Materiaux, Domaine Universitaire de la Source, B.P. 6749, 45067 Orleans, Cedex 2, France).

July 23 - 25, 1987

SOUTH ATLANTIC EVOLUTION (2nd Symposium), Rio de Janeiro, Brazil. (D. Dias-Brito, PETROBRAS/CENPES, 11ha do Fundaq, Quadra 7, Rio de Janeiro 21.910, Brazil).

July 29 - 31, 1987

PACIFIC NEOGENE STRATIGRAPHY (4th International Congress of Regional Committee and Meeting of IGCP 246), Berkeley, Calif., USA. (Dr. C. Brunner Dept of Paleontology, University of California, Berkeley, Ca. 94720, USA).

July 31 - August 9, 1987

INTERNATIONAL UNION FOR QUATERNARY RESEARCH (12th Congress), Ottawa, Ontario, Canada. (Dr. Alan V. Morgan, Department of Earth Sciences, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1)

August 1987

PACIFIC NEOGENE PALAEOCEANOGRAPHIC AND BIOSTRATIGRAPHIC EVENTS (Meeting), Berkeley, Calif., U.S.A. (Dr. C. Brunner Department of Paleontology, University of California, Berkeley, CA 94720, U.S.A.)

August 1 - 12, 1987

LANDSLIDES (5th International Conference/Workshop), Australia and New Zealand. (5th ICFL-Anzslide '87, P.O. Box 56, Rosny Park, Tasmania 7018, Australia).

August 3 - 7, 1987

EROSION AND SEDIMENT TRANSPORT IN PACIFIC RIM MOUNTAINOUS LANDS (International Symposium and IAHS/IUGG Meeting), Corvallis, Oregon, USA. (Conference Coordinator, College of Forestry, Oregon State University, Corvallis, OR 97331, USA).

August 3 - 13, 1987

MAGMATIC SULPHIDES (5th International Sulphides Conference), Harare, Zimbabwe. (Secretary, 5th International Sulphides Conference, Box 1795, Harare, Zimbabwe).

August 9 - 11, 1987

TRACE FOSSILS, SMALL SHELLY FOSSILS, AND THE PRECAMBRIAN-CAMBRIAN BOUNDARY, ST. JOHN'S, NEWFOUNDLAND (IUGS Commission on Stratigraphy Conference and Fieldtrip), eastern Newfoundland. (Dr. G.M. Narbonne, Dept. of Geological Sciences, Queen's University, Kingston, Ontario, Canada K7L 3N6).

August 9 - 18, 1987

PRECAMBRIAN-CAMBRIAN BOUNDARY WORKING GROUP (Meeting), St. John's, Newfoundland, Canada (Dr. G. Narbonne, Dept. of Geological Sciences, Queen's University, Kingston, Ont., Canada K7L 3N6).

August 9 - 22, 1987

IUGG (XIX General Assembly), Vancouver, Canada. (R.D. Russell, Department of Geophysics and Astronomy, University of British Columbia, Vancouver, B.C., Canada V6T 1W5)

August 12 - 20, 1987

INTERNATIONAL UNION OF CRYSTALLOGRAPHY (Congress), Perth, Western Australia. (E.N. Masien, Crystallography Centre, University of Western Australia, Nedlands, 6009, Australia)

August 12 - 13, 1987

GEOTECHNICAL ENGINEERING ON SOFT SOILS (International Symposium), Mexico City. (M. Mendoza, Chairman, Organizing Committee, Instituto de Ingeniera - UNAM, Apdo. Postal 70-472, 04510 Mexico, D.F., Mexico).

August 17 - 21, 1987

BASEMENT TECTONICS (7th International Conference), Kingston, Ontario, Canada. (Bob Mason, c/o Events Management Inc., 4 Cataragui Street, Suite 209, Kingston, Ontario, Canada K7K 1Z7).

August 17 - 20, 1987

DEVONIAN SYSTEM (CSPG 2nd International Symposium), Calgary, Alberta, Canada. (Devonian Symposium, Canadian Society of Petroleum Geologists, 505-206 7th Avenue SW, Calgary, Alberta, Canada T2P 0W7)

August 18 - 22, 1987

AFRICAN GEOLOGY (14th Colloquium), Berlin (West). (G. Matheis, Technical University of Berlin, SRP/69, Ackerstrasse 71-76, D-1000 Berlin 65, F.R.G.).

August 20 - 22, 1987

X-RAY POWDER DIFFRACTOMETRY (Meeting with 14th Congress of the International Union of Crystallography), Perth, Western Australia. (Dr. E.H. Nickel, Division of Minerals & Geochemistry, CSIRO, Private Bag P.O., Wembley, W.A. Australia 6014).

August 20 - 30, 1987

PACIFIC SCIENCE ASSOCIATION (16th Congress), Seoul, South Korea. Section B: Solid Earth Sciences (Prof. Bong Kyun Kim, Department of Geological Sciences, College of Natural Sciences, Seoul National Univ., Seoul, South Korea)

August 21 - 22, 1987

DEVONIAN SUBCOMMISSION (Open Meeting), Calgary, Alberta, Canada. (Dr. W.A. Oliver, Jr., U.S. Geological Survey, E-305 Natural History Building, Smithsonian Institution, Washington, DC. 20560, USA).

August 24 - 28, 1987

ANTARCTIC EARTH SCIENCES (5th International Symposium), Cambridge, U.K. (Dr. M.R.A. Thomson, British Antarctic Survey, High Cross, Madingley Road, Cambridge, U.K. CB3 0ET)

August 26 - 29, 1987

PACIFIC RIM CONGRESS 87 (International Congress), Gold Coast, Southern Queensland, Australia. (Aus. IMM Congress Secretariat, P.O. Box 731 Toowong, 4066 Queensland, Australia).

August 26 - September 7, 1987

CRETACEOUS SYMPOSIUM (3rd International Symposium), Tübingen, F.R.G. (Prof. Dr. J. Wiedmann, Institut und Museum für Geologie und Paläontologie, Sigwartstrasse 10, 7400 Tübingen 1, Federal Republic of Germany).

August 30 - September 4, 1987

INTERNATIONAL SOCIETY FOR ROCK MECHANICS (6th International Congress), Montreal, Canada. (Prof. B. Ladanyi, Dept. Civil Engineering, Ecole Polytechnique, Box 6079, Stn. A, Montreal, Canada H3C 3A7)

August 31 - September 3, 1987

SOIL MECHANICS AND FOUNDATION ENGINEERING (9th European Conference), Dublin, Ireland. Languages: English and French. (Dr. Trevor Orr, Civil Engineering Department, Trinity College, Dublin 2, Ireland)

August 31 - September 2, 1987

AFRICAN MINING (International Conference), Harare, Zimbabwe. (The Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, UK).

August 31 - September 4, 1987

CARBONIFEROUS STRATIGRAPHY AND GEOLOGY (11th International Congress), Beijing, P.R. China. Languages: Chinese and English. (Prof. Yang Jing-zhi, Nanjing Institute of Geology and Palaeontology, 39 East Beijing Road, Chi-Ming-Ssu, Nanjing, P.R. China).

August 31 - September 5, 1987

YELLOWKNIFE '87 (GAC Field Meeting), Yellowknife, NWT, Canada. (W.A. Padgham, Geological Surveys, Bag 9100, Yellowknife, NWT, Canada X1A 2R3).

- September 1 - 5, 1987
AFRICAN GEOLOGY (14th Colloquium), Berlin, (West), F.R.G. (Dr. G. Matheis, Technical University of Berlin, SFB 69, Ackerstrasse 71, D-1000 Berlin 65, F.R.G.)
- September 6 - 12, 1987
EASIN ANALYSIS (GOGEODATA Workshop), Budapest, Hungary. (Dr. G. Gabert, Federal Institute for Geosciences and Natural Resources, P.O. Box 51 01 53, D-3000 Hannover 51, Federal Republic of Germany).
- September 7 - 9, 1987
DEFORMATION AND PLATE TECTONICS (International Conference), Oviedo, Spain. Language: English. (A. Perez-Estaun, Dpto de Geologia, Universidad de Oviedo, 33005 Oviedo, Spain).
- September 7 - 11, 1987
CARBONIFEROUS STRATIGRAPHY AND GEOLOGY (11th International Congress), Beijing, P.R. China. (Prof. Yang Jingzhi, Nanjing Institute of Geology and Palaeontology, Chi-Ming-Ssu, Nanjing, P.R. China)
- September 7 - 12, 1987
ANTARCTIC GLACIOLOGY (4th International SCAR Symposium), Bremerhaven, F.R.G. (Heinz Kohnen, Alfred Wegener Institute for Polar Research, Columbus Center, D-2850 Bremerhaven, F.R.G.)
- September 7 - 12, 1987
COMPUTERIZED BASIN ANALYSIS (GOGEODATA International Workshop), Szeged, Hungary. Language: English. (Dr. L. Somos, Geological Survey of Hungary, Ph. 106, R-1442, Budapest, Hungary).
- September 8 - 14, 1987
TERMINAL PRECAMBRIAN AND CAMBRIAN GEOLOGY (International Symposium), Yichang, China. Languages: Chinese and English. (Dr. Wang Xiao-feng, Terminal Precambrian and Cambrian Geology, Yichang Institute of Geology and Mineral Resources, P.O. Box 502, Yichang City, Hubei Province, People's Republic of China).
- September 11 - 14, 1987
SEPM (4th Annual Midyear Meeting), Austin, Texas. (SEPM, P.O. Box 4756, Tulsa, OK 74159, U.S.A.)
- September 11 - 17, 1987
PALEOENVIRONMENTAL INTERPRETATION OF PALEOZOLS (GSA Penrose Conference), Warm Spring Indian Reservation, Oregon, USA. (G.J. Retallack, Dept. of Geology, Univ. of Oregon, Eugene, OR 97403, USA).
- September 12 - 23, 1987
COMPUTER APPLICATIONS AND MANAGEMENT OF PETROLOGICAL DATA BASES (Workshop), Kuwait. Co-sponsors include IUGS and IGCP-239. (Dr. Ali T. Al-Mishwt, Geology Dept. Kuwait University, P.O. Box 5969, Safat, Kuwait).
- September 14 - 16, 1987
THE ORIGIN OF GRANITES (Symposium), Edinburgh, Scotland, U.K. (The Meetings Secretary, The Royal Society of Edinburgh, 22-24 George Street, Edinburgh EH2 2PQ, Scotland, UK).
- September 14 - 18, 1987
ANDEAN VOLCANISM SYMPOSIUM (10th Argentine Geological Congress), San Salvador de Jujuy, Argentina. Co-sponsors include IAVCEI and IGCP-249. (Dr. B. Coira, CONICET-Univ. Nac de Jujuy, Casilla de Correo No. 258, 4600 San Salvador de Jujuy, Argentina).
- September 14 - 18, 1987
CIRCUM-PACIFIC PHANEROZOIC GRANITES (International Symposium), Tucuman, Argentina. Jointly with 10th Argentine Geological Congress. Languages: English and Spanish. (Dr. Carlos W. Rapela, Centro de Investigaciones Geologicas, Universidad Nacional de La Plata, Calle 1 no 644, 1900 La Plata, Argentina)
- September 14 - 18, 1987
NEOTECTONICS AND SEISMICITY OF THE ANDES (Regional Symposium) San Miguel de Tucuman, Argentina. (Dr. V. Ramos, Dept. of Geology, University of Buenos Aires, Pabellon 2 - City University 1428, Nunez, Buenos Aires, Argentina).
- September 14 - 18, 1987
HYDROGEOLOGY OF COAL BASINS (IUGS/IAH Symposium), Katowice, Poland. (Dr. A. Rozkowski, Geological Institute, Bialego 1, 41-200 Sosnowiec, Poland).
- September 17 - 27, 1987
EVOLUTION OF METAMORPHIC BELTS (Geological Society and IGCP-235 Joint Meeting), Dublin, Ireland. (J.S. Daly, Dept. of Geology, University College, Belfield Campus, Dublin 4, Ireland).
- September 21 - 25, 1987
NATURAL GLASSES (Meeting), Prague, Czechoslovakia. Language: English. (V. Bouska, Faculty of Science, Charles University, Albertov 6, 128 43 Prague 2, Czechoslovakia).
- September 21 - 25, 1987
METALS AND METALLOIDS IN THE HYDROSPHERE: IMPACT THROUGH MINING AND INDUSTRY AND PREVENTION TECHNOLOGY (Unesco/IHP International Workshop), Bochum, F.R.G. (IHP/OHP Sekretariat, c/o Bundesanstalt fur Gewasserkunde, Postfach 309, D-5400 Koblenz, F.R.G.).
- September 24 - October 1, 1987
FOSSILS, ROCKS AND HISTORY (13th INHIGEO Symposium), Pisa, Italy. (Prof. G. Giglia, Dip. Scienze della Terra, Via S. Maria 53, 56100 Pisa, Italy).
- September 25 - 27, 1987
CATASTROPHIC FLOODING (18th Annual Geomorphology Symposium), Oxford, Ohio, USA. (Dr. Larry Mayer, Dept. of Geology, Miami University, Oxford, Ohio 45056, USA).
- September 27 - October 1, 1987
EXPLORATION '87 (3rd Decennial) Conference on Geophysical and Geochemical Exploration for Minerals and Ground-water (3rd Decennial Conference), Toronto, Canada. (Exploration '87, c/o 222 Snidercroft Road, Conford, Ontario L4K 1B5, Canada).

October 6 - 9, 1987

OROGENY, MAGMATISM AND METALLOGENY IN EUROPE (European Geological Societies 5th Meeting), Dubrovnik, Yugoslavia. Languages: English and French. (European Centre for Peace and Development, Secretariat MEGS 5, Sava-Centre, P.O. Box 5, 11000 Beograd, Yugoslavia).

October 11 - 15, 1987

SOCIETY OF EXPLORATION GEOPHYSICISTS (57th Annual Meeting), New Orleans, La., U.S.A. (Marvin R. Hewitt, Amoco Production Co., Box 591, Tulsa, OK 74102, U.S.A.)

October 12 - 16, 1987

MATHEMATICAL METHODS IN GEOLOGY (16th Annual Geochautauqua), Pribram, Czechoslovakia. Co-sponsored by IAMG. (A. Ryel, The Mining Pribram, Box 41, 261 02 Pribram, Czechoslovakia).

October 19 - 23, 1987

APPLICATION OF COMPUTERS AND MATHEMATICS IN THE MINERAL INDUSTRIES (20th International Symposium), Johannesburg, South Africa. (The Conference Secretary (C.31), Mintek, Private Bag X3015, Randburg, 2125 South Africa).

October 26 - 29, 1987

GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Phoenix, Arizona, U.S.A. (Meetings Department, GSA Headquarters, Box 9140, Boulder, CO 80301, U.S.A.)

December 7 - 11, 1987

AMERICAN GEOPHYSICAL UNION (Fall Meeting), San Francisco, California, U.S.A. (AGU Meetings, 2000 Florida Avenue NW, Washington, DC 20009, U.S.A.)

December 7 - 10, 1987

TECTONOTHERMAL EVOLUTION OF WEST AFRICAN OROGENS (IGCP-233 International Conference), Nouakchott, Mauritania. (R.D. Dallmeyer, Dept. of Geology, University of Georgia, Athens, Georgia 30602, USA).

December 7 - 11, 1987

SOUTHEAST ASIAN GEOTECHNICAL CONFERENCE (9th) Bangkok, Thailand. Language: English. (The Hon. Secretary, 9th SEAGC, c/o Division of Geotechnical & Transportation Engineering, Asian Institute of Technology, P.O. Box 2754, Bangkok 10501, Thailand).

1988

January 31 - February 5, 1988

ACHIEVEMENTS IN AUSTRALIAN GEOSCIENCE (9th Australian Geological Convention), Brisbane, Australia. (Dr. G.W. Hoffmann, Geological Survey of Queensland, GPO Box 194, Brisbane, Queensland 4001, Australia).

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 20 - 23, 1988

AAPG/SEPM (Annual Meeting), Houston, Texas, U.S.A. (Convention Department, AAPG Headquarters, Box 979, Tulsa, OK 74101, U.S.A.)

May 16 - 20, 1988

BICENTENNIAL GOLD 88 (Conference), Melbourne, Australia. Cosponsored 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, U.S.A. (AGU Meetings, 2000 Florida Avenue NW, Washington, DC 20009, U.S.A.)

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/CSFG (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, Ontario, Canada. (P.J. Reynolds, President, Canadian Committee - International Water Resources Association, 3 Valley View Road, Ottawa, Ontario, Canada K2H 5Y6).

July 1988

APPLIED GEOCHEMISTRY OF THE CONTINENTAL CRUST (IAGC Conference), Sao Paulo, Brazil. (Dr. A.J. Melfi, Institute of Astronomy and Geophysics, University of Sao Paulo, C.P. 30627, Sao Paulo 01000, Brazil).

July 1988

THERMODYNAMICS OF NATURAL PROCESSES (International Symposium), Strasbourg, France. Co-sponsored by IAGC, IGCP, IMA, CODATA. (Dr. B. Fritz, Centre de Sedimentologie et de Geochimie de la Surface, 1 rue Blessig, F-67084 Strasbourg Cedex, France).

July - August 1988

OSTRACODA AND GLOBAL EVENTS (10th International Symposium), Aberystwyth, Wales, U.K. Supported by IPA. (Dr. R.C. Whitley, Dept. of Geology, University College of Wales, Aberystwyth, Dyfed SY23 3DB, Wales).

July 1 - 8, 1988

SEISMIC PROBING OF THE CONTINENTS AND THEIR MARGINS (Symposium), Canberra, Australia. (Dr. J. Leven, BMR, P.O. Box 378, Canberra, ACT 2601, Australia).

June 7 - 10, 1988

EUROPEAN ASSOCIATION OF EXPLORATION GEOPHYSICISTS (50th Congress), Den Haag, The Netherlands. (E. van der Gaag, European Association of Exploration Geophysicists, P.O. Box 162, NL-2501 AN The Hague, The Netherlands)

June 20 - July 9, 1988

SEISMIC PROBING OF THE CONTINENTS AND THEIR MARGINS (Meeting), Canberra, Australia. (Dr. J.H. Leven, BMR, Box 378, Canberra, ACT 2601, Australia)

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).

August 14 - 21, 1988

PEAT (8th International Congress), Leningrad, U.S.S.R. (Peat Congress, Ministry of Fuel Industry of the RSFSR, Sadovaya-Chernogryazskaya 8, Moscow 107813, U.S.S.R.).

August 20 - 27, 1988

INTERNATIONAL PALAEOBOTANICAL CONGRESS (3rd) Melbourne, Australia. (Secretary, 3rd IOP Conference, Conventions Department, P.O. Box 1901R, GPO Melbourne 3001, Australia).

August 22 - 26, 1988

GEOGRAPHICAL CONGRESS (IGU 26th International), Sydney, Australia. (Prof. B. Thom, Department of Geography, Institute Building, University of Sydney, Sydney, Australia 2006).

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).

September 1988

ENGINEERING GEOLOGY AS RELATED TO THE STUDY, PRESERVATION OF ANCIENT WORKS, MONUMENTS AND HISTORICAL SITES (IAEG International Symposium), Athens, Greece. (Dr. L. Primel, IAEG, Lab. Central des Ponts et Chaussees, 58 Boulevard Lefebvre, 75732 Paris Cedex 15, France).

October 1988

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

October 30 - November 1988

SOCIETY OF EXPLORATION GEOPHYSICISTS (Annual Meeting), Anaheim, California, U.S.A. (Convention Assistant, Society of Exploration Geophysicists, P.O. Box 3098, Tulsa, OK 74101, U.S.A.)

October 31 - November 3, 1988

GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Denver, Colorado, U.S.A. (Meetings Department, Geological Society of America, P.O. Box 9140, Boulder, CO 80301, U.S.A.)

December 5 - 9, 1988

AMERICAN GEOPHYSICAL UNION (Fall Meeting), San Francisco, California, U.S.A. (AGU Meetings, 2000 Florida Avenue NW, Washington, DC 20009, U.S.A.)

1989

July 9 - 19, 1989

INTERNATIONAL GEOLOGICAL CONGRESS (28th), Washington, D.C., U.S.A. (International Geological Congress, P.O. Box 1001, Herndon, VA 22070, U.S.A.)

October 29 - November 2, 1989

SOCIETY OF EXPLORATION GEOPHYSICISTS (Annual Meeting), Dallas, Texas, U.S.A. (Convention Assistant, Society of Exploration Geophysicists, P.O. Box 3098, Tulsa, OK 74101, U.S.A.)

November 9 - 12, 1989

GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), St. Louis, Missouri, U.S.A. (Meetings Department, Geological Society of America, P.O. Box 9140, Boulder, CO 80301, U.S.A.)

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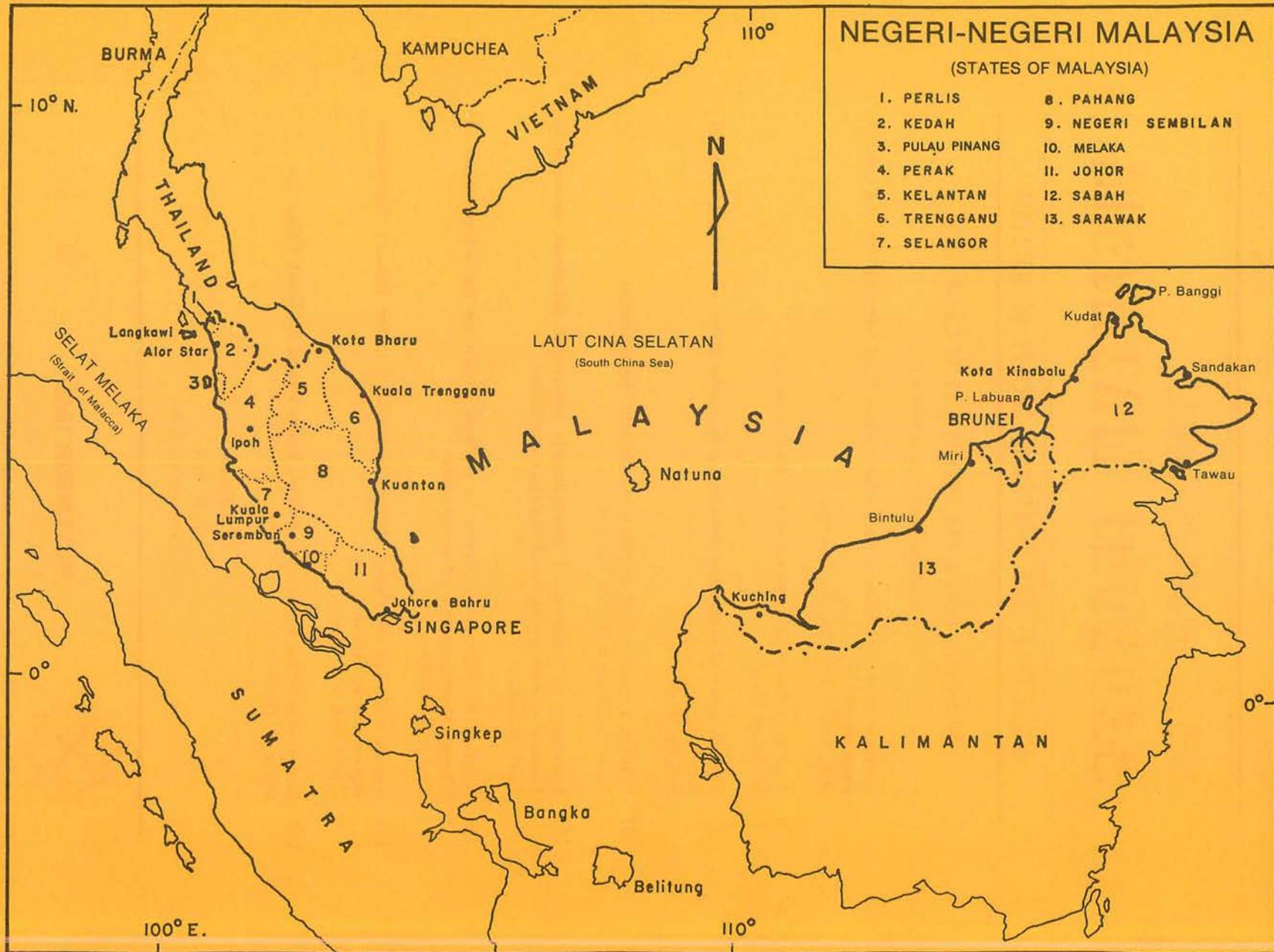
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