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CATATAN GEOLOGI (GEOLOGICAL NOTES)

GUNUNG TAHAN - GUNUNG TANGGA DUA BELAS: STRUCTURAL OBSERVATIONS

Ibrahim Komoo, Mohd. Shafeea Leman & H.D. Tjia, Department of Geology,
Universiti Kebangsaan Malaysia, Bangi, Selangor.

In mid-October 1985 we were part of a seven-man trekking party that hiked up to the 2187 m summit of Gunung Tahan, at the Pahang-Kelantan border, using the usual route from Kuala Tahan via Kuala Teku. Rock outcrops are rare for the larger part of the route and only beyond Wray camp (1100 m) did the soil cover become minimal, vegetation stunted, while bed-rock outcrops become extensive (Fig. 1).

The rocks belong to the Upper Triassic-Jurassic Tembeling Formation (Koopmans, 1968; Seet, 1983). The outcrops between Gunung Tangga Dua Belas and the summit consist of usually oligomict quartz conglomerate and conglomeratic sandstone banks; coarse-, medium- and fine-grained quartz sandstone beds (the fine-grained variety exhibiting excellent cm-size bedding in which incipient slump folds also occur); commonly reddish siltstone and mudstone. The mudstone is probably tuffaceous. The sandstone and conglomerate beds are intruded by some quartz sills, quartz dykes and more commonly by quartz veins. The veins may occur singly, up to 2 dm wide and traceable for a few metres distance, or frequently occur in *en echelon* sets. In such sets individual veins may reach lengths of 2 metres and widths of 15 cm. The *en echelon* zones may range in width up to 1.2 m. Almost all veins arranged in *en echelon* are inclined very steeply to vertical. On rare occasions veins arranged *en echelon* in zones dipping approximately 30 degrees were observed. These *en echelon* veins clearly represent filled tension gashes. In the mudstone and siltstone, quartz veins are rarely found while *en echelon* sets are definitely absent.

Figure 2 shows an equal-area, lower hemisphere plot of various structural elements that were recorded between Gunung Tangga Dua Belas and Gunung Tahan. Most readings were from the vicinity of Padang camp, the highest base camp along the Tahan trail. The *en echelon* gashes filled by quartz occurring in zones trending between 18° and 82° were all produced by right-lateral slip. Those occurring between 80° and 145° were produced by left-lateral slip. Figure 2 further shows that several quartz veins between 68° and 75° occur singly and are not arranged *en echelon*. It was also observed that *en echelon* veins tend to become sigmoidal if they occur in zones striking between 65° and 70° . From these it was concluded that a general horizontal compression acted in approximately 65° - 75° and produced right-lateral and left-lateral slips in those directions as indicated by the respective tension gashes. The single veins between 68° and 75° are fillings of extension fractures by the same compression. Local and slight deviations (presumably less than 10 degrees) of this general compression direction are interpreted to have produced the tension gashes indicating a slip sense that appears inconsistent with respect to the general compression direction. An example is the right-lateral slip indicated by an 82° zone of *en echelon* veins. Its generating compression should possess an azimuth of more than 82° . Morphology and bedding measurements indicate that the trail between Gunung Tangga Dua Belas and Gunung Tahan roughly follows the

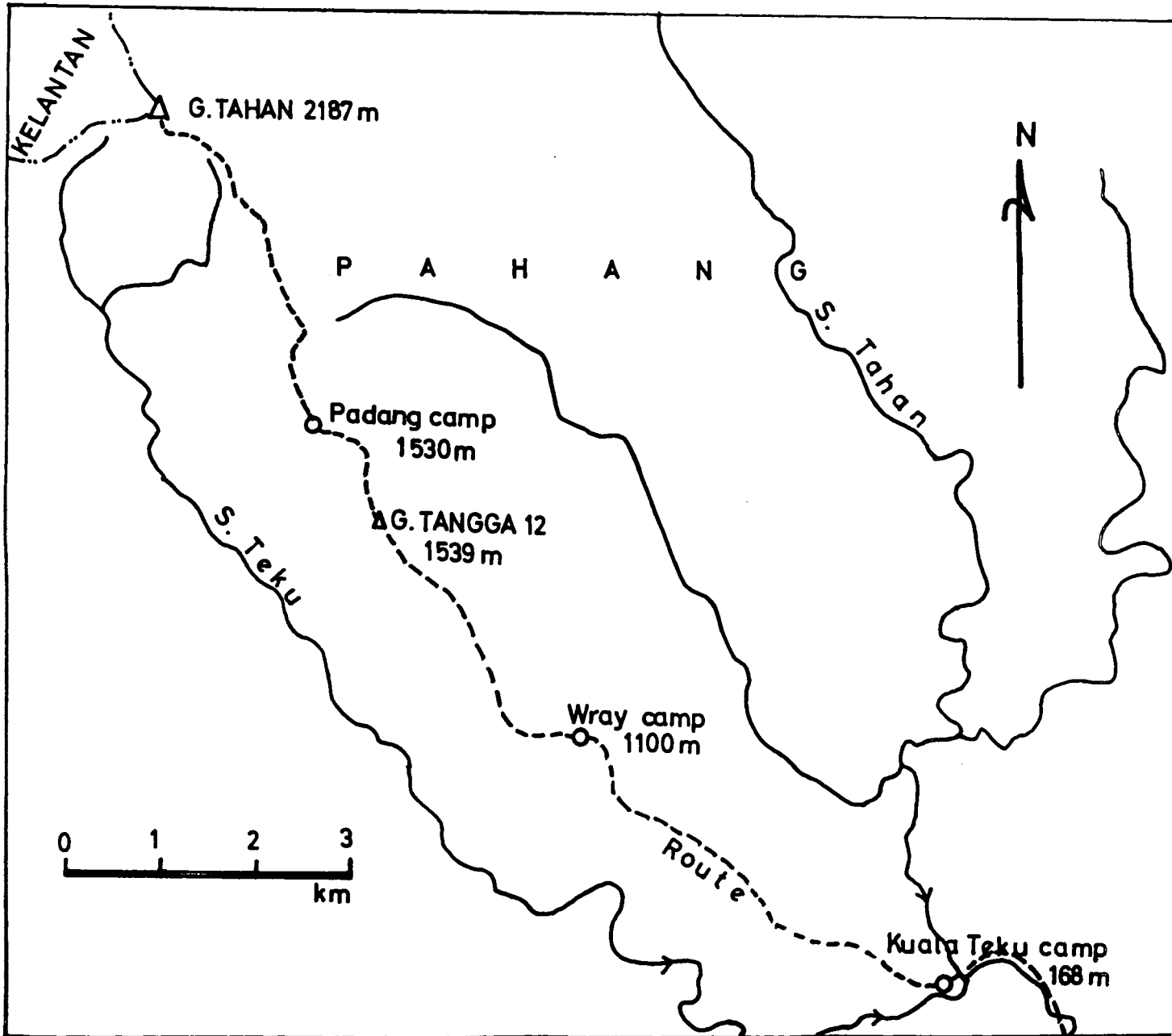


Fig. 1. Plan of the Gunung Tahan area. An extensive, undulating plateau occurs around Padang camp. Mohd. Amin Abu Bakar mapped the trail.

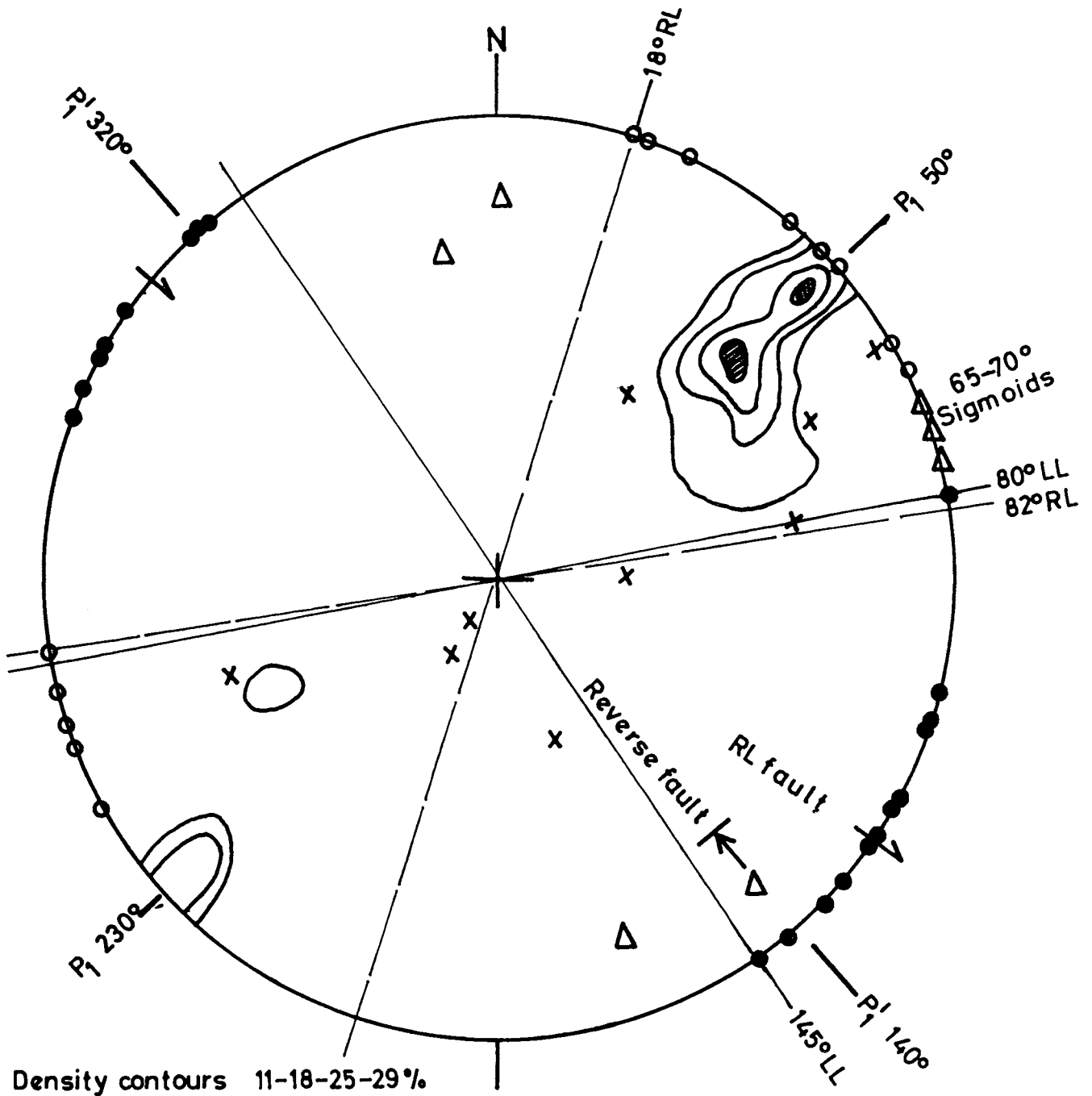


Fig. 2. Equal-area, lower hemisphere plot of various structural elements in Tembeling Formation that outcrops between Gunung Tangga Dua Belas and Gunung Tahan.

Attitudes of 36 beds are contoured and only those of beds occurring outside the contoured areas of the plot are individually shown by crosses. Other symbols are: Open triangles = single quartz vein; open circles = zones of *en echelon* quartz veins indicating right slip; closed circles = zones of *en echelon* quartz veins indicating left slip; half-tipped arrows = horizontal striations on right lateral fault planes; arrow with cross bar = pitch of striations on reverse fault plane.

In sectors $18-82^\circ$ and $80-145^\circ$ *en echelon* quartz veins indicate right-lateral and left-lateral slip, respectively. These slips were caused by horizontal compression P_1 in approximately $65-75^\circ$. Discussion is in the text.

crest of the Tahan Anticline (see also Koopmans, 1966). This anticline trends NW. Along the trail were smaller open folds of wavelengths of 25 m to a few hundred metres. These folds should be considered as subsidiary folds on the larger (km-sized wavelength) open folds that characterize the Tembeling Formation. Bedding attitudes along the trail indicate that a $50-230^{\circ}$ direction regional compression P_1 was responsible for the folding or ductile deformation.

Finally, small to medium scale vertical fault zones with lateral displacement in the dm range suggest responses to lateral compression in $140-320^{\circ}$ direction, or perpendicular to P_1 . This SE-NW compression is also indicated by dm-thick quartz veins arranged *en echelon* in a zone that strikes 50° and dips 30° to SE. These filled tension gashes were the result of low-angle reverse motion in SE-NW direction.

In summary it can be concluded that the following deformation sequence took place in the Tembeling rocks.

- (1) Ductile deformation by regional compression in $50-230^{\circ}$, the Tembeling beds became folded into open structures.
- (2) The succeeding compression acted in approximately $65-75^{\circ}$ to $245-255^{\circ}$ and produced brittle deformation in the shape of tension gashes and extension fractures. These were filled by quartz.
- (3) Locally, probably deriving its energy from strain stored by the NE-SW regional compression, NW-SE directed compression caused brittle deformation, that is, small to medium size faulting with dm-order lateral displacements. All lateral slip faults are quartz-free and were, therefore, formed after the quartz intrusions terminated. Only very rarely was infilling of quartz seen in fractures that appear related to the NW-SE compression. One example is the *en echelon* of quartz veins that define a zone striking 50° and dipping 30° SE.

These and other observations on the summit area of Gunung Tahan will be published in the 1986-issue of Sains Malaysiana (Sains Bumi edition).

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PERTEMUAN PERSATUAN
(MEETINGS OF THE SOCIETY)

CERAMAH TEKNIK (TECHNICAL TALKS)

M.G. Audley-Charles: Did the flowering plants (angiosperms) first evolve in Malaya? A geological look at the problem.

Abstract

Based on what have been argued are similarities of fossil faunas and floras and distinctive lithofacies and igneous rocks it has been suggested that Burma, Thailand, Malaya and Sumatra comprise continental fragments rifted from northern Australia-New Guinea. An outstanding problem concerns the precise date of separation of these Asian continental fragments from the Australia-New Guinea part of Gondwanaland. There is some geological evidence for the separation being as late as late Jurassic Oxfordian stage (160 Ma), but some indications have been taken to mean that the rifting occurred as early as Permian. Palaeomagnetic measurements that could provide such an important guide through the apparently conflicting geological evidence are too few at present and it is hoped that this work will be undertaken soon.

The conclusion put forward on the basis of the available evidence appears to me to be strongly in favour of Burma, western Thailand, Malaya and Sumatra having been rifted from the north Australia-New Guinea continental margin during the Jurassic. These southeast Asian blocks became relatively isolated within the Tethys ocean between Gondwanaland and the Asian mainland for possibly as long as 60 Ma or even possibly 100 Ma. Equally important there are indications that from the late Cretaceous (100 Ma) onwards they provided an archipelago of islands between the Asian mainland and Australia-New Guinea. By being above sea-level from the late Jurassic and into the Cretaceous these regions may have acted as Noah's arks for the land plants of that time.

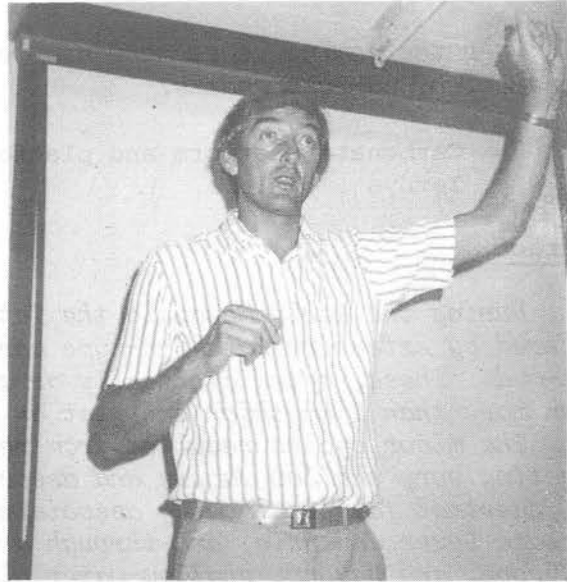
It may be significant for the history of land plant development as well as for geotectonics that large parts of northern Australia, Burma, western Thailand, Malaya and Sumatra escaped the flooding of the world-wide marine transgression of late Cretaceous time. This may have permitted land plants related to those which had evolved in the late Jurassic to have survived in these parts of southeast Asia. This suggests that the fossil land plants of Jurassic and Cretaceous age in these parts of southeast Asia may be found to contain the most primitive forms of the great flowering land flora that dominates the forests of this part of the world at the present day.

Laporan (Report)

Pada 27hb November, 1985 lalu, bertempat di Bangunan Jabatan Geologi, Universiti Kebangsaan Malaysia, Bangi, Prof. M.G. Audley Charles daripada University College, London, telah menyampaikan sebuah ceramah teknik bertajuk, "Did the flowering plants (angiosperms) first evolve in Malaya? - A geological look at the problem". Ceramah ini telah dihadiri oleh kira-kira 40 ahli persatuan, dan diakhiri dengan jamuan 'Satay Kajang'! Prof. Audley Charles



M.G. AUDLEY-CHARLES



B.W. SELLWOOD

berada di U.K.M. sebagai ahli dalam projek penyelidikan bersama UKM-UCL "Stratigraphical-Structural Evolution of Malay Peninsula", tajaan Sarawak Shell Berhad, yang baru bermula.

Hamzah Mohamad

B.W. Sellwood: 1) Habitat of onshore oil accumulations in Southern England
2) Carbonate platform and platform-collapse facies in the Mesozoic Tethys

1) The habitat of onshore oil accumulations in Southern England

Abstract

Onshore oil discoveries have been made in Southern England over the last twenty years but the last ten years have witnessed a dramatic increase in exploration activity. The most significant finds have been located in the Wessex Basin both adjacent to the English Channel and further to the north. Minor discoveries have been made in the Weald Basin due south of London. The most significant traps are tilted fault blocks that developed during the Jurassic. Reservoirs are provided by Triassic desert sands and conglomerates, early Jurassic marine sandstones, Mid-Jurassic marine carbonates and Late Jurassic marine sands. The Triassic red-beds accumulated in a N-S wrench graben which cuts the Hercynian basement. Later Mesozoic facies follow predominantly E-W trends. The prime source-rocks are late Triassic and early Jurassic black shales. Late Jurassic (Kimmeridge) shales, which are the main North Sea source-rocks, are not mature in Southern England.

Hydrocarbon generation and migration can be shown to have been initiated before the end of the early Cretaceous when regional heat-flow is thought to have been higher than present values. The regionally extensive Mid-Jurassic carbonates have suffered a long and complex diagenetic history involving both deeper burial diagenesis and palaeo-aquifer alteration.

Over the coming years many new wells are planned enabling further refinement of current models.

2) Carbonate platform and platform-collapse facies in the Mesozoic Tethys

Abstract

During the early Mesozoic the Tethyan margins of southern Europe were bordered by extensive Bahamian-type carbonates predominantly composed of lime-mud. These, often cyclically arranged, carbonate shelf successions are often more than 1 km thick and rest on continental red beds of early Triassic age. The minor cycles resulted from regressive-transgressive episodes affecting very shallow waters and associated structures include stromatolites and fenestral fabrics locally associated with palaeokarstic surfaces. During the late Lower Jurassic, and through a wide belt embracing N. Africa, S. and C. Europe, and beyond, shallow-water platform facies are suddenly replaced by pelagic sequences of two contrasting types: a) thick limestone-marl successions that formed in pelagic and hemi-pelagic basins (Fleckenkalk facies) and b) condensed red modular limestones (Ammonitico Rosso) that formed over submarine highs (seamounts). Surfaces separating pelagic sequences from platform ones are usually sharp, corroded, penetrated by neptunian dykes and sills and coated in crusts of Fe-Mn oxide. Condensed seamount facies locally exhibit deep-water sand waves composed of *Bositra* (a bivalve), or crinoidal debris that accumulated as the seamount submerged.

Pelagic basinal sequences generally accumulated below the aragonite compensation depth and contain only calcitic fauna and ammonite aptychi. Ammonitico Rosso facies occur periodically through the Jurassic but are never well represented after the start of the Cretaceous when true chalks appear. Chalky limestones with abundant coccoliths (the Maiolica) record the evolutionary burst in these planktonic organisms.

The more-or-less simultaneous collapse of Tethyan carbonate platforms in the late Lower Jurassic records the westward extension of the Tethys and initial opening of the Central Atlantic. Collapse of platforms marks the subsidence of newly generated continental margins adjacent to the new ocean system. The Central Atlantic is thus a remnant of the old Tethys Ocean.

Report

Dr. Bruce Sellwood, of the University of Reading, England, was in Malaysia for 6 weeks as a Visiting Professor of Petroleum Geology at the University of Malaya. He was involved in the Petroleum Geology course for the undergraduates as well as advising on research in Petroleum Geology. He took time off his heavy schedule to present two talks to the GSM on the 11th and 12th December 1985 at the Geology Department, University of Malaya.

Azhar Hj. Husin

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PETROLEUM GEOLOGY SEMINAR 1985



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PETROLEUM GEOLOGY SEMINAR 1985



GSM Petroleum Geology Seminar '85
Captions to photos

- 1 & 2: Early registrants of the Seminar.
- 3, 8, 9 & 10: The large audience at the Opening Ceremony.
- 4: The arrival of YB Tan Sri Abdullah Mohd. Salleh.
- 5: GSM President, John Kuna Raj with his welcoming address.
- 6: YB Tan Sri Abdullah Mohd. Salleh addressing the gathering.
- 7: A token of appreciation from the Society to YB Tan Sri Abdullah Mohd. Salleh.
- 11: Abu Samad of PETRONAS-Carigali starting off the technical sessions.
- 12: Alistair Brown of GSI on 2D Seismic Date.
- 13: C.S. Hutchison (UM) with his paper.
- 14: K.R. Chakraborty (UM) with some comments.
- 15: Harun Mohd. Noor of EPMI on analysing a DHI.
- 16: J. Hageman of Sarawak Shell presenting his paper.
- 17: J.K. Raj with a token of appreciation for Session Chairman David Maughn of EPMI.
- 18: Plenty to choose from at Lunch.
- 19: Martin Glaus presenting J.K. Raj Shell's generous contribution.
- 20: A word from R. Cory before EPMI's contribution.
- 21: J.K. Raj receiving Schlumberger's contribution from Orlandi.
- 22: K.F. Ho presenting Exploration Consultant Ltd.'s contribution.
- 23: Ted Selby of GSI presenting his paper.
- 24: Lin Kuo-An of CPC on Seismic Stratigraphic Interpretation.
- 25: G. Shanor of Schlumberger introducing the Dipmeter Advisor.
- 26: R.C. Mummery of Teknika Resources on the use of Seislog.
- 27: H.D. Tjia (UKM) on Lower Tertiary sediments near Tatau, Sarawak.
- 28: Palle F. Miller of GECO on 3D Seismic Interpretation.
- 29: Session Chairman Dharam Singh receiving a souvenir.
- 30: Phillip Lesslar of Sarawak Shell with his paper.
- 31: H. Buchholtz of Prakla-Seismos on Seismic Depth Sections.
- 32: Nik Mohamad of Sarawak Shell on the Watergun.
- 33: Ng Tong San of PETRONAS-Carigali on the Tenggol Arch.
- 34: Chiem Boon Hong of Sarawak Shell talking on Marine Statics.
- 35: H.D. Johnson of Sabah Shell presenting a joint paper on Erb West Field.
- 36: Bruce K. Levell of Sabah Shell on regional unconformities offshore west Sabah.
- 37: A last visit to the ever popular Hospitality Suite.

PETROLEUM GEOLOGY SEMINAR 1985 - REPORT

The Geological Society of Malaysia held its Petroleum Geology Seminar '85 at the Ming Court Hotel in Kuala Lumpur from December 6-7, 1985. Petronas' President, YB Tan Sri Abdullah Mohd Salleh took time off from his busy schedule after the Ascope '85 Conference and Exhibition to declare the Seminar open on December 6, 1985.

The "Petroleum Geology Seminar '85" is the ninth in a series of such annual seminars which were first introduced in 1977 with the main objective of bringing together local as well as foreign geoscientists, explorationists, academicians, researchers and government officials involved in petroleum geology and the petroleum industry to exchange information and share their knowledge and experience on various aspects of petroleum geology in this region and new techniques of petroleum exploration.

About 200 participants attended the Seminar this year and strong representation was recorded from Petronas, Petronas Carigali Sdn. Bhd., Production Sharing Contractors (SHELL, Esso Production Malaysia Inc. (EPMI), Elf Aquitaine Malaysia, Overseas Petroleum & Investment Corp. (OPIC)), foreign and local oil and service companies as well as local universities.

The Seminar was generously supported by a large number of foreign and local oil companies as well as petroleum related service companies. Delcom Services Sdn. Bhd./GECO and Schlumberger hosted hospitality suites on 6 and 7 December 1985 respectively while Laiman Corporation Sdn Bhd. and Western Geophysical hosted a cocktail on 6 December 1985 for participants of the Seminar.

A total of 18 excellent technical papers were presented at this Seminar by professionals from various oil, consultancy and service companies as well as academicians from local universities. Various aspects of geology, in particular petroleum geology in this region, as well as new advances and techniques in petroleum exploration were addressed in these papers.

Tan Sri Abdullah in his opening address at the "Petroleum Geology Seminar '85" supported the fact that the achievements of geologists have been unheralded and that geologists have not been given the publicity they deserve even on the petroleum front where "the very existence of oil would not be known" if not for geologists. According to him, "headlines are more often than not devoted to politicians, entrepreneurs, doctors, physicists and even plane hijackers but never geologists!" The progress and development achieved by Malaysia in its petroleum industry are largely due to the geologists' success in locating and increasing the petroleum reserves in the country.

On the future of exploration activities in Malaysia, Tan Sri Abdullah commented that although the pace of exploration activities has been slow over the last two years, a turn for the better can be expected in the light of proposed amendments to the production sharing contract and the present plan for Petronas to open 3 areas for bidding in 1986.

The Geological Society of Malaysia was also commended by Tan Sri Abdullah for its efforts in holding the Seminar to provide a better insight into the many aspects of petroleum geology in the region and the latest methods and techniques currently employed in petroleum operations. He also

hoped that local petroleum geologists would be able to make greater contributions to the local petroleum industry from the additional information and knowledge gained from this Seminar and to provide guidance and training to a new generation of would-be geologists who would be able to produce pioneering work in their chosen field.

Michael Leong
Organising Chairman
Petroleum Geology Seminar '85
Geological Society of Malaysia

OPENING ADDRESS BY YB TAN SRI ABDULLAH MOHD SALLEH, PRESIDENT OF PETRONAS, AT THE "PETROLEUM GEOLOGY SEMINAR '85" ON DECEMBER 6, 1985.

Mr. Chairman, Distinguished Guests, Ladies and Gentlemen,

I am honoured to be invited to deliver the opening address to this distinguished gathering of the Geological Society of Malaysia's Petroleum Geology Seminar '85. For far too long, geologists have not been given the publicity they deserve and the achievements of geologists are unheralded by the public. The headlines are more often than not devoted to politicians, entrepreneurs, doctors, physicists and even plane hijackers but never geologists! Even on the petroleum front, those involved in the marketing and pricing of oil are more often in the news than geologists without whom the very existence of oil would not be known. The discovery of petroleum and its application in diverse uses has transformed the quality of life in so many ways - transport, communications, medicine, agriculture and so on. Without petroleum, one could even doubt the very existence of this meeting. Hence, I would like to suggest that petroleum geologists meet often and make their contributions better known to the general public.

Two of the most significant contributions made by geologists during the early stages of the petroleum industry, which I would like to mention, are the theory of anticlinal accumulation and the skill in interpreting subsurface structures and the accurate mapping of these structures. The theory of anticlinal accumulation, which was put forward in the 1860's, was based on the belief that gas, oil and water are separated according to their densities, thereby suggesting that oil and gas tend to be found at culminations of anticlinal folds. However, because oil at that time was mostly discovered near the earth's surface, this theory did not attract much attention. I recall a story about how the local people in Miri laughed at the foreigners who undertook drilling operations on top of the hill when oil was easily obtained at the foothills. It was only around 1910 onwards, as the demand for petroleum increased sharply and shallow oil fields became more difficult to find, that the emphasis of oil exploration efforts was directed towards the search for anticlines. This proved to be a major turning point for the world's petroleum industry. Statistics have since proven that a majority of the world's giant oil fields, such as Kuwait's Burgan and Iraq's Kirkuk fields, and more than half of oil and gas fields in non-communist countries,

including the ones in Malaysia, are located in anticlinal structures. Till today, efforts are still being made to locate anticlines.

Since oil explorationists during those days did not have the sophisticated equipment which we now have, surface mapping proved to be invaluable in enabling them to locate the crestal portions of the anticlines where the oil and gas may be trapped. Surface geological maps have also enabled the preparation of sub-surface contour maps which are used as the basis for exploration drilling programmes. Today, almost all the mapping is based on seismic data which allows not only the mapping of anticlinal features but also the more subtle fault and stratigraphic traps. Since the investments needed to undertake exploratory drillings are very huge, about M\$10 million per well in Malaysia, the accuracy of such maps can either lead to huge amount of savings and gains, or heavy losses.

Geologists who have been involved in the development of this country's petroleum industry should be proud that the progress and development achieved by Malaysia, to a great extent, was due to their success in locating and increasing Malaysia's petroleum reserves. From about 700 million barrels in 1974, our oil reserves have since increased to about 3.1 billion barrels as at January 1, this year. Malaysia's oil production has also increased sharply from about 90,000 b/d in 1974 to the present level of about 420,000 b/d. With the increase in production level, petroleum has since assumed a vital role in the nation's economy. For this year, export earnings, to be obtained from petroleum including LNG, are expected to be about \$10.9 billion, while revenue to the government, excluding import and excise duties, is expected to total about \$6.4 billion. Petroleum accounts for about 29% of both Malaysia's total exports and total government revenue. At the present production level of 420,000 b/d, our oil reserves will last for another 20 years. Thus, in view of the increasing trend towards heavier dependence on petroleum to provide the nation with the much needed foreign exchange, as evidenced by the higher production level planned for 1986, it is imperative that we step up efforts to find more oil to replace those depleted.

In this respect, Malaysia is fortunate to have large and thick sedimentary basins which are considered to be favourable for trapping hydrocarbons. It is estimated that out of 414,000 sq. km. of our continental shelf considered to have hydrocarbon potential, only about 30,000 sq. km. have been well explored and 54,000 sq. km. relatively explored, and about 330,000 sq. km. not tested by drilling. In addition, 100,000 sq. km. off Sabah and Sarawak, which are mostly in deeper waters, have not been explored at all. Coupled with our success ratio of 1:6, which is very good by international standards, I strongly believe that the chances of more oil being struck within our territory in future are still excellent. Although the pace of exploration operations in the last two years has been slow, we expect a turn for the better with the proposed amendments to our PSC, which have been announced by the Minister of Finance. Our plan for next year is to open about 3 areas for bidding. Already, we have received several enquiries from oil companies expressing their interest to undertake exploration efforts in several areas.

Ladies and Gentlemen,

It is heartening to note that more companies, both local and foreign, are willing to cooperate and share their expertise, experience and knowledge with others. From the list of papers which will be presented, I am sure that

you will be able to garner better insight into many aspects of the petroleum geology in this region and the latest methods and techniques currently employed in petroleum operations. Generous exchange of views are necessary if geologists are to make even more positive contributions towards the development of the country. In this respect, I would like to commend the Geological Society of Malaysia for its role and efforts in organizing this Seminar. This is the ninth year that such a seminar has been held, testifying to the devotion that members have towards their field of interest.

To conclude, I would like to reiterate here that a key challenge being faced by Malaysia's petroleum industry in future is to find more oil. Exploration operations have now moved to drilling in deeper waters, which are more costly and technically demanding. The challenge to petroleum geologists is to develop means to further improve on their ability to interpret available data so as to enhance the chances of locating structures suitable for trapping hydrocarbons. This task should not be taken lightly as the petroleum sector is one of the most significant contributors to the economy. I hope then that local petroleum geologists, equipped with the additional knowledge and information from this Seminar, will be spurred to contribute more to the local petroleum industry. It is my hope that you would be able to also provide better guidance and training to would-be geologists so as to produce a new generation of geologists who would, in future, be able to even produce pioneering work in their chosen field of endeavour.

I should like once again to thank the Organizers for inviting me to give this opening address. It is with great pleasure that I declare this Seminar open.

Thank you.

PETROLEUM GEOLOGY SEMINAR '85 - ABSTRACTS OF PAPERS

Stratigraphic scheme for PETRONAS Carigali's operating areas offshore Peninsular Malaysia

Abu Samad & Md. Nazri Ramli, PETRONAS Carigali Sdn. Bhd.

Geological evaluations of PETRONAS Carigali's operating areas in Peninsular Malaysia are now performed, based on a new stratigraphic scheme. This scheme has seven broad stratigraphic units which are recognised throughout the entire Tertiary sequence. Four of these units are related to regional transgressions in early-, middle- and late-Miocene. The subdivisions are based on regional shale markers and an unconformity, which are correlatable over a distance of 120 km.

Most of the stratigraphic tops are easily identifiable from biostratigraphic assemblages, wireline logs and seismic sections. The scheme therefore can provide basic correlative time-stratigraphic markers for regional studies.

Interactive Interpretation of 2D Seismic Data

Alistair Brown, Geophysical Service (M) Sdn. Bhd.

Interactive interpretation first became possible for 3D data because of the regular closely-spaced array of data points which a 3D survey provides.

Now the 2D interpreter can also enjoy the benefits of an interactive system. He can select the desired lines from a prospect basemap, display the sections in colour for optimum dynamic range, cut, fold and shift to establish correlations and automatically track the horizons of interest.

Mapping includes fault connection, manual contouring, automatic contouring, amplitude mapping and superimposition of final displays for interpretive synthesis.

A re-assessment of the evidence that the S.E. Asian Shear Basins resulted from the India-Tibet Collision

Charles S. Hutchison, Department of Geology, University of Malaya, Kuala Lumpur.

The indentation experiments of Tappoiner et al. (1982) provide strong support for a working hypothesis that the "back arc" shear basins (Red River; Gulf of Bacbo; Tonle-Sap, Mekong; Malay) resulted from the indentation of India into Eurasia. The alternative hypothesis that they resulted from E-W compression and that the Indian collision may be irrelevant has been presented to this meeting last year by B.G.M. Wood.

The timing of the closure of the Tethys by collision of India with the Lhasa-Gandise Block of S. Tibet along the Indus-Zangbo-Yarlung Suture may now be constrained by isotope date (Wang, 1984). The first and second cycles of the Linzizong volcanics of the Gandise arc are predominantly andesites of subduction-related calc-alkaline affinity. Cycle I gave a Rb:Sr age of 97.5 Ma (Cenomanian). Cycle III is of rhyolite, welded tuff and trachy-dacite interbedded with continental strata. K:Ar dates are 60 Ma (Palaeocene). The chemistry of Cycle III indicates a continental crustal origin. Therefore the Tethys was closed after the Cenomanian and soon before the Palaeocene.

However, there is evidence that S.E. Asia began its rifting history before the Palaeocene: (1) the tholeiitic basaltic dykes of the east coast province of Peninsular Malaysia have been dated at Kuantan by Haile et al. (1983) as 104 ± 10 Ma (Albian) and (2) the basins of the Pearl River Mouth and Beibu Gulf were already beginning to receive their sedimentary fill in Cretaceous times (Li, 1984). Such rifting and subsidence could not have resulted from the Indian collision.

In China, this spectacular period of rifting and basin development is referred to as the "Yenshanian Earth movements". Its effects were felt throughout the whole continental crustal part of S.E. Asia. The rifting was accompanied by a high heat flux from the mantle, resulting in high geothermal gradients which even today have not waned below 40 C km⁻¹

Many of the Chinese basins are flooded by Late Cretaceous (Late Yenshanian) granites, of S-type, formed by partial melting of the continental crust, and dated at 80-130 Ma. They have been responsible for the greatest part of the mineral wealth of China. These granites cannot be regarded as "basement" to the basins, which in many cases began their formation before the granites were emplaced. They are therefore an integral part of the rifting and subsidence process. Several wells in the S. China Sea region have drilled into such Late Yenshanian granites, and locally they occur in Peninsular Malaysia and on S. China Sea islands.

It therefore appears that S.E. Asia, extending from the Sunda Shelf into China, was a province of spectacular rifting associated with anomalously high heat flow resulting in crustally derived granites and subsidence, before the collision of India with Tibet.

The major NW-SE shears may have resulted from the collision, but it appears they were superimposed on an already rifting high heat flow province.

The indentation model of India predicts that (1) South China should have moved eastwards (supported by palaeomagnetic data); (2) that Indo-China and the Malay Peninsula should have rotated clockwise and remained at the same latitude (this is proved for Indochina, but data on Peninsular Malaysia contradict the prediction); (3) that the Lhasa Block should have moved northwards ahead of India (proved by the palaeomagnetic data).

The palaeomagnetic data on Peninsular Malaysia and Borneo (Haile and Briden, 1982) suggest a strong anti-clockwise rotation between the Late Cretaceous and the Early Miocene, but no movement since Miocene times. These observations contradict the indentation model.

Continuing rifting along the NW-SE shears has given Late Cenozoic alkaline basalts especially along the Tonle Sap-Mekong basin and in several Chinese basins and at Kuantan on the edge of the Penyu Basin. Such alkaline basalts are to be expected and they must occur within and along the margins of the Malay and Natuna Basins (for example on the margin of the Tenggol Arch) but none has been documented in the literature. Hopefully the petroleum industry can document such volcanism without endangering their proprietary information.

Analyzing a DHI - Tinggi Field Malay Basin, Malaysia

Haron Mohd Noor, Esso Production Malaysia Inc.

The Tinggi field, which is in the Malay Basin, offshore Peninsular Malaysia, is a fully developed and producing field in Esso Production Malaysia Inc.'s production sharing contract area.

A detailed pre-development field study of direct hydrocarbon indicators or DHI's and geohazards, using conventional seismic and high resolution sparker data, provided invaluable information that helped in the accident-free development of Tinggi which has numerous uneconomic but hazardous shallow gas sands. These sands cause depth prediction problem. Seismic modelling of one gas DHI is discussed in detail.

This seismic modelling study provided a better understanding of the seismic expressions of gas reservoirs in the Malay Basin.

Palaeobathymetrical Changes in NW Sarawak during the Oligocene to Pliocene

J. Hageman, Sarawak Shell Berhad.

The predominantly siliciclastic Oligocene to Pliocene deposits of NW Sarawak were deposited during a number of successive transgressions and regressions. These cyclic phases are relatively well known and they are used within Shell for a subdivision of the stratigraphical record into informal lithostratigraphical units consisting of sediments deposited during one cyclic sedimentation phase. Little is known, however, about the nature and origin of the palaeobathymetrical changes which caused the transgressions and regressions, and little information is available on the individual impact of the main factors controlling these relative sea level changes: eustacy, epeirogenesis, sedimentation rate and compaction. Therefore a study was initiated which focused on the following:

1. *What were the main factors controlling the palaeobathymetrical changes which occurred in NW Sarawak during the Oligocene to Pliocene?*
2. *What were the lateral and vertical dimensions of these palaeobathymetrical changes?*
3. *To what extent were these palaeobathymetrical changes isochronous over the area?*
4. *Are these changes a local feature or can they be correlated with global events?*

To find the answers to these questions the following method was applied:

The palaeobathymetrical history was interpreted for each adequately documented Balingian and Luconia well on file in SSB. This was done by plotting palaeodepths of deposition against geological time and by constructing a "palaeobathymetrical curve". Next the main observed palaeobathymetrical events in all wells were defined and subsequently mutually compared. It appeared then that a great number of the relative sea level changes observed in the individual wells were of a more or less general character, suggesting that they occurred over a wide area within a relatively short time interval, i.e. within one foram or pollen zone (0.5-4-m.y.). By combining all data, a "best fit" curve could be constructed which shows the major palaeobathymetrical changes in Balingian and Luconia for Late Oligocene to Pliocene times. These observed "general" palaeobathymetrical changes reflect the combined, averaged result of eustacy, subsidence, sedimentation rate and compaction.

Although the constructed palaeobathymetrical curve is thought to be valid on a regional scale, local deviations do occur. The reason for these deviations is probably mainly the difference in magnitude between epeirogeny/sedimentation rates on one hand and regional relative sea level changes on the other. The study showed that the subsidence rate is generally

several times greater than the amount of relative sea level change, indicating that local minor changes in the subsidence/sedimentation ratio may obscure regional palaeobathymetrical changes.

Advances in Marine Seismic Energy Source Technology

Ted Selby, Geophysical Service (M) Sdn. Bhd.

Over the past 15-20 years, the airgun has emerged as the dominant marine energy source.

In the early 1980's it was seen that the requirements for offshore seismic exploration were becoming more diverse with increasing demands for even more penetration, and for higher resolution from both 3D and 2D surveys.

Each of these needs could be met with a different source but this approach has significant economic and logistical problems. GSI set out to develop a single source system capable of meeting all offshore seismic requirements. The successful development program led to an entirely new airgun - the External Sleeve Airgun.

Greater power output and frequency bandwidth at greater economy can be demonstrated from this design.

Further, deployment of this source will yield a much higher frequency content and resolution level in the shallow zone coupled with gross improvements in terms of continuity of deep horizons.

Seismic Stratigraphic Interpretation for Thin Layer-Cases

Lin Kuo-An, Chinese Petroleum Corporation, Taipei, R.O.C.

A Quantitative Analysis System was developed to estimate successfully thin reservoirs which could not be revealed by traditional methods.

The seismic data were first processed carefully. Synthetic seismograms generated demonstrate the reliable quality of the seismic data, and provided basic data for generation of interpretation template curves to be used for stratigraphic interpretation. Digital computers were then used to derive the accurate coordinates of the peak and the trough of seismic wavelet associated with the thin layer of interest. Then, the effective net thickness of the thin layer was estimated from the amplitude and the time separation between the peak and the trough.

Two cases of thin stratigraphy of porous sand buried within shale in Taiwan were studied by using the method mentioned above. The sand in the first case is distributed under the footwall of a fault, at a depth of about 2,000 m, in an offshore area. The effective net thickness varies from 2 m to

10 m. The sand in the second case is distributed over channel sediments, at depth of about 1,000 m. The effective net thickness varies from 2 m to 5 m. The predicted production zones in the two cases approximate the drilling results.

The dipmeter advisor - A dipmeter interpretation workstation

Gordy G. Shanor, Schlumberger Overseas S.A.

The Dipmeter Advisor is a knowledge-base system, linked to a computer workstation, designed to aid in the interpretation of dipmeter results through interaction between the interpreter and the "expert" system.

The system utilizes dipmeter results, other wireline log data, computer-processed results such as Litho, and user-input local geological knowledge as the framework for the interpretation. A work session proceeds through a number of phases, which leads to first a structural, then a stratigraphic interpretation of the well data.*

Conclusions made by the Dipmeter Advisor can be accepted, modified, or rejected by the interpreter at any stage of the work session. The user may also make his own conclusions and comments, which are stored as part of the final interpretation and become part of an updated knowledge-base for input to further field studies.

Use of Seislog for Basin Evaluation and Field Development

R.C. Mummery, Teknica Resource Development Ltd., Calgary, Alberta, Canada-T2P 2Y5.

Generation of synthetic sonic logs (Seislogs) from seismic data can provide lithologic, porosity and in some case fluid content identifications in a variety of geological settings. In this period of high exploratory and development costs, Seislog data can significantly reduce exploration risks and contribute to the planning of drilling programmes in both exploration and development settings.

This paper briefly describes the techniques involved and illustrates examples from a variety of structural and stratigraphic settings. Carbonate examples include North Sea Chalk, fractured limestones in Venezuela, and porosity development in regional deposited limestones of Western Canada. The clastic examples are from Southeast Asia and include deltaic, transitional marine-shoreline and marine facies within Miocene age sediments.

3-D Seismic Interpretation and Modelling Using an Interactive Computer System

Palle F. Miller, GECO A/S, Norway.

A 3-D seismic survey consists of a large amount of sectors (lines, crosslines and time slices).

The interpreter is here faced with several problems such as simple book-keeping, 3-dimensional overview, folding, tying and marking of seismic events, and digitizing.

An interactive interpretation system will limit these problems and thereby automatically cut down the time used and the cost to accomplish a 3-D interpretation. In addition several other features can be applied, features which normally would be too time consuming for normal paper interpretation.

Also 2-D seismic interpretation can be performed on interactive computers.

Seismic modelling with the help of geomodel construction is possible with the help of a "solid block" concept, ray tracing, survey simulation and synthetic seismogram generation.

Superimposed Deformations and Vergence of Lower Tertiary Sediments near Tatau, Sarawak.

H.D. Tjia and Borhan Sidi, Department of Geology, Universiti Kebangsaan Malaysia.

Good quality outcrops along a 9-km stretch of the trunk road passing near Tatau, in the southern part of the Balingian province, provide the following information. The stratigraphic succession becomes younger from west to east and in that order consists of dm-dm thick sandstone-shale intercalations, followed by a dominantly dark grey shale part, then metre-thick sandstone banks, succeeded by thicker dm-dm sandstone-shale turbidites, and capped by cross-bedded sandstone and polymict conglomerate. Flat shale clasts in the latter and its argillaceous groundmass suggest large-scale disturbance during its deposition. This entire section is considered to represent the lower part of the Tatau formation of Central Sarawak and is of Eocene age. Locally, metres-wide zones of chaotically folded sandstone-shale interbeds and sandstone banks deformed in ductile-brittle manner represent slump horizons in the sequence. Slickensiding and incipient crystallisation of gouge upon surfaces of competent rock fragments plus phyllitic character of the argillaceous groundmass indicate that most, if not all, of these slump horizons were also shear zones during subsequent tectonic events.

The structural style is that of large recumbent folds with north vergence upon which was superimposed northwest-verging, medium scale overturned folds. The larger structure was probably developed in the late Eocene that in Central Sarawak represented a major orogenic event. The second structure

was probably the result of the Pre-Liang and Post-Liang folding phases of the Pliocene-Pleistocene.

The regional geological map of Sarawak indicates that in the vicinity of Tatau, structures trend east-west, but change towards east and west into ENE and WNW strikes, respectively. In the section that we studied, the WNW trend is only vaguely represented.

Computer-assisted Interpretation of Depositional Palaeoenvironments Based on Foraminifera

Philip Lesslar, Sarawak Shell Berhad

In Sarawak Shell's Geological laboratory, well samples are analysed in part for their foraminiferal content and this information is used for interpreting the depositional environment as well as the age where possible. This paper addresses the former usage of foraminiferal data.

Recognition of the palaeoenvironments in samples of well sections is mainly based on the presence/absence and frequency of particular benthonic foraminifera which are considered to reflect the depth and nature of their living environment. Other guidelines used are the planktonic/benthonic ratio as well as species diversity.

The large number of species found in this area (~1,500) and the uniqueness that each sample assemblage possesses in terms of species content, frequencies, diversity and preservation, make objective and consistent interpretations of depositional palaeoenvironments a difficult task. The problem is accentuated when interpretations are made by several investigators since personal concepts and criteria tend to be developed in addition to established ones depending on the knowledge and experience of particular investigators.

With the aim of minimising the subjectivity involved and of attaining a consistent basis for interpretations, cluster analysis, environmental range charts, identification matrices and a set of interactive programs have been worked into a scheme which enables probabilistic computer-assisted interpretation to be carried out on samples utilising the presence or absence of species. Results are listed with their corresponding probability values and aid the investigator in making consistent environmental interpretations.

Derivation of Seismic Depth Sections

H. Buchholtz and W. Houba, Prakla-Seismos GMBH

The purpose of seismic migration generally is to present the exact subsurface situation with respect to the spatial location of reflecting elements. The procedure is usually performed in the time or frequency domain. The transformation to the depth domain requires the reliable knowledge of

the underlying velocity model. A simple depth conversion of the time scale is a very limited procedure and fails completely in the presence of dipping overburden layers. In this case of substantial lateral velocity variation, the result of time migration is already erroneous. The error depends on the amount of refraction and the depth difference between the refracting and the reflecting interface.

If steep and/or conflicting dips are involved a special dip-move-out (DMO) processing is required to improve the stacked data for migration.

Wave theoretical depth migration takes the effect of the refraction of rays exactly into account by considering the so-called thin-lens term in the migration algorithm. This technique solves both the imaging and lateral positioning problems. For evaluation of a proper depth dependent velocity field an interactive procedure is suggested applying a horizon by horizon migration based on a ray tracing method. The resulting velocity distribution is then used in the wave equation migration of seismic data leading to more reliable depth sections.

The effectiveness of the method is illustrated by a sequence of examples.

Experience with Watergun (a new Seismic Source) offshore Sarawak

Nik Mohamed, Sarawak Shell Berhad.

Waterguns have recently been used as an attractive alternative to airguns for marine seismic surveys in many areas. Sarawak Shell Berhad conducted an experiment to compare two Soder P400 waterguns with various well-tuned airgun arrays in order to evaluate the potentials of the watergun for our marine seismic surveys.

The experiment involved the evaluation of farfield signature characteristics as well as production testing on seismic line shooting using the two waterguns and various airgun arrays. The seismic line was chosen such that it incorporated areas of poor and good seismic reflectivity, gentle and steep dips.

Signature spectral analyses showed that although watergun signatures are rich in high frequencies these are beyond the cut off frequencies at 2 ms sampling. At this sampling interval a well-tuned airgun array can match the performance of the watergun. In the lower frequency range there is a definite lack of energies below 15 Hz. Here a well-tuned airgun array is superior.

Trap Styles of the Tenggol Arch and the southern part of the Malay Basin

Ng Tong San, PETRONAS Carigali Sdn. Bhd.

The Tenggol Arch and the southern part of the Malay Basin are situated offshore Terengganu, Peninsular Malaysia. They are believed to form part

of a rift system of probable early Oligocene.

Drape and anticline features and fault/dip closures have been identified in the area and all these trap types have been tested. The drapes are generally of low relief features caused by post-depositional compaction over basement highs comprising horsts and tilted fault blocks along the basin margin and erosional remnants on the Tenggol Arch. The anticlines are generally elongated and have great relief and are believed to have been caused by right-lateral shear stresses during Miocene. Fault/dip closures are found along the eastern flank of the basin against the faulted margin of the Tenggol Arch.

Commercial quantities of hydrocarbons have been found in both the compressional anticlines and drape features but exploration tests of fault/dip traps have been unsuccessful to date.

Marine Statics

Chiem Boon Hong, Sarawak Shell Berhad.

Statics are in general a problem which is commonly encountered in land seismic because of weathering layers and the elevation of shots and receivers. In marine seismic, similar problems exist, though to a lesser extent, in areas where there are shallow anomalies which could be due to gas, soft weathering layers on the sea bottom, or coral reefs. Such irregular changes in very shallow lithology create seismic ray path problems by either increasing or decreasing the seismic velocity and therefore introducing statics problems.

Examples of such problems are seen in several areas offshore Sarawak. The shallow anomalies differ in area size and are rather irregular in shape.

To solve marine statics problems in 2D processing, the assumptions usually made are:-

- (1) Feathering angle is negligible and therefore shot and receiver stations lie nearly in a straight line.
- (2) The statics to be computed are surface consistent.

Our experience while processing data acquired in 1985 and some of the older vintages shows that remarkable improvement can be achieved on the stack sections with statics application. Application of statics gave an overall improvement in continuity of events resulting in better interpretable stacks.

Reservoir Geological Framework of Upper Miocene Shallow Marine Sandstones in the Erb West Field, Offshore Sabah, NW Borneo

S. Levell, A.H. Mohamed and H.D. Johnson, Sabah Shell Petroleum Co.

The Erb West field is a prominent NE-SW trending anticlinal structure containing sizeable gas and oil reserves. The hydrocarbons are contained within a ca. 800 ft thick sequence of Upper Miocene shallow marine sandstones, in which eight main sandstone reservoirs have been defined (M4 and N2-N8 Sands). The development and quality (porosity and permeability) of these reservoir sands display significant variations across the field and this has influenced both hydrocarbon distribution and field development strategy. The nature and origin of these variations in reservoir characteristics are discussed in terms of the depositional and tectonic setting of the Erb West field.

The reservoir interval comprises a series of gradationally-bounded facies types, ranging from mudstones, through mixed sand-mud (heterolithic) lithologies, into well-sorted sandstones. These facies are typically arranged in coarsening upward sequences which are paralleled by increases in sandstone porosity (15 to 26%) and permeability (10-2000 mD). Neritic microfaunas and abundant bioturbation indicate a shallow marine or shelf environment of deposition. Within the sandstones common parallel to wavy lamination (probably including hummocky cross-stratification), wave ripples and grading are considered indicative of a storm-dominated depositional regime, probably within an inner shelf setting.

The main reservoir sands (N Sands) are interpreted as having been derived from the reworking of coastal sediments flanking the emergent and tectonically-active Erb High. These sands were also probably partly associated with erosion of a regionally extensive unconformity (the Shallow Regional Unconformity-SRU), with the N Sands progressively onlapping the SRU to the southeast of the field. The result is a stack of transgressive shelf sands which individually display progradational sequences.

These coarsening upward sequences are ca. 50-100 ft thick and are recognised by funnel-shaped gamma ray log patterns. Correlation of facies and log sequences across the field indicate good continuity of individual packages but they exhibit variations in facies types, thickness and rock quality. This typically comprises the following trend: (1) relatively condensed, "proximal" sequences to the E and NE, (2) well-developed, complete ("intermediate") sequences in the centre of the field, and (3) well-developed but finer grained, "distal" sequences to the W and NW. Superimposed on this facies trend is a subsidence trend which is manifested by a northward increase in the gross thickness of individual reservoir units (i.e. increasing towards the more distal part of the basin). The resulting reservoir quality maps show optimum sand development in the central part of the field which decreases in both proximal (to E and NE) and distal (to W and NW) directions.

This reservoir geological framework has been used as a basis for predicting rock quality and pore volume distribution, for estimating hydrocarbon reserves and for planning and monitoring the development of the Erb West field, some aspects of which will be discussed.

The palaeobathymetrical curve for Sarawak was constructed with data from the Balingian and Luconia Provinces only. In the thicker, mainly Upper Miocene/Pliocene deposits of the Baram Delta Province, these major oscillations cannot be identified with certainty. There, palaeobathymetrical changes are generally small (less than 100') and numerous (several per biozone). It appears that in this area, where average rates of deposition were often 3 to 5 times as high as in Balingian/Luconia, the depositional history was

largely controlled by high subsidence and sedimentation rates, which largely obscured regional sea level changes.

In the interval between 16 and 3.5 m.y. the similarity between the global sea level curve and the palaeobathymetric curve for NW Sarawak is striking, and it suggests that in the Balingian/Luconia Provinces an equilibrium between subsidence (compaction) and sedimentation existed during this time interval, whereby regional transgressions and regressions were largely controlled by eustasy. For the interval older than 16 m.y., no correlation between the global sea level curve and the palaeobathymetric curve for NW Sarawak is possible, which is probably due to the fact that during this time the effect of global sea level changes was largely masked by the major tectonic movements which affected NW Sarawak in the Early Miocene.

The Nature and Significance of Regional Unconformities in the Hydrocarbon-bearing Neogene Sequence Offshore West Sabah.

Bruce K. Levell, Sabah Shell Petroleum Co.

The Tertiary N.W. Sabah basin is a 350 km long, 140 km wide NE-SW orientated sedimentary basin containing up to 12 km of predominantly siliciclastic sediments. The basin history can be divided into two phases:

1. Pre-Middle Miocene deposition of deep marine deposits with tectonic imbrication related to southeastward subduction along the fore-runners of the Palawan Trough/NW Borneo Trench.
2. Post Middle Miocene deposition after the cessation of subduction by a series of northwest-prograding shelf/slope sequences associated with important wrench-faulting in the basement.

Although a small amount of oil and gas has been discovered in the Pre-Middle Miocene deep water deposits, all commercial accumulations discovered to date are in the Post Middle Miocene deposits.

The boundary between the two sequences is an unconformity at the landward margin of the basin, where deformation was the most intense, with terrestrial or coastal deposits directly overlying deep marine sediments. Towards the northwest, this 'Deep Regional Unconformity' becomes a conformable horizon. The deformation of individual structures at this time clearly occurred together with regional tilting down towards the northwest. There are indications that the Deep Regional Unconformity reappears beneath the inner wall of the Palawan Trough/NW Borneo Trench as an onlap surface above imbricate thrust slices but this correlation is based solely on seismic data.

Deposition of the post Middle-Miocene sequence was characterised by syn-depositional tectonic deformation. However, accelerated rates of deformation at certain times resulted in the formation of five regional unconformities which provide the correlation framework of the basin. These unconformities are: the Lower and Upper Intermediate Unconformities (LIU and UIU) in the late Middle Miocene, the Shallow Regional Unconformity (SRU) in the middle Late Miocene and Horizons II and I in the Pliocene and Pleistocene

respectively. Each of these unconformities was the product of both local structure formation and a regional tilting down towards the northwest. Typically each unconformity passes from an erosion surface to an onlap surface towards the NW.

Repeated re-activation of basement wrench faults in response to varying regional stress fields on five occasions has led to a complicated tectonic and stratigraphic picture. Layer maps indicating which structures were active prior to the formation of a given unconformity, and the line along which that unconformity passes into a conformable sequence, demonstrate that the inner part of the NW Sabah basin is underlain by at least four separate basement blocks which were internally deformed only at certain times and remained undeformed at other times, presumably due to the relative orientation of the regional stress pattern and the block-bounding faults. A swing in the orientation of the major structures (from N-S in the south to NE-SW in the north) at around P. Mangalum in the centre of the basin coincides with an inferred tectonic block boundary and, although the exact orientation of the dividing line is unclear, probably represents transverse segmentation of the margin.

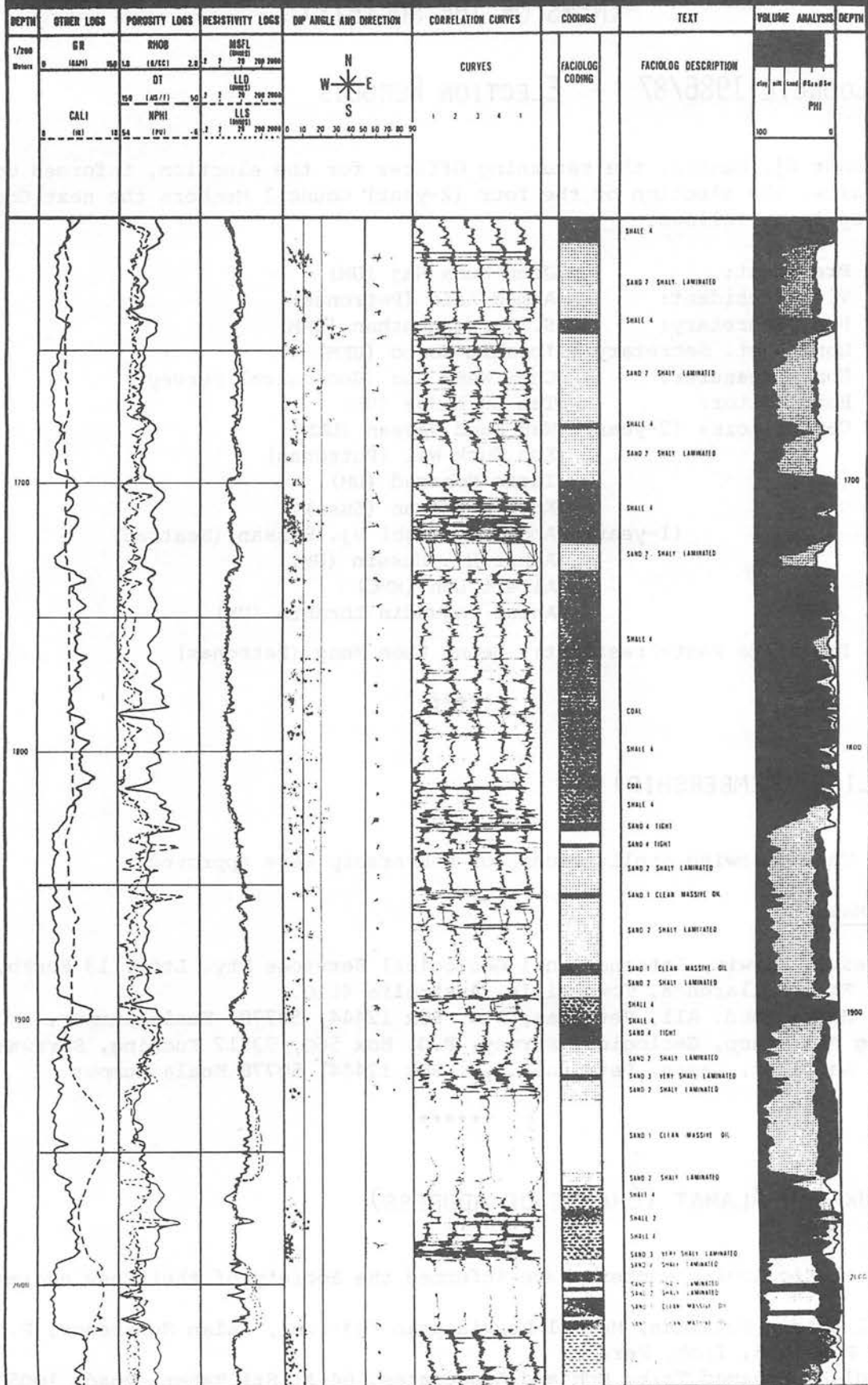
The style of deformation also varied temporally. Erosion of the UIU and Horizon II were both being preceded by open flexural folding and tilting whereas the LIU and SRU were associated with tight folds and reverse or strike slip faulting.

The layer maps demonstrate, despite the local structural complexity, the seaward migration of successive unconformities as the landward basin margin was progressively uplifted. This pattern is familiar from other trench-related/fore-arc basins.

The character of each unconformity depends not only upon the nature of the preceding deformation phase but also upon rates of regional relative sea level change. For instance deformation associated with the Lower Intermediate Unconformity took place during a relative sea level high stand with the result that the unconformity is commonly a non-erosional submarine onlap surface. The Upper Intermediate Unconformity in North Sabah is an erosional surface in most places but was followed by a rapid relative sea level rise resulting in carbonate deposition. The Shallow Regional Unconformity was followed by a slower rate of relative sea level rise and appears to be a shoreface erosion plane over large areas.

In a tectonically active basin the interactions between rates of relative sea level change, rates and timing of structural growth, and changes in the rates of sediment input, control the depositional histories. The interaction of these factors is well illustrated by considering the nature of the five unconformities and intervening deposits in three superficially similar synclines: the Labuan, Prichard and Furious synclines.

FACIOLOG



Wireline logging data is finding wider applications in sedimentology. This began with the study of log curve shapes to identify different depositional sequences. Recent developments have led to the use of logs to identify "electrofacies"—that is, a set of log responses that characterizes a sediment and distinguish it from others. The objective is to associate a certain type of lithofacies defined by core data with a set of log responses so that such a lithofacies can be identified in other wells without core data. This can also be used to guide the choice of interpretation model and in well to well correlations.

BERITA-BERITA PERSATUAN
(NEWS OF THE SOCIETY)

GSM COUNCIL 1986/87 - ELECTION RESULTS

Dr. Azhar Hj. Hussin, the returning Officer for the election, informed Council that after the election of the four (2-year) Council Members the next Council line-up is as follows:-

President:	John Kuna Raj (UM)
Vice President:	Ahmad Said (Petronas)
Hon. Secretary:	S. Paramanathan (UPM)
Hon. Asst. Secretary:	Ibrahim Komoo (UKM)
Hon. Treasurer:	Chow Weng Sum (Geological Survey)
Hon. Editor:	Teh Guan Hoe (UM)
Councillors: (2-year)	Wan Fuad Hassan (UKM)
	Koh Tuck Wai (Petronas)
	Idris Mohamad (UM)
	Khee Kok Kean (Esso)
	(1-year) Abdullah Hasbi Hj. Hassan (Seatrad)
	Azhar Hj. Hussin (UM)
	Albert Loh (MMC)
	Ahmad Tajuddin Ibrahim (UM)

Immediate Past-President: Leong Khee Meng (Petronas)

KEAHLIAN (MEMBERSHIP)

The following applications for membership were approved:

Full Members

Douglas J. Kirwin, International Geological Services Pty. Ltd., 13 Buckby St., Pallarenda, Townsville, Australia 4810.
 Mohd. Hatta Mohd. Ali, Petronas, P.O. Box 12444, 50778 Kuala Lumpur.
 Sulong Ak. Enjop, Geological Survey, P.O. Box 560, 93712 Kuching, Sarawak.
 Mohd. Badri Hj. Hasan, Petronas, P.O. Box 12444, 50778 Kuala Lumpur.

PERTUKARAN ALAMAT (CHANGE OF ADDRESS)

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

Zainol Abidin Sulaiman, Makmal Penyiasatan Kajibumi, Jalan Scrivenor, P.O. Box 1015, Ipoh, Perak.
 Baddrul H. Mohamad Taib, Moh and Associates, 64-A, Sri Bahari Road, 10050 P. Pinang.

Kenneth George Christie, The Analysts Malaysia Sdn. Bhd., 10th Floor Wisma On-Tai, P.O. Box 29, Jalan Ampang, 50450 Kuala Lumpur.
 Adi Suprpto, P.O. Box 49, Newton Post Office, Singapore 9122.
 Tan Yong Phang, Jabatan Geologi, Universiti Kebangsaan Malaysia, 43600, Bangi, Selangor.
 Wilson S. Fontanelli, Rua Mangaloeira, 33 - Jardim Jaguaripe, Piata - Salvador - Bahia (Brazil)
 John Pitts, c/o Harry Stanger Ltd., The Laboratories, Fortune Lane, Elstree WD6 3HQ, Hertfordshire, United Kingdom.
 Eric S.C. Toh, c/o 5 Colwell Crescent, Chatswood West, Sydney 2067, Australia.
 R.F. Goninon, c/o Abu Dhabi Drilling Chemicals and Products Ltd., P.O. Box 6121, Abu Dhabi, United Arab Emirates.

PERTAMBAHAN BARU PERPUSTAKAAN (NEW LIBRARY ADDITIONS)

The following publications were added to the Library:

1. Chronique de la recherche miniere, no. 480, 1985.
2. Memoir of Nanjing Inst. of Geol. & Palaeont. Acad. Sinica, no. 21, 1985.
3. Fossils from the Middle-Upper Jurassic and Lower Cretaceous in Eastern Heilongjiang Province, China 1984.
4. Geophysical Research Bulletin, vol. 23, no. 3, 1985.
5. Contributions from the various organizations of Ministry of Geology and Mineral Resources, Peoples' Republic of China, 1983.
6. Annual Report, Chinese Academy of Geological Sciences, 1982.
7. The University of Kansas, Palaeotological Contributions, Papers 115 & 116, 1985.
8. AAPG Explorer, Oct. & November, 1985.
9. Oklahoma Geological Survey, Bull. 137, 1985.
10. National Library Singapore: adult reference collections, accessions list. Sep. 1985.
11. Institution of Mining & Metallurgy, Bulletin no. 948, 1985.
12. Geological Survey of India News, vol. 16, nos. 1-3, 1985.
13. American Museum Novitates, nos. 2820 & 2822, 1985.
14. The Journal of the Geological Society of Korea, vol. 21, nos. 1-3, 1985.
15. Recovery of NB/TA as by-products of the tin industry in Malaysia by Abdullah Hasbi bin Haji Hassan.
16. Geochemical and radiometric studies in the Khao Khata Khwam granite. Takua Pa, Thailand by Thanawut Sirinawin & W.K. Fletcher.
17. Institution of Mining & Metallurgy, Section A, vol. 94, Oct. 1985.
18. The importance of being small by W.G. Yuill.
19. National Geophysical Research Institute, Hyderabad, Annual Report 1982-83 & 1983-84.
20. Grondboor en Hamer, no. 6 (1984), nos. 1-5, 1985.
21. Indian Geoscience Abstracts 1975, 1984.
22. Commonwealth Science Council, Nov-Dec 1985.
23. Centro de Investigacion Cientifica y Educacion Superior de Ensenada, vol. 7 (1982).

BERITA-BERITA LAIN
(OTHER NEWS)

UNIVERSITY OF MALAYA B.Sc. THESES 1984/85

During the 1984-85 session, given a choice, only 14 out of a class of 31 opted to pursue the usual theses preparation while the rest chose to write a series of project reports on softrock, hardrock and structural geology.

The 14 theses titles are as follows:

1. Geology of Bukit Sagu and Bukit Tenggek, Sagu, Pahang.
- Yong Siew Kee
2. Geology and Geomagnetic Survey between and to the south of Kuala Pilah-Bahau Area, Negeri Sembilan.
- Cheah Boon Huat
3. The General Geology of Suanlamba, Lukau Area, Sandakan, Sabah East Malaysia.
- Chuah Teong Ban
4. Geology of the North Bentong Area, Pahang.
- Ng Kok Mun
5. The Geology of Subis-Ulu Niah Area, Sarawak.
- Lim Heng Gaul
6. Geology of the Kuala Lumpur Area with Emphasis on Geotechnical Aspects of Jalan Ampang Project Site.
- Ahmad Mohd. Jais
7. Stratigraphy, Sedimentology & Structural Geology of the Western Gambang Area, Pahang.
- Md. Saufi Rahiman
8. Geology, Mineralisation and Soil Geochemical studies of the Kroh-Klian Intan Area, Upper Perak.
- Leong Kheng Sun
9. Geology of East Seremban Area with some Engineering Geological Aspects on the Sg. Terip Damsite.
- Chong Kwong Yean
10. The Geology of Mantanoni Islands, Sabah.
- Kok Keng Hung
11. Geology and Mineralisation of the Temoh-Chenderiang Area, Perak.
- Lee Fook Weng
12. The General Geology of the Bahau-Air Hitam-Pertang-Batu Kikir Area, Negeri Sembilan, West Malaysia.
- Subramaniam Krishnan
13. Petrology and Geochemistry of the Granitoids of Gunung Bujang Melaka Area, Perak.
- Arshad Ali
14. The Geology & Petrology of the Pulau Pangkor Granites.
- Huzaidi Hashim

G.H. Teh

ORS AWARDS FOR RESEARCH STUDENTS IN BRITAIN

The Committee of Vice-Chancellors and Principals of the Universities of the United Kingdom (CVCP) will offer some 800 ORS Awards to overseas postgraduate students who, in session 1986-87, are commencing full-time study for a higher degree as registered research students at a university in Britain. The Awards will be offered on a competitive basis, and each Award will cover the difference between the tuition fee for a home postgraduate student and the full cost fee chargeable to an overseas postgraduate student. The only criteria for the Awards are outstanding merit and research potential.

The Awards are made to individuals and not to Academic Institutions. They may be held in any field of study. Subject to the satisfactory progress of the Awardholder, they will be renewed for a second and third year, according to the normal or remaining length of the research course being undertaken.

Applications should be made on a form available from the Registrar of any of the universities.

LIST OF ACADEMIC INSTITUTIONS

UNIVERSITIES

Aberdeen
Aston in Birmingham
Bath
Belfast
Birmingham
Bradford
Bristol
Brunel
Cambridge
City
Dundee
Durham
East Anglia
Edinburgh
Essex
Exeter
Glasgow
Heriot-Watt
Hull
Leeds
Leeds
Kent at Canterbury
Lancaster
Leeds
Leicester
Liverpool
Loughborough
Manchester
University of Manchester Institute of Science & Technology
Newcastle upon Tyne

Nottingham
Open
Oxford
Reading
St Andrews
Sheffield
Sheffield
Southampton
Stirling
Swansea
Surrey
Sussex
Ulster
Warwick
York

Wales:—
Aberystwyth—University College of Wales
Bangor—University College of North Wales
Cardiff—University College
Swansea—University College
University of Wales Institute of Science & Technology
University of Wales College of Medicine
Lampeter—St David's University College

London:—

Blackburn College
Imperial College of Science & Technology
King's College London
London School of Economics & Political Science
Queen Mary College
Royal Holloway & Bedford New College
Royal Veterinary College
School of Oriental & African Studies
School of Pharmacy
University College London
Westfield College
Wye College
Heythrop College

London:—

Charing Cross and Westminster Medical School
London Hospital Medical College
Middlesex Hospital Medical School
Royal Free Hospital School of Medicine
St Bartholomew's Hospital Medical College
St George's Hospital Medical School
St Mary's Hospital Medical School
The United Medical and Dental Schools of Guy's and St Thomas's Hospitals
British Postgraduate Medical Federation
London School of Hygiene & Tropical Medicine
Royal Postgraduate Medical School

OTHER INSTITUTIONS

Cranfield Institute of Technology
London Graduate School of Business Studies
Manchester Business School
Royal College of Art

Courtauld Institute of Art
Institute of Advanced Legal Studies
Institute of Archaeology
Institute of Classical Studies
Institute of Commonwealth Studies
Institute of Education
Institute of Germanic Studies
Institute of Historical Research
Institute of Latin American Studies
British Institute in Paris
School of Slavonic & East European Studies
Institute of United States Studies
Warburg Institute

Printed by Edna Peinters Ltd., Wexford, Hertis.

Prospective applicants should contact British Council Education Counselling Service, Jalan Bukit Aman, P.O. Box 10539, 50916 Kuala Lumpur (telephone 2987555) for details of research facilities available at the universities before making their application.

IGCP PROJECT No. 218

QUATERNARY PROCESSES AND EVENTS IN SOUTHEAST ASIA - MEETING REPORT

The second meeting of the IGCP Project No. 218 "Quaternary Processes

and Events in Southeast Asia" was convened by N. Thiramongkol (Department of Geology, Chulalongkorn University) on 20-21 May 1985, at Chulalongkorn University, Bangkok, Thailand. About 19 participants attended including representatives of the governments of Malaysia, Indonesia, Thailand and from CCOP (Committee for Co-ordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas) and from ESCAP.

The scope of the meeting was to organize the working groups and subprojects and to arrange workshops or symposia in Thailand, Malaysia, Indonesia and the Philippines. In addition the present status of Quaternary research in the region was reviewed.

The meeting opened with a general introduction to the purpose of the project which is to evolve a better understanding of exogenic and endogenic processes and events in Southeast Asia during the Quaternary and to establish stratigraphic correlation of the Quaternary sequences in Southeast Asia. After that a brief outline of Quaternary geology and the present status of Quaternary research in the region were presented by P. Dheeradilok of Thailand, B.K. Tan of Malaysia, HMS. Hartono of Indonesia and J. Okkerman on behalf of the Philippines. In addition the current and future activities of CCOP in Southeast Asia and the Pacific region was also presented by JAM. Ten Cate. The information from this meeting and the first meeting in Kuala Lumpur in 1984 have indicated that a large number of geoscientists both within and outside the Southeast Asian region are currently engaged in a wide range of research activities related to the Quaternary of Southeast Asia.

The meeting agreed that the field covered under Project 218 is very wide and includes all aspects of the Quaternary in Southeast Asia.

Project 218 will also include:

1. Quaternary stratigraphy of S.E. Asia
2. Quaternary economic mineral deposits
3. Applied Quaternary including engineering properties and characteristics of Quaternary deposits, both onshore and offshore
4. Rates of tectonic uplifts
5. Palaeoenvironments
6. Lake deposits

In addition, the studies are related to other IGCP on-going projects such as:

- (a) Siliceous deposits of the Pacific region (Project 115)
- (b) Biostratigraphic datum-planes of the Pacific Neogene (Project 114)
- (c) Sea level changes (Project 200)

A tentative programme over the next four years is as follows:

- (a) 1985, Thailand: Workshop/Training with field trip to a key area (convenors: Drs. N. Thiramongkol and Jon L. Rau)
- (b) 1986, Thailand: Workshop with field trip to a key area (convenor: Dr. N. Thiramongkol)
- (c) 1987, Indonesia: Workshop with field trip to a key area (convenor: Dr. HMS. Hartono)

- (d) 1988, Malaysia: Workshop with field trip and overall review of Project 218 (convenor: Dr. B.K. Tan)

Dr. N. Thiramongkol
 (Project Leader)
 Department of Geology,
 Faculty of Sciences,
 Chulalongkorn University,
 Bangkok 10500,
 Thailand.

AAPG ANNUAL CONVENTION, JUNE 15-18, 1986.

Housing and Advance Registration is now open for the 1986 AAPG Annual Convention, to be held in Atlanta, Georgia, June 15-18, 1986. The theme for the meeting is "New Frontiers in Old Areas". Over 500 papers will be presented in technical sessions. The annual meeting of AAPG's Division - SEPM, EMD and DPA will be held in conjunction with the meeting.

Reservations must be made through AAPG on the official form available from AAPG, P.O. Box 979, Tulsa, Oklahoma 74101, 918-584-2555.

During the meeting, the services of an Employment Interviews Center will be available to facilitate arranging interviews between applicants and potential employers. If you are interested in this service contact: William B. Size, Employment Interviews Chairman, Emory University, Department of Geology, Atlanta, Georgia 30322, telephone 404-727-6491.

The AAPG headquarters hotel will be the Atlanta Hilton, and the SEPM headquarters will be the Atlanta Marriott Marquis. Technical sessions, exhibits, and our headquarters office will be at the Georgia World Congress Center.

If you need additional information about the convention, please contact the AAPG Headquarters, P.O. Box 979, Tulsa, Oklahoma 74101, telephone 918-584-2555.

TECHNIQUES OF HYDROLOGIC INVESTIGATIONS FOR INTERNATIONAL PARTICIPANTS

U.S. Geological Survey, Water Resources Division - Branch of International Hydrology.
 1986 International Training Course

The U.S. Geological Survey (USGS), Water Resources Division, Branch of International Hydrology, is pleased to announce the 1986 course "Techniques of Hydrologic Investigations for International Participants".

Date: June 11 through August 22, 1986. (Ten weeks)

Locations: Orientation - USGS National Center, Reston, Virginia.
 Class and Field Instruction - USGS National Training Center,
 Denver, Colorado.
 On-The-Job-Training - Throughout the United States.

Cost: \$7,600 U.S. dollars per participant.

Language of Instruction: English (no interpreters will be provided).

Application Deadline: April 30, 1986. Applications must include the following attached documents:

1. Curriculum Vitae
2. Personal data for on-the-job training
3. Waiver of Claim for Reimbursement
4. Official Request for Training Form
5. Medical Expense Form

Contact: Branch of International Hydrology
 Water Resources Division,
 U.S. Geological Survey,
 470 National Center,
 Reston, Virginia 22092.

Telex No.. 89-9153

Purpose

The purpose of this training is to provide international hydrologists with the opportunity to learn the techniques and methods of data collection and analysis used by the USGS for hydrologic investigations. Participating hydrologists are expected to adapt these techniques and methods to their own particular needs and to share their new knowledge and insights with their colleagues.

Organization of the Course

The course will begin with orientation at the USGA National Center in Reston, Virginia, June 11 through 13, 1986, and continue on June 16, 1986, at the USGS National Training Center in Denver, Colorado. On August 11, the students will begin two weeks of on the job training at various locations.

For Further Information

Early application is encouraged due to the limited number of spaces available.

Requests for information and applications should be submitted by the national government or by an international organization (not by personal request) to:

Branch of International Hydrology,
 Water Resources Division,
 U.S. Geological Survey
 470 National Center,
 Reston, Virginia 22092 USA.

Telex inquiries may be addressed to government telex number 89-9153 in Reston, Virginia.

INTERNATIONAL REMOTE SENSING WORKSHOP

Eros Data Center, Sioux Falls, South Dakota.
September-October, 1986.

In response to continuing interest in the use of remote sensing technology for natural resources inventory and assessment, the U.S. Geological Survey offers a program of training workshops for non-U.S. scientists, engineers, and resource managers. Since 1973, more than 625 scientists representing more than 80 countries have participated in these workshops.

In 1986 this program will include:

The 25th International Workshop in Remote Sensing: Fundamentals of Applications and Analysis Techniques, September 2 - October 3, 1986, Sioux Falls, South Dakota.

International Workshop: Objectives and Program

The workshop is designed to familiarize the participant with the data characteristics and applications of a variety of remote sensing systems, as well as to provide experience in analyzing and interpreting remotely sensed data to produce information useful in resource management and planning. Emphasis is placed on the analysis of Landsat data, although attention is also given to the interpretation of aerial photographs. The workshop concentrates on discipline applications of remotely sensed data and will include both manual and introductory digital data analysis. The program consists of a combination of classroom lectures, workshop exercises, homework, and field work. Limited demonstrations will be given on computer-driven analysis equipment.

Procedure for Application

Candidates sponsored by a university, private company, or a non-national government entity must submit their applications through their national government agency. All applications should be sent to:

Training Section, Office of International Geology
U.S. Geological Survey
National Center (917)
Reston, Virginia 22092
U.S.A.

Schedule pertinent to the workshop series:

- June 20, 1986 - Deadline for receipt of application for the workshop.
- June 30, 1986 - Notification by USGS to those selected for the workshop.

- September 2, 1986 - Twenty-fifth International Workshop begins in Sioux Falls, South Dakota. \$3,000 tuition for International Workshop tuition due.
- October 3, 1986 - Workshop concludes.

THE ENVIRONMENTAL EFFECTS OF MINING AND RESTORATION

A one-day meeting entitled 'The environmental effects of mining and restoration' will be held on 23 September, 1986, at the University of Manchester Institute of Science and Technology, Manchester, England. Jointly organized by The Institution of Mining and Metallurgy, The Royal Institution of Chartered Surveyors and the Mineral Industry Research Organisation (MIRO), the meeting will take the form of a state-of-the-art review of the 1981 minerals planning legislation. Topics to be covered at the meeting include ecology, landscape architecture, planning and pollution control, industrial considerations and landfill.

Full details of the meeting and the proposed technical visits will be given in the Conference Circular/Registration Form, available in February/March, 1986, from The Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, England (telephone: 01-580 3802, telex: 261410 IMM G)

DRILLEX 87 - AN INTERNATIONAL EXHIBITION AND CONFERENCE ON DRILLING FOR THE MINERALS INDUSTRY AND GEOTECHNICAL ENGINEERING

7-10 April 1987

'Drillex '87' organized by the Institution of Mining and Metallurgy and the British Drilling Association, with the cooperation of the British Geotechnical Society, the Geological Society Engineering Group, the Institution of Geologists, the Institution of Mining Engineers and the Institution of Mining and Metallurgy Midlands Section, will be held at the National Agricultural Centre, Stoneleigh, Warwickshire, England, from 7 to 10 April, 1987.

Theme and Papers

The theme of the conference is 'Drilling - the minerals industry and geotechnical engineering' (metalliferous and industrial minerals, coal and water).

Papers are being invited for presentation at the conference under session headings that include 'Drilling equipment - recent and future developments', 'Drilling techniques', 'Planning and implementation of drilling programmes, including environmental considerations', 'Exploration drilling case histories', 'In-the-hole equipment and methods' and 'Geological requirements from drilling'. Intending authors are requested to submit abstracts of their proposed papers (250-350 words) for consideration by the

Organizing Committee. Abstracts should be sent to:

The Conference Office,
The Institution of Mining and Metallurgy,
44 Portland Place,
London W1N 4BR,
England.

before 10 April, 1986.

The completed manuscripts of selected papers will be required by mid-October, 1986; those which are accepted for presentation at the technical sessions will be published in the volume of papers, *Driller '87*, which will be distributed to registrants in March, 1987.

Requests for further information should be addressed to the organizers:

CONFERENCE

The Institution of Mining and Metallurgy,
44 Portland Place,
London W1N 4BR,
England.

(Telephone: 01-580 3802; telex: 261410)

REMOTE SENSING AND ITS APPLICATION TO VARIOUS THEMES SUCH AS WATER RESOURCES, MINERAL RESOURCES, TERRAIN EVALUATION AND LANDUSE PLANNING.

21st July 1986 to 27th February 1987 (32 weeks duration)

Organised by: Centre of Studies in Resources Engineering, I.I.T., Bombay-400 076.

Objectives of the Course

To train middle level in service engineers and scientists in the area of fundamentals of satellite remote sensing and its application to themes such as water resources, mineral resources, terrain evaluation and landuse planning.

Duration

32 weeks - 21st July 1986 to 27th Feb. 1987.

- (a) with 9 weeks teaching followed by 1 week educational tour and 1 week break.
- (b) Next 9 weeks teaching 1 week educational tour and 1 week break.
- (c) 2 weeks teaching, 2 weeks field work, 2 weeks audio visual session and discussions and 3 weeks project report writing. Last week evaluation - certification.

Intended for

The course is designed for persons working in the area of remote sensing. Candidates possessing degree in engineering or equivalent qualifications or degree in science, with electives, physics or mathematics or chemistry or geology or forestry or agriculture/soil science or diploma in engineering with experience in Remote sensing will be eligible. Candidates sponsored by the Institute/Agency/Department are preferred.

No. of Participants

Maximum of 30 participants
 10 each in (i) Water resources,
 (ii) Mineral Exploration,
 (iii) Terrain evaluation and Landuse Planning.

Fee

Fees Rs. 2,000/- per participant. The expenses towards extra computer time hire charges, educational tour expenses, expenses related to project report writing, field trip and evaluation will have to be borne by the participants.

Accommodation

Participants will be provided rooms in student's hostel. The charges for lodging and boarding will be as per the rules of hostels of IIT - Bombay and have to be met by the participants.

Enrolment

The applications will be scrutinised by a committee and only 10 trainees in each of the discipline (i.e.) Water Resources, Mineral Exploration and Terrain Evaluation and Landuse Planning will be selected. The Selection Committee's decision will be final. Last date for receipt of application 30th April 1986.

All correspondence related to this course should be addressed to:

Dr. T.V. Pavate,
 Chief Project Engineer,
 Training, Extension and Project Cell,
 R.S.D. No. VI, C.S.R.E., IIT,
 Bombay - 400 076.

EMPLOYMENT CORNER

The Society is running this section specially for members and their colleagues who are in need of employment. Please write in to the Editor or Hon. Secretary giving us an idea of the job you seek, a brief curriculum vitae or any special request.

Prospective employers are also invited to advertise (free-of-charge) in this section in our Warta Geologi.

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

March 1986 - April 1986

MINERAL EXPLORATION (Paris, France). Short course based on a simulation method organized annually by the Ecole Nationale Supérieure des Mines and sponsored by Unesco. Language: French. For Information: Prof. H. Pelissonnier, Ecole des Mines, 60 Bd Saint Michel, 75272 Paris, Cedex 06, France.

March 1986 - April 1986

STRUCTURAL GEOLOGY (Dehra Dun, India). Regional training course organized by Wadia Institute of Himalayan Geology and sponsored by Unesco. For Information: Dr. V.C. Thakur, Wadia Institute of Himalayan Geology, Dehra Dun - 248001, India.

March 1986 - November 1986

PHOTOINTERPRETATION APPLIED TO GEOLOGY AND GEOTECHNICS (Bogota, Colombia). Diploma course organized by the Centro Interamericano por Fotointerpretacion (CIAF) in cooperation with ITC and Unesco. Language: Spanish. For Information: Academic Secretariat of the CIAF, Apartado Aereo 53754, Bogota 2, Colombia.

April 1986 - July 1986

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

May 1986 - June 1986

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

May 1986 - June 1986

BASE MAPPING TECHNIQUES (Washington, D.C., U.S.A.). A training course organized by the U.S. Geological Survey for foreign participants in the preparation, publication, and use of base maps. For Information: U.S. Geological Survey, Training Section, National Center (917), Reston, Virginia 22092, U.S.A.

June 1986 - August 1986

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, Virginia 22092, U.S.A.

July 1986 - August 1986

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

July 1986 - September 1986

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

August 1986 - June 1988

SOIL SCIENCE AND WATER MANAGEMENT (Wageningen, The Netherlands). Two-year M.Sc. course designed for B.Sc. graduates from developing countries. Language: English. For Information: Director of Studies of the M.Sc. course in Soil Science and Water Management, P.O. Box 37, 6700 AA Wageningen, The Netherlands.

September 1986 - October 1986

REMOTE SENSING FUNDAMENTALS OF APPLICATIONS AND ANALYSIS TECHNIQUES, 25th International Workshop. (Sioux Falls, South Dakota, U.S.A.). Program of training workshops organized by the U.S. Geological Survey for non-U.S. scientists, engineers, and resources managers. For Information: Training Section, Office of International Geology, U.S. Geological Survey, National Center (917), Reston, VA 22092, U.S.A.

September 1986 - October 1986

GEOLOGIC AND HYDROLOGIC HAZARDS (Denver, Colorado, U.S.A.). A training program organized by the U.S. Geological Survey for international participants from disaster-prone countries. For Information: U.S. Geological Survey, Training Section, 917 National Center, Reston, Virginia 22092, U.S.A.

September 1986 - November 1986

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

September 1986 - November 1986

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

September 1986 - November 1986

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

September 1986 - June 1987

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

September 1986 - August 1987

MINING EXPLORATION AND EXPLORATION GEOPHYSICS (Delft, The Netherlands). Annual diploma courses organized by the International Institute for Aerial Survey and Earth Sciences and sponsored by Unesco. Language: English. For Information: ITC (ME), 3, Kanaalweg, 2628 Delft, The Netherlands.

October 1986 - November 1986

TECTONICS, SEISMOLOGY AND SEISMIC RISK ASSESSMENTS (Potsdam, East Germany). One-month training course organized annually by East German Academy of Sciences in collaboration with Unesco. Language: English. For Information: Prof. Dr. H. Kautzleben, Director, Central Earth's Physics Institute, Academy of Sciences of the German Democratic Republic, Telegraphenberg, DDR 1500 Postdam, German Democratic Republic.

October 1986 - July 1987

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

October 1986 - September 1987

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

October 1986 - September 1987

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

October 1986 - September 1987

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

November 1986 - December 1986

REMOTE SENSING APPLICATIONS COURSE FOR EARTH SCIENCES (Enschede, The Netherlands). Annual course organized by International Institute for Aerial Survey and Earth Sciences and sponsored by Unesco. Language: English. For Information: ITC Student Registration Office, P.O. Box 6, 7500 AA Enschede, The Netherlands.

November 1986 - December 1986

SMALL MINE POTENTIAL AND TECHNOLOGY (Leoben, Austria). Annual training course sponsored by Austria and Unesco. Language: English. For Information: Prof. Wolfbauer, Forschungsgesellschaft Joanneum, Roseggerstrasse 15, A-8700 Leoben, Austria.

November 1986 for two 11-month sessions

ENGINEERING GEOLOGY (Delft, The Netherlands). New post-graduate diploma course leading to M.Sc. degree in Engineering Geology. For Information: ITC Student Registration Office, P.O. Box 6, 7500 AA Enschede, The Netherlands.

December 1986 - January 1987

METHODS AND TECHNIQUES IN EXPLORATION GEOPHYSICS (Hyderabad, India). Diploma course organized annually 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.

January 1987 - April 1987

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

May 1987 - November 1987

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

August 1987 - October 1987

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

September 1987 - October 1987

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

KALENDAR (CALENDAR)

1986

April 2 - 5, 1986

GEOCHEMISTRY AND MINERALIZATION OF PROTEROZOIC VOLCANIC SUITES (International Symposium), Keyworth, Nottingham, U.K. Co-sponsored by IGCP Project 217 and ILP Working Group 3. (Dr. Tim Pharaoh, Deep Geology Research Group, British Geological Survey, Keyworth, Nottingham NG12 5GG, U.K.)

April 7 - 12, 1986

CONTINENTAL LITHOSPHERE - STRUCTURE, COMPOSITION AND PROCESSES (Symposium), Karlsruhe, F.R.G. Sponsored by ICL (H. Wilhelm, Geophysikalisches Institut, Universitaet Karlsruhe 21, F.R.G.)

April 8 - 11, 1986

COAL AND COAL-BEARING STRATA (International Symposium), London, U.K. (A.C. Scott, Department of Geology, Chelsea College, 552 King's Road, London SW10 0UA, U.K.)

April 9 - 11, 1986

COMPARISON OF URBAN DRAINAGE MODELS WITH REAL CATCHMENTS (IAHR/IAWPRC International Conference), Dubrovnik, Yugoslavia. (Dr. C. Maksimovic, Institute of Hydraulic Engineering, University of Belgrade, Belgrade, Yugoslavia)

April 12 - 15, 1986

CRETACEOUS-EOCENE TETHYAN PHOSPHORITES (Field Workshop and Special Session), Baghdad, Iraq. In conjunction with 7th Iraqi Geological Congress and IGCP 156. (The Secretary, Phosphorites, P.O. Box 3092 Saadoon, Baghdad, Iraq)

April 14 - 19, 1986

ENGINEERING GEOLOGY: PROBLEMS IN SEISMIC AREAS (IAEG International Symposium), Bari, Italy. (Prof. G. Melidoro, Istituto di Geologia Applicata e Geotecnica, Via Re David 200, 70125 Bari, Italy)

April 15 - 17, 1986

MICROBIAL PROBLEMS IN THE OFFSHORE OIL INDUSTRY (International Conference), Aberdeen, Scotland, U.K. (Conference Officer, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR, U.K.)

April 16 - 19, 1986

BOUNDARIES AND PALYNOLOGY (Meeting), Sheffield, U.K. (Dr. E.G. Spinner, Department of Geology, University of Sheffield, Mappin Street, Sheffield S1 3JD, U.K.)

April 17 - 19, 1986

EXPERIMENTAL MINERALOGY AND GEOCHEMISTRY: APPLICATIONS TO PETROLOGY AND ORE DEPOSITS (Meeting), Nancy, France. (A. Weisbrod, E.N.S.G., B.P. 452, 54001 Nancy Cedex, France)

April 21 - 24, 1986

ENVIRONMENTAL GEOTECHNOLOGY (International Symposium), Allentown, Penn., U.S.A. (Prof. H.Y. Fang, Symposium Chairman, Geotechnical Engineering Division, Department of Civil Engineering, Lehigh University 13, Bethlehem, PA 18015, U.S.A.)

April 21 - 25, 1986

GLOBAL CHANGE IN AFRICA DURING QUATERNARY, PAST - PRESENT - FUTURE (International Symposium), Dakar, Senegal. Sponsored by INQUA, GSA, AGID, IUGS, IGCP, ILP. Languages: English and French. (INQUA/1986 Dakar Symposium Secretariat, Laboratoire de Geologie du Quaternaire, Faculte des Sciences, LUMINY, Case 907, 13288 Marseille Cedex 9, France)

April 24 - 27, 1986

INDUSTRIAL MINERALS (7th International Congress), Athens, Greece. (G.M. Clarke, Editor, Industrial Minerals, 16 Lower Marsh, London SE1, U.K.)

May 6 - 9, 1986

GEOLOGICAL MAPPING IN THE SERVICE OF ENVIRONMENTAL PLANNING (International Symposium), Trondheim, Norway. Co-sponsored by CGMW. (SC-MEG Secretary Fredrik Chr. Wolff, Geological Survey of Norway, Box 3006, N-7001 Trondheim, Norway)

May 7 - 8, 1986

GONDWANA AND TETHYS (Lyell Meeting, Geological Society), London, U.K. (A. Hallam, Department of Geological Sciences, University of Birmingham, P.O. Box 363, Edgbaston, Birmingham B15 2TT, U.K.)

May 11 - 16, 1986

GROUNDWATER SYSTEMS UNDER STRESS (International Conference), Brisbane, Queensland, Australia. (Conference Manager, Groundwater System Under Stress, Uni Quest Conference Systems, University of Queensland, St. Lucia, Queensland 4067, Australia)

May 11 - 16, 1986

MINING AND METALLURGICAL INSTITUTIONS (13th Congress), Canberra, Australia. (Council of Mining and Metallurgical Institutions, c/o The Australian Institute of Mining and Metallurgy, P.O. Box 310, Carlton South, Victoria, Australia 3053)

May 12 - 14, 1986

GEOEXPO-86 (Symposium), Vancouver, B.C., Canada. Co-sponsored by AEG and GAC. (GEOEXPO-86 Regional Symposium, Association of Exploration Geochemists, 700-409 Granville Street, Vancouver, B.C., Canada V6C 1T8)

May 17 - 19, 1986

SEDIMENT-HOSTED STRATIFORM COPPER DEPOSITS (International Symposium), Ottawa, Ontario, Canada. Sponsored by GAC/MAC. (Prof. A.J. Naldrett, Department of Geology, University of Toronto, Toronto, Ontario, Canada M5S 1A1)

- May 17 - 21, 1986
REEFAL DEVELOPMENT IN A TERRIGENOUS PROVINCE (GSA Penrose Conference), Veracruz, Mexico. (Paul R. Krutak, Arco Exploration Company, P.O. Box 51408, Lafayette, LA 70505, U.S.A.).
- May 19 - 21, 1986
GEOLOGICAL, MINERALOGICAL ASSOCIATIONS OF CANADA (Joint Annual Meeting with Canadian Geophysical Union), Ottawa, Ontario, Canada. (Dr. J.A. Donaldson, Department of Geology, Carleton University, Ottawa, Ontario, Canada K1S 5B6)
- May 19 - 23, 1986
AMERICAN GEOPHYSICAL UNION (Spring Meeting), Baltimore, Maryland, U.S.A. (AGU Meetings, 2000 Florida Avenue NW, Washington, DC 20009, U.S.A.)
- May 20 - 21, 1986
DESERT SEDIMENTS: ANCIENT AND MODERN (Meeting), London, U.K. (Carolyn Symonds, The Geological Society, Burlington House, Piccadilly, London W1, U.K.)
- May 20 - 27, 1986
SEISMIC ANISOTROPY (2nd International Workshop), Puschyno, U.S.S.R. Co-sponsored by IASPEI. (A.G. Bugayevsky, Soviet Geophysical Committee, Molodeznaya 3, Moscow 117296, U.S.S.R.)
- May 21 - 24, 1986
STABLE ISOTOPES IN LACUSTRINE SEDIMENTS (IGCP-219 Workshop), Krakow, Poland. (Dr. St. Leszczynski, Institute of Geological Sciences, Jagellonian University, Oleandry 2a, 30-063 Krakow, Poland)
- May 22 - 26, 1986
SHEAR CRITERIA IN BRITTLE AND DUCTILE ROCK (International Workshop), Rennes, France. (D. Gapais, CAESS, Universite de Rennes, Campus de Beaulieu, 35042 Rennes Cedex, France)
- May 23 - 25, 1986
INTERNATIONAL ASSOCIATION OF SEDIMENTOLOGISTS (7th Regional Meeting), Krakow, Poland. (Dr. St. Leszczynski, Institute of Geological Sciences, Jagellonian University, Oleandry 2A, 30-063 Krakow, Poland)
- June 1986
METALLOGENY OF OPHIOLITES (IGCP-197 Meeting), Athens, Greece. Languages: Greek and English. (Institute of Geology & Mineral Exploration, 70 Messoghion Street, 115 27 Athens, Greece)
- June 1 - 6, 1986
GEOSCIENCE INFORMATION (3rd International Conference), Adelaide, South Australia. (Conference Secretariat 31CGI, c/o Australian Mineral Foundation, Private Bag 97, Glenside, South Australia, 5065, Australia)
- June 2 - 4, 1986
CANADIAN SOCIETY OF PETROLEUM GEOLOGISTS (Annual Convention), Calgary, Alberta, Canada. (H.J. Sullivan, Amoco Canada Petroleum, 444 - 7th Avenue SW, Calgary, Alberta, Canada T2P 0Y2)
- June 2 - 5, 1986
DINOSAUR SYSTEMATICS (Symposium), Drumheller, Alberta, Canada. (Kenneth Carpenter, Academy of Natural Sciences, 19th and the Parkway, Philadelphia, PA 19103, U.S.A.)
- June 3 - 6, 1986
EUROPEAN ASSOCIATION OF EXPLORATION GEOPHYSICISTS (Meeting), Ostend, Belgium. (E. van der Gaag, European Association of Exploration Geophysicists, P.O. Box 162, NL-2501 AN The Hague, The Netherlands)
- June 8 - 13, 1986
MIGMATITES AND CRUSTAL MELTING (GSA Penrose Conference), Amherst, Massachusetts, U.S.A. (R.J. Tracy, Department of Geology and Geophysics, Yale University, New Haven, CT 06511, U.S.A.)
- June 15 - 18, 1986
AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (Annual Convention), Atlanta, Georgia, U.S.A. (Howard Cramer, Emory University, Department of Geology, Atlanta, GA 30322, U.S.A.)
- June 16 - 21, 1986
CLIMATIC FLUCTUATIONS DURING THE QUATERNARY IN THE WESTERN MEDITERRANEAN REGIONS (Symposium), Madrid, Spain. Languages: Spanish, French and English. (Prof. F. Lopez-Vera, Dpto. De Geologia y Geoquimica, Universidad Autonoma, 28049 Madrid, Spain)
- June 22 - 26, 1986
HYDROGEOLOGY (3rd Annual Canadian/American Conference), Banff, Alberta, Canada. (Canadian/American Conferences on Hydrogeology, Brian Hitchon, Alberta Resrarch Council, 4445 Calgary Trail South, Edmonton, Alberta, Canada T6H 5R7)
- June 23 - 26, 1986
ARENACEOUS FORAMINIFERA (2nd Workshop), Vienna, Austria. (Dr. Fred Rogl, Naturhistorisches Museum, Burgring 7, A-1014 Vienna, Austria)
- June 30 - July 2, 1986
CORRELATION AND RESOURCE EVALUATION OF TIN/TUNGSTEN GRANITES SOUTH-EAST ASIA AND THE WESTERN PACIFIC REGION (Meeting), Canberra, ACT, Australia. Sponsored by IGCP Project 220. (Dr. N.C. Higgins, Organizing Secretary, Bureau of Mineral Resources, P.O. Box 378, Canberra, ACT 2601, Australia)
- June 30 - July 4, 1986
GEOCHRONOLOGY, COSMOCHRONOLOGY AND ISOTOPE GEOLOGY (6th International Conference), Cambridge, U.K. Sponsored by IAVCEI. (Organizing Committee, 6th International Conference, Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge CB2 3EQ, U.K.)

- June 30 - July 12, 1986
COSPAR (26th Plenary Meeting), Toulouse, France. Includes a Symposium co-sponsored by IUGS. (Z. Niemirowicz, COSPAR Secretariat, 5, boulevard de Montmorency, 75016 Paris, France)
- July 2, 1986
TIME SCALE CALIBRATION (4th Annual Meeting of IGCP Project 196), Cambridge, U.K. Co-sponsored by IUGS. To be held during 6th International Conference on Geochronology. (Organizing Committee, 6th ICOG, Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge CB2 3EQ, U.K.)
- July 2 - 10, 1986
INTERNATIONAL ASSOCIATION OF HYDROLOGICAL SCIENCES (2nd General Assembly), Budapest, Hungary. Languages: English and French. (Dr. A. Szollosi-Nagy, VITUKI, H-1453, Budapest, Pf27, Hungary)
- July 4 - 12, 1986
PERMIAN AND PERMO-TRIASSIC BOUNDARY IN THE WESTERN TETHYAN REALM (Meeting and Field Trip), northern Italy and northern Yugoslavia. Co-sponsored by IGCP Project 203. (G. Cassinis, Dipartimento di Scienze della Terra, Sezione geologico-paleontologica, Università degli Studi, Strada Nuova 65, Pavia 27100, Italy)
- July 7 - 11, 1986
GEOCONGRESS '86 (GSSA 21st Biennial Congress), Johannesburg, South Africa. Co-sponsored by IUGS. (The Symposium Secretariat, S. 339, CSIR, P.O. Box 395, Pretoria, South Africa 0001)
- July 7 - 14, 1986
SEA-LEVEL CHANGES AND QUATERNARY SHORELINES (International Symposium and Field Conference), Sao Paulo, Brazil. Co-sponsored by INQUA Shorelines Commission, IGCP Projects 200 and 201, and AGEQUA. (Prof. K. Suguio, Inst. de Geociencias, Univ. de Sao Paulo, C.P. 20899, Sao Paulo, Brazil)
- July 13 - 18, 1986
INTERNATIONAL MINERALOGICAL ASSOCIATION (General Meeting), Stanford, Calif., U.S.A. (Prof. C.T. Prewitt, Department of Earth and Space Sciences, State University of New York, Stony Brook, NY 11794, U.S.A.)
- July 13 - 19, 1986
PROTEROZOIC GEOCHEMISTRY (International Field Conference), Central Colorado, U.S.A. (K.C. Condie, Department of Geoscience, New Mexico Institute of Mining and Technology, Socorro, NM 87801, U.S.A.)
- July 14 - 17, 1986
THE COMPUTER HANDLING AND DISSEMINATION OF DATA: Numerical Data Processing and Dissemination in the Geosciences (Part of 10th International CODATA Conference), Ottawa, Canada. (Mrs. Lois Baignee, Conference Services, National Research Council of Canada, Montreal Road, Ottawa, Ontario, Canada K1A 0R6)
- July 15 - 17, 1986
DEEP SEISMIC REFLECTION PROFILING OF THE CONTINENTAL LITHOSPHERE (Meeting), Cambridge, U.K. (BIRPS, Bullard Labs, Magingley Road, Cambridge, CB3 0EZ, U.K.)
- July 21 - 25, 1986
THE ORIGIN OF LIFE (5th ISSOL Meeting and 8th International Conference), Berkeley, California, U.S.A. (Dr. S. Chang, Ames Research Center, Moffett Field, CA 94035, U.S.A.)
- August/September 1986
LANDSCAPES OF THE SOUTHERN HEMISPHERE (International Conference), Adelaide, Australia. (Prof. Jon Firman, S.A. Department of Mines and Energy, P.O. Box 151, Eastwood, S.A. 5063, Australia)
- August 1 - 7, 1986
SPELEOLOGY (9th International Congress), Barcelona, Spain. Languages: English and French. (General Secretary of the Congress, P.O. Box 343, E-08080 Barcelona, Spain)
- August 3 - 9, 1986
NATURAL AND MAN-MADE HAZARDS (international Symposium), Quebec, Canada. Sponsored by the Tsunami Society. (Mohammed El-Sabh, Department of Oceanography, University of Quebec at Rimouski, 310 Avenue des Ursulines, Rimouski, Quebec, Canada G5L 3A1)
- August 4 - 6, 1986
SPOROGENESIS IN ARCHEGONIATES (Meeting), Stockholm, Sweden. (Dr. E. Scheffield, Department of Botany, University of Manchester, Manchester M13 9PL, U.K.)
- August 4 - 7, 1986
INTERMONTANE BASINS (IAS Symposium), Chiang Mai, Thailand. (T. Thanasuthipitak, Department of Geological Science, Chiang Mai University, Chiang Mai 50002, Thailand)
- August 4 - 8, 1986
DRAINAGE BASIN SEDIMENT DELIVERY (International Symposium), Albuquerque, New Mexico, U.S.A. (R.F. Hadley, Secretary ICCE, c/o Department of Geography, University of Denver, Denver, CO 80208-0183, U.S.A.)
- August 4 - 8, 1986
HUMIC SUBSTANCES SOCIETY (3rd Annual Meeting), Oslo, Norway. (E. Gjessing, Norwegian Institute for Water Research, P.O. Box 333, Blindern Oslo 3, Norway; or W.L. Campbell, IHSS Standards & Reference Committee, 5293 Ward Road, Arvada, CO 80002, U.S.A.)
- August 4 - 11, 1986
PROCESSES IN THE DEEP ARCHEAN CRUST (Field Workshop), Northern Manitoba, Canada. (Archean Crust Field Workshop, Lunar and Planetary Institute, 3303 NASA Road 1, Houston TX 77052, U.S.A.)
- August 8 - 17, 1986
WATER-ROCK INTERACTION (5th International Symposium), Reykjavik, Iceland. Sponsored by IAGC. (Dr. Haldor Armannsson, Orkustofnun - The National Energy Authority, Grensasvegur 9, 108 Reykjavik, Iceland)

- August 10 - 14, 1986
HEAT FLOW STUDIES IN SOUTH AMERICA (Meeting), Sao Paulo, Brazil. Sponsored by International Heat Flow Commission. (Dr. V. Hamza, Inst. Astronomico e Geofisico, Univ. de Sao Paulo, CP 30.627, Sao Paulo, Brazil)
- August 10 - 15, 1986
MAGMATISM OF EXTENSIONAL REGIONS (International Congress), Lubumbashi, Zaire. Co-sponsored by IGCP Project 227. (Prof. A.B. Kampunzu, Laboratoire de Petrologie, Universite de Lubumbashi--B.P. 1825, Lubumbashi, Zaire)
- August 11 - 14, 1986
ENERGY RESOURCES IN ASIA (International Conference), Hong Kong. Language: English. (The Co-ordinator, AEMP, Asian Research Service, G.P.O. Box 2232, Hong Kong)
- August 11 - 15, 1986
KIMBERLITE (4th International Conference), Perth, Western Australia. (Dr. A.F. Trendall, Geological Survey of Western Australia, 66 Adelaide Terrace, Perth, W.A., Australia)
- August 12 - 15, 1986
NAPC IV (North American Palaeontological Convention), Boulder, Colorado, U.S.A. (Erle G. Kauffman, The Organizing Committee, NAPC IV, Department of Geological Sciences, University of Colorado, CB 250, Boulder, CO 80309, U.S.A.)
- August 13 - 15, 1986
BASINS OF EASTERN CANADA AND WORLD-WIDE ANALOGUES (Symposium), Halifax, Canada. Co-sponsored by Atlantic Geoscience Society, CSPG, and ICL. (C. Beaumont, Oceanography Department, Dalhousie University, Halifax, Nova Scotia, Canada B3H 4J1)
- August 13 - 20, 1986
SOIL SCIENCE (13th ISSS International Congress), Hamburg, F.R.G. (Prof. Dr. K.H. Hartge, Inst. fur Bodenkunde, Univ. Hannover, Herrenhaserstrasse 2, D-3000 Hannover 21, F.R.G.)
- August 15 - 16, 1986
QUATERNARY SEA LEVELS OF AUSTRALIA (Meeting), Warrnambool, Victoria, Australia. Sponsored by IGCP-200 and INQUA. (Associate Prof. D. Hopley, Department of Geography, James Cook University, Townsville, Queensland, Australia)
- August 17 - 22, 1986
CIRCUM-PACIFIC ENERGY AND MINERAL RESOURCES (4th Conference), Singapore. (Circum-Pacific Conference IV, c/o AAPG, P.O. Box 979, Tulsa, OK 74101, U.S.A.)
- August 18 - 22, 1986
INTERNATIONAL ASSOCIATION ON THE GENESIS OF ORE DEPOSITS (7th Symposium), Lulea, Sweden. (Centek Conference, S-951 87 Lulea, Sweden)
- August 21 - 30, 1986
EUROPEAN GEOPHYSICAL SOCIETY/EUROPEAN SEISMOLOGICAL COMMISSION (Joint Meeting), Kiel, F.R.G. (Prof. R. Meissner, Institut fur Geophysik, Christian-Albrechts-Universitat, Olshausenstrasse 40, D-2300 Kiel 1, F.R.G.)
- August 24 - 30, 1986
SHALLOW TETHYS (International Symposium), Wagga Wagga, Australia. Sponsored by IPA. (K.G. McKenzie, School of Applied Science, Riverina C.A.E., P.O. Box 588, Wagga Wagga, N.S.W. 2650, Australia)
- August 24 - 30, 1986
SEDIMENTS DOWN-UNDER (12th International Sedimentological Congress), Canberra, Australia. Sponsored by IAS. (12th International Sedimentological Congress, ACTS, GPO Box 1929, Canberra ACT 2601, Australia)
- August 25 - 28, 1986
LARGE ROCK CAVERNS (meeting), Helsinki, Finland. (Dr. K. Saari, Technical Research Centre of Finland, Lehtisaarentie 2, SF-00340 Helsinki, Finland)
- August 25 - 29, 1986
REMOTE SENSING FOR RESOURCES DEVELOPMENT AND ENVIRONMENTAL MANAGEMENT (International Symposium), Enschede, The Netherlands. (Secretariat Symposium Commission VII, ISPRS, c/o ITC, P.O. Box 6, 7500 AA Enschede, The Netherlands)
- August 25 - 30, 1986
FIGURE AND DYNAMICS OF THE EARTH, MOON AND PLANETS (International Symposium), Prague, Czechoslovakia. (Dr. P. Holota, Research Institute of Geodesy, Topography and Cartography, T. Politických veznu 12, Praha 1, Czechoslovakia)
- September 1 - 3, 1986
ROCK STRESS AND ROCK STRESS MEASUREMENTS (International Conference), Stockholm, Sweden. Languages: English, German, and French. (Centek Conference, Lulea University, S-951 87 Lulea, Sweden)
- September 4 - 10, 1986
GEOMECHANICS (International Symposium), Beijing, P.R. China. (Secretariat of International Symposium on Geomechanics, c/o Institute of Geomechanics, Chinese Academy of Geological Sciences, Fahuasi, Xijiao, Beijing, P.R. China)
- September 6 - 13, 1986
MAN'S IMPACT ON COASTAL ENVIRONMENT (Field Meeting), Spanish coast between French border and Valencia. Sponsored by IGU Commission on the Coastal Environment. (Dr. Maria-Angels Marques, Facultad de Geologia, Universidad de Barcelona, Gran Via 585, Barcelona 08011, Spain)
- September 8 - 10, 1986
INNOVATIVE DIRECTIONS IN PETROLEUM EXPLORATION (Symposium), Dallas, Texas. (I. Williamson, Department of Geology, Imperial College, Prince Consort Road, London SW7 2BP, U.K.)
- September 8 - 11, 1986
GEOSCIENCE AND REMOTE SENSING (International Symposium), Zurich, Switzerland. Sponsored by IEEE Geoscience & Remote Sensing Society. (Prof. H. Haefner, Remote Sensing Laboratory, Department of Geography, Universitat Zurich-Irchel, Winterthurerstrasse 190, 8057 Zurich, Switzerland)

- September 8 - 12, 1986
 INTEGRATED LAND USE PLANNING AND GROUNDWATER PROTECTION MANAGEMENT IN RURAL AREAS (IAH 19th International Congress), Karlovy Vary, Czechoslovakia. (Dr. J. Vrba, Gorkeho namesti 7, 11309 Praha 1, Czechoslovakia)
- September 8 - 12, 1986
 PALAEOCEANOGRAPHY (2nd International Conference), Woods Hole, U.S.A. (W.A. Berggren, Woods Hole Oceanographic Institute, Woods Hole, MA 02543, U.S.A.)
- September 8 - 13, 1986
 ANISOTROPY AND INHOMOGENEITY OF THE LITHOSPHERE AND ASTHENOSPHERE (Meeting), Bechyne, Czechoslovakia. (Dr. V. Babuska, Geophysical Institute, Bocni II, 14131 Prague 4, Czechoslovakia)
- September 8 - 13, 1986
 UNDERGROUND MINING SCIENCES AND TECHNOLOGY (International Symposium), Nottingham, U.K. (Dr. M.J. Richards, Mining Engineering Department, University of Nottingham, University Park, Nottingham NG7 2RD, U.K.)
- September 8 - 13, 1986
 RECENT CRUSTAL MOVEMENTS OF THE EARTH (7th International Symposium), Tallinn, Estonian S.S.R. (Prof. Yu. D. Boulanger, International Symposium CRCM-86, Soviet Geophysical Committee, Academy of Sciences of the U.S.S.R., Molodezhnaya, 3, 117296, Moscow, U.S.S.R.)
- September 8 - 15, 1986
 INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS (Congress), Karlovy Vary, Czechoslovakia. (A. Zaporozec, AIH, 3817 Mineral Point Road, Madison, WI 53705, U.S.A.)
- September 14 - 19, 1986
 AVALANCHE FORMATION, MOVEMENT AND EFFECTS (International Symposium), Davos, Switzerland. (Symposium 1986, EISLF, Weissfluhjoch, CH-7260 Davos-Dorf, Switzerland)
- September 15 - 19, 1986
 GOLD '86 (International Conference), Johannesburg, South Africa. (The Conference Secretary (C.29), Mintek, Private Bag X3015, Randburg, 2125 South Africa)
- September 22 - 25, 1986
 METEORITICAL SOCIETY (49th Annual Meeting), New York, U.S.A. (Martin Prinz, Department of Mineral Sciences, American Museum of Natural History, New York, NY 10024, U.S.A.)
- September 22 - 27, 1986
 UNDERGROUND WATER TRACING (5th International Symposium), Athens, Greece. Languages: English, German and Greek. (5th SUWT, Institute of Geology and Mineral Exploration, 70 Messoghion Street, 115 27 Athens, Greece)
- September 22 - 28, 1986
 BENTHOS '86 (3rd International Symposium on Benthic Foraminifera), Geneva, Switzerland. (D. Decrouez, Department of geology and invertebrate palaeontology, Museum d'Histoire naturelle de Geneve, CP 434, 1211 Geneve 6, Switzerland)
- September 23 - 27, 1986
 SOIL MECHANICS AND FOUNDATION ENGINEERING (8th Danube European Conference), Nuremberg, F.R.G. (Prof. U. Smolczyk, Deutsche Gesellschaft fur Erd-und- Grundbau, e.V. Kronprinzenstrasse 35 A, D-4300, Essex 1, F.R.G.)
- September 26 - 28, 1986
 SEPM (3rd Annual Midyear Meeting), Raleigh, North Carolina. (SEPM, P.O. Box 4756, Tulsa, OK 74159, U.S.A.)
- September 28 - October 1, 1986
 GOLD '86 (International Symposium), Toronto, Canada. (E. Craigie, Selco Division of BP Resources Canada Ltd., 55 University Avenue, Suite 1700, Toronto, Ontario, Canada M5J 2H7)
- October, 1986
 EXPLORATION GEOCHEMISTRY OF CHINA (3rd Symposium), Guilin, P.R. China. Languages: Chinese and English. (Professor Xie Xuejing, 3rd Chinese Exploration Geochemistry Symposium, Institute of Geophysical and Geochemical Exploration, Langfang, Hebei 102801 P.R. China)
- October 2 - 4, 1986
 COMPUTERS IN THE PETROLEUM INDUSTRY: INTEGRATED APPROACHES (15th Annual Geochautauqua), Calgary, Alberta, Canada. (Michael Marchand, Geochautauqua 86, c/o Canterra Energy Ltd., Box 1051, Calgary, Alberta, Canada T2P 2K7)
- October 5 - 11, 1986
 WORLD ENERGY (13th Congress), Cannes, France. (R. Ruttley, World Energy Conference, 34 St. James' Street, London SW1A 1HD, U.K.)
- October 6 - 10, 1986
 SEDIMENTOLOGY OF ARGENTINA (Meeting), La Plata, Argentina. (L. Spalletti, Centro de Investigaciones Geologicas, calle 1 n° 644, 1900 La Plata, Argentina)
- October 7 - 14, 1986
 SEA-LEVEL CHANGES AND APPLICATIONS (Symposium), Qingdao, P.R. China. IGCP Project 200. Language: English. (Prof. Zhao Songling, Institute of Oceanology, Academia Sinica, 7 Nan-hai Road, Qingdao, P.R. China)
- October 14 - 18, 1986
 ORIGIN AND EVOLUTION OF PLANETARY AND SATELLITE SYSTEMS (International Symposium), Potsdam, German Democratic Republic. (Prof. Dr. H. Stiller, Zentralinstitut fur Astrophysik, Potsdam, German Democratic Republic)
- October 20 - 25, 1986
 INTERNATIONAL ASSOCIATION OF ENGINEERING GEOLOGY (Meeting), Buenos Aires, Argentina. (C.A. Di Salvo, Moreno 584, 9 piso, 1091 Buenos Aires, Argentina)

October 26 - 29, 1986

PETROLEUM GEOLOGY OF NW EUROPE (3rd Conference), London, U.K. (Petroleum Geology of NW Europe Conf. '86, Conference Co-ordinators, 70 Richmond Road, Twickenham, Middlesex TW1 3BE, U.K.)

October 29 - 31, 1986

AMERICAN ASSOCIATION OF STRATIGRAPHIC PALYNOLOGISTS (Annual Meeting with Congrès Internationale du Microflore Paléozoïque), New York, U.S.A. (Dan Habib, Graduate School of the City University of New York, 33 West 42nd Street, New York, NY 10036, U.S.A.)

November 1986

ENGINEERING IN COMPLEX ROCK FORMATIONS (International Symposium), Beijing, P.R. China. Languages: English and Chinese. (Secretary of the ECRF Symposium, Institute of Geophysics, Academia Sinica, P.O. Box 928, Beijing, P.R. China)

November 1986

GEOLOGY OF SOMALIA AND SURROUNDING REGION (First Congress), Mogadishu, Somalia. Organized and sponsored by IUGS. (G.O. Gatto, Institute of Mineralogy, University of Padova, Corso Garibaldi 37, I-35100 Padova, Italy)

November 2 - 6, 1986

SOCIETY OF EXPLORATION GEOPHYSICISTS (56th Annual Meeting), Houston, Texas, U.S.A. (Convention Assistant, Society of Exploration Geophysicists, P.O. Box 3098, Tulsa, OK 74101, U.S.A.)

November 9 - 14, 1986

COASTAL ENGINEERING (International Conference), Taipei, Taiwan. (B.L. Edge, Cubit Engineering Limited, 207 East Bay Street, Suite 311, Charleston, SC 29401, U.S.A.)

November 10 - 11, 1986

EXPLORATION GEOCHEMISTRY (International South European Symposium), Athens, Greece. Co-sponsored by AEG. (Organizing Committee, International South European Symposium in Exploration Geochemistry, Institute of Geology and Mineral Exploration, 70 Messoghion Street, 115 27 Athens, Greece)

November 10 - 13, 1986

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

December 1 - 5, 1986

RESEARCH IN GEOPHYSICS AND GEOPHYSICAL EXPLORATION IN AFRICA (International Conference), Kano, Nigeria. Co-sponsored by International Lithosphere Program. (AGERA Conference, c/o Department of Physics, University of Jos, Jos, Nigeria)

December 5 - 7, 1986

GEOLOGY OF INDOCHINA (Conference), Ho Chi Minh City, Vietnam. (Conference Secretariat CGI, General Department of Geology, 6 Pham Ngu Lao St., Hanoi, Vietnam)

December 8 - 12, 1986

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

1987

January 9 - 9, 1987

MAGMATISM IN THE OCEAN BASINS (Meeting), Leicester, U.K. (A.D. Saunders, Department of Geology, The University, Leicester LE1 7RH)

January 19 - 23, 1987

HOW VOLCANOES WORK (Hawaii Symposium), Hilo, Hawaii. (Robert Decker, U.S. Geological Survey, MS-910, 345 Middlefield Road, Menlo Park, CA 94025, U.S.A.)

January 21 - 31, 1987

GRANITES AND ASSOCIATED MINERALIZATIONS (International Symposium), Salvador, Bahia, Brazil. Languages: English, French and Portuguese. (ISGAM, Augusto J. Pedreira, SMECPM: Rua Ceara, 3-Pituba, 40,000, Salvador, Bahia Brazil)

January 27 - 30, 1987

CANADIAN REEF RESEARCH (Symposium), Banff, Alberta, Canada. (Canadian Reef Research Symposium, The University of Calgary, Conference Office, Faculty of Continuing Education, 2500 University Drive NW, Calgary, Alberta, Canada T2N 1N4)

February 1987

QUATERNARY SEDIMENTS OF THE ARABIAN GULF AND THE MESOPOTAMIAN PLAIN (International Conference), Kuwait. (Secretary-General 1987, Dept. of Geology, Kuwait University, Box 5969, Kuwait)

February 2 - 6, 1987

ASH: A NEW RESOURCE, (Symposium), Pretoria, South Africa. (Dr. R.A. Kruger, CSIR-Frd, POB 395, Pretoria 0001, South Africa)

April 6 - 10, 1987

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

April 13 - 16, 1987

EUROPEAN UNION OF GEOSCIENCES (IV Biennial Conference), Strasbourg, France. (Prof. Dr. W. Lowrie, Inst. für Geophysik, HPP P 5, ETH Honggerberg 8093 Zurich, Switzerland)

April 23 - 26, 1987

INTERNATIONAL GEOCHEMICAL EXPLORATION (12th Symposium) and METHODS OF GEOCHEMICAL PROSPECTING (4th Symposium), Orleans La Source, France. (The Organizing Committee, 12th IGES - 4th SMGP, BRGM, B.P. 6009, 45060 Orleans Cedex, France)

April 27 - May 1, 1987

DRILLEX '87 (International Conference and Exhibition on Drilling - The Minerals Industry and Geotechnical Engineering), Stoneleigh, Warwickshire, U.K. (IMM, 44 Portland Place, London W1N 4BR, U.K.)

April 28 - May 7, 1987

ZECHSTEIN: STRATIGRAPHY-PALEOGEOGRAPHY-GEOCHEMISTRY (International Symposium), Hannover/Kassel, F.R.G. (J. Lepper, Niedersächsisches Landesamt für Bodenforschung, P.O. Box 51 01 53, D-3000 Hannover 51, F.R.G.)

May 3 - 7, 1987

ENGINEERING GEOLOGICAL ENVIRONMENT IN MOUNTAINOUS AREAS (International Symposium), Beijing, P.R. China. (Geological Society of China, Ministry of Geology, Pai Wan Chung, Fuchengmenwai, Beijing, P.R. China)

May 18 - 22, 1987

AMERICAN GEOPHYSICAL UNION (Spring Meeting), Baltimore, Maryland, U.S.A. (AGU Meetings, 2000 Florida Avenue NW, Washington, DC 20009, U.S.A.)

May 25 - 27, 1987

COASTAL LOWLANDS: GEOLOGY AND GEOTECHNOLOGY (International Symposium), The Hague, The Netherlands. (Dr. H.J.W.G. Schalke, P.O. Box 85947, 2508 CP The Hague, The Netherlands)

May 25 - 27, 1987

GEOLOGICAL, MINERALOGICAL ASSOCIATIONS OF CANADA (Joint Annual Meeting), Saskatoon, Canada. (Dr. W.O. Kupsch, Department of Geological Sciences, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 0W0)

May 28 - 30, 1987

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

May 21 - June 5, 1987

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

June 1987

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

June 7 - 10, 1987

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

July 31 - August 9, 1987

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

August 1987

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

August 9 - 22, 1987

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

August 12 - 20, 1987

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

August 17 - 20, 1987

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

August 20 - 30, 1987

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

August 24 - 28, 1987

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

August 30 - September 4, 1987

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

August 31 - September 3, 1987

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

September 1 - 5, 1987

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

September 7 - 11, 1987

CARBONIFEROUS STRATIGRAPHY AND GEOLOGY (11th International Congress), Beijing, P.R. China. (Prof. Yang Jingzhi, Nanjing Institute of Geology and Palaeontology, Chi-Ming-Ssu, Nanjing, P.R. China)

September 7 - 12, 1987

ANTARCTIC GLACIOLOGY (4th International SCAR Symposium), Bremerhaven, F.R.G. (Heinz Kohnen, Alfred Wegener Institute for Polar Research, Columbus Center, D-2850 Bremerhaven, F.R.G.)

September 11 - 14, 1987

SEPM (4th Annual Midyear Meeting), Austin, Texas. (SEPM, P.O. Box 4756, Tulsa, OK 74159, U.S.A.)

September 14 - 18, 1987

CIRCUM-PACIFIC PHANEROZOIC GRANITES (International Symposium), Tucuman, Argentina. Jointly with 10th Argentine Geological Congress. Languages: English and Spanish. (Dr. Carlos W. Rapela, Centro de Investigaciones Geologicas, Universidad Nacional de La Plata, Calle 1 no 644, 1900 La Plata, Argentina)

October 11 - 15, 1987

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

October 26 - 29, 1987

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

December 7 - 11, 1987

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

1988

March 8 - 11, 1988

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

March 20 - 23, 1988

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

May 16 - 20, 1988

BICENTENNIAL GOLD 88 (Conference), Melbourne, Australia. Cosponsored by Society of Economic Geologists. (Dr. R.R. Keays, Department of Geology, University of Melbourne, Parkville Vic 3052, Australia)

May 16 - 20, 1988

AMERICAN GEOPHYSICAL UNION (Spring Meeting), Baltimore, Maryland, U.S.A. (AGU Meetings, 2000 Florida Avenue NW, Washington, DC 20009, U.S.A.)

May 29 - June 3, 1988

WATER RESOURCES (6th IWRA World Congress), Ottawa, Ontario, Canada. (P.J. Reynolds, President, Canadian Committee - IWRA, 3 Valley View Road, Ottawa, Ontario, Canada K2H 5Y6)

June 7 - 10, 1988

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

June 20 - July 9, 1988

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

October 1988

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

October 30 - November 1988

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

October 31 - November 3, 1988

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

December 5 - 9, 1988

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

1989

July 9 - 19, 1989

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

October 29 - November 2, 1989

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

November 9 - 12, 1989

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

