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KANDUNGAN (Contents)

DIKELUARKAN DWIBULANAN
ISSUED BIMONTHLY

PERSATUAN GEOLOGI MALAYSIA
(GEOLOGICAL SOCIETY OF MALAYSIA)

Majlis (Council) 1990/91

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STRUCTURAL MAPPING OF THE MALIAU BASIN, SABAH, BY SYNTHETIC APERTURE RADAR (SAR)

Lai Kok Hoong,
Geological Survey of Malaysia, 30820 Ipoh.

Abstract

Synthetic aperture radar (SAR) is found to be an effective tool for structural mapping of a remote, heavily forested area with perennial adverse weather conditions. The technique despite some inherent limitations has provided an excellent data base for structural analyses.

Abstrak

Radar apertur sintetik adalah didapati satu peralatan yang berkesan untuk pemetaan struktur di kawasan hutan tebal, terpencil dan yang sentiasa di dalam keadaan cuaca buruk. Teknik ini telah memperuntukan satu pengkalan data yang baik untuk analisis struktur walaupun sendiri mempunyai beberapa sifat yang menghadkan.

Introduction

The Maliau Tertiary Basin is located in the remote interior of Sabah (Figure 1). The region is largely uninhabitated and is covered by dense rain forest. The topography is rugged, and is nearly cloud-covered throughout the year. Previous ground information (Collenette, 1965, and P.S. Lim, 1989) is scant, and the Maliau Basin is known to be of closely interbedded mudstone and sandstone with local seams of the Lower to Middle Miocene Tanjong Formation.

Synthethic aperture radar (SAR) imagery (Figure 2) at a scale of 1:100,000, acquired by Intera Technologies (Canada)'s STAR-1 airborne system, covering about 1,000 sq km was made available for study by Terra-Control Technologies, Malaysia. Three strips of radar imagery which side-lapped by about 60 percent permitted stereoscopic analysis of the terrain. The aim of the analysis was to provide additional data for ongoing fieldwork. Geological information was required for development planning.

Image interpretation

The radar imagery, especially when viewed stereoscopically, was particularly amenable to structures elucidation. SAR clearly reveals more geological information than shown on published geological maps (Collenette, 1985), as illustrated in Figure 3. The map indicates that the Maliau Basin is roughly circular in shape. It has an almost continuous rim which forms rugged ridges particularly in the north where the highest peaks e.g. Gunung Lotong, are located. It also has a prominent plateau

developed near the southern rim but not at the center of the basin. Between the plateau and the northern rim ridges are a series of cuesta landforms with well developed dip and scarp slopes. The dips as determined from the dip slopes are fairly uniform and gentle (about 15°). Some horizontal beds are observed near the eastern basin rim and on the plateau in the south.

Lineaments mainly trend, NNE and NW. The NNE trending lineaments appear to be mostly joints whilst those trending NNW are interpreted as faults generally of a dip-slip nature. Most of these dip-slip faults are also interpreted as normal faults which occur in a step-like fashion, somewhat similar to block faults in landslides. A long, prominent semi-circular lineament running parallel to the north basin rim on the southern flank of the Gunung Lotong mountain ridge appears to be a large normal fault. The Lanod fault (Collenette, 1965) which marked the south-eastern

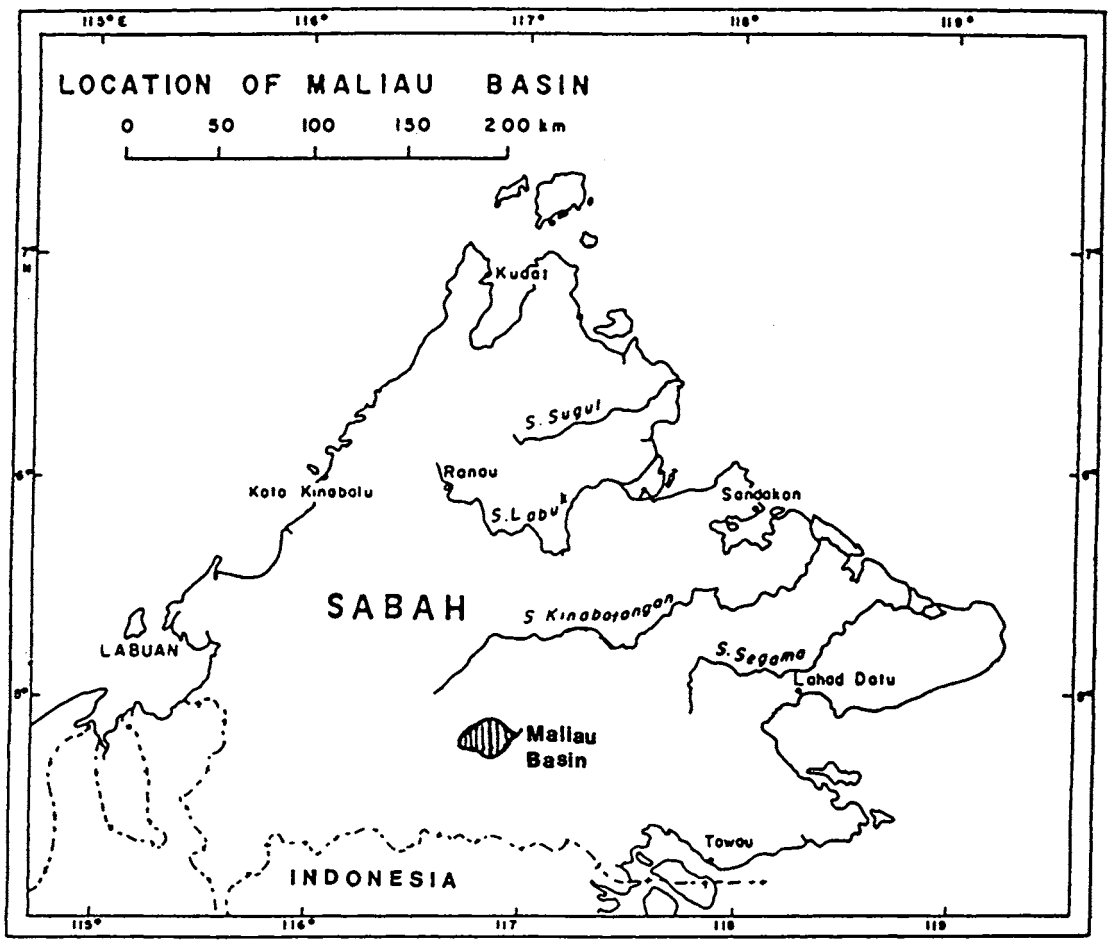

Fig. 1. Location of Maliau Basin, Sabah.

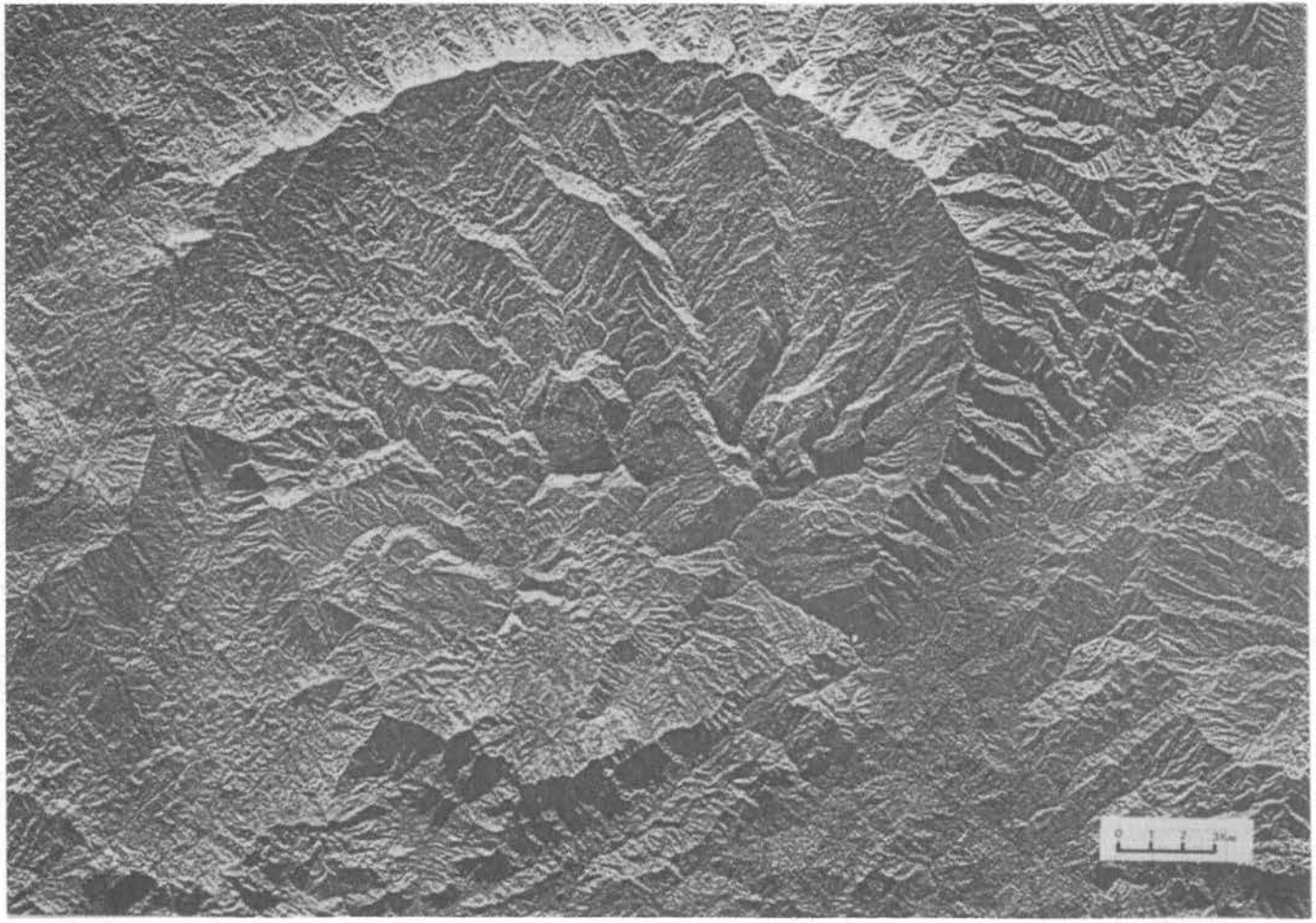

Fig. 2. Synthetic aperture radar image of the Maliau Basin, Sabah, Malaysia.

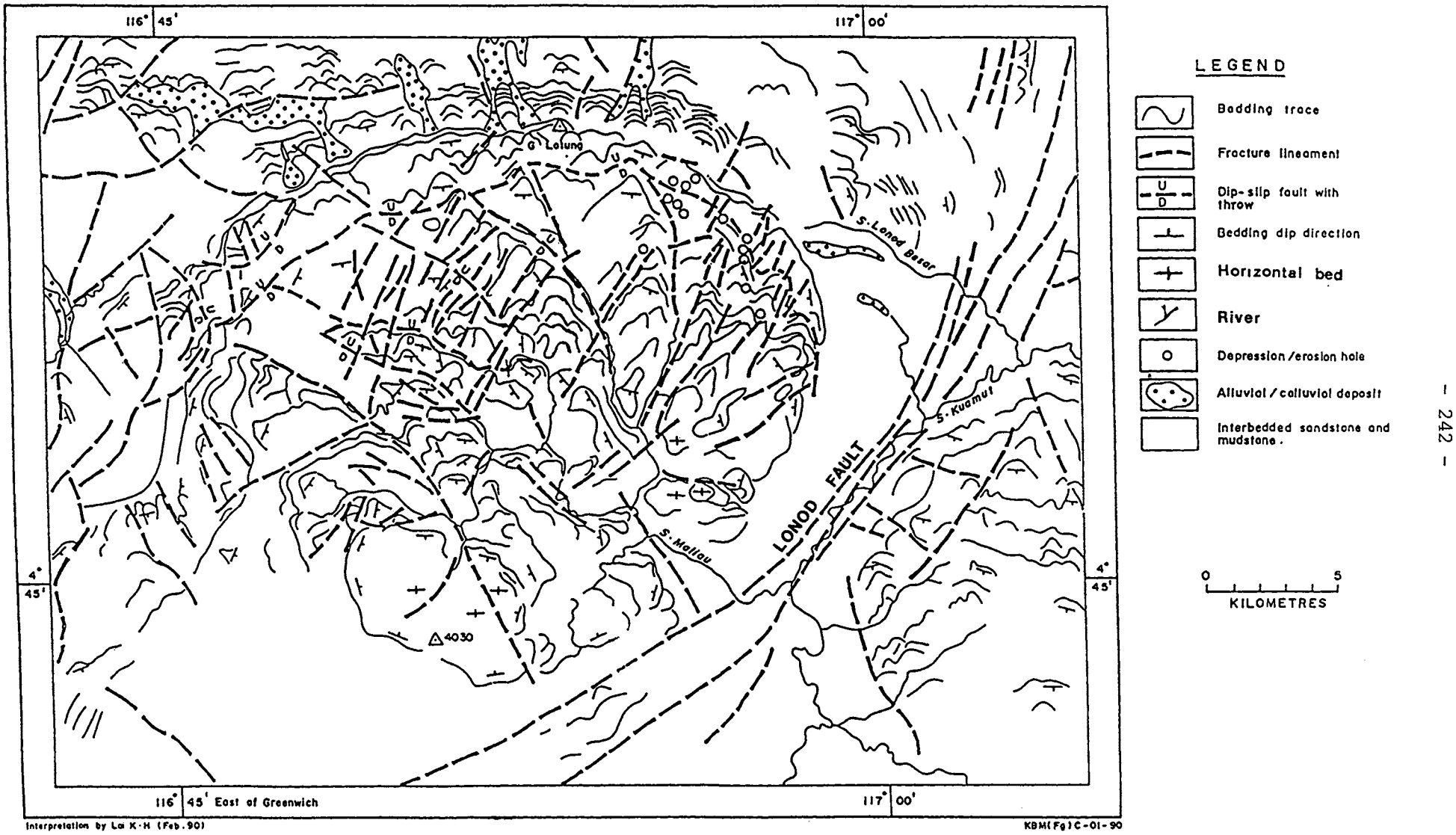

Fig. 3. Preliminary photogeological map of the Maliau Basin area, Sabah from airborne synthetic aperture radar (SAR) imagery (south look) of Intera (Canada) STAR-1 system.

limit of the Maliau Basin proper is not very apparent in the imagery, probably due to its oblique alignment to the flight path thus resulting in less return of the radar signal.

Although it is possible to recognise broad lithologies on SAR imagery based on vegetation texture (Lai, 1989), it is not applicable in this instance to discriminate the main rock types of the Tanjung Formation as vegetation cover is almost homogeneous. However, an exception was noted where the south-facing slopes of the Gunung Lotong ridge appears to form from a distinct bed composed of friable coarse sandstone (confirmed by P.S. Lim, personal communication) as evident from the smoother texture and the presence of numerous erosion holes in this bed (like karst sinkholes!). In addition, areas underlain by superficial deposits, especially those from mass-wasting processes, like the series of screes and alluvial tracts on the northern flank of Gunung Lotong Ridge are easily seen with SAR.

Comments

SAR has been shown, particularly in this region, to be a very useful tool for rapid geological reconnaissance in remote areas with adverse weather conditions. In this instance and considering its ability to provide digital mosaic, it is superior to Landsat or Spot and aerial photographs for interpreting geological structures. However, it is important to note that there are some limitations resulting in loss of information due to shadow effects and saturation (flare zones). It has also a highly directional bias, as exemplified in this case, where east-west trending features were highlighted and north-south features (normal to flight path) were suppressed. Thus in areas where structural directions are highly divergent and where there is an emphasis on the application of lineament analysis, a radar survey with two or more different look or scan directions is advisable. In fact, Gellnet (1978) had recommended that four look directions, with orthogonal flight lines, are necessary to obtain maximum data information.

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BULETIN PERSATUAN GEOLOGI MALAYSIA

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SPECIAL ISSUE ON PETROLEUM GEOLOGY VOL. V

KANDUNGAN (CONTENTS)

Editor
G.H. TEH

NOVEMBER 1990 **No. 27**

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PERTEMUAN PERSATUAN
(MEETINGS OF THE SOCIETY)

PETROLEUM GEOLOGY SEMINAR '90 - LAPORAN (REPORT)

The 14th in the series of Annual Petroleum Geology Seminar organised by the Geological Society of Malaysia was held on the 27 & 28th November 1990 at Dewan Tun Hussain Onn, Putra World Trade Centre, Kuala Lumpur.

This is the first Seminar of the Society to be held in a Convention Centre. There was again a large turnout at the Seminar, almost 400. There were 26 interesting papers presented and in addition, for the first time, there were 2 keynote papers, one by Dr. Douglas Waples and the other by Dr. Robert Morley. For the papers, the Society again had support from the local oil companies, service companies, Petronas Petroleum Research Institute and the local universities.

In his speech, Dato' Wong See Wah, Deputy Minister in the Prime Minister's Department cautioned that Malaysia's current oil reserves of 3.1 billion barrels of oil produced at an exceptionally high production rate of 650,000 barrels of oil per day will mean that the country will have to switch her position from a net exporter to a net importer of oil in 13 years. The challenge therefore is for explorationists to find new oil accumulations. Research and development programmes need therefore to be coordinated to intensify exploration efforts utilising the latest technology and innovative exploration concepts.

Donations and sponsorship of the lunches and Hi-Tea were most encouraging. This augurs well for the Society's Annual Petroleum Geology Seminar remaining as the major seminar of its kind in this region.

G.H. Teh

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OPENING ADDRESS BY DATO' WONG SEE WAH, THE DEPUTY MINISTER IN THE PRIME MINISTER'S DEPARTMENT AT THE 14TH PETROLEUM GEOLOGY SEMINAR 1990 - 27TH NOVEMBER 1990

Tuan Pengerusi Majlis, Encik Ahmad Said, Presiden, Persatuan Geologi Malaysia, Encik Abu Samad bin Nordin, Pengerusi, Jawatankuasa Pengelola, Seminar Geologi Petrolium Yang ke 14, Tan Sri-Tan Sri, Dato'Dato', Tuan-tuan dan Puan-puan, Ladies and Gentlemen.

I am very pleased indeed to be able to present today the opening address at your 14th Petroleum Geology Seminar 1990. As the Deputy Minister in the Prime Minister's Department incharge of petroleum affairs I am indeed fortunate to meet all of you at this annual gathering of geoscientists

from and outside Malaysia to discuss on the advancement of petroleum geology and geophysics which essentially form the core subjects of petroleum exploration. I am certainly not wrong to say that I am addressing today, professionals, who in my mind are instrumental in undertaking and promoting petroleum exploration in this country.

Ladies and Gentlemen,

The first exploration for petroleum began in Malaysia about 90 years ago. The numerous surface oil seeps in Sarawak managed to arouse the curiosity of the explorers. The first big break came with the discovery of the Miri Field in 1910. Since then exploration had surged forward, first onshore and later on offshore. Up to 1976, 200,000 line km of seismic had been acquired and 357 wells drilled. These activities were however not well coordinated under then then "Concession Agreements". It was only in 1974 with the incorporation of the Petroleum Development Act, that the management of the country's petroleum resources was more streamlined. This move has helped to accelerate petroleum exploration further resulting in an acquisition of 328,175 line km of seismic and 358 exploration wells drilled over a period of just 13 years.

All these efforts led to the discovery of 54 oil fields and 52 non associated gas fields with reserves of 4.8 billion barrels of oil and 56.1 trillion cu ft of gas within the onshore and the shallow continental shelf area with water depths less than 200 meters.

The shallow continental shelf area constitute about 65% of the available exploration acreage in Malaysia. Another 16% of the 523,100 sq km are on land and the remaining 19% or 100,000 sq km are in deepwaters. Unlike the land acreage which, is now being revisited the deepwater areas are as yet undrilled. These "frontier" areas will be the focus of a new round of exploration in the 1990's which will be announced by Petronas in 1991.

Malaysia's current remaining oil reserves of 3.1 billion barrels of oil is currently being produced at an unprecedented high production rate of 650,000 barrels of oil per day. This simply means that in 13 years Malaysia will switch her position from a net exporter to a net importer of oil. This outlook is rather worrying particularly if we do not make any new discoveries.

The challenge therefore facing Malaysia is to keep the "reserves to production" ratio of 13 years for as long as possible. For the explorationists, this means finding new oil accumulations.

This difficult task has been partly achieved with discoveries made in Kinabalu and Nosong in Sabah, Asam Paya in Sarawak and recently in Larut in Peninsular Malaysia in the last three years. Further appraisal efforts are being conducted prior to embarking on their field development plans.

On the regional context, we are also very encouraged to learn about the discoveries made by our neighbours particularly on the Indonesian side of the South China Sea and in offshore Brunei. These recent discoveries are located very near to Malaysian borders and in sedimentary basins geologically similar to those in Malaysia. Their successes should provide us with the encouragement and incentive that oil accumulations still exist inspite of the big fields already found.

While every effort is made to explore for oil, we should not be discouraged if we encounter gas only. Like oil, Malaysia is also blessed with substantial amount of gas reserves currently estimated at 56 TSCF. The government, through Petronas is promoting the use of the large gas reserves as a major new source of energy to meet the fuel requirements and as feedstock for power and energy dependant industrial plants.

In the 1990's the country will see some major downstream gas utilization projects like the Peninsular gas utilisation scheme, petrochemical, middle distillate synthesis (MDS) and expansion of the LNG project. These projects, will ensure optimum utilisation of the gas reserves and as well as making more oil available for export. With these ready markets the government hope to provide the incentives to also explore for gas while looking for oil.

Looking ahead, the Exploration for petroleum in future will become more demanding. As most of the larger oil and gas fields have already been discovered and developed leaving behind only subtle traps the exploration for remaining hydrocarbons requires intensive exploration efforts utilising the latest technology and innovative exploration concepts.

To meet the above needs, it is necessary to embark on a coordinated Research and Development programme to cater for the meets of the Malaysian oil industry. Ultimately, it is hoped that the R & D efforts will perfect the current technologies and also develop future ones.

In promoting R & D in the country, it is felt that a climate more conducive to invention, innovation and technological advancement be developed. In this context the Government would like to acknowledge Petronas' efforts in launching the Inventors Award scheme aimed at promoting R & D and to give Malaysians and Malaysian registered organisations the opportunity to contribute and develop new ideas in the field of petroleum, petrochemicals and other related areas. This scheme certainly applies to you and me.

This seminar which you will be attending for the next two days contains many high quality scientific papers which have the right ingredients to qualify for the award. I therefore wish the presenters every success and hope that your contributions will lead to further advancement in the Petroleum Exploration efforts in Malaysia.

Finally, I like to congratulate the Geological Society of Malaysia for the splendid work they have done over the last 23 years in promoting the knowledge of earth sciences.

On that note, I wish you a successful seminar.

Thank you.

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GEOLOGICAL SOCIETY OF MALAYSIA
PETROLEUM GEOLOGY SEMINAR 1990

PROGRAMME

DATE: 27TH NOVEMBER 1990 (Tuesday)

08:00: Registration

08:50: Arrival of Invited Guests

09:05: Welcoming address by Chairman of Organising Committee

09:10: Speech by the President Geological Society of Malaysia

09:20: Opening address by YB Dato' Wong See Wah, Deputy Minister in Prime Minister's Dept.

09:30 : **COFFEE BREAK**

Session 1: Session Chairman: **Dennis E. Francis,** EPMI.

10:00 : Keynote address by **Dr. Douglas Waples**
– Advances in current trend in Geochemistry

11:00 : The southward tilting of Sundaland: Tectonic vs eustatic controls on sedimentation in the Cenozoic Basins of Thailand and offshore Peninsular Malaysia
– **Mazlan Madon**
(PETRONAS Petroleum Research Institute)

11:25 : A Quantitative Fluorescence Technique (QFT) for the evaluation of oil shows
– **D.C. Kothari**
(TEXACO Exploration Penyu Inc.)

11:50 : Application of the Gassman's Model in hydrocarbon bearing reservoir characterisation
– **Ng Tong San & Dr Leong Lap Sau**
(PCSB/USM)

12:15 : The application of gas ratios in Papua New Guinea
– **M. Daniels & N. Duncan**
Chevron Niugini P/L / Exlog International Singapore

12:40: **LUNCH BREAK**

GEOLOGICAL SOCIETY OF MALAYSIA
PETROLEUM GEOLOGY SEMINAR 1990

PROGRAMME

Session II: Session Chairman: **Dr. Khalid Ngah,** PRI.

14:00: Structural continuity between Sumatra, Peninsular Malaysia and Thailand
– **Prof. C. S. Hutchison**
(University of Malaya)

14:25: Application of the borehole electrical imagery to the study of reservoir anisotrophy
– **Mohamed Taha**
(Schlumberger (Malaysia) Sdn. Bhd.)

14:50: Shallow marine seismic survey over Saracen Bank, offshore Sarawak
– **Elieen Lau, R.C. Hoogenboom & J. Smethurst**
(SSPC)

15:15: **TEA BREAK**

15:45 : Formation evaluation by Quartz Gauge FMT Tool
– **Fumio Okitsu & Naoki Ogawa**
(MBODC)

16:10 : A time migration before stack
– **Richard C. Cooper & Malcolm R. Hobson**
(Digicon)

16:35: Prediction of Total Organic Carbon content using wireline logs in the Malay Basin
– **Ahmad Sharby Abdul Hamid**
(PETRONAS Petroleum Research Institute)

17:00 : Chronostratigraphy of EPMI's Blocks PM-5 and PM-8
– **Lye Yue Hong**
(EPMI)

18:00 : **HI-TEA**

GEOLOGICAL SOCIETY OF MALAYSIA
PETROLEUM GEOLOGY SEMINAR 1990

PROGRAMME

DATE: 28TH NOVEMBER 1990 (Wednesday)

Session III: Session Chairman: **Peter Woodrof,** British Gas.

08:00: Airborne geophysical surveys as an aid to hydrocarbon exploration in onshore Sarawak
– **Wee Eng Swee & Lai Soo Khuan**
(OPIC)

08:25 : Application of sequence stratigraphy to the Triassic limestones in northwest Peninsular Malaysia
– **Ann Yasmin**
(EPMI)

08:50 : Fault patterns in Malay Peninsula: Implications for offshore basins and regional tectonics
– **K.R. Chakraborty & S.P. Sivam**
(University of Malaya)

09:15: Porosities in the Pulai-II sandstone – Implication for hydrocarbon exploration in older reservoirs
– **Dr. Khalid Ngah**
(PETRONAS Petroleum Research Institute)

09:40: **COFFEE BREAK**

10:10: Keynote address by **Dr. Robert Morley**
– Tertiary stratigraphic palynology in Southeast Asia: Current status and new directions

11:10: The application of integrated 3D seismic and reservoir geological studies in a complex oilfield, D18 Field, Sarawak, Malaysia
– **L.R. Williams, J. Almond & P.W. Vincent**
(Sarawak Shell Berhad)

11:35: An integrated approach to reservoir petrophysical parameters evaluation
– **E. Poggiagliolmi & D.J. Lowden**
(ENTEC Energy Consultants)

12:00: A new concept in borehole seismic measurement and applications
– **N. Oikawa & Dr. Roopa Gir**
(JTOC/Schlumberger)

GEOLOGICAL SOCIETY OF MALAYSIA
PETROLEUM GEOLOGY SEMINAR 1990

PROGRAMME

12:25: Cross-border correlation of geological formations in Sarawak & Kalimantan
– **Robert B. Tate**
(University of Malaya)

12:50: **LUNCH BREAK**

Session IV: Session Chairman: **Arthur van Vliet,** Sarawak Shell Berhad/ Sabah Shell Petroleum Co.

14:00: Oil-generating potential of coals from Spitsbergen, Svalbard
– **Wan Hasiah Abdullah**
(University of Malaya)

14:25: Cement-stratigraphy of Tigapapan Unit, Sabah Basin : Clue to timing of hydrocarbon migration
– **Mohammad Yamin Ali**
(PETRONAS Petroleum Research Institute)

14:50: DMO accuracy requirements for AVO analysis
– **Dr. Craig J. Beasley**
(Western Geophysical, Singapore)

15:15: **TEA BREAK**

15:45 : Multiple and noise attenuation with Tau-p seismic data processing
– **Dr. Leong Lap Sau & Ng Tong San**
(USM/PCSB)

16:10: Sequence stratigraphy of the group J in the Malay Basin and its impact on development opportunities
– **Yap Kok Thye**
(EPMI)

16:35: Units of measurement in Petroleum Geoscience : Towards the elimination of ambiguity
– **Dr. Neville Haile**
(PETRONAS Petroleum Research Institute)

17:00 : Geochemistry of selected crude oils from Sabah and Sarawak
– **Awang Sapawi Awang Jamil, Mona Liza Anwar & Eric Seah Peng Kiang**
(PETRONAS Petroleum Research Institute)

17:25 : **CLOSING REMARK**

PETROLEUM GEOLOGY SEMINAR '90

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PETROLEUM GEOLOGY SEMINAR '90

14TH PETROLEUM GEOLOGY SEMINAR '90

Captions to photos

1-5. At the registration desk.
6-7. Council members on hand to receive Dato' Wee on arrival.
8. Organising Chairman, Haji Abu Samad Nordin with his Welcoming Address.
9. Ahmad Said, GSM President, with his speech.
10. YB Dato' Wong See Wah with the Opening Address.
11-12. Dato' Wong at Coffee Break with Council Members and guests.
13-23. Different angles of the large turnout.
24. D. Waples and his Keynote Address.
25. Mazlan Madon on tilting of Sundaland.
26. D.C. Kothari on the QFT.
27. Ng Tong San with his paper.
28. M. Daniels on application of gas ratios.
29. Kenny Goh with a question.
30-31. It's LUNCH time!
32. Haji Abu Samad receiving Exlog's cheque from Michael Hope-Jones.
33. Jimmie Aung Khin with a word after presenting Petromin's cheque.
34. Dennis E. Francis with EPMI's contribution.
35. Arthur von Vliet and SHELL's donation.
36. C.S. Hutchison continues the technical session.
37. Mohamed Taha of Schlumberger.
38. P.W. Vincent on shallow marine seismic survey.
39. Fumio Okitsu on the Quartz Gauge FMT tool.
40. Richard C. Cooper of Digicon.
41. Ahmad Sharby Abdul Hamid of PRI.
42. Lye Yue Hong with his paper.
43. Wee Eng Swee of OPIC on airborne geophysical surveys.
44. E. Poggialiolmi with a comment.
45. Ann Yasmin on sequence stratigraphy.
46. K.R. Chakraborty on fault patterns.
47. Khalid Ngah of PRI on the Pulai-II sandstone.
48. Robert Morley with his Keynote Address.
49. L.R. Williams on the D18 Field.
50. E. Poggiagliolmi presenting his paper.
51. Azhar Hj. Hussin expressing his point.
52. Roopa Gir with her contribution.
53. Robert B. Tate on Sarawak-Kalimantan correlations.
54. Wan Hasiah Abdullah with her presentation.
55. The Organising Chairman thanking Session Chairman Peter Woodrof.
56. Mohamad Yamin Ali of PRI.
57. Leong Lap Sau on Tau-p seismic data processing.
58. Craig J. Beasley of Western Geophysical.
59. Yap Kok Thye on sequence stratigraphy of the Group J.
60. Neville Haile on units of measurement.
61. Awang Sapawi Awang Jamil of PRI.
62. The Organising Chairman with his Closing Remarks.

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Abstracts of Papers

Geological Society of Malaysia — Petroleum Geology Seminar 1990

THE SOUTHWARD TILTING OF SUNDALAND: TECTONIC VS EUSTATIC CONTROL ON SEDIMENTATION IN THE CENOZOIC BASINS OF THAILAND AND OFFSHORE PENINSULAR MALAYSIA

MAZLAN MADON
PETRONAS PETROLEUM RESEARCH INSTITUTE
54200 ULU KLANG

The Cenozoic basins of Thailand and offshore Peninsular Malaysia occur in a zone that extends from northern Thailand into the offshore area east of Peninsular Malaysia. These basins are generally N-S trending fault-bounded basins believed to have formed in a strike-slip stress regime associated with the collision of India and Eurasia in the early Cenozoic. Regional stratigraphic correlation shows similarities in the sedimentation patterns in these basins. From north to south, the present-day elevation of the basin floor generally decreases, whereas the thickness of basin-fill and "marine character" of the sediments increase. Palynological records from the Thai basins suggest that marine incursions had reached as far north as the Fang Basin by early Miocene. The Fang Basin lies approximately 700 km north of the present shoreline, more than 1000 m above sea-level. The rise in sea-level during the late Oligocene to early Miocene probably reached only 150 m above present level, and could not have been sufficient to cause marine incursion to reach that far north. This must mean that the 'intermontane' basins of Thailand were at a much lower elevation than at present.

The data suggest that there has been a regional southward tilting of Sundaland during the Cenozoic, which has caused the basins in the north to rise relative to those in the south. The observed sedimentation patterns in these basins were controlled both by this tilting and the changes in sea-level.

Geological Society of Malaysia — Petroleum Geology Seminar 1990

A Quantitative Fluorescence Technique (QFT) for the Evaluation of Oil Shows

D.C. Kothari
Texaco Exploration Penyu Inc.

Fluorescence has been used by wellsite geologists and mud loggers to identify oil shows for decades. However, the method used to determine the fluorescence of samples at the rig site has not improved appreciably and is limited in its usefulness and applicability. Consequently, Texaco has developed the QFT as a means to make a more quantitative, more sensitive, and more discriminating measurement of the fluorescence of well samples. This development has resulted in a log much more indicative of the true oil content of the drilled formation than previously employed techniques. QFT reduces the risk of overlooking potential oil pay zones in wells being drilled and provides a method of looking for bypassed oil zones in older wells.

At present, fluorescence is "determined" when an operator shines a broad-spectrum ultraviolet light source (black light) on samples and then records what he sees. There are several problems inherent in this procedure which make it non-quantitative at best and misleading at worst. First, the presence or amount of oil on the surface of the cuttings samples may not be representative of the oil in the pore structure of the formation. The mud logger or wellsite geologist sees only the surface with this technique. Second, the excitation source is not concentrated in the spectral region where the oil is likely to absorb radiation and re- emit it as fluorescence. Third, and most serious, the oil is quite likely to emit a fluorescence radiation predominately, if not totally, at wavelengths which cannot be seen by the human eye. Of course a fourth problem is the fact that the operator's descriptions of the phenomenon are highly subjective. Such words as strong, weak, bright, dull, yellow, gold, etc. prohibit any quantitative analysis of the data.

Texaco has therefore developed a drill site QFT method in which oil is extracted from samples with an alkaline solvent and the fluorescence of the extract quantitatively measured by a fluorometer in the spectral region most likely to fluorescence strongly.

The technique is both specific and sensitive, the procedure is quickly accomplished, and the instrument is portable and field rugged. QFT is an operational technique currently in use worldwide by Texaco on exploration wells.

Geological Society of Malaysia — Petroleum Geology Seminar 1990

APPLICATION OF GASSMANN'S MODEL IN HYDROCARBON-BEARING RESERVOIR CHARACTERISATION

NG TONG SAN
PETRONAS CARIGALI SDN BHD
KUALA LUMPUR
&
LEONG LAP SAU
UNIVERSITI SAINS MALAYSIA
PENANG

The effect of gas saturation and resultant decrease in acoustic impedance (density x velocity) in sandstone and carbonate reservoirs can be predicted from seismic wave propagation in a porous fluid-filled media and is commonly used in detecting hydrocarbon from seismic data before drilling.

The use of observed high amplitude or 'bright spot' as a direct hydrocarbon indicator, tacitly assumes that any pronounced lateral change in relative amplitudes can be attributed to a change in the hydrocarbon contents of the reflecting horizon. However, many important gas discoveries have been made in the absence of any 'bright spot' build-up on the seismic sections. This study attempts to explain the general lack of anomalous high amplitudes in charging a water-bearing layer with a gas from an innovative application of the Gassmann's equation. Density and velocity values from selected well logs, in conjunction with a judicious adjustment of various elastic module, are used to calibrate the Gassmann acoustic model.

From this study, we conclude that if water charged reservoirs have an initial gas saturation of as little as 2.5%, subsequent increase in gas saturation will only be reflected in a furthur but minor decrease in compressional wave velocity in the porous medium. We suggest this initial gas saturation is innate and derived from a biogenic origin. This results in 'normal' reflection amplitudes.

Secondly, for a given input value of porosity and compressional wave velocity, reduction of the grain bulk modulus towards a critical value will narrow the percentage velocity drop between a 100% water charged reservoir and a similar with initial 2.5% gas saturation. At the critical limit, the porous rock behaves like an elastic isotropic medium where the computed matrix bulk modulus equals that of the assigned input mineral bulk modulus. The presence of clay, siltstone and bounded waters within the reservoir matrix changes the computed value of frame bulk modulus. This results in 'normal' reflection amplitudes.

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THE APPLICATION OF GAS RATIOS IN PAPUA NEW GUINEA

M. DANIELS
CHEVRON NIUGINI P/L, PORT MORESBY,
PAPUA NEW GUINEA
&
N. DUNCAN
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Hydrocarbon reservoir fluids contain discrete gas elements including methane through pentane, which occur in concentrations proportional to the nature of the fluid. The release of these gases during drilling, and subsequent alteration caused by changes in temperature and pressure during the rise to the surface, make quantitative analysis quite subjective. The analysis of trends of the Gas Ratios, however can aid in the characterization of reservoir fluids.

Rank wildcat drilling, presently underway in Papua New Guinea, has utilized this trend analysis for a first pass evaluation of the presence and characterization of the reservoir fluids.

Although the absolute values of the gas ratio curves vary slightly from those first introduced by Haworth *et al.* (1984) a distinct range of curve separation is exhibited that is directly correlative with the reservoir fluid. Values of separation generally below 10 are indicative of gas; the higher the value the richer in condensate is the gas. Values usually between 35 and 55 are indicative of a liquid-phase hydrocarbon. Occurrences of residual oil can also be identified utilizing trend analysis which create an overall decrease in separation with depth; a situation only present with a water contact or transitional zone of increasing water saturation.

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STRUCTURAL CONTINUITY BETWEEN SUMATRA, PENINSULAR MALAYSIA AND THAILAND

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The spectacular N-S Bengkalis Graben, aligned at 102.3° E, deepens southwards from Malacca to more than 3 km below sea level over a horizontal distance of 265 km. It terminates abruptly against a NW-SE wrench fault defining the northeast margin of the Tigapuloh Mountains. The Paleogene drainage flowed southwards on the tilted basement landsurface, and initial sediments were alluvial, fluvial and lacustrine.

In Peninsular Malaysia, Mesozoic molasse strata occur at progressively higher elevations northwards, and deep-seated metamorphic rocks outcrop in the north. The continental block, extending from the Thai Border to Central Sumatra, is southerly down-tilted. The sea level hinge lies in the Straits of Malacca. The Sumatran pre-Tertiary topography has been infilled by Tertiary oil-bearing formations, while the similar Malaysian topography has been eroded since the Paleogene.

The Muar River is a relict of its past glory. The Tembeling-Muar was the premier Paleogene river, flowing south down the regional slope, probably reaching the Indian Ocean on the South Sumatran coast. It was responsible for the Paleogene lakes and source rocks in the Bengkalis Graben, and later provenanced granite-derived reservoir sands from Malaysia. It has been captured and now flows east as the Pahang River. Tasek Bera is one of its extant lakes, comparable to those of the Bengkalis Trough, but it has not been geologically investigated.

The N-S trending system continues uninterrupted to north Thailand. However there must exist a major fault beneath the coastal plain from Songkla to Kota Baru, with spectacular northwards downthrow. Surprisingly it does not appear on any map. The continental block is progressively up-tilted from the southern Gulf, where the Paleogene lacustrine basins are deep below sea level, to north Thailand, where they are high above sea level. The Paleogene Chao Phraya-Mekong river flowed southwards along this regional slope; a direct analogue of the Tembeling-Muar.

The Bengkalis Graben was interpreted by Tjia (1989) as a southwards continuation of the Malaysian Bentong-Raub Suture. This is an unlikely hypothesis. The Suture is structurally conformable with and defines the western margin of the Central Triassic Basin. The Gemas Formation continues southwards as the Jurong Formation, and the regional N-S strike swings abruptly SE at Gunung Pulai, and continues through Singapore into the predominantly Triassic Riau Archipelago. The Bentong-Raub Suture therefore swings SE from Malacca to follow this trend, and it must be located between Kundur and Batam islands. This is the favoured position based on granite petrology and Triassic stratal distribution.

The basement geology of the Central Sumatran Basin may be satisfactorily equated with that around and south of Kuala Lumpur. Late Triassic and younger granites occur at depth in Sumatra, and Carboniferous basement "quartzites" may represent the Kenny Hill Formation. The "Mutus Assemblage" of Central Sumatra may have been regionally misinterpreted, and its lithologies may be found in the Hawthornden and Dinding schists and the Kuala Lumpur Limestone. The Central Sumatran rift-related Miocene basalts and gabbros may be equated with the poorly dated Segamat and Kuantan suites of Malaysia.

The dominant N-S and NW-SE Cainozoic fault directions of Peninsular Malaysia and Sumatra have been inherited from Indosinian Orogenic directions in Triassic and older rocks. N-S strikes dominate Peninsular Malaysia and NW-SE dominate Sumatra. The oroclinal swing is in the Straits of Malacca. Since these faults represent reactivation of basement weaknesses, their orientations cannot be analysed by strain ellipse analysis, and the Cainozoic stress field may remain elusive.

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APPLICATIONS OF THE BOREHOLE ELECTRICAL IMAGERY TO THE STUDY OF RESERVOIR ANISOTROPY

MOHAMED TAHA
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Detailed work on hydrocarbon bearing formations show that most of the reservoir rocks are of anisotropic nature regarding their production properties. Such anisotropic nature, in fact, is the result of heterogeneities induced by a complex interplay of processes involving, sedimentological chracteristics, tectonics and diagenesis. Mapping such heterogeneities is found to be of prime importance for a precise geological reservoir modelling of such rocks.

Borehole electrical imagery, due to its high vertical resolution, proves to be of great help in tackling such task where standard well log evaluation tend to miss or give unreliable results.

Faults intersected by boreholes and based on their morphology can increase the water encroachment within the hydrocarbon bearing upthrown blocks or create different hydrocarbon/water contacts along the same field. Stresses related to such faults may produce certain fracture patterns within the reservoir rocks. These fractures may enhance or degrade the productivity of such reservoirs.

Defining the various types of sedimentary structures including size and orientation along a particular stratigraphic sequence are of great value in recognizing the different kinds of depositional environments and delineating the primary reservoir anisotropy. It has been evidenced that the layered nature and direction exert a great control on permeability orientation within reservoir rocks.

Reservoir rocks are often subjected to a various kinds and degrees of diagenesis which occur within depositional environments and during burial. Bioturbation, for example, by causing intermixing of clay and sand is invariably detrimental to the horizontal permeability but, however, may create a certain vertical permeability.

Highly laminated reservoirs and turbidite sediments have become important exploration plays in South-East Asia. In that regard, the borehole electrical imagery is able to reveal thin reservoir layers, attain its gross thickness, leads to more realistic computation for hydrocarbon saturation and help in setting proper testing procedures.

The full borehole electrical imagery with enhanced vertical resolution and better borehole coverage is expected to increase our capacity, even more, in mapping such fine formation heterogeneities and reservoir anisotropies.

SHALLOW MARINE SEISMIC SURVEY OVER THE SARACEN BANK, OFFSHORE SABAH

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SABAH SHELL PETROLEUM COMPANY LIMITED

After the P.S.C. for the offshore Block SB1 (7746 sq km) between Sabah Shell Petroleum Company, Pecten Malaysia, Petronas Carigali as Joint Ventures and PETRONAS was signed in mid 1987, a fairly comprehensive Exploration seismic programme of over 8000 km of 2D and nearly 3000 sq km of 3D data was carried out over the Block. Due essentially to very shallow water depths of less than 10 m, the Saracen Bank area, which is located some 80 km West of Kota Kinabalu, and includes some corals, remained uncovered by these conventional surveys. This paper describes the key aspect of the survey preparation, the seismic programme and acquisition techniques, and discusses some of the results of a unique marine seismic survey over the offshore shallow water area. The environmental impact of this successful survey was closely monitored before and during this project and the results recorded.

FORMATION EVALUATION BY QUARTZ GAUGE FMT TOOL

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MIRI FIELD OFFICE

Detailed formation pressure evaluation was made in Exploratory well utilizing Quartz Gauge FMT (Formation Multitester).

To determine the fluid distribution in 1-0.5 m accuracy, the formation pressure reading is required to be in 0.1 psi accuracy. The resolution of Quartz Gauge FMT is 0.1 psi which is sufficient for such purpose and reliability of the pressure reading of the Guage is also very high.

The pressure gradients of gas, oil and water were recognized. The result of pressure interpretation matches the hydrocarbon showings and DST results. It is suggested that formation pressure may give more reliable information on fluid distribution than resistivity logs. In one of the interval, an oil pressure gradient was recognized where high Sw (almost 100%) is calculated. The interval produced 1000 bbl/day of water-free oil at DST.

Perforation intervals of DST were selected to avoid gas zones determined by pressure interpretation. The results of DSTs confirmed that no gas zone was perforated and supported the interpretation based on pressure survey.

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A TIME MIGRATION BEFORE STACK

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DIGICON SINGAPORE
06–01, 37, JALAN PEMIMPIN,
SINGAPORE 2057

The 1970's saw the introduction and development of post-stack migration algorithms to the extent that migrated stacks were routinely produced as part of a basic processing sequence.

Similarly during the 1980's, we saw a proliferation of research and development of partial pre-stack migration operators, or Dip-Moveout (DMO). DMO is now almost universally employed in both 2D and 3D processing sequences.

As it well known, DMO followed by post-stack time- migration is not a complete substitute for a full pre-stack time-migration. In this discussion we will present a method for full pre-stack time-migration which offers the following features:

1. The method overcomes the limitations of DMO in the presence of lateral and vertical velocity gradients, symptomatic in areas of complex geology.
2. A velocity analysis procedure is inherent in the process. These velocities are derived along image rays and therefore more closely represent vertical rms velocities. Thus we benefit from having both a better migrated output with a commensurate increase in reliability and accuracy of our seismic derived velocity field.
3. The method is sufficiently robust and efficient to allow for routine processing of large volumes of seismic data.

We suggest that long before the turn of this decade, such pre-stack time migration strategies will be as commonly employed as DMO is today.

PREDICTION OF TOTAL ORGANIC CARBON CONTENT USING WIRELINE LOGS IN THE MALAY BASIN

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A study to predict Total Organic Carbon (TOC) content in shales using wireline log measurements has been undertaken for the southeastern Malay basin, offshore Peninsular Malaysia.

Four exploration wells were used in this study. From the study, it was found that the bulk density and microresistivity logs exhibited significant correlations with TOC. High TOC content have been shown to correlate with low bulk density and high microresistivity measurements.

CHRONOSTRATIGRAPHY OF EPMI'S BLOCKS PM-5 AND PM-8

LYE YUE HONG
ESSO PRODUCTION MALAYSIA INC.

The presentation will address the progressive development and the understanding of chronostratigraphy in EPMI's PM-5 and PM-8 acreage blocks in particular and the Malay Basin in general. This talk had previously been presented on 30 June 1990 at the GSM Workshop on *"Stratigraphic Framework of Offshore Basins in Malaysia : Basis, Applications and Problems"*.

Based on available sedimentary data of the basin derived mainly from wells drilled and seismic data acquired during the search for hydrocarbons, it is found that the stratigraphy of the Tertiary aged Malay Basin sediments to various extents have been influenced by 5 factors. They are namely :

1. Tectonics (uplift versus subsidence rates)
2. Eustatic sea-level changes
3. Sedimentation rates/types
4. Basin configuration and communication with ancestral South China Sea
5. Climate.

These factors affect the stratigraphy of the basin sediments and they will be discussed.

Regionally, chronostratigraphy in EPMI contract areas is achieved through the analysis and integration of sequence stratigraphy, seismic stratigraphy, global eustatic sea-level chart correlations as well as paleontological and palynological age datings. Conventional biostratigraphic age dating within EPMI's Malay Basin contract areas has been problematic largely due to the rare to total absence of age diagnostic planktonic foraminifera and nannoplanktons as well as the long ranging nature of palynological assemblages that lack the age resolution desired. As such, sequence stratigraphy, seismic stratigraphy and correlations with global eustatic sea-level charts are extensively used in conjunction with the limited good quality biostratigraphic age datings to establish a high resolution chronostratigraphic understanding of the Malay Basin sediments. This process will be discussed and examples of the sequence stratigraphy for the Groups K, I and E will be presented together with schematic chronostratigraphic sections of PM-5 and PM-8.

Further, the implications of using sequence chronostratigraphy versus that of previously used conventional litho-stratigraphic correlations within EPMI contract areas will also be presented.

In conclusion, the talk would demonstrate that by integrating sequence stratigraphic concepts with seismic stratigraphy, paleo age datings and eustatic sea-level correlations, EPMI has been able to better understand the chronostratigraphy of sediments within EPMI's contract areas in the Malay Basin. We are able to more consistently and satisfactorily unreveal the past confusion with regard to the age and stratigraphy of the basin.

AIRBORNE GEOPHYSICAL SURVEY AS AN AID TO HYDROCARBON EXPLORATION IN ONSHORE SARAWAK

WEE ENG SWEE & LAI SOO KHUAN
OVERSEAS PETROLEUM & INVESTMENT CORP.

An airborne gravity and magnetic survey over SK-12, Onshore Sarawak involved some 3232 km of aerogravity data and 6349 km of aeromagnetic data. The main objective of the survey was to identify the regional structural pattern within the surveyed area to aid further exploration activities.

Airborne gravity and magnetic surveying can be performed with a single forward motion of the aircraft. Data is processed and quality controlled to determine its acceptance. Colour Relief Images for both data types were generated to aid the interpretation which was carried out using residual maps of aerogravity and aeromagnetic data at a scale of 1:250,000.

A good correlation was observed between the orientation of the aerogravity anomalies and the known regional geological trends in north central Sarawak. Several basinal areas namely the Balingian Basin, Igan-Oya Half Graben, Mukah Graben and Bawan Basin were identified in the central part of the block. The basins contain considerable thickness of sediments and may be potential kitchen areas for hydrocarbon generation. The aeromagnetic data shows a deep seated magnetic basement in the central part of the block and a northwest-southeast trending fault in the western part.

The results of the quantitative interpretation can be evaluated based on their agreement with both well and seismic data.

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APPLICATIONS OF SEQUENCE STRATIGRAPHY TO THE TRIASSIC LIMESTONES IN NORTHWEST PENINSULAR MALAYSIA

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Recent sedimentological study of the Triassic Kodiang Formation in Perlis and North Kedah reveals the presence of several facies representing supratidal, intertidal, subtidal, open shelf, shelf crest and deepwater environments. This facies interpretation differs widely from those put forward by previous workers. Jones (1981) suggested a wholly shelf environment while de Coo and Smit (1973), Ahmad Nazeri (1973) and Abdul Latif (1979) postulated a slowly subsiding basin for the same area.

Planar and wavy micritic-dolomitic laminations are interpreted as algal mat stuctures and suggest an intertidal setting while largely mottled (bioturbated) laminites indicate a subtidal environment. Irregular calcite-filled voids (birds-eye structure) and relict anhydritic pseudomorphs within the algal laminites indicate an upper intertidal to supratidal setting. Bedded grey limestone facies consisting of skeletal-crinoidal packstone-grainstone characterize the shelfal facies while massive mud-encrusted sponges and coral limestone are interpreted as being deposited on the shelf crest. Bedded black micritic to spiculitic limestone was deposited in deeper water setting.

Although outcrops of the Kodiang Formation do not show good lateral continuity, some facies associations can be reconstructed from their vertical relationships. In the Kodiang Formation, seven conformable depositional sequences, bounded by interregional unconformities, have been recognized and related to changes in relative sea-level. Each depositional sequence consists of a lowstand systems tract, a transgressive systems tract and a highstand systems tract. The base of each sequence is characterized by the erosional truncation, including cut and fill, of the underlying highstand strata which are mainly deepwater limestones. In some of the unconformities observed, karstificatlon surfaces and limestone breccia are present, interpreted as results of meteoric leaching associated with eustatic falls in sea-level. Additionally, the presence of widely dolomitized limestones are interpreted to be due to the regional migration of the mixing zone in the basinward direction as a result of eustatic falls in sea-level. Algal laminite, shelf and shelf-crest facies overlie these erosional basal

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Present address: Esso Production Malaysia Inc.

contacts (sequence boundaries) and are interpreted as being deposited during the late lowstand to early transgressive systems tracts. Bedded micritic limestone with nodular chert facies which overlie all the other facies are interpreted as deepwater limestones and inferred as being deposited during a relative rise in sea- level (late transgressive to early highstand systems tract).

The application of sequence stratigraphy to the Kodiang Formation is useful since it facilitates the interpretation and prediction of its stratigraphy beyond the scope of accessible outcrops.

POROSITIES IN PULAI-II SANDSTONE – IMPLICATION FOR HYDROCARBON EXPLORATION IN OLDER RESERVOIRS

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The sandstones of the Pulai-II Formation [Pulai Formation and Unit IIB - IIA(u)] consist primarily of braided fluvial channels and near-shore barrier bars, and secondarily distributary and tidal channels. Petrological, SEM and XRD studies of these sandstones indicate that the reservoir quality is primarily the result of burial diagenesis, and is related to facies, depth of burial (and temperature), structuring and hydrocarbon occurrences. Dominant textural modifications are the destruction of primary porosity by the precipitation of authigenic minerals, primarily quartz and ferroan-calcite, and porosity enhancement by the dissolution of framework feldspars and chert. Up to 40 percent of the total porosity is believed to have been caused by the dissolution process, in places by percolating meteoric waters. Porosity values exceeding 45 percent have been recorded in the medium to coarse-grained sandstones, and porosity of less than 15 percent is generally found mostly in fine-grained sandstones, and in medium to coarse-grained and sandstones which are, or have been buried deeper than 3000 meters.

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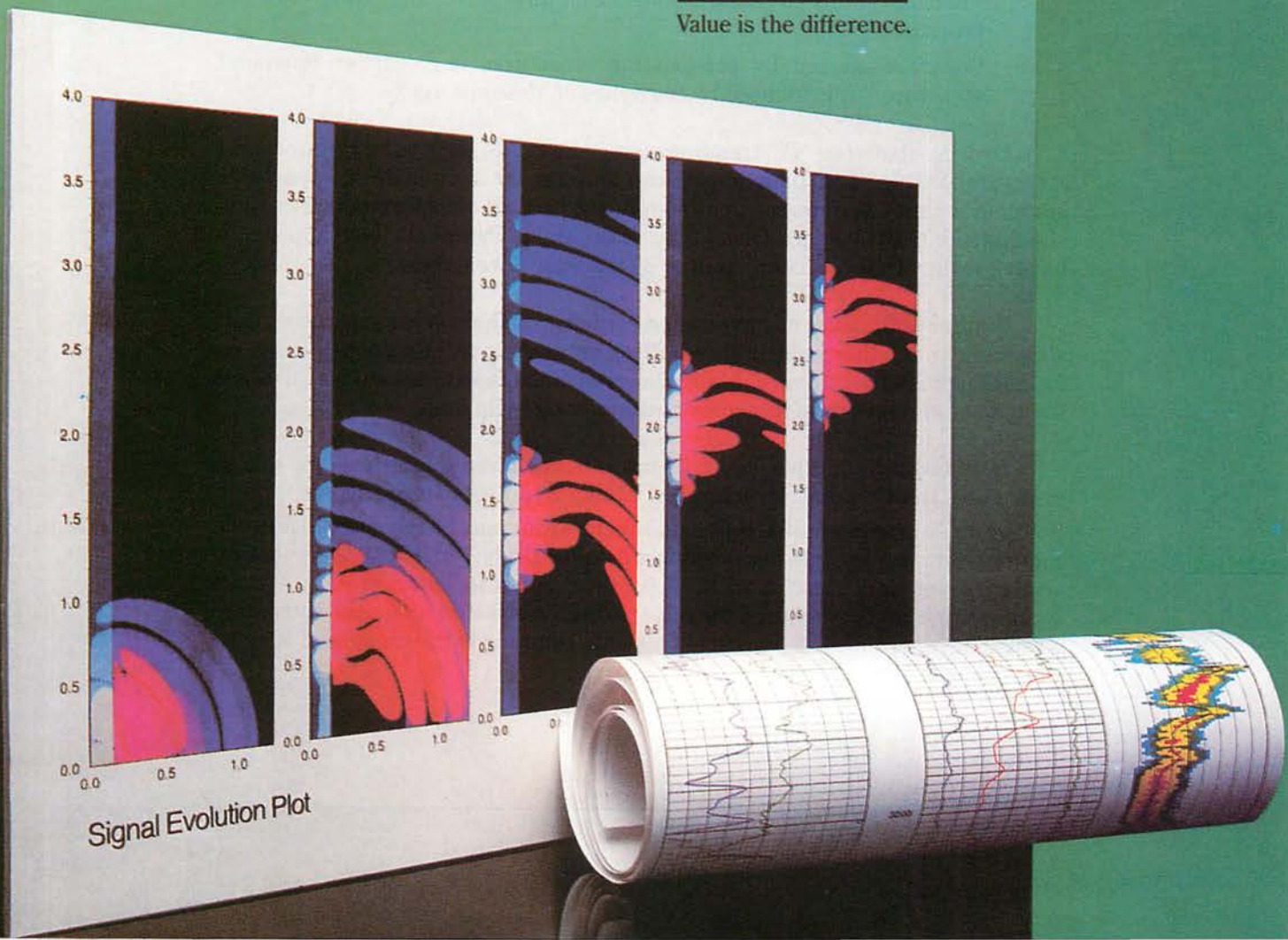

FAULT PATTERNS IN MALAY PENINSULA: IMPLICATIONS FOR OFFSHORE BASINS AND REGIONAL TECTONICS

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Malay Peninsula is cut by numerous faults that seem to have formed or reactivated during the Cenozoic. Three prominent trends are evident : NW-SE, N-S and NE-SW. A very subordinate E-W trend is also discernible. NW-trending faults are mainly sinistral strike-slip with significant dip-slip components in places. N-S and NE-SW trending groups comprise both sinistral and dextral strike-slip faults as well as normal faults. E-W striking faults are mainly normal. Thrust faults of diverse orientations also occur.

Different genetic models are considered to interpret the observed fault patterns. It is possible to explain the origin and geometric relationships of the various types of faults in terms of the following :

a) NW-SE trending sinistral 'simple shear' with probably an earlier episode of sinistral N-S 'simple shear'.
b) 'Termination effects' and 'overlap effects' of large strike-slip faults.
c) Thermally induced rifts (responsible mainly for N-S and NE-SW normal faults).
d) Controls exerted by pre-existing structures (e.g. earlier tensional structures as evidenced by the dykes of Mesozoic age).

Overlaps between NW-trending strike-slip faults seem to be an important structural feature and their effects can account for a number of apparently anomalous characteristics such as significant vertical displacements in strike-slip faults (e.g. Bt. Tinggi). On a larger scale, Malay Peninsula itself appears to be an 'overlap' that has been uplifted by transpressive forces.

Similar fault patterns have been recorded in offshore areas suggesting that simple shear and thermally induced rifting processes may be responsible for the formation of offshore basins. Many observed offshore extensional features are likely to be the results of interplay between strike-slip faults.

N-W trending 'simple shear' seems to have played a fundamental role in controlling the Cenozoic structures of Malay Peninsula in particular, and of Southeast Asia in general. Geodynamic factors that may be responsible for such motions remain uncertain and begs more detailed study. Published geodynamical scenarios not only conflict with each other, but also suffer from a serious weakness in that they ignored the role thermal events that undoubtedly created a tensional environment, caused extensional thinning of the crust, and affected the rheology.

THE APPLICATION OF INTEGRATED 3D SEISMIC AND RESERVOIR GEOLOGICAL STUDIES IN A COMPLEX OILFIELD, D18 FIELD, SARAWAK, MALAYSIA

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SARAWAK SHELL BERHAD

The D18 oil field is located in the Balingian Province of offshore Sarawak, Malaysia. The field is structurally complex, being situated in the West Balingian Fold Belt, a province affected by complicated compressional wrench tectonics. The productive reservoirs comprise Lower to Middle Miocene lower coastal and delta plain deposits which are characterised by variable lateral continuity.

Development of the field began in 1986 with the drilling of five wells. However, poorer than expected performance of these initial wells, combined with the presence of different fluid contacts and variable sand distribution, raised uncertainties concerning the degree of interconnectedness of the reservoir sands, and curtailed further development of the field.

A detailed 3D seismic review was therefore undertaken in order to refine the initial structural maps and to develop a valid structural model for the field- in particular, to determine the extent of reservoir level faulting. This study was supported by the latest techniques in 3D interpretation, including horizon attribute extraction (dip and azimuth mapping), and was successful in highlighting the presence of subtle faulting which was previously not detected.

Integration of these results with a detailed reservoir geological review and with well performance data has enabled a more accurate determination of hydrocarbon volumes and prediction of well recoveries, and was rewarded by the identification of further development potential for the field. The study provides a model for the successful integration of detailed geophysical and geological studies in similar complex and marginal fields.

AN INTEGRATED APPROACH TO RESERVOIR PETROPHYSICAL PARAMETERS EVALUATION

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ENTEC ENERGY CONSULTANTS

Petrophysical parameters necessary for reservoir characterisation are normally derived from borehole data. Such information can be very accurate in the depth direction but has a small lateral penetration. Surface seismic on the other hand has low vertical resolution but is laterally continuous. Calibration of the seismic data to borehole information through integrated processing permits reservoir petrophysical parameters to be accurately mapped from seismic data. The relationship between seismic and petrophysical properties is addressed with reference to a reservoir evaluation study. The relationships are used to calibrate seismic data and to map heterogeneities in reservoir description parameters.

A NEW CONCEPT IN BOREHOLE SEISMIC MEASUREMENT AND APPLICATIONS

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&
ROOPA GIR
SCHLUMBERGER (MALAYSIA) SDN. BHD.

Reservoir delineation is a key step in the development of an oil field, however, getting a reliable high resolution image of the reservoir away from the borehole remains the *tricky* issue. A new technique in borehole seismic measurement allows recording of high quality three components data by decoupling the sensor module from the rest of the tool body thereby maintaining waveform integrity. Vertical seismic profile results from such measurement allows accurate calibration of the surface seismic for possible time and phase shifts. The surface seismic section can then be inverted to produce stratigraphic image of the subsurface. The consistency at the well with log data and the high resolution of the acoustic impedance section allows a reliable lateral imaging in the vicinity of the borehole.

Other applications such as frequency attenuation as a function of depth and amplitude variation as a function of offset distance (AVO) are discussed.

CROSS-BORDER CORRELATION OF GEOLOGICAL FORMATIONS IN SARAWAK AND KALIMANTAN

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Recent geological mapping by an Australian/Indonesian team in West and Central Kalimantan has resulted in a revised stratigraphy for the Paleozoic - Tertiary igneous and sedimentary successions in terms of (1) Continental Basement and Platform Sedimentary rocks, (2) Continental Arc intrusives and volcanics, (3) Oceanic Basement and overlying sedimentary rocks and (4) Foreland rocks, (5) Tectonic melange and (6) Surficial deposits.

Correlation charts are presented to reconcile the stratigraphic terminology across the International border.

OIL-GENERATING POTENTIAL OF COALS FROM SPITSBERGEN, SVALBARD

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KUALA LUMPUR

The Upper Palaeozoic through to Cenozoic of Spitsbergen includes at least five separate coal-bearing stratigraphic units. The sequences richest in coal are the Lower Carboniferous Billefjorden Group (Hoelbreen Member and Birger Johnsonfjellet Member), the Cretaceous Glitrefjellet Member and the Palaeocene and Oligocene-Miocene coals. The oil- generating potential of these coals has been investigated using coal petrographic and organic geochemical techniques. The coals of the Birger Johnsonfjellet Member possess good oil-generating potential, being algal-rich, with high hydrocarbon indices and are early mature. The Hoelbreen Member coals are in general liptinite-rich, with high relative hydrogen indices and possess fair to good oil- generating potential. Coals of the Glitrefjellet Member and the Tertiary coals are predominantly vitrinite-rich, with relatively low oil-generating potential, having a lower liptinitic content which is supported by low relative hydrogen indices. The presence of a range of vitrinitic macerals, their inhomogeneity, their capability to fluoresce under certain conditions, and the occurrence of oil-like smears, may also contribute to the oil-generating potential of coals.

CEMENT-STRATIGRAPHY OF TIGAPAPAN UNIT, SABAH BASIN: CLUE TO TIMING OF HYDROCARBON MIGRATION

MOHAMMAD YAMIN ALI
PETRONAS PETROLEUM RESEARCH INSTITUTE
HULU KLANG, SELANGOR

The Tigapapan Unit (upper Miocene) in the Tigapapan Field is a bioclast-rich clastic-carbonate mixture and has been interpreted as a progradation storm-shoal complex. Cathodoluminescence, geochemical, and isotope studies of four wells indicate that the sediments have undergone a complex diagenetic history including at least 11 cementation episodes (stages A to K). These episodes can be related to distinctive cement textures, reflecting various burial stages, thermal regimes and carbon sources. The stages of diagenetic evolution are as follows: The stages of diagenetic B-radiaxial-fibrous calcite; C-scalenohedral, blocky calcite; D-blocky and vein-filling Fe-calcite; E-vein-filling Fe-calcite; F-clay-associated dolomite; G-H: dolomite; I-J: ankerite; and K-late Fe-rich calcite. Five episodes of fracturing and dissolution have also been identified.

Each cement stage shows distinctive differences in Sr^{4+}, Mn^{2+}, Mg^{2+} and Fe^{2+} concentrations, correlatable over the whole Tigapapan Field. These differences are believed to reflect changes in paleo-pore fluids from which the carbonate cements were precipitated.

The cementation occured from very early to late phases at near surface to 2.0 km depth. The early, stage A cement ($\delta^{13}C$ =- 33.7‰ PDB, $\delta^{18}O$ = -0.1‰ PDB) was precipitated at near surface temperature. With progressive burial and temperature increase, oxygen isotopes become strongly negative (stage K: δ^{13} C = +1.7 ‰ PDB, $\delta^{18}O$ = 6.8‰ PDB). Oxygen isotope data indicate that cements were precipitated at relatively low temperature regimes, between 26° C (early, stage A cement) to about 70° C (late, stage K cement).

The presence of oil-stains indicates that the timing of oil migration was after stage E and before stage F, when the reservoir was at 54° C, corresponding to a burial depth of 1.2 km, assuming the present day geothermal gradient of 25.3° C/km and allowing for compaction.

Geological Society of Malaysia *— Petroleum Geology Seminar 1990*

DMO ACCURACY REQUIREMENTS FOR AVO ANALYSIS

CRAIG J. BEASLEY
WESTERN GEOPHYSICAL COMPANY SINGAPORE

Dip-moveout (DMO) is commonly used in seismic data processing because of its proven ability to image events with conflicting dips and thereby increase lateral resolution in stacked data. Many different algorithms for doing DMO have been described in recent years, each achieving a different level of accuracy and efficiency. Hale (1984) described an accurate, but computationally intensive, algorithm cast in the frequency-wavenumber (f - k) domain. For efficiency, particularly when DMO is done in 3-D, algorithms have also been devised for doing DMO in the space-time (x - t) domain. In transforming Hale's operator from the f - k domain to the x - t domain, however, amplitude and phase approximations are made that impose accuracy limitations that may be unacceptable, particularly in light of interest in interpreting amplitude variations with offset (AVO).

Accurate x - t DMO is particularly important when it is done in 3-D (Hale, 1983; Beasley *et al.*, 1984). For 2-D DMO, in which the "processing unit" is typically a large group of traces, such as common-offset data or shot gathers, f - k DMO and other methods can be economical. Proper honouring of azimuthal variation in 3-D DMO, however, requires that *each trace* individually have DMO applied, and techniques involving transforms tend to lose their efficiency. For this situation, x - t algorithms are particularly cost-effective.

This paper suggests an x - t domain DMO that overcomes these difficulties. This method is based upon a reformulation of f - k domain DMO as a two-step procedure: normal-moveout (NMO) done with dip-corrected velocity, followed by an appropriate velocity-dependent dip filter (Jakubowicz, 1990). We first analyse the limitations of current approaches to DMO in the $x-t$ domain, then describe the new algorithm and compare its accuracy with that of alternative approaches to DMO.

Geological Society of Malaysia — Petroleum Geology Seminar 1990

MULTIPLE AND NOISE ATTENUATION WITH TAU-P SEISMIC DATA PROCESSING

LEONG LAP SAU
UNIVERSITI SAINS MALAYSIA
PENANG
&
NG TONG SAN
PETRONAS CARIGALI SDN BHD
KUALA LUMPUR

New techniques for the solution of inverse problems in seismic signal processing are required by the petroleum industry in the search for latent reserves. The Radon transform, or Tau-p transform as is commonly known provides an alternative domain to conventional methods for filtering, velocity analysis, and imaging. Data in the (x,t) plane is mapped onto a domain defined by the slowness (reciprocal of horizontal phase velocity) or ray parameter (p) and the intercept time (T).

The projection slice theorem provides a method for computing the T-p transfrom from the 2-D Fourier transform. Compared to conventional processing in the (x, t) plane, the T-p domain has several advantages. This study examines some examples and advantages of sea bottom multiple suppression and non-coherent signal reduction in the T-p domain from considerations of path geometry and noise characteristics.

In an original shot gather, multiples are not periodic in time for all non-zero offsets. The T-p transform separates out events which interfere with one another: reflection hyperbolas transform into ellipses, linear refractions direct arrivals and ground roll transform to points or small regions about a point. Multiples are removed by selective muting and predictive deconvolution.

Coherency filtering of CDP stacks along ray parameters with semblance reduces non-coherent noise and suppresses spatial aliasing. This is desirable for poor quality data with low S/N ratios. Substantial improvement has been found from stacked sections with T-p filtering. Depending on the application further understanding is required on amplitude and waveform distortion for "true" amplitude measurements.

SEQUENCE STRATIGRAPHY OF THE GROUP J IN THE MALAY BASIN AND ITS IMPACT ON DEVELOPMENT OPPORTUNITIES

YAP KOK THYE
ESSO PRODUCTION MALAYSIA INC.

In the southeastern part of the Malay Basin, the lower group J is seen as a series of sandy prograding lowstand clinoforms, which abruptly but conformably overlie the upper group K shale, a regionally extensive highstand offshore mud. The lower group J clinoforms (J-80, J-70, J-60, J-55, J-50) are overlain by a single transgressive parasequence (J-45), followed by a strongly progradational highstand parasequence set (J-40). The recognition of both the maximum flooding and transgressive surface facilitates meaningful correlation of units of the lower group J, which often exhibit quite different well log characters between wells.

The lower group J is overlain by two thin depositional sequences (J-35, J-30) which occasionally cut relatively shallow incised valleys. These are overlain by the major J-20 depositional sequence, which cuts incised valleys up to 100 m deep. The J-20 incised valleys are filled with good quality estuarine sandstone, which accounts for the biggest single oil reservoir in the Malay Basin. Towards the basin margin, the J-20 sequence boundary beveled out the older depositional sequences, resulting in a single massive, composite reservoir made up of the J-20 sandstone and those of the lower J clinoforms.

The upper group J overlying the J-20 is made up of seven thin high frequency cycles (J-18, J-15, J-10, J-7, J-5, J-3, J-2) typically exhibiting a layer cake-like stratigraphy. Each depositional sequence is made up of a sandy to silty subtidal/coastal plain lowstand unit overlain by one or more transgressive to highstand offshore shale parasequences. Reservoir, if present, is thin but laterally rather continuous having its own top and bottom seal. Like the J-20 sequence boundary, the group J to is a major sequence boundary which progressively bevels out the upper group J unit towards the basin margin.

Mapping of the lower J clinoforms and the J-20 incised valley indicate a sediment source to the southeast: an inverted half-graben called the Ledang-AR high which thrusted up pre-group J sedimentary rocks to be eroded and subsequently redeposited. This area ceased to be a major provenance post J-20 time after which sediments were derived from the former Sunda landmass to the northeast towards Vietnam.

The revised geological interpretations resulted from the sequence stratigraphic study contributed towards the locations of platforms in the Seligi field to optimise recovery, the explanation of North Seligi J-15/16 DHI and the recognition of additional development opportunities in Bekok and Tapis fields.

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UNITS OF MEASUREMENT IN PETROLEUM GEOSCIENCE: TOWARDS THE ELIMINATION OF AMBIGUITY

NEVILLE HAILE
PETRONAS PETROLEUM RESEARCH INSTITUTE

The petroleum industry, for historical reasons, has been landed with a mixture of US, British, and SI (metric based) units. The resulting confusion has been compounded by incorrect use of symbols, and use of several different non-standard symbols for the same unit. Errors and ambiguity arising are at best vexatious to the reader, at worst can result in serious, expensive, and conceivably dangerous consequences. Petroleum scientists, to be worthy of the name, should aim to eliminate ambiguity by using standard symbols and abbreviations, where possible in the SI system. The extraction of large amounts of data from various sources for use in computer modelling, makes precision, clarity, and elimination of errors that result from lack of adherence to internationally understood abbreviations and symbols increasingly important.

Clarity is important in all reports, but particularly so in publications. A geoscience paper should be intelligible not only to the in-group of the writer's company or speciality, but to as broad a spectrum of scientists as possible, including others such as economists and administrators, who may be interested in aspects of the data presented.

Table 1: Correct and incorrect symbols for common SI units

UNIT	SYMBOL	
	CORRECT	INCORRECT
metre(s)	m	ms, Ms, M, m., Mt.
kilometre(s)	km	km., kms, Km, Km.
gram(s)	g	gm, g., gms, gs
kilogram(s)	kg	Kg, kg., kgs, etc
seconds	s, sec	Sec., s., secs
cubic metres	m^3	cu.m, cm, CM etc
cubic centimetres	cm^3	cc, c.c., ccm, cu.cm.
tonne	t	T, t., tn

Geological Society of Malaysia — Petroleum Geology Seminar 1990

GEOCHEMISTRY OF SELECTED CRUDE OILS FROM SABAH AND SARAWAK

AWANG SAPAWI AWANG JAMIL, MONA LIZA ANWAR & ERIC SEAH PENG KIANG
PETRONAS PETROLEUM RESEARCH INSTITUTE
LOT 1026, PKNS INDUSTRIAL ESTATE
54200 KUALA LUMPUR

A total of thirty-four crude oils from eleven fields from offshore Sabah and Sarawak have been analysed and characterised using liquid and gas chromatography, and gas chromatography - mass spectrometry. The normal alkane distributions show that the oils have three different characteristics. These are;

i) normal, non-waxy crude oils

ii) high waxy (high proportion of C_{20+} n-alkanes)

iii) biodegraded (less abundance of n-alkanes relative to isoprenoids)

Biological marker distributions (i.e. steranes and triterpanes) show that the oils were derived from source rocks of terrigenous origin containing mixtures of different types of land plant organic matter including resins. Features of these distributions include the presence of relatively high concentrations of 18∝ (H)-oleanane, a number of resin derived compounds, a predominance of C_{29} normal-, iso- and dia- steranes and relatively low concentrations of C_{28} and C_{27} steranes and the absence of C_{30} steranes in all of the samples.

Source rocks for these oils were probably shales deposited in an oxidising environment, as indicated by the high pristane/phytane (>3.0) and pristane/nC_{17} (>1.0) ratios. Biological marker distributions indicate that the oils were generated from source rocks having maturity of 0.7 to 1.0% VRe which is in agreement with the low odd-over-even predominance (CPI) values (1.0 -1.2) calculated for all of the samples.

BERITA-BERITA PERSATUAN
(NEWS OF THE SOCIETY)

RESIGNATION OF ASSISTANT SECRETARY

Tan Boon Kong, the Assistant Secretary resigned recently as he will be overseas on sabbatical leave. The Council in its meeting in November 1990 co-opted Councillor Dr. Tan Teong Hing to assume the duties of Assistant Secretary.

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APPOINTMENT OF NEW COUNCIL MEMBERS

In its November 1990 meeting, the Council co-opted Dr. Cheang Kok Keong to fill the Councillor 1990-92 vacancy that arose when Dr. Tan Teong Hing was appointed Assistant Secretary.

At the same Meeting, the Council also co-opted Dr. Khalid Ngah to replace Noor Azim Ibrahim, who is away overseas for further studies, as Councillor 1990-91.

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NOMINATIONS COMMITTEE

The following were appointed by the Council to prepare the slate of Council Members for 1991/92.

Fateh Chand (Chairman)
S. Paramananthan
Azhar Hj. Hussin

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EDITORIAL SUBCOMMITTEE

The Council has approved two additional members to the Editorial Subcommittee, namely, Tan Teong Hing and Mazlan Madan in addition to the two previously (Lee Chai Peng and Lili Sulastri). Their main duties are helping the Editor with proof-reading.

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KEAHLIAN (MEMBERSHIP)

The following applications for membership were approved:

Full Members

1. Tajul Anuar Jamaluddin, Minconsult, No. 14, Jalan 20/16A, 46300 Petaling Jaya.
2. Ishak Awang, MMC, P.O. Box 10300, 50710 Kuala Lumpur.
3. Mohd. Suhaili Ismail, Pejabat Kajibumi, Bukit Kerajaan, 33000 Kuala Kangsar, Perak.
4. Ramly Manja, MMC, P.O. Box 10300, 50710 Kuala Lumpur.
5. Rene B.P. Caline, SSB., PEG/31, 98100 Lutong, Sarawak.
6. Khalid Ngah, PRI, Lot 1026, PKNS Industrial Area, 54200 Ulu Kelang.
7. Lee Chiong Ting, 24 Gleddon Road, Bull Creek, W.A. 6155.
8. Cleo Verl Proctor, Hamilton Oil, 18 Fl., UBN Tower, 10 Jalan P. Ramlee, 50250 Kuala Lumpur.
9. Robert John Morley, Lemigas, P.O. Box 1089/JKT, Jakarta 10010, Indonesia.
10. Muhammad Kamal Embong, Petronas Carigali, 50776 Kuala Lumpur.

Student Members

1. Yong Chwee Choo, School of Physics, 11800 USM, P. Pinang.
2. Yew Chin Chong, School of Physics, 11800 USM, P. Pinang.
3. Wong Kam Poh, School of Physics, 11800 USM, P. Pinang.
4. Ting Tai Ming, School of Physics, 11800 USM, P. Pinang.
5. Shafie Yaacob, School of Physics, 11800 USM, P. Pinang.
6. Samrat Selamat, School of Physics, 11800 USM, P. Pinang.
7. Rosli Abdul Wahab, School of Physics, 11800 USM, P. Pinang.
8. Rahimi Abdul Rahman, School of Physics, 11800 USM, P. Pinang.
9. Lee Kong Yean, School of Physics, 11800 USM, P. Pinang.
10. Khek Lay Kin, School of Physics, 11800 USM, P. Pinang.
11. Khairul Anam Musa, School of Physics, 11800 USM, P. Pinang.
12. Jumain Marzuki, School of Physics, 11800 USM, P. Pinang.
13. Ho Koon Hong, School of Physics, 11800 USM, P. Pinang.
14. Edwin John, School of Physics, 11800 USM, P. Pinang.
15. Clarissa Loke, School of Physics, 11800 USM, P. Pinang.
16. Ch'ng Hong Chai, School of Physics, 11800 USM, P. Pinang.
17. Chai Ing Chiew, School of Physics, 11800 USM, P. Pinang.
18. Ang Beng Lee, School of Physics, 11800 USM, P. Pinang.
19. Abd. Kadir Sulaiman, School of Physics, 11800 USM, P. Pinang.
20. Zailani Abdul Kadir, School of Physics, 11800 USM, P. Pinang.
21. Yew Soo Lee, School of Physics, 11800 USM, P. Pinang.
22. Norhanisah Ahmad, School of Physics, 11800 USM, P. Pinang.
23. Zainal Abidin Hasan, School of Physics, 11800 USM, P. Pinang.
24. Lim Tech Kean, School of Physics, 11800 USM, P. Pinang.
25. Salina Safiullah, School of Physics, 11800 USM, P. Pinang.
26. Melati Ahmad, School of Physics, 11800 USM, P. Pinang.
27. Ali Almurtadha Ab. Rauf, School of Physics, 11800 USM, P. Pinang.
28. Zakpar Mahput, School of Physics, 11800 USM, P. Pinang.
29. Hairani Sham Manas, School of Physics, 11800 USM, P. Pinang.
30. Mohamed Nasran Abdul Ghani, School of Physics, 11800 USM, P. Pinang.
31. Mohd. Rais Ramli, School of Physics, 11800 USM, P. Pinang.

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PERTUKARAN ALAMAT (CHANGE OF ADDRESS)

The following members have informed the Society of their new addresses:

1. Kuang Koo Sing, 6 Hooking Ave., Royston Park, A.A. 5070.
2. Mohd Redzuan Said, Esso Prod. Mal. Inc., Kompleks Esso, P.O. Box 1, 24207 Kerteh.
3. S. Senathi Rajah, 37 Jalan Dato Khong Kam Tak, 31400 Ipoh, Perak.
4. Keith Burton, c/o UNDP, MIA Road, P.O. Box 7285 (ADC), Pasay City, Metro Manila, Philippines.
5. M. Selvarajah, Pej. Peny. Kajibumi, JKR 241 Jalan Bukit, 28700 Bentong, Pahang.
6. Ian Metcalfe, Department of Geology & Geophysics, The University of New England, Armidale, New South Wales 2351, Australia.
7. Noor Azim Ibrahim, Department of Earth Sciences, Downing Street, Cambridge, CB2 3EQ.
8. Ong Chu Yin, Fugro McClelland (m), 51 Jalan SS15/4, 47500 Subang Jaya.
9. F.E.H. Haser, 232, Soi Srinakorn, Off Nang Linchee Road, Chongnonsri, Bangkok 10120, Thailand.
10. H.W. Ziemand, P.O. Box 819, High River, Alberta, Canada TOL 1BO.

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ADDRESS WANTED

The following member is advised to informed the Society of his new address:

1. Erlend J. Frederickson, formerly of Accipiter Research Pte. Ltd., 643 Murray St., W. Perth, W. Australia.

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PERTAMBAHAN BARU PERPUSTAKAAN (NEW LIBRARY ADDITIONS)

The Society has received the following publications:

1. Geological Survey of Japan, Bulletin: vol. 40, nos. 1-12, 1989; vol. 41, nos. 1-5, 1990.
2. Journal of Geosciences, Osaka City U. vol. 33, 1990.
3. Transactions of the Institution of Mining & Metallurgy, Section A, vol. 99, May-Aug & Sept-Dec. 1990.
4. AAPG Explorer, Nov. 1990.
5. Principal Scientific & technical results, Analysis of activity, 1988.
6. Institution of Mining & Metallurgy, no. 996, 1990.
7. AGID News, nos. 63/64, 1990.
8. U.S.G.S. Circular 1046, 1990.
9. Memoirs of the Ehime University, vol. XI, no. 3, 1990.
10. Commonwealth Science Council, Sept-Oct 1990.
11. U.S.G.S. Bulletin 1792 ('87), (1990): 1881, 1920, 1864, 1894, 1757-1, 1673.
12. U.S.G.S. Professional Paper 1370-G, 1990.

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BERITA-BERITA LAIN
(OTHER NEWS)

GABUNGAN PERSATUAN PERSATUAN SAINS DAN TEKNOLOGI MALAYSIA (CONFEDERATION OF SCIENTIFIC AND TECHNOLOGICAL ASSOCIATIONS IN MALAYSIA (COSTAM))

COSTAM is publishing a magazine entitled Science and Technology in Malaysia. This publication will address science and technology related to everyday life with articles of human interest relevent to Malaysia. It is aimed primarily at the lower and upper form six students. The magazine will be published on a quarterly basis and the first issue is targetted to appear in June 1991 with a launching by the Minister of Science, Technology and the Environment.

Objectives of the magazine are:-

* to promote science and technology among students, teachers and parents.
* to relate science and technology to everyday life.
* to create awareness in science and technology among the Malaysian public.
* to promote better public appreciation of the role of science and technology in nation building.

Features articles in the magazine will include among other things engineering, technology, science, design, environment, nature, medical, health, agriculture, horticulture, mathematic, forestry, astronomy, transportation, information technology, personality and student section.

All articles will be deliberated by the editorial board and all published articles will be suitably renumerated. All articles could be addressed to the editor:

Dr. Wan Noordin bin Wan Daud
Rubber Research Institute of Malaysia
260 Jalan Ampang
50450 Kuala Lumpur

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13TH WORLD PETROLEUM CONGRESS

World Petroleum Congresses over the past half century have traditionally covered all scientific and technological aspects of the industry. Recently the scope has expanded to include petroleum finance, economics and management. All these activities are dedicated to the application of scientific advances in the petroleum industry and the use of this resource for the benefit of mankind.

The 13th World Petroleum Congress, which will take place in Buenos Aires, Argentina, between October 20th and 25th, 1991 will bring together senior management and executives from oil companies worldwide, scientists and technologists, academic and research workers, government and international organization officials, independent consultants, economic and financial specialists, and service and equipment industry personnel.

Programme

Designed to provide maximum contact and interaction among participants, the programme will review recent developments and future trends and their impact on the industry, and will include:

- Plenary addresses by world-renowned speakers on major topics of interest to the industry as a whole.

- Discussion forums on exploration technologies, offshore developments, drilling, reservoir management, enhanced recovery, heavy oil, refining and petrochemical activities, natural gas, supply and demand on international markets, economics, finance, safety and environmental issues.

- Review and forecast papers on topics where recent or expected advances are of general interest.

- Poster sessions on specific new areas and processes, with opportunities for individual discussions with poster presenters.

- Information on special achievements and future perspectives of the Latin American oil industry.

Events

In addition to the formal sessions, a full programme of events for participants and accompanying persons is planned. This will be a unique opportunity to admire the impressive countryside and to experience Argentina's cultural inheritance and industrial development.

Argentina has more than 6,000 oil and gas producing wells spread out in different environments and climates and is the fourth country worldwide in terms of the number of wells completed per year. All its production is refined locally, and almost all international oil field service companies have branches in Argentina. Technical visits will be arranged so that visitors can see for themselves these important developments in Argentina's petroleum activities. Aerolineas Argentinas has been named the official air carrier for the Congress.

Post-Congress tours to different areas of Argentina are also planned. This includes Ushuaia, the world's southernmost city; historic Salta and Tucumán; the Andean mountains on the Chilean border; and Iguazú Falls, in a tropical environment near Paraguay and Brazil.

Social events include the traditional WPC welcome and farewell parties, musical entertainment and sports tournaments, all in a typically relaxed Argentine style.

A number of special excursions have been arranged for accompanying persons, including museum visits, shopping, and cultural and sporting events.

The Argentine Committee will publish a preliminary brochure in 1990 and a publication containing the detailed congress programme and registration forms in 1991. If you wish to receive these brochures or additional information, please contact:

Mr. A.H. Torrea, c/o Congresos Internacionales S.A.,
Moreno 584-9th floor-1091 Buenos Aires-Argentina.
Phones: (541) 34-4216/34-3283-Telex: (33) 22036 Jecon Ar-
Fax: (541) 331-0223

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1991 AAPG International Conference and Exhibition - The Way Ahead Hydrocarbons for the 1990s

September 29 - October 2, 1991
Queen Elizabeth II Conference Center, London, England.

In recognition of the steady growth of the international industry, the AAPG recently committed to holding international conferences and exhibitions in locations outside North America on an annual basis. The first of this series will be held in London, England September 29 - October 2, 1991 at the Queen Elizabeth II Conference Centre. The Geological Society of London is co-sponsoring the event with the Petroleum Exploration Society of Great Britain as host society.

In pursuing the theme "The Way Ahead - Hydrocarbons for the 1990's", the conference's sessions and fieldtrips will focus upon hydrocarbon exploration potential for the coming decade in the USSR, Eastern Europe, the Middle East and North Africa. The program is designed to look at areas and problems which are predicted to be of interest to the industry in the future. It will become especially important that the industry make the most of established oil and gas provinces, particularly those which are logistically and commercially accessible.

It is hoped that the conference will provide a service to and will attract support from explorers working in Europe, Africa and the Middle East. A large potential oil business remains in the areas under consideration and they merit the attention this conference will bring.

Technical Program

Keynote Address: E.J.P. Browne, Managing Director, BP Exploration Co. Ltd.
"The Way Ahead - Hydrocarbons for the 1990s"

Regional Themes:

Areas Ready for Re-Exploration:

Middle East Region: Exploration Potential and New Plays
David L. Loftus, Chairman

North African Region: Exploration Potential and New Plays
Lucien Montadert, Chairman

Areas of Interest New to Western Industry:

USSR: Basin Development - Stratigraphic and Structural Evolution
John F. Dewey, Chairman

USSR: Petroleum Provinces - Exploration History, Hydrocarbon Habitat and Future Potential
USSR Ministry of Geology, Chairman

Eastern Europe: Petroleum Provinces - Exploration History, Hydrocarbon Habitat and Future Potential
Ferenc Horvath, Chairman

Technology Themes:

Advances in Geophysics and Geological Prediction
S.A. David Bamford, Chairman

Reservoir Geoscience - Improving Prediction, Reservoir Management and Recovery
Charles D. Curtis, Chairman

Remote Sensing
Jean-Paul Xavier, Chairman

High-Resolution Biostratigraphy: Its Application to Basin Analysis and Reservoir Management
Earnest A. Hailwood, Chairman

The conference will feature both oral and poster sessions on the above topics. Speakers may present their subject in either format. For a copy of the call for papers, mark the appropriate box on the enclosed reply card.

Short Courses

The following courses are sponsored by the American Association of Petroleum Geologists and the Joint Association for Petroleum Exploration Courses. Detailed information will appear in the conference brochure.

AAPG # 1. Well Log Sequence Stratigraphy Tied to Seismic Record Section
Saturday, September 28 through Sunday, September 29
Lecturers: Peter R. Vail (Rice University, Houston) and Walter W. Wornardt (Micro-Strat Inc., Denver)

AAPG # 2. Depositional System and Sequences in the Exploration for Sandstone Reservoirs and Stratigraphic Traps
Thursday, October 3 through Friday, October 4
Lecturer: William E. Galloway (University of Texas, Austin)

JAPEC/AAPG # 1. Managing Petroleum Risk in International Areas
Thursday, October 3 through Friday, October 4
Lecturer: Peter R. Rose (Consultant, Austin)

Fieldtrips

The following fieldtrips are sponsored either by the American Association of Petroleum Geologists or the Petroleum Exploration Society of Great Britain.

PESGB # 1. Permo/Carboniferous and Jurassic of Northeast England
Saturday, September 28 through Sunday, September 29
Leaders: J.M. Jones (University of Newcastle-upon-Tyne, Newcastle-upon-Tyne) and P.F. Fawson (University College, London)

PESBG # 2. Albo-Aptian of Central England
Sunday, September 29
Leader: S. Buck (Schlumberger, London)

AAPG # 1. Structural Styles and Sedimentation of Northern and Central Tunisia
Sunday, September 22 through Saturday, September 28
Leaders: T.T.J. Moody (Kingston Geological Services, Kingston) and J. Grocott (Kingston Polytechnic, Kingston)

AAPG # 2. Geology of the Holy Cross Mountains and the Carpathian Oil and Gas Provinces of Poland
Sunday, September 22 through Saturday, September 28
Leader: W.A. Weil (Polish Oil and Gas Company, Warsaw)

AAPG # 3. Wessex Basin: Examination of the Controls on Hydrocarbon Occurrence Along the South Coast of England
Thursday, September 26 through Sunday, September 29
Leader: R. Stonely (Imperial College, University of London, London)

AAPG # 4. Origins of Stragigraphy - Somerset England
Sunday, September 29
Leaders: John Fuller (Consultant, Tunbridge Wells) and Hugh Torrens (University of Keele, Keele)

AAPG # 5. Sedimentology and Tectonics of Pre-Rift, Syn-Rift and Post-Rift Episodes of a Mesozoic Atlantic Margin Basin: the Lusitanian Basin of Portugal
Thursday, October 3 through Wednesday, October 9
Leaders: R.C.L. Wilson (Open University, Milton Keynes), R.R. Leinfelder (University of Stuttgart, Stuttgart), and M.P. Watkinson (University of Rome, Rome)

AAPG # 6. Sediments of the Vienna Basin Region and Adjacent Alpine-Carpathian Thrustbelt, Significance for the Habitat of Hydrocarbons
Thursday, October 3 through Wednesday, October 9
Leaders: R. Sauer, P. Seifert, G. Wessely (OMV Aktiengesellschaft, Vienna)

AAPG # 7. Geology and Structure of Central Sicily Basin with Overview on Sicilian Petroleum Geology
Thursday, October 3 through Wednesday, October 9
Leader: G. Flores (Consultant, Florence)

For further information:

AAPG,
P.O. Box 979,
Tulsa, OK 74101-0979,
USA.

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An International Conference on Seismicity in Eastern Asia

Hong Kong
23-26 October 1991
Organized by: The Geological Society of Hong Kong

Objective

The conference will address aspects of seismicity, tectonic geology, seismic hazards and earthquake countermeasures with an emphasis on the problem of seismicity and earthquake hazards reduction in Eastern Asia Asia and neighbouring areas.

In keeping with the geographical location of the conference, there will be local coverage of Eastern and Southern China, but the conference is expressly aimed at coverage of East Asia as a whole, including offshore and island arc areas.

This list of themes given below is intended to give a general indication of the fields which is hoped to cover. The intention is to provide a meeting place for exchange of information and ideas on the regional seismicity, its causes and distribution, the hazards it presents, and how they may be mitigated or prevented by seismological and planning methods.

Scope

The conference will encompass the following aspects:

1. Seismic activity
2. Earthquake precursors and prediction
3. Seismic tectonics
4. Seismic zonation
5. Seismic engineering
6. Seismic countermeasures

Conference language

The official language of the conference will be English.

Call for papers

Original papers relevant to any of the themes listed above are invited. Intending authors are requested to return the attached preliminary registration form as soon as possible. Summaries of papers (Abstracts), not exceeding 1,000 words, should be submitted in three copies to the Conference Secretary.

It is intended to publish the Proceedings of the Conference, issued free to registered participants, during 1992.

Registration

The registration fee for the participants is US$80. For accompaning persons US$50. The registration fee covers the cost of program, book of abstracts and social events.

Venue and accommodation

The conference will be held at the Hong Kong Arts Centre in the centre of the city near the harbour on Hong Kong Island.

A variety of moderately priced to luxury hotel accommodation is available near the conference venue ranging from US$25 to US$200 for one day.

Technical visits and tours

A one-day scientific visit will be arranged to the nuclear power station of Guangdong Province in Daya Bay. Other tours, both scientific and sight seeing in and around Hong Kong will also be organized.

Correspondence

All correspondence should be addressed to

The Conference Secretary, Geological Society of Hong Kong,
K.W. Lee,
Charles Haswell and Partners (Far East) Ltd.,
3/F, Bay Tower,
2-4 Sunning Road,
Causeway Bay,
Hong Kong.

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PELANCARAN DAN PAMERAN BUKU-BUKU GEOSAINS PENGAJIAN TINGGI DALAM BAHASA MALAYSIA

Majlis Pelancaran dan Pameran Buku-buku Geosains Pengajian Tinggi dalam Bahasa Malaysia ini dijadualkan berlangsung pada hari Isnin 17 Disember 1990 (Pelancaran) diikuti dengan pameran pada 17 dan 18 Disember 1990, bertempat di Jabatan Geologi, Universiti Kebangsaan Malaysia Bangi. Kegiatan bersempena menyambut genap 20 tahun usia UKM dan Jabatan Geologi ini akan dirasmikan oleh YB Dr. Leo Michael Toyad, Timbalan Menteri Pendidikan pada jam 10 pagi, 17 Disember 1990.

Sembilan buah buku karya asli yang baru terbit akan dilancarkan, sementara 40 yang lain, yang diterbitkan dalam jangka 1980-1989 akan dipamerkan. Pada keseluruhannya jumlah karya asli yang dilancar dan dipamerkan ialah 31 buah, sementara 18 merupakan karya terjemahan. Bidang cakupan adalah luas - geologi fizik dan pemetaan, geomorfologi, mineralogi, petrografi, petrologi, geokimia, geofizik, geotektonik, fotogeologi, geologi ekonomi, geologi petroleum, hidrogeologi/hidrologi, sains tanah, mekanik tanah dan sejarah sains.

Sepanjang pameran Dewan Bahasa dan Pustaka dan Penerbit UKM akan mengadakan jualan buku-buku yang dilancar dan dipamerkan itu dengan potongan istimewa 20%.

Bersama-sama ini disertakan tajuk-tajuk buku yang dilancar dan dipamerkan.

TAJUK-TAJUK BUKU YANG DILANCAR DAN DIPAMERKAN

Majlis Pelancaran (karya asli)

1. Pengenalan Mineralogi Optik (DBP, 1990)
2. Geofizik: Konsep dan Penggunaan (DBP, 1990)
3. Bimbingan Amali Petrografi (DBP, 1990)
4. Ringkasan Sejarah Sains (DBP, 1990)
5. Geologi Asas Untuk Juruukur (DBP, 1990)
6. Pengenalan Mekanik Tanah (DBP, 1990)
7. Kamus Istilah Geologi Asas (UKM, 1990)
8. Tektonik (UKM, 1990)
9. Sifat dan Pengurusan Tanah di Malaysia (DBP, 1990)

Pameran

Karya Asli

1. Teknik Pemetaan Geologi (UKM, 1989)
2. Kaedah Geokimia Gunaan (DBP, 1989)
3. Istilah Sains Tanah (DBP, 1989)
4. Penggunaan dan Pelaksanaan Bahasa Malaysia dalam Bidang Geosains (DBP, 1989)
5. Istilah Geologi (DBP, 1988)
6. Kamus Kejuruteraan Petroleum (DBP, 1988)
7. Geomorfologi (DBP, 1987)
8. Geologi dan Manusia (UKM, 1987)
9. Proses-Proses Eksogen (DBP, 1987)

10 Bumi: Sifat Fizik & Kimia (DBP, 1987)
11. Kamus Hidrologi (DBP, 1986)
12. Latihan Pengenalan kepada Peta Geologi (DBP, 1986)
13 Analisis Mineralogi/Morfologi Tanah (DBP, 1985)
14. Latihan Peta Geologi (UKM, 1984)
15. Geologi Kuaternari Asia Tenggara (UKM, 1984)
16. Beberapa Pulau di Perairan Sabah: Aspek Geologi, Flora dan Fauna (UKM, 1984)
17. Kamus Hidrogeologi (DBP, 1982)
18. Sains Tanah (DBP, 1982)
19. Asas Sains Tanah (DBP, 1981)
20. Istilah Geologi (UKM, 1975)
21. Geografi Tanah Tanih (DBP, 1983)
22. Pengantar Geomorfologi (DBP, 1989)

Terjemahan

1. Fotogeologi dan Pemetaan Kawasan (DBP, 1990)
2. Pengenalan Geologi Bijih (DBP, 1990)
3. Batuan dan Mineral (DBP, 1990)
4. Hidrologi Air Tanah (DBP, 1989)
5. Prinsip-prinsip Geologi Jilid I (DBP, 1989)
6. Prinsip-prinsip Geologi Jilid II (DBP, 1989)
7. Prinsip-prinsip Geokimia (DBP, 1989)
8. Fosil (DBP, 1989)
9. Pemetaan Geologi Asas (DBP, 1989)
10. Petrologi Batuan Metamorf (DBP, 1988)
11. Pembacaan Peta Geologi (DBP, 1988)
12. Geomorfologi Tropika (DBP, 1987)
13. Geologi Petroleum dan Gas Asli I (DBP, 1987)
14. Geologi Petroleum dan Gas Asli II (DBP, 1986)
15. Peta-peta Geologi (DBP, 1986)
16. Sepintas Lalu Mengenai Minyak (DBP, 1985)
17. Struktur Geologi Ringkas (DBP, 1984)
18. Geomorfologi (DBP, 1981)

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PP 169/12/87 ISSN 0126-5539

PERSATUAN GEOLOGI MALAYSIA

WARTA GEOLOGI

NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MALAYSIA

Jil. 14, No. 5 (Vol. 14, No. 5) Sep-Okt 1988

KANDUNGAN (Contents)

DIKELUARKAN DWIBULANAN
ISSUED BIMONTHLY

Warta Geologi (Newsletter of the Geological Society of Malaysia).
Price: M$5.00 (US$3.20)
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GEOLOGICAL SOCIETY OF MALAYSIA PUBLICATIONS
Back Issues Available

Bulletin 1 (1968). 79p. Studies in Malaysian Geology. Edited by P.H. Stauffer. A collection of papers presented at a meeting of the Geological Society on 31st January 1967. Price: M$3.00 (US$1.50). **Out of stock**

Bulletin 2 (1968). 152 p. Bibliography and Index of the Geology of West Malaysia and Singapore by D.J. Gobbett. Price: M$10.00 (US$5.00) — Softcover; M$15.00 (US$7.50).

Bulletin 3 (1970). 146 p. Papers in Geomorphology and Stratigraphy (with Bibliography supplement). Edited by P.H. Stauffer. Price: M$10.00 (US$5.00).

Bulletin 4 (1971). 100 p. Papers in Petrology, Structure and Economic Geology. Edited by P.H. Stauffer. Price: M$10.00 (US$5.00).

Bulletin 5 (1973). 70 p. The Search for Tungsten Deposits by K.F.G. Hosking. Price: M$10.00 (US$5.00).

Bulletin 6 (1973). 334 p. Proceedings, Regional Conference on the Geology of Southeast Asia. A collection of papers, Kuala Lumpur, March, 1972. Edited by B.K. Tan. Price: M$22.00 (US$11.00) — hardcover only.

Bulletin 7 (1974). 138 p. A collection of papers on geology. Edited by B.K. Tan. Price: M$12.00 (US$6.00).

Bulletin 8 (1977). 158 p. A collection of papers on geology. Edited by T.T. Khoo. Price: M$12.00 (US$6.00).

Bulletin 9 (1977). 277 p. The relations between granitoids and associated ore deposits of the Circum-Pacific region. A collection of papers presented at the IGCP Circum-Pacific Plutonism Project Fifth Meeting. 12–13 November 1975, Kuala Lumpur. Edited by J.A. Roddick & T.T. Khoo. Price: M$25.00 (US$12.00). **Out of stock**

Bulletin 10 (1978). 95 p. A collection of papers on the geology of Southeast Asia. Edited by C.H. Yeap. Price: M$10.00 (US$5.00).

Bulletin 11 (1979). 393 p. Geology of Tin Deposits. A collection of papers presented at the International Symposium of 'Geology of Tin Deposits', 23–25 March 1978, Kuala Lumpur. Edited by C.H. Yeap. Price: M$50.00 (US$22.00).

Bulletin 12 (1980). 86 p. A collection of papers on geology. Edited by G.H. Teh. Price: M$20.00 (US$9.50).

Bulletin 13 (1980). 111 p. A collection of papers on geology of Malaysia and Thailand. Edited by G.H. Teh. Price: M$20.00 (US$9.50).

Bulletin 14 (1981). 151 p. A collection of papers on geology of Southeast Asia. Edited by G.H. Teh. Price: M$30.00 (US$14.00).

Bulletin 15 (1982). 151 p. A collection of papers on geology. Edited by G.H. Teh. Price: M$30.00 (US$14.00).

Bulletin 16 (1983). 239 p. A collection of papers on geology. Edited by G.H. Teh. Price: M$30.00 (US$14.00).

Bulletin 17 (1984). 371 p. A collection of papers on geology. Edited by G.H. Teh. Price: M$35.00 (US$15.00).

Bulletin 18 (1985). 209 p. Special Issue on Petroleum Geology. Edited by G.H. Teh & S. Paramananthan. Price: M$30.00 (US$14.00).

Bulletins 19 & 20 (1986). GEOSEA V Proceedings Vols. I & II, Fifth Regional Congress on Geology, Mineral and Energy Resources of Southeast Asia, Kuala Lumpur, 9–13 April 1984. Edited by G.H. Teh & S. Paramananthan. Price for both Bulletins 19 & 20: Members — M$50.00 (US$21.90), Non-members — M$125.00 (US$53.20).

Bulletin 21 (1987). 271 p. Special Issue on Petroleum Geology Vol. II. Edited by G.H. Teh. Price: M$40.00 (US$17.00).

Bulletin 22 (1988). 272 p. Special Issue on Petroleum Geology Vol. III. Edited by G.H. Teh. Price: M$40.00 (US$17.00).

Bulletin 23 (1989). 215 p. A collection of papers on the geology of Malaysia, Thailand and Burma. Edited by G.H. Teh. Price: M$35.00 (US$15.00).

Bulletin 24 (1989). 199 p. A collection of papers presented at GSM Annual Conference 1987 and 1988. Edited by G.H. Teh. Price: M$35.00 (US$15.00).

Bulletin 25 (1989). 161 p. Special Issue on Petroleum Geology Vol. IV. Edited by G.H. Teh. Price: M$40.00 (US$17.00).

Field Guide 1 (1973). A 7-day one thousand mile, geological excursion in Central and South Malaya (West Malaysia and Singapore). 40 p. by C.S. Hutchison. Price: M$5.00 (US$2.50).

Abstracts of papers. (1972). Regional Conference on the Geology of Southeast Asia, Kuala Lumpur, 1972. 64 p. 8 figs. 3 tables, many extended abstracts. Edited by N.S. Haile. Price: M$6.00 (US$3.00).

Proceedings of the Workshop on Stratigraphic Correlation of Thailand and Malaysia Vol. 1. (1983). Technical Papers. 383 p. Price: M$25.00 (US$12.40) (Members: M$12.00/US$6.50).

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KANDUNGAN (CONTENTS)

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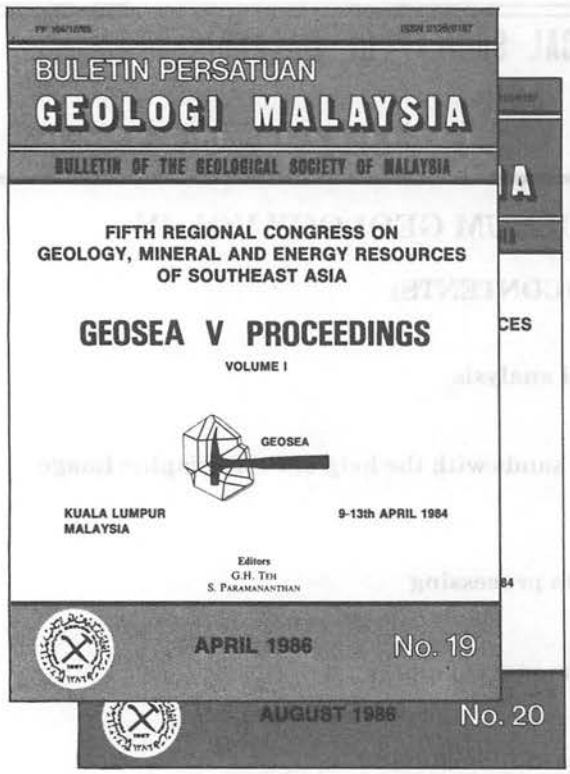
(Bulletin Geological Society of Malaysia Nos. 19 & 20)



Some of the articles appearing include:-

Massive sulphide deposits and their possible significance to other ores—R.W. Hutchinson; **Palaeogeographic development of west Sarawak**—Denis N.K. Tan; **Geological evolution of the Southern Philippines**—C.K. Burton; **Southeast Asia as a part of an early Palaeozoic Australian Gondwanaland**—C. Burrett & B. Stait; **Tertiary basins of S.E. Asia—their disparate tectonic origins and eustatic stratigraphical similarities**—C.S. Hutchison; **Late Palaeozoic palaeogeography of Southeast Asia: some stratigraphical, palaeontological and palaeomagnetic constraints**—I. Metcalfe; **The REE geochemistry of Lingshan W-Sn-bearing granites and their applications to petrogenesis of the granites**—Yuan Zhongxing *et al.*; **Chromite deposits of Papua New Guinea**—P.M. Afenya; **Recent advances in exploration modelling for tin deposits and their application to the SE Asian environment**—R.G. Taylor & P.J. Pollard; **Some thoughts on the development of the alluvial tinfields of the Malay-Thai Peninsula**—D. Taylor; **Base metal exploration in Sabah**—David T.C. Lee & H.S. Weber; **The nature and potential of gold mineralisation in Kelantan**—L.H. Chu & D. Santokh Singh; **Quaternary deposits of Thailand**—P. Dheeradilok & W. Kaewyana; **Soil landscapes in Peninsular Malaysia**—S. Paramananthan & S. Zauyah; **Aspects of the geochemistry of Malaysian cassiterites**—W. Fuad Hassan; **Geological evolution of the Indonesian Archipelago**—H.M.S. Hartono & S. Tjokrosapoetro; **The nature, distribution and genesis of certain authigenic minerals in the stanniferous alluvial deposits of S.E. Asia**—K.F.G. Hosking; **Global tectonics and resources**—W.S. Fyfe; **Tin/tungsten-bearing granites in S. China and their metallogenetic relations**—Xu Keqin & Zhu Jinchu; **Hydrogeological activities in Peninsular Malaysia and Sarawak**—F.S. Chong & Denis N.K. Tan; **Status of uranium exploration in Peninsular Malaysia**—L.H. Chu & F. Chand; **Directions of geologic transport in Peninsular Malaysia**—H.D. Tjia; **Cathaysia, Gondwanaland and the Palaeotethys in the evolution of Continental S.E. Asia**—Y.G. Gatinsky & C.S. Hutchison; **Marginal sea formation by rifting of the Chinese and Australian Continental Margins and implications for Borneo**—C.S. Hutchison; **Mesozoic and Cenozoic regional tectonics and metallogenesis in Mainland S.E. Asia**—A.H.G. Mitchell; **Coal potential and exploration in Sarawak**—S.P. Chen; **The succession of vertebrate faunas in the continental Mesozoic of Thailand**—E. Buffetaut & R. Ingavat; **Regional controls of hydrothermal ore localization in northern Thailand**—P. Asnachinda & S. Chantaramee; **Late Palaeozoic glacial marine facies in S.E. Asia and its implications**—P.H. Stauffer & C.P. Lee. **Cretaceous melange in West Kalimantan and its tectonic implications**—P.R. Williams *et al.*; **Recent advances in the knowledge of geology, mineral and energy resources of Singapore since 1981**—Ansafur Rahman & P.P. Wong; **The integration of remote sensing, terrain evaluation and engineering geology in Southeast Asia**—Beaumont, T.E. & Hunt, T; **Recent advances in the knowledge of geology and mineral resources of Vietnam since 1981**—Le Thai Xinh & Nguyen Xuan An.

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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.

April 1990 - July 1990
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, U.K.

April 1990 - July 1990
ENVIRONMENTAL EVALUATION MANAGEMENT AND CONTROL (Liverpool, U.K.). Annual 12-week training course for administrators, consultants and professionals. For Information: Dr. H.W. Pearson, Environmental Management Course, Department of Botany, University of Liverpool, P.O. Box 147, Liverpool L69 3BX, U.K.

May 1990
HYDROLOGY OF FRACTURED ROCKS (Montpellier, France). Annual three-week post-graduate course sponsored by Unesco. For Information: Professeur C. Drogue, Laboratoire d'Hydrogeologie, Universite des Sciences et Techniques du Languedoc, Place Eugene Bataillon, 34060 Montpellier, France.

June 1990
SEDIMENT TECHNOLOGY (Ankara, Turkey). An annual four-week Unesco-sponsored post-graduate course. For Information: Dr. Ergun Demiroz, DSI Teknik Arastirma ve Kalite Kontrol, Dairesi Baskanligi, 06100 Ankara, Turkey.

June 1990 - August 1990
TECHNIQUES OF HYDROLOGIC INVESTIGATIONS (Washington, D.C. and Denver, Colorado, U.S.A.). Annual training course for international participants. For Information: Office of International Hydrology, Water Resources Division, U.S. Geological Survey, 470 National Center, Reston, VA 22092, U.S.A.

July 1990 - August 1990
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: Departamento de Geologia y Geoquimica, Facultad de Ciencias, Universidad Autonoma de Madrid, Canto Blanco, Madrid 34, Spain.

October 1990 - September 1992
GEOLOGICAL EXPLORATION METHODS (Nottingham, U.K.). Two-year MSc course starting every other year with emphasis on applied methodology, data acquisition and interpretations). For Information: Dr. M.A. Lovell, Department of Geology, University of Nottingham NG7 2RD, U.K.

September 13-16, 1990
1990 WORKSHOP ON COASTAL ZONE MANAGEMENT (Coastal processes and public risk; sea-level rise; engineering and management aspects; field visits) at the Iwasaki Resort, Yappoon, Queensland, Australia. For Information: Dr. Aro Arakel, CSEG, Dept. of Applied Geology, Queensland University of Technology, Box 2434, Brisbane, Queensland 4001, Australia.

December 1990 - January 1991
METHODS AND TECHNIQUES IN EXPLORATION GEOPHYSICS (Hyderabad, India). Diploma course organized every second year by the National Geophysical Research Institute of the Council of Scientific and Industrial Research, Hyderabad, India, and sponsored by Unesco. Language: English. For Information: The Director, International Training Course on Methods and Techniques in Geophysical Exploration, National Geophysical Research Institute, Hyderabad, 500 007 (A.P.) India.

1991

February 1991 - March 1991
STRUCTURAL GEOLOGY (Dehra Dun, India). A six weeks training course organized every second year by the Wadia Institute of Himalayan Geology, sponsored by the Government of India and Unesco. Language: English. For Information: The Organizer of the Regional Training Course in Structural Geology, Wadia Institute of Himalayan Geology, 33 General Mahadev Singh Road, Dehra Dun 24 8001, India.

May 1991 - November 1991
GENERAL HYDROLOGY with emphasis on groundwater (Buenos Aires, Argentina). A six-month post-graduate diploma course organized every other year and sponsored by Unesco. Language: Spanish. For Information: Comité Nacional para el Programa Hidrologico Internacional de la Republica Argentina, Av. 9 de Julio 1925-15° piso, 1332 Buenos Aires, Argentina.

August 1991 - June 1993
SOIL SCIENCE AND WATER MANAGEMENT (Wageningen, The Netherlands). A 2-year MSc. course organized by Agricultural University Wageningen. Course starts every other year. Language: English. For Information: The Director of Studies of the MSc. Course in Soil Science and Water Management, P.O. Box 37, 6700 AA Wageningen, The Netherlands.

August 1991 - October 1991
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, Malostranské nam. 19, 11821 Prague 1, Czechoslovakia.

KALENDAR (CALENDAR)

1991

January 23-25, 1991
MINERAL DEVELOPMENT AND ENVIRONMENT (International Conference), New Delhi, India. (Prof. K.L. Rai, Indian School of Mines, Dhanbad 826 004, Bihar, India).

February 2-4, 1991
SMALL SCALE MINING (International Conference), Calcutta, India. (Organising Secretary ICSSM, c/o The Mining, Geological and Metallurgical Institute of India, 29 Chowringhee Road, Calcutta 700 016, India).

February 20-24, 1991
TECTONICS AND MINERAL DEPOSITS OF THE CARIBBEAN (10th Annual Symposium on Caribbean Geology) Mayaguez, Puerto Rico. (J.H. Schellekens, Department of Geology, University of Puerto Rico, P.O. Box 5000, Mayaguez, Puerto Rico 00709-5000).

March 1991
ECONOMIC EVALUATION OF MINERAL RESOURCES (International Conference), Kosice, Czechoslovakia. Languages: Russian and English. (Intergeoekonomika 1991 CSSR, GEOFOND, Eng St Richter, Garbanova 1, 040 11 Kosice, Czechoslovakia.

April 15-19, 1991
AQUIFER OVEREXPLOITATION (23rd International Congress), Puerto de la Cruz, Tenerife (Islas Canarias), Spain. (Dr. Fermin Villaroga, Departamento de Geodinamica, Facultad de Ciencias Geologicas, Universidad Complutense, 29040 Madrid, Spain).

April 26 - May 1, 1991
ASSOCIATION OF EXPLORATION GEOCHEMISTS (15th International Geochemical Exploration Symposium), Reno, U.S.A. (Richard B. Jones, Nevada Bureau of Mines and Geology, University of Nevada, Reno, Nevada 89557-0088, U.S.A.)

May 1991
QUANTITATIVE METHODS OF INVESTIGATION OF THE STRUCTURE OF SOILS AND ROCKS (IAEG International Symposium), Moscow. (Dr. M. Primel, LCPC, 58 Bd. Lafebvre, 75732 Paris Cedex 15, France)

May 7-22, 1991
GOLD '91 (5th International Conference), Belo Horizonte, Minas Gerais, Brazil. (Brazil Gold '91 Organizing Committee, Avenida Alfonso Pena, 3880-3°/5° andares, 30130 Belo Horizonte, MG, Brazil).

May 12-18, 1991
LAND SUBSIDENCE (4th International Symposium), Houston, Texas, USA. (Ivan Johnson, FISOLS, 7474 Upham Court, Arvada CO 80003, USA).

June 10-12, 1991
AFRICAN MINING '91 (2nd International Conference), incorporating PROSPECTING IN AREAS OF ARID TERRAIN and MINE-EX '91, Harare, Zimbabwe: geology, exploration, mining, mineral processing, extractive metallurgy, finance. Organized by The Institution of Mining and Metallurgy in association with The Zimbabwe Section of IMM, The Geological Society of Zimbabwe and The Zimbabwe Institution of Engineers. (The Conference Office, IMM, 44 Portland Place, London W1N 4BR, UK).

August 2-9, 1991
QUATERNARY RESEARCH (13th INQUA International Congress), Beijing, People's Republic of China. (Secretariat, 13th INQUA Congress, Chinese Academy of Sciences, 52 Sanlihe, Beijing 100864, PRC).

August 11-24, 1991
IUGG (XX General Assembly), Vienna, Austria. (IUGG '91 Organizing Committee, c/o Prof. Peter Steihauser, ZAMG, Hohe Warte 38, A-1190 Vienna, Austria).

September 6-11, 1991
PALEOECOLOGY (2nd International Congress), Nanjing, People's Republic of China. (Ma Yu-Ying, Nanjing Institute of Geology and Palaeontology, Academia Sinica, Chi-Ming-Ssu, Nanjing 210008, PRC).

September 16-20, 1991
ROCK MECHANICS (7th International Congress), Aachen, F.R. Germany. (Deutsche Gesellschaft für Erd- und Grundbau, Kronprinzenstrasse 35a, D-4300 Essen 1, F.R.G.).

September 22-27, 1991
CARBONIFEROUS-PERMIAN STRATIGRAPHY AND GEOLOGY (12th International Congress), Buenos Aires, Argentina. Language: English. (Dr. S. Archangelsky, Museo Argentino de Ciencias Naturales, Avenida A. Gallardo 470, Buenos Aires 1405, Argentina).

1992

February 9-12, 1992
LANDSLIDES (6th International Symposium), New Zealand. (Dr. M. Primel, LCPC, 58 Bd. Lafebvre, 75732 Paris Cedex 15, France)

June 1992
WORLD MINING (15th Congress), Seville, Spain. (World Mining Congress, Al Ujazdwskie 1-3, PL-00583, Warsaw, Poland.

GEOLOGICAL SOCIETY OF MALAYSIA PUBLICATIONS

General Information

The Society publishes the *Buletin Geologi Malaysia* (Bulletin of the Geological Society of Malaysia) and the bimonthly *Warta Geologi* (Newsletter of the Geological Society of Malaysia).

Papers of general interest or on the geology of the Southeast Asian region (South China, Burma, Thailand, Indochina, Malaysia, Singapore, Indonesia, Brunei and the Philippines) and also marine areas within the region are welcome for publication in the *Buletin*. Short notes, progress reports and general items of information are best submitted to the *Warta Geologi*.

Papers should be as concise as possible. However, there is no fixed limit as to the length and number of illustrations. Therefore, papers of monograph length are also welcome. Normally, the whole paper should not exceed 30 printed pages and it is advisable that authors of papers longer than 30 printed pages should obtain the consent of the Editor before submission of the papers.

The final decision of any paper submitted for publication rests with the Editor who is aided by an Editorial Advisory Board. The Editor may send any paper submitted for review by one or more reviewers. Scripts of papers found to be unsuitable for publication may not be returned to the authors but reasons for the rejection will be given. The authors of papers found to be unsuitable for publication may appeal only to the Editor for re-consideration if they do not agree with the reasons for rejection. The Editor will consider the appeal together with the Editorial Advisory Board.

Unless with the consent of the Editor, papers which have been published before should not be submitted for consideration.

Authors must agree not to publish elsewhere a paper submitted to and accepted by the Society.

Authors alone are responsible for the facts and opinions given in their papers and for the correctness of references etc.

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All papers should be submitted to the Editor, Geological Society of Malaysia, c/o Department of Geology, University of Malaya, 59100 Kuala Lumpur, MALAYSIA.

Script Requirements

Scripts must be written in Bahasa Malaysia (Malay) or English.

Two copies of the text and illustrations must be submitted. The scripts must be typewritten double-spaced on papers not exceeding 21 × 33 cm. One side of the page must only be typed on.

Figure captions must be typed on a separate sheet of paper. The captions must not be drafted on the figures.

Original maps and illustrations or as glossy prints should ideally be submitted with sufficiently bold and large lettering to permit reduction to 15 × 22 cm: fold-outs and large maps will be considered only under special circumstances.

Photographs should be of good quality, sharp and with contrast. For each photograph, submit two glossy prints, at least 8 × 12 cm and preferably larger. Use of metric system of measurements (ISU) is strongly urged wherever possible.

Reference cited in the text should be listed at the end of the paper and arranged in alphabetical order and typed double-spaced. The references should be quoted in the following manner:

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Hosking, K.F.G., 1973. Primary mineral deposits. *In* Gobbett, D.J. and Hutchison, C.S. (Eds), *"Geology of the Malay Peninsula (West Malaysia and Singapore)"*. Wiley-Interscience, New York, 335 – 390.

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For format, kinds of subheadings and general style, use this and the previous *Buletins* as a guide.

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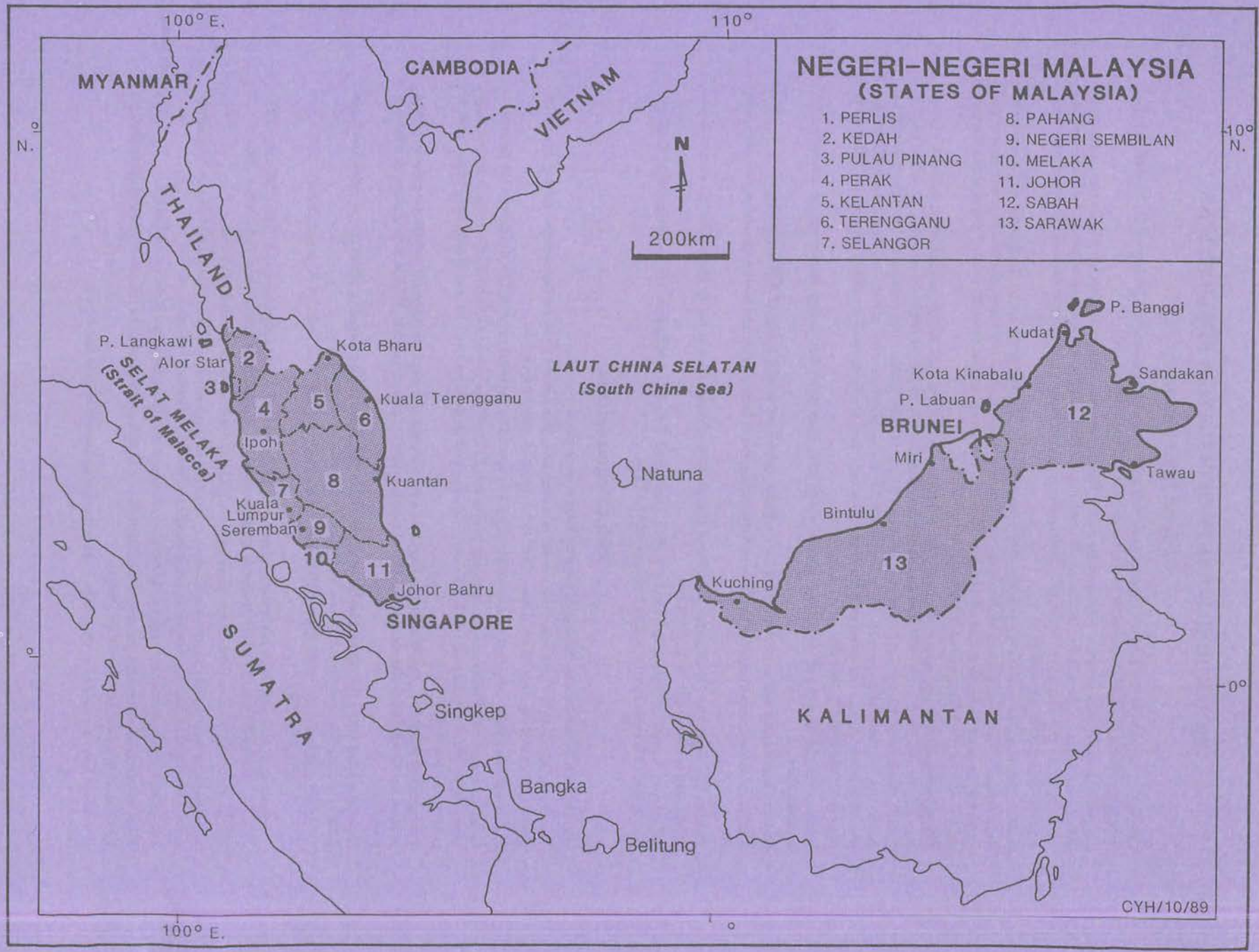
NEGERI-NEGERI MALAYSIA
(STATES OF MALAYSIA)
1. PERLIS
2. KEDAH
3. PULAU PINANG
4. PERAK
5. KELANTAN
6. TERENGGANU
7. SELANGOR
8. PAHANG
9. NEGERI SEMBILAN
10. MELAKA
11. JOHOR
12. SABAH
13. SARAWAK
100° E.
110°
10° N.
0°
MYANMAR
CAMBODIA
VIETNAM
THAILAND
N
200km
P. Langkawi
Alor Star
Kota Bharu
Kuala Terengganu
Ipoh
Kuantan
Kuala Lumpur
Seremban
Johor Bahru
SINGAPORE
SELAT MELAKA
(Strait of Malacca)
LAUT CHINA SELATAN
(South China Sea)
Natuna
SUMATRA
Singkep
Bangka
Belitung
P. Banggi
Kudat
Kota Kinabalu
Sandakan
P. Labuan
BRUNEI
Miri
Tawau
Bintulu
Kuching
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CYH/10/89