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CATATAN GEOLOGI (GEOLOGICAL NOTES)

NOTE ON THE OCCURRENCE OF LIMESTONE IN THE SEMANGGOL FORMATION, KEDAH, PENINSULAR MALAYSIA

Ahmad Jantan, Basir Jasin, Ibrahim Abdullah, Abd. Rahim Samsudin and
Uyop Said, Department of Geology, Universiti Kebangsaan Malaysia

Abstract

Thinly bedded micritic limestone and limestone lenticles were found interbedded within bedded chert and siliceous shale at an earth quarry at Bukit Barak, Kuala Nerang, Kedah. Thin section studies reveal that the thinly bedded micritic limestone consists of minute calcite crystals and diagenetically altered calcite to euhedral rhombic-shaped dolomite. The limestone occurring as lenticles consist of minute calcite crystals, calcispheres, foraminifera, conodonts, pelagic ostracods, and hemipelagic bivalves. Both the micritic texture and microfossil content are indicative of a pelagic deposit.

Abstrak

Lapisan-lapisan nipis dan kekanta batukapur mikrit ditemui berselang lapis dengan cert berlapis dan syal bersilika di satu kuari tanah di Bukit Barak, Kuala Nerang, Kedah. Kajian irisan nipis menunjukkan bahawa batukapur mikrit berlapis terdiri dari hablur halus kalsit dan hablur enhedra dolomit berbentuk rhombus, ubahan diagenesis dari kalsit. Batukapur yang didapati sebagai kekanta terdiri dari hablur halus kalsit, kalsisfera, foraminifera, konodon, ostrakod pelagos dan dwikatup hemipelagos. Kedua-dua tekstur mikrit dan kandungan mikrofosil menunjukkan batukapur adalah jenis endapan pelagos.

Introduction

During a recent field reconnaissance trip to identify and select suitable exposures/sections to be measured for systematic and detailed research on the lithostratigraphy, palaeontology, sedimentation, palaeo-environment, palaeomagnetism and post depositional structures of the Triassic Semanggol Formation in North Perak and East Kedah, we came across 'lenticular' limestone bodies in siliceous shale interbedded with bedded chert within the formation's typical deep-sea sediments at an isolated earth quarry along Pokok Sena - Kuala Nerang Road. Thin section study reveals that the limestone is a carbonate mudstone and that both the limestone and chert are microfossiliferous.

To date this is the first reported occurrence of limestone in the Semanggol Formation. Burton (1973) designated three major members within the Semanggol Formation; these are from west to east, presumably from

bottom to top, the Chert Member consisting mainly of bedded chert, the Rhythmite Member consisting of thinly interbedded shale and sandstone and the Conglomerate Member consisting of variously interbedded thick-bedded to massive sandstone and conglomerate. Though in detail Burton's subdivision might be oversimplified, the lenticular limestone bodies may be placed within the Chert Member.

The Outcrop

The exposure is a still active earth quarry at Bukit Barak, at kilometer 30 Alor Setar - Kuala Nerang Road (Fig. 1). The exposure exhibits a low angle (18°), almost north-south striking (010°) east dipping main thrust fault that cuts the Bukit Barak section and brings two lithologically different sequences adjacent to one another, to be referred to as Section A for the one on the west and Section B for the other on the east (Fig. 2). The Lenticular limestone bodies of interest are found in Section A and will be the substance of this short communication.

Field Description of Section A

Beds of Section A young to the west with strikes and dips ranging from $162^{\circ} - 175^{\circ}/70^{\circ} - 72^{\circ}$ (Fig. 2). Dip directions of beds near the thrust fault however are different due to drag by the faults. There are beds near the fault that dip to the east and are therefore overturned.

About 30 m of sedimentary sequence is exposed (Fig. 3). This consists of:

- (a) over 5 m of thinly bedded yellowish-brown siliceous shale,
- (b) about 20 m of variously interbedded grey-black chert, grey calcareous chert and siliceous limestone (Plate 1) within which are two thin micritic limestones interbedded with siliceous shale at levels 6.5 m and 16.7 m, and
- (c) about 3.5 m of siliceous shale interbedded with very thin shaly limestone interbeds. This limestone lenticle is within this top siliceous shale.

In some instances it is difficult in the field to differentiate between beds of pure chert, calcareous chert, siliceous limestone and limestone because there is almost a complete spectrum from chert with calcite speckles to limestone with cryptocrystalline silica, and to limestone. Some of the beds in places are intensely fractured and cut by minute calcite-filled veins and veinlets that the acid test even on apparently pure chert gave effervescence. Laboratory confirmation, in some cases, necessary.

The Limestone Lenticles

The limestone lenticles were found within the 3.5 m thick thinly bedded siliceous shale (Plate 2). The shale is partly weathered into soil and as a result no laterally continuous exposure is observable. From what is available, the shale appears to be evenly bedded. There is no indication that it has been folded, be it tectonic or sedimentary. The shale in addition, contains very calcareous, apparently shaly limestone bands (Plate 3).

Five limestone lenticles are exposed, four are aligned in one place and at one horizon, and one lies above a lenticle in the middle (Fig. 4). They range from 0.4 m to 2.5 m thick and from 1 m to 4.5 m long and are 3 m, 4 m and 14 m apart respectively. They are dark grey in colour.

Internally the lenticles appear to have yellowish - brown bands, apparently argillaceous in composition.

Age of the Limestone

The limestone has yielded conodonts indicative of a late Ladinian or early Carnian age, that is around the Middle/Upper Triassic boundary (Metcalfe, pers. comm).

Petrography

Bedded chert, consisting almost entirely of cryptocrystalline silica, is not that common. More common is the almost complete range of rock from calcareous chert containing about 5% of calcite crystals to siliceous limestone containing about 5% cryptocrystalline silica. In most samples, part of the calcite crystals have been altered to euhedral rhombic-shaped dolomite. The rocks are cut by generations of calcite and quartz veinlets. The more siliceous samples apparently contain more radiolaria whilst the more calcareous ones contain more calcispheres. Radiolarian bedded chert is typically of deep water origin.

There are only two beds of limestone in the bedded sequence, that is at level 6.5 m and 16.7 m in Figure 2. These are micritic limestone in which part of the original calcite mineral has been sporadically diagenetically altered into euhedral rhombic-shaped dolomite (Plate 4).

Samples from the limestone lenticles are made of speckles of minute calcite crystal. They contain some spherical objects, calcitic in composition, apparently calcispheres (Pl. 5), conodonts, foraminifera, and thin shelled hemi-pelagic bivalves. They are lime-mudstones or micrites and are typically deep-water carbonates. Both the micritic texture (lime-mudstone) and calcisphere content are indicative of a pelagic origin (Flügel, 1982).

Probable Emplacement of the Limestone Lenticles

Gravity folding and other slumping features are not uncommon elsewhere in the Semanggol Formation. It could be seen at the base of Bukit Barak itself. It could therefore be very tempting to assume that those lenticular bodies had been slumped from somewhere down the palaeoslope or some kind of local sea mounts, if only the shape of limestone bodies is considered. However the following observations already described in previous headings suggest otherwise, that is the limestone lenticles were not slumped-in but were contemporaneous *in-situ* deposit. These are:

1. Limestone occurs not only in lenticular forms, but also as bedded limestone as at levels 6.5 m and 16.7 m in Figure 3, therefore suggesting similar origin.
2. The siliceous shale within which the limestone lenticles were found, has argillaceous limestone bands (Pl. 3), and the limestone lenticles themselves have argillaceous bands, therefore suggesting related origin.

3. The siliceous shale unit within which the limestone lenticles were found was even-bedded and not folded, and therefore does not indicate and does not support slumping.
4. The limestone lenticles are not haphazardly disposed but are aligned in one plane one horizon, again not supporting slumping.
5. The bedded limestone and the limestone lenticles are similar in texture, a lime mudstone or micrite of deep water carbonate.

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Manuscript received 15 May 1987



Plate 1. The middle part of Section A showing interbedded chert, calcareous chert, siliceous limestone and limestone.

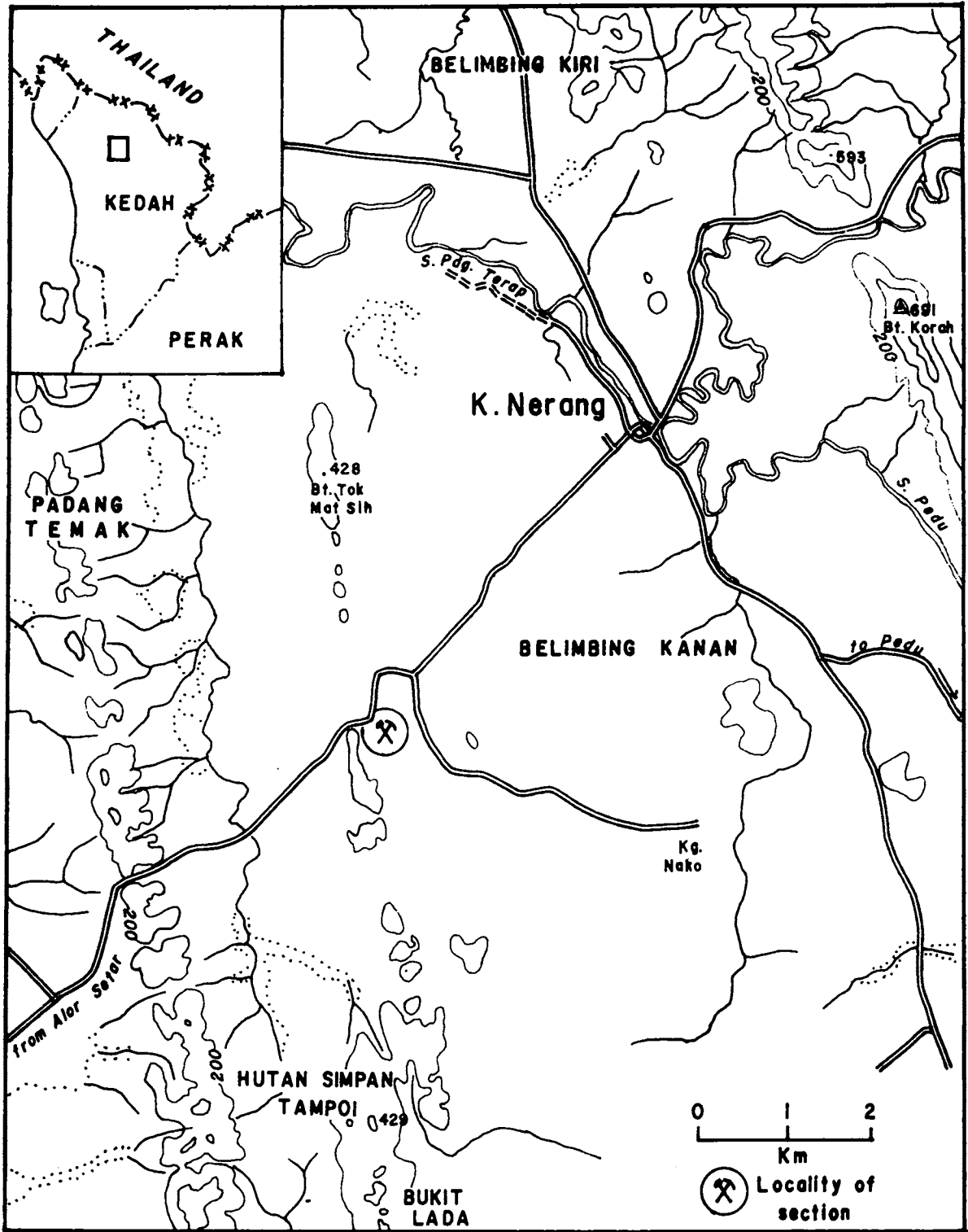


Fig. 1. Map of Kuala Nerang area showing the locality of Earth Quarry Section at Bukit Barak.

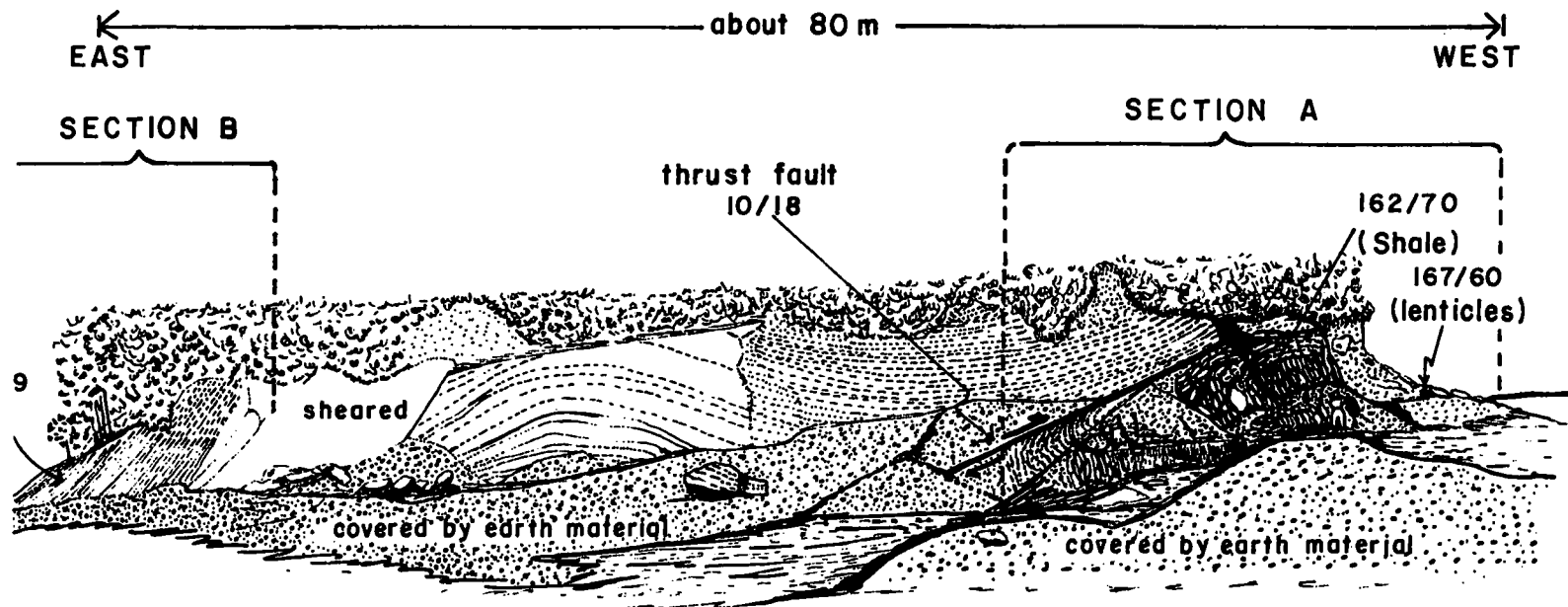


Fig. 2. Field Sketch of Bukit Barak Earth Quarry showing position of SECTION A described in the text.

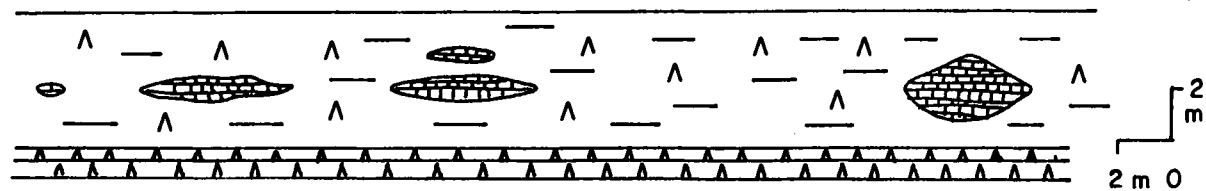


Fig. 4. Scaled Sketch of siliceous shale unit containing lensoid - shaped limestone bodies.

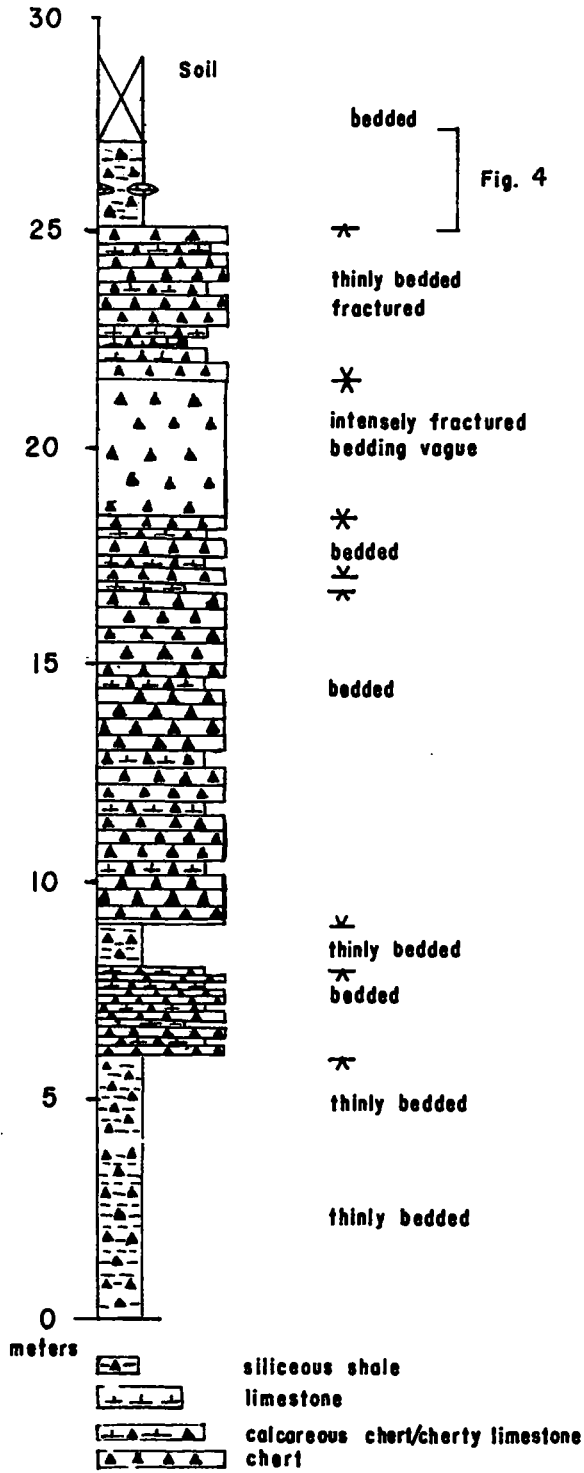


Fig. 3 Lithologic log of Section A
Bukit Barak, Kedah.



Plate 2. The upper part of Section A showing the lenticular limestone bodies within siliceous shale.



Plate 3. Block from the upper part of Section A showing calcareous shale band (at the coin) within siliceous shale.

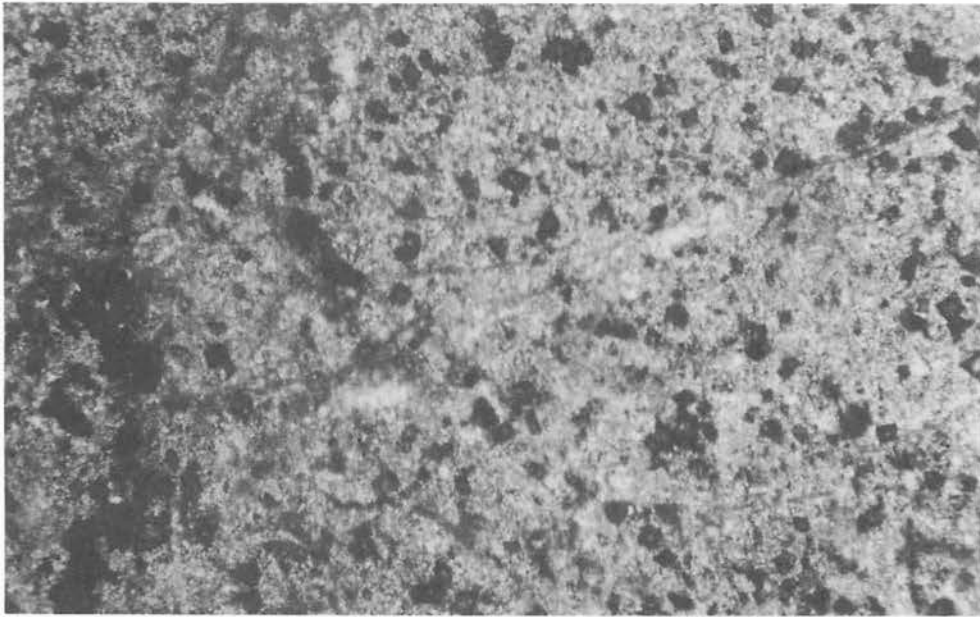
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Plate 4. Photomicrograph from the bedded limestone showing micrite and sporadic euhedral dolomite crystals.

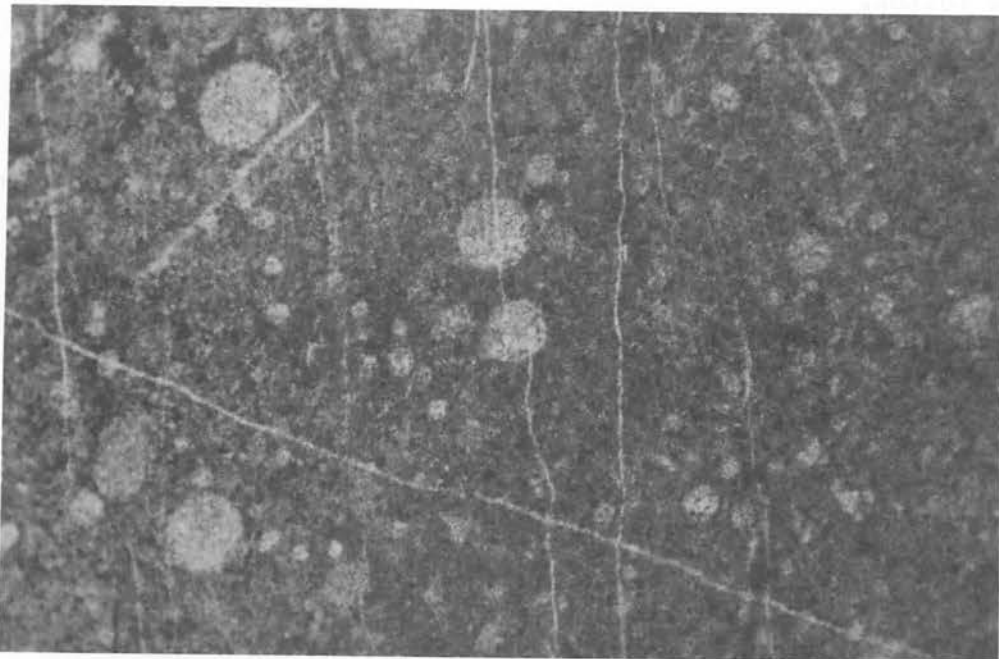
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Plate 5. Photomicrograph from the lenticular limestone showing the spherical calcispheres and sporadic dolomite crystals within micritic ground mass.

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BUKTI LAPANGAN SESAR BOK-BAK DI LUAR KAWASAN BALING (FIELD EVIDENCE OF THE BOK-BAK FAULT BEYOND THE BALING AREA)

Abd. Majid Sahat, Jabatan Penyiasatan Kajibumi Malaysia

Abstrak

Kelurusan yang ditunjukkan oleh sistem saliran, terumbu kuarza serta singkapan lapangan yang terdiri dari batuan kataklasit, milonit dan zon ricih di kawasan Lasah, Sg. Siput Utara, menjadi bukti utama kewujudan lanjutan sesar Bok-Bak di kawasan berkenaan. Ini adalah bukti-bukti lapangan untuk menyokong pemikiran yang menyatakan lanjutan sesar Bok-Bak di luar kawasan Baling.

Abstract

The linear drainage system together with quartz reefs and outcrops of cataclasite, mylonite and shear zone in the Lasah area of Sg. Siput North provide strong evidence of the continuation of the Bok-Bak fault into this area. These field evidences thus strongly support the contention that the Bok-Bak fault extends beyond the Baling region.

Pengenalan

Sesar Bok-Bak diperkenalkan oleh Burton (1965, 1970) semasa menjalankan penyiasatan geologi di kawasan Baling. Beliau seterusnya membuat hipotesis ia itu lanjutan sesar Bok-Bak ini berterusan hingga ke Selatan Semenanjung di negeri Johor. Pemikiran ini dikritik oleh Jones and Proctor (1967) kerana kekurangan bukti lapangan. Melalui kajian imej-imej satelit Raj (1982) dan Lai (1987) telah membuat interpretasi lanjutan sesar Bok-Bak hingga ke baratdaya Kelantan (Rajah 1). Mengikut Lai (1984), lineamen juga boleh dikesan daripada fotoudara dari Baling ke kawasan Gunung Bedong, Ulu Kelantan melalui Lawin (dekat Grik), Lasah dan Post Brook (Cameron Highlands). Walau bagaimanapun, semua hipotesis sesar Bok-Bak di luar kawasan Baling tidak mempunyai sebarang bukti lapangan.

Penulis berpeluang melihat bukti-bukti lapangan tentang lanjutan sesar Bok-Bak di luar kawasan Baling semasa menjalankan kerjalapangan di kawasan Lasah, Sg. Siput Utara. Kawasan ini terletak lebih kurang 70 km dari tenggara kawasan Baling dan 50 km ke utara Ipoh.

Pemerhatian Lapangan

Kewujudan lineamen yang memanjang hingga ke beberapa kilometer dapat dilihat dengan menggunakan fotoudara dan peta topografi. Lineamen utamanya menjurus pada arah baratlaut-tenggara di sekitar 325° - 338° (Abd. Majid Sahat, 1986). Lineamen ini disahihkan sebagai zon sesar dengan terjumpanya batuan milonit, kataklasit, semisyis, terumbu kuarza dan zon ricih. Kelebarannya mencapai hingga keratusan meter. Kelurusan yang paling menonjol ditunjukkan oleh Sungai Kawan (Rajah 2). Di kawasan ini, zon sesar boleh dikesan sejauh 8 km di sepanjang Sg. Kawan dan Sg. Rengkih. Batuan granit di kawasan ini telah mengalami ricihan. Milonit yang bersaiz sangat halus, berwarna kecerahan dan kataklasit dengan

tekstur kekantan yang terdiri dari kuarza dan feldspar boleh ditemui.

Di kawasan Sg. Perlus, batuan milonit dan kataklasit (semisyis) boleh ditemui di cawangan Sg. Perlus yang mengalir ke arah timurlaut. Batuan semisyis bewarna gelap dan berbutir halus. Semisyis dikenalpasti sebagai akibat tindakan sesar melalui pemerhatian di bawah mikroskop. Di kawasan ini, sesar Bok-Bak juga menjadi pemisah litologi antara batuan metamorf dan batuan granit. Kelurusan antara Sg. Kawan dan Sg. Perlus disambung oleh jajaran terumbu kuarza yang hampir selari sepanjang 18 km.

Kesimpulan

Pemerhatian lapangan sesar Bok-Bak di kawasan ini menjadi bukti paling teguh tentang kewujudan lanjutan sesar Bok-Bak di luar kawasan Baling. Walaupun kewujudan sesar ini hingga keselatan Semenanjung masih diragui, bukti lapangan yang ditemui memastikan kewujudan sesar Bok-Bak hingga ke kawasan ini. Berdasarkan kepada pengetahuan geologi hingga masa kini, adalah percayai iaitu bukti lapangan sesar Bok-Bak juga boleh ditemui hingga ke baratdaya Kelantan.

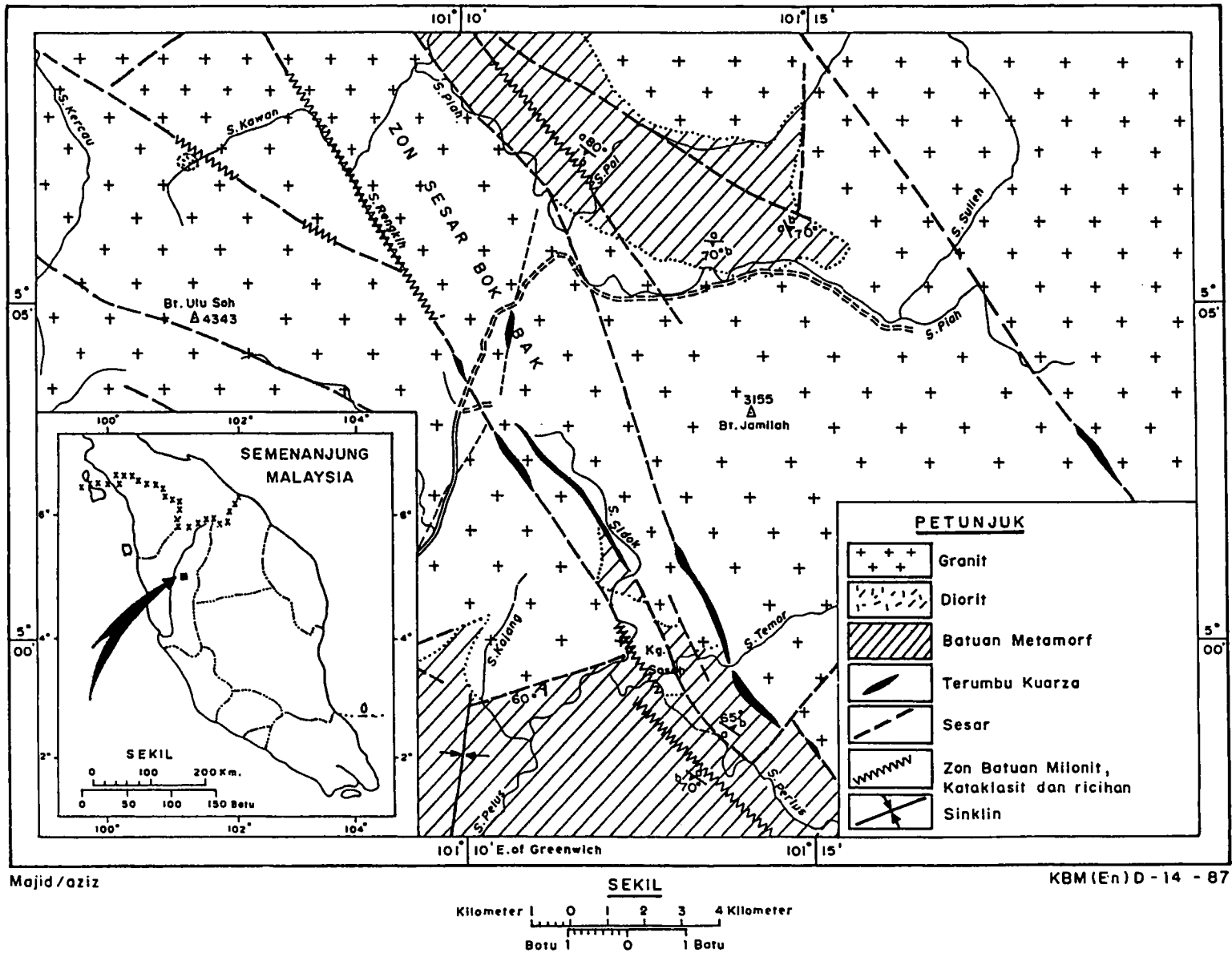
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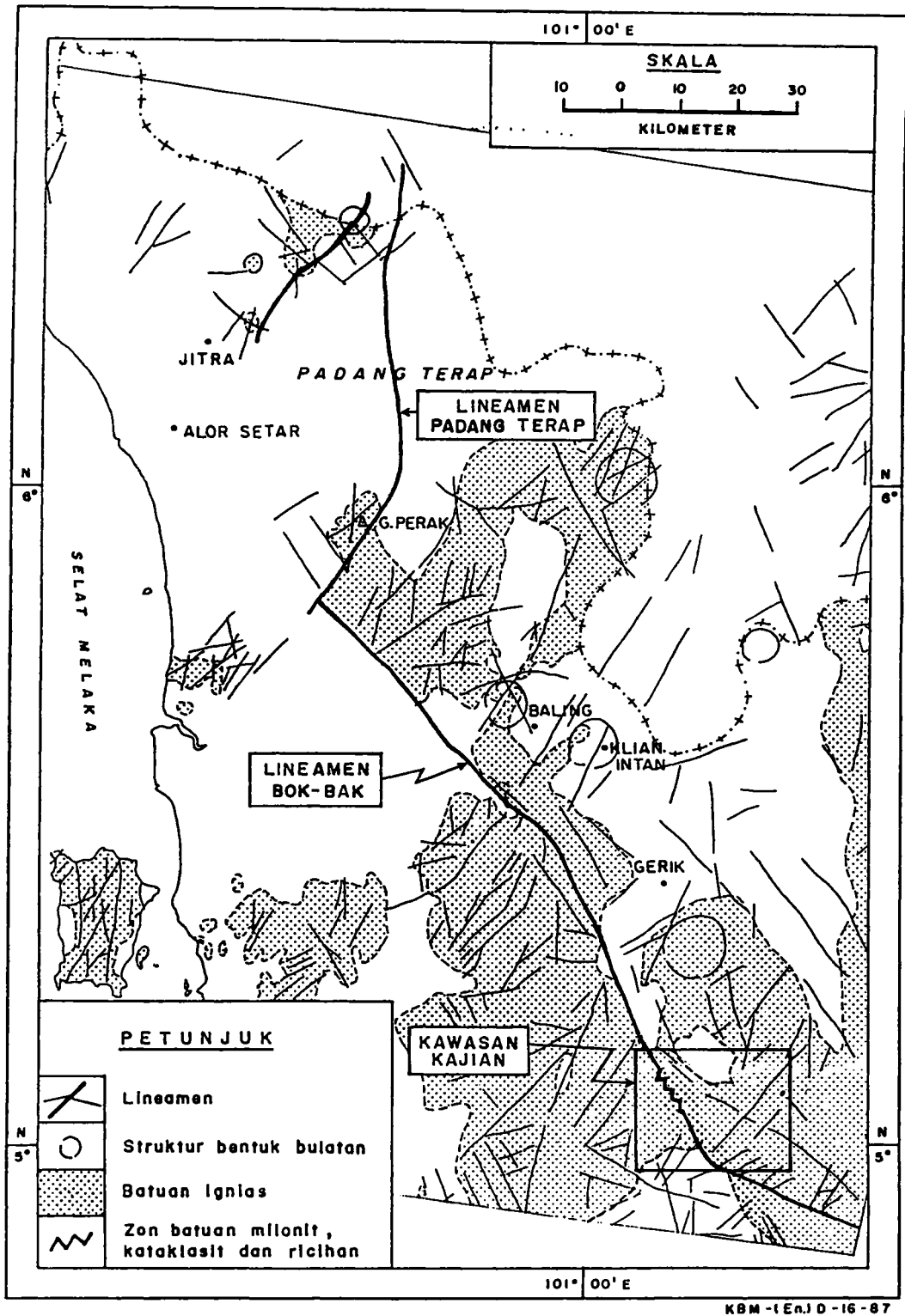
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Rajah 1. Lineamen di Barat laut Semenanjung Malaysia. Interpretasi dari imej satelit, selepas Lai (1987).



KBM-(En.) D-16-87

Rajah 2. Zon sesar Bok-Bak di Kawasan Lasah, Sg. Siput (U).

THE SEDIMENTOLOGY OF THE 'BEGRIH-LIANG' FORMATION

Sriyanee de Silva, Dept. of Geology, Oxford University, England

Abstract

The 'Begrih-Liang' Formation was formed in a paralic environment and its sedimentology attests to this. The fluvial presence is pervasive. The formation is divided into five lithofacies namely, argillaceous, arenaceous, heterolithic, rudaceous and organic facies, and various sub-facies, each of which is summarized.

Ikhtisar

Formasi 'Begrih-Liang' telah diterapkan dalam lingkungan pengendapan dekat pastai. Ciri-ciri pengendapannya menunjukkan bahawa pengaruh sungai adalah tegas. Formasi ini dapat dibahagikan kepada lima litofasis iaitu, fasis lempung, pasiran, heterolitik, rudit dan organik, dan berbagi subfasis.

The 'Begrih-Liang' Formation (de Silva, 1986) south of Mukah (Sarawak) represents a range of facies from fluvial to paludal to tidal (Fig. 1). Each facies is interpreted as having been formed in a paralic environment. Various lithofacies have been recognized and interpreted accordingly. Five lithofacies are proposed.

1. The argillaceous facies, which was subdivided based on its contents, is seen to be gley-like in the field, probably due to the high water-table in the region -
 - a. rootlet bed subfacies is a bluish-grey mudstone which contains coalified root remains. The remains may or not be concreted. The concretions where present, are limonitized. The rootlet bed is always succeeded by a coal seam. In places 'tonstein' is found in contact with the seam. This subfacies is interpreted as being the seat-earth - a source of initial anchorage, root attachment and nutrients. The concretions are explained as being weathering products of the pyrite formed during epidiagenesis and syndiagenesis (de Silva, 1986).
 - b. nodular bed subfacies has prominent reddish-brown coalesced nodules as well as tree-trunks strewn chaotically. The limonite is sideritic in thin-section. The formation of sideritic 'clay-ironstones' instead of pyrite is a result of a decrease in the availability of the sulphur species HS⁻ facilitated by a greater sediment influx with a reduced organic content, such as in a transgression.
 - c. lenticular bed subfacies contain lenses of coarse to medium grained sand is characteristic of the subtidal to intertidal zones where the preservation potential of mud is greater than that for sand.
2. Heterolithic facies represents in lithologic terms the transition from the argillaceous to arenaceous facies -
 - a. flaser bedded subfacies have wavy and occasionally bifurcate

- flasers. Escape burrows are present. This is typical of the transitional environment.
- b. wavy bedded subfacies is characterized by almost equal amounts of mud and sand and can contain horizontal *Planolites* sp. burrows. The increased mud to sand ratio may be attributed to a greater influx of mud as a result of seasonal changes or a slight change in the environment. The lack of fossils favours a rate of sedimentation rapid enough to preserve on-surface trails.
 - c. layered sandstone-mud subfacies has an arenaceous fraction which is poorly sorted. This is interpreted to be fluvial in origin and broadly recognized as 'over-bank' deposits - the spill of sediments over the banks of a channel transporting sediments.
3. Arenaceous facies is poorly consolidated and friable -
 - a. laminated sandstone subfacies has the lamination accentuated by organic debris. While biogenic evidence is sparse, leaves were found. A possible environment would be on floodplain in a delta, which would allow for the grain segregation under conditions of plane bed sediment transport.
 - b. fine sandstone subfacies is well sorted and contains a plethora of sedimentary structures which include transitional, erosional and deformational bedding planes; small-scale channels; climbing ripples, cross lamination and antedunes; load and flame structures, convoluted bedding, drag folds and listric faulting; dewatering structures escape burrows and limonitized sideritic nodules. Deposition is rapid within a subaqueous environment such as in the lower coastal plain.
 4. The rudaceous facies occurs as two subfacies - a sandy conglomerate and an orthoconglomerate -
 - a. sandy conglomerate is found associated with the arenaceous facies and contain clasts identical to that of the orthoconglomerate. The conglomerate is interpreted as being channel lag deposits.
 - b. orthoconglomerates are of two varieties - polymictic and oligomictic. The clasts of the polymictic orthoconglomerate are extrabasinal and intrabasinal. The morphology of the conglomerate resembles that of a conglomerate typical in alluvial fan deposits of tectonically active regions. This conglomerate is recognized as the basal conglomerate of the 'Begrih-Liang' Formation separating it from the Balingian and Belaga Formations. The presence of clay-gall conglomerate indicates heavy floods which resulted in the vigorous erosion and redeposition of the underlying sediments.
 5. Orogenic facies is represented by coal and peat in the field -
 - a. coal subfacies is represented by brown coals and bituminous coal, with the former in greater abundance. Seams are usually 1 - 2 metres thick. Coal analysis has shown that they were found in paralic, angiosperm-dominated swamps in a tropical environment.
 - b. peat is poorly consolidated, lacks the black homogeneity of coal

and contains a high percentage of siliclastics. It is normally found preceding and succeeding the coal. Therefore, it is considered to represent the transition from a clastic facies to the organic facies and vice-versa.

The 'Begrih-Liang' Formation with its coal seams and ironstones, required a subsiding basin. The lack of calcareous fossils may be due to the original paucity or to diagenetic dissolution which has been enhanced by the vast quantities of organic matter present. The diagenetic history of the formation is entwined with that of the coalification of the organic matter.

Acknowledgements

This has been extracted from my B.Sc. thesis and I thank all the people who gave advice, criticisms and assistance. I especially like to thank Dr. Azhar.

Reference

De Silva, S., 1986. *Geology of south Mukah - Balingian, Sarawak*. Unpublished B.Sc. thesis, University of Malaya, Kuala Lumpur. 134 p.

Manuscript received 24 Sept. 1986

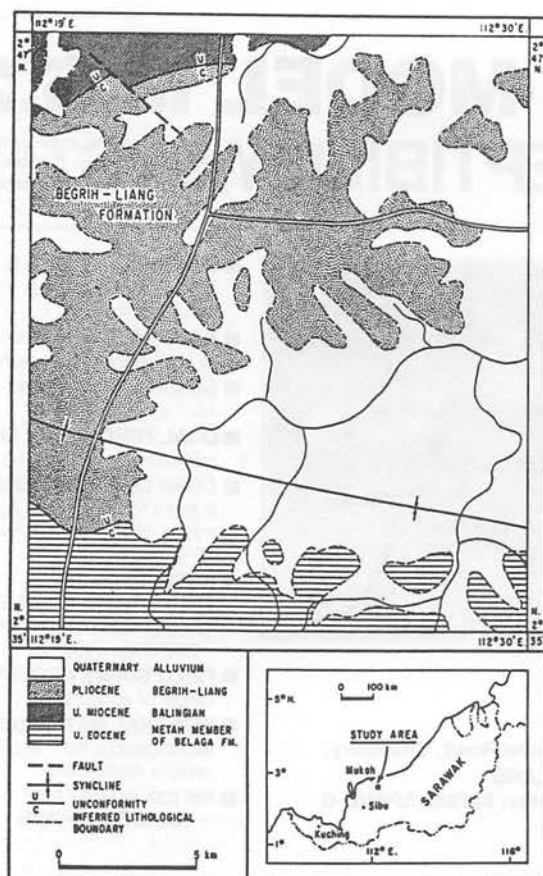


Fig. 1. The Begrih-Liang Formation, south of Mukah, Sarawak.

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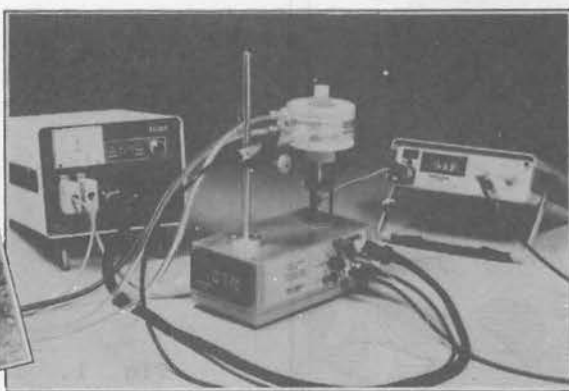
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PERTEMUAN PERSATUAN (MEETINGS OF THE SOCIETY)

CERAMAH TEKNIK (TECHNICAL TALKS)

SEMINAR 'TEKTONIK DAN GEOLOGI SEKITARAN'

Pada hari Sabtu, 8 Ogos, 1987 bertempat di Jabatan Geologi, Universiti Kebangsaan Malaysia, seminar setengah hari bertemakan 'Tektonik dan Geologi Sekitaran' telah berlangsung. Seramai 36 orang ahli telah hadir. Sebanyak tujuh kertas mengenai perkembangan geologi tempatan telah dibentangkan oleh tujuh ahli akademik Jabatan Geologi, UKM. Kertas-kertas tersebut ialah seperti berikut:

1. The Bentong Suture (H.D. Tjia)
2. The Main Range Batholith's Role in Fault Development (Syed Sheikh Almashoor)
3. The Clasts of Genting Sempah Sheared Zone: Development and Origin (Zaiton Harun)
4. Structural Differences between the Lower and Upper Paleozoic Rocks of Langkawi Islands (Ibrahim Abdullah)
5. Wind-stress Features and their Paleoenvironmental Implication in the East Coast of Johore (Anizan Ishak)
6. Engineering Properties of the Igneous Rocks in Peninsular Malaysia (Ibrahim Komoo)
7. Hydrochemical Character of Groundwater in Northeast Peninsular Malaysia (Ismail Mohd. Noor)

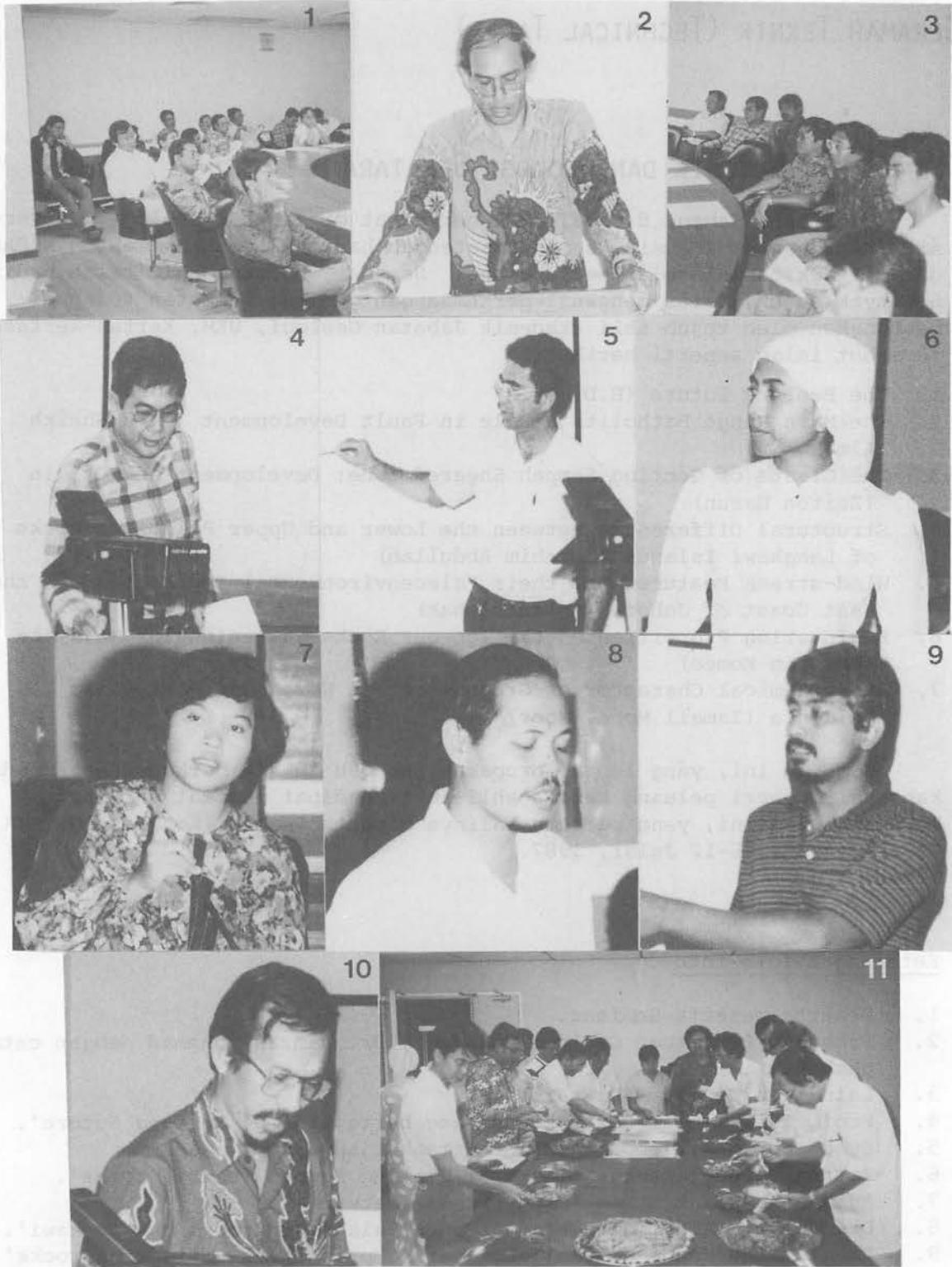
Seminar ini, yang lebih merupakan ceramah teknik berkumpulan, diadakan bagi memberi peluang kepada ahli-ahli mendapat manfaat daripada kertas-kertas ini, yang pertama kalinya dibentangkan di Kongress GEOSEA VI di Jakarta, 6-12 Julai, 1987.

Hamzah Mohamad

Keterangan foto-foto

1. Peserta-peserta Seminar.
2. Presiden Persatuan Geologi Malaysia, Dr. Hamzah Mohamad dengan catatan pembukaan.
3. Lain-lain peserta Seminar.
4. Prof. Tjia dengan kertaskerja yang bertajuk 'The Bentong Suture'.
5. Syed Sheikh Almashoor dengan kertaskerjanya.
6. Zaiton Harun tentang 'clasts of Genting Sempah sheared zones'.
7. Anizan Isahak tentang 'wind-stress features'.
8. Dr. Ibrahim Abdullah tentang 'Upper Palaeozoic rocks of Langkawi'.
9. Dr. Ibrahim Komoo dengan 'engineering properties of igneous rocks'.
10. Dr. Ismail Mohd. Noor tentang 'groundwater in NW Peninsular Malaysia'.
11. Jamuan makan tengahari.

Seminar Tektonik Dan Geologi Sekitaran



SEMINAR 'TEKTONIK DAN GEOLOGI SEKITARAN' - ABSTRAK-ABSTRAK KERTAS

The Bentong Suture

H.D. Tjia, Jabatan Geologi, Universiti Kebangsaan Malaysia.

The Bentong Suture is an approximately 13 km wide zone of deformed rocks that extends from the Thai border near Sungai Tiang southward as far as Karak whence it changes direction to SSE until it crosses the shoreline between Melaka and Muar. There is evidence that this suture continues across the Strait of Melaka, follows the Lalang Fault zone and abuts against the north end of the Tigapuluh Mountains in Sumatra. The rocks in the suture zone are distributed in two main belts: in the west the pre-Silurian schists and in the east a lower Silurian to Permian clastic-chert unit. Within the eastern rock unit are small but mappable occurrences of serpentinite, crystalline limestone and red clastic sediments. Also within this unit occur several zones, up to a few hundred metres wide, of olistostrome separated from each other and from non-olistostrome sediments by wide phyllonite/fault zones. The olistostromes, associated rocks, and wide fault zones probably represent a Palaeozoic accretionary prism that developed on the inner wall of a subduction trench. Earliest vergence was east to southeast which is consistent with westward subduction. Later vergence towards west may reflect a flip of the subduction zone to the opposite direction.

The Main Range batholith's role in fault development

Syed Sheikh Almashoor, Jabatan Geologi, Universiti Kebangsaan Malaysia.

Of the major faults in Peninsular Malaysia three are found to traverse, either wholly or partly, the approximately N-S trending Main Range batholith. All three are left-lateral faults. Two of the faults, namely the Bok Bak fault (striking 325° - 330°) and the Kuala Lumpur fault (striking 290°) possess features that indicate that they are pre-granite in age. These two faults were initiated during the folding phase of the geocline, probably in Early Permian.

The granite intrusion and emplacement in the mesozone obliterated the faults. However, fault movements could still continue without fracturing the granite as the latter had not consolidated much. When the granites were uplifted and solidified during the Late Triassic-Early Jurassic time the whole terrain, including the enveloping country rocks, became rigid. Structural accommodation to the post-uplift compression was only possible by faulting along the inherent fault zones if not for the presence of a ready-made weak linear zone, represented by pluton/

pluton interfaces, the interpluton meta-sedimentary screens, and the batholith's interface with the meta-sedimentary terrain. This led to the initiation of the Bukit Tinggi Fault zone (striking 320° - 330°), which possesses post-uplift features.

The clasts of Genting Sempah sheared zone: Development and origin

Zaiton Harun, Jabatan Geologi, Universiti Kebangsaan Malaysia.

In between the presumably lower Palaeozoic Selut Schist and Gombak Chert, a zone of sheared clasts outcrops approximately 60 metres along the Kuala Lumpur-Karak Highway in the Genting Thrust Belt of at least 650 metres width. The zone exhibits clasts of grey sandstone, red sandstone, granule to pebbly sandstone, quartz schist, quartz mica schist, mudstone, quartz and phyllite in various sizes from granules to 2 metres long blocks. There are also various shapes ranging from strips of disrupted layers to discoids, or from indefinite shapes to augen, embedded in a matrix of mylonite, phyllonite or lutite. This zone consists of several units, each with its own characteristics, each bounded by moderately to vertical dipping faults. Asymmetrical augen clasts are often useful to determine the sense of movement.

Some of the folds and folded faults could have resulted from penecontemporaneous deformation. The thrusting was probably towards the west and is represented by low angle to moderately steep thrust and reverse faults. The third phase of deformation is represented by strike-slip faults that occur on newly developed and on previous suitably oriented planes by probably east-west compressive stress. Then normal motion occurred on the previous faults planes.

The Genting Sempah clasts resemble rocks of the Selut Schist, some of clasts in the diamictite and the redbeds of Raub.

Structural differences between the Lower and Upper Palaeozoic rocks of the Langkawi Islands

Ibrahim Abdullah, Jabatan Geologi, Universiti Kebangsaan Malaysia.

The reasonably good exposures of rocks ranging from Precambrian to Permian in age, provide a good area for structural comparison between the various formations, namely the Macincang and Setul Formations (Lower Palaeozoic), and the Singa and Chuping Formations (Upper Palaeozoic).

The result of the study shows that there are three major structural differences, between the Lower Palaeozoic and the Upper Palaeozoic rocks,

that is a) the existence of inclined to recumbent folds with gentle axial cleavage in the Lower Palaeozoic rocks, b) three generations of folding took place in Lower Palaeozoic rocks as compared to only two in the Upper Palaeozoic rocks, and c) extensive development of small scale structures in the argillaceous sedimentary rocks of the Lower Palaeozoic, but not in those of the Upper Palaeozoic.

The structural differences as mentioned above can be considered as the result of the differences in the structural history and structural development between the rock groups of the two ages. These differences furthermore support the proposed idea about a Mid-Palaeozoic Orogeny of the Malay Peninsula. The orogeny affected the Lower Palaeozoic rocks and produced the inclined to recumbent folds with axes plunging towards north, and with the tectonic transport towards west.

Wind-stress features and their palaeoenvironmental implication in the east coast of Johore

Anizan Isahak, Jabatan Geologi, Universiti Kebangsaan Malaysia.

Several surface markings on calcareous conglomeratic sandstone in the east coast of Johore were identified to be features related to wind stress and wind deposition. Deposition was effected by the adhesion of wind transported sand to a damp surface while the high shear strength of the wind was able to push and shape the cohesive and plastic material. These markings are named corrugated marks, knots, horseshoe marks and beads. Their strong parallel and unidirectional orientation in addition to other morphological evidences suggest that the wind was strong, unidirectional and it blew from the land to the sea. A higher daily range of temperature was indicated. These processes are interpreted to have been active when the sea was about 0.5 m above the present sea-level.

Engineering properties of the igneous rocks in Peninsular Malaysia

Ibrahim Komoo, Jabatan Geologi, Universiti Kebangsaan Malaysia.

Research on basic engineering properties was conducted on igneous rocks in Peninsular Malaysia. The work on their rock properties was carried out on deep road-cuts and quarry faces while samples for the understanding of engineering properties of intact rocks were taken mainly from quarry sites and some from boreholes. Among the rock types studied were several granitic rocks, rhyolite, trachyte, andesite, dolerite, gabbro and basalt.

Two main characteristics which influence the mass properties, that is the nature of discontinuity and state of weathering, were investigated. Discontinuity characteristics were studied by using the scanline method. The discontinuity parameters highlighted were orientations, spacing, frequency, aperture, infilling materials and roughness. The state of weathering was described based on the nature of weathering profiles. The typical weathered profiles on granitic areas were also discussed.

Physical and mechanical properties of intact rocks were obtained through laboratory testing. Among the engineering properties investigated were water content, porosity, density, shore hardness, point load index, uniaxial compressive and tensile strengths and the deformability behaviour. The classification of intact rocks and the correlation between Shore hardness and point load index with strength values are also illustrated.

Hydrochemical character of groundwater in northwest Peninsular Malaysia

Ismail Mohd Noor, Jabatan Geologi, Universiti Kebangsaan Malaysia.

The groundwater in the northwest region of Peninsular Malaysia generally changes its character from the bicarbonate facies to the chloride facies. The change occurs as water flows down the hydraulic gradient. The zonation of each facies depends on the chemistry of the environment within the locality of the flow. The distribution of the facies changes with season. The pattern of distribution for the dry season slightly differ from that of the wet season in that the chloride zone appear to have broadened landward.

The hydrochemical data can also be plotted in many different ways. From them one can gather the general pattern of changes of various major cations and anions with respect to groundwater movement.

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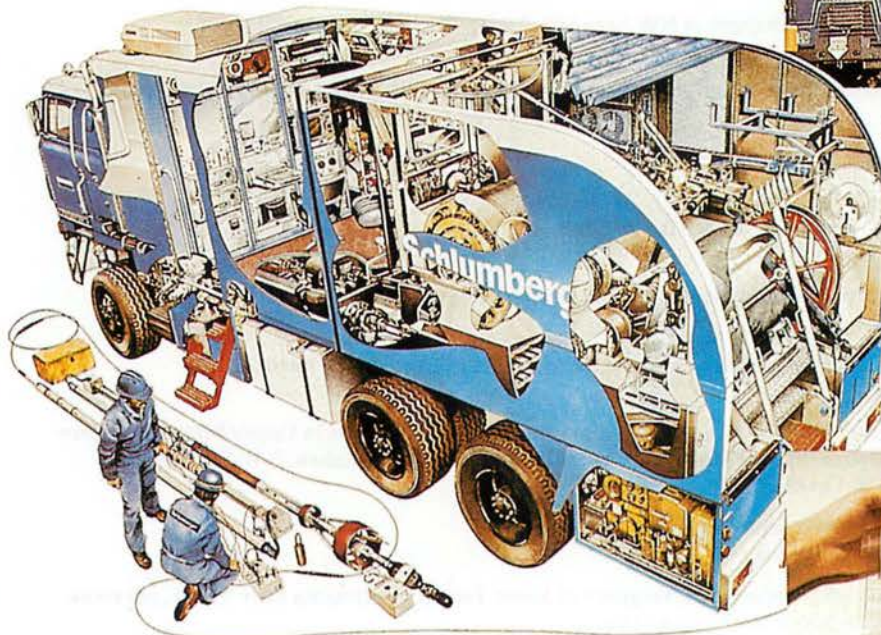
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C.S. HUTCHISON: UNRESOLVED PROBLEMS OF MALAYSIAN GEOLOGY (RETIREMENT ADDRESS)

Professor Charles S. Hutchison, who is retiring at the end of August 1987, consented to give the above "Retirement Address" on Friday, 14 August 1987 at the Geology Department, University of Malaya. Being an Honorary Member and former President of the Society, Prof. Hutchison has keenly and actively supported the Society's activities and contributed immeasurably to the geology of Malaysia.

Prof. Hutchison has been involved in Malaysian geology since he joined the Geology Department, University of Malaya in Singapore in 1967. 20 years was not sufficient to straighten out the geology of the Malay Peninsula, let alone Sabah and Sarawak. In his talk he highlighted the many areas of Malaysian geology that need to be looked into, the problems encountered and advice on how to overcome them. A clear indication of Prof. Hutchison's knowledge of Malaysian geology can best be reflected by the presence of the present (Mr. E.H. Yin) and past (Mr. S.K. Chung and Mr. Santokh Singh), Director-Generals of the Geological Survey of Malaysia and well over a hundred odd geologists from all the major fields of geology in the country.

To him the areas of interest which warrant more follow-up work include the gabbros of Singapore and Linden Estate in Johore, the Eastern Belt granitoids and their associated basic rocks, the Mersing Beds and what lies east of it in the South China Sea, together with the age of metamorphism need to be looked into. Prof. Hutchison drew the audience to the similarity in deformation of the Mersing Beds and similar turbidites in Terengganu. A N-S suture dissecting the peninsula shows that in Permian, the east had Cathaysian affinity with warm conditions (plant fossils in Jengka and Johore) and Gondwana affinity west of the suture with cold conditions and glaciers.

The famous outcrop at Jengka Pass poses many unanswered questions. Is it continental post Permian or marine Permian? Is there an unconformity? Is it imbricated? Prof. Hutchison draws the audience to the weakness of structural geology in the country and need for it to go hand-in-hand with stratigraphy and palaeontology to enlighten the geology of the country.

Next Prof. Hutchison came up with some illustrations depicting the eastward thrusts in the Palaeozoic and Triassic rocks. These eastward thrusts however have westward movements by Tjia as compared to Richardson's eastward movements.

Another problem is in the limestone of Malaysia, which range in age from Permian to Lower Triassic. Recently Fontaine showed that the limestones in Pahang are warm water limestones while those in Langkawi are cold water ones.

Next Prof. Hutchison demonstrated by diagrams, the closure of the suture and tectonics of the peninsula in 20 Ma with the Hawthornden Schist as accretionary material, orogeny in Late Triassic - Early Jurassic and granitoids intruding into deep water sediments.

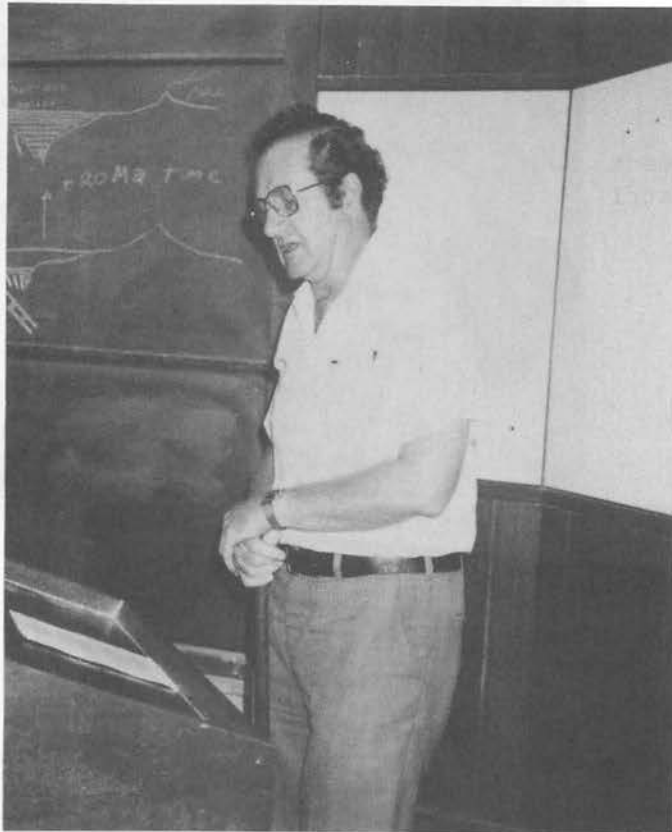
He then touched on the Raub-Bentong Line which he was responsible in delineating and the Raub Group rocks which form a complex zone and have been well documented by Richardson.

Among other things, Prof. Hutchison feels that more work should be done on faulting in the country, especially their ages, the Tertiary continental basins, palaeomagnetic studies and the significance of the river systems.

On East Malaysia, he prefers to maintain the zones proposed by Haile with the Sibul accretionary prism between the Lupar Line and Bt. Mersing Line. Incidentally ophiolite material is not everywhere in the accretionary prism. At the moment Prof. Hutchison considers Sabah the graveyard of Malaysian geology as a lot of detailed mapping still needs to be done especially the Rajang Group and structural geology.

The discussion that followed turned out to be just as exciting and informative. However, due to time constraint, the session had to be cut short as there was a farewell dinner organised by the Society at the University of Malaysia's Rumah Universiti.

G.H. Teh



PROF. C.S. HUTCHISON



Hutchison's Retirement
Address - a question
from D. Santokh Singh.

Hutchison's Retirement
Address - Dr. Sastri
of Petronas with a
query.



Hutchison's farewell
dinner at Rumah
Universiti - Prof.
Hutchison with his
speech.

BERITA - BERITA PERSATUAN (NEWS OF THE SOCIETY)

KEAHLIAN (MEMBERSHIP)

The following applications for membership were approved:

Full Members

1. Edward Flwming Durkee, 801 Reed St., Lakewood, Colorado, USA.

Student Members

1. Mohd. Khalis Khan, No. 27, Jln. Gobek, Sec. 11/9, 40000 Shah Alam.
2. Flavia Alk Kandan, Jabatan Geologi, Universiti Malaya, Kuala Lumpur
3. Norlia Yub Ghazalli, - ditto -

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PERTUKARAN ALAMAT

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

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2. Kamal Rosland Mohamed, Dept. of Geology, University College London,
Gower St., London WC1E 6BT, England
3. Beng-Teck Oh, 60 Dakota Crescent, 12-201, Singapore 1439
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9. Ibrahim Amnan, Geological Survey Malaysia, P.O. Box 1015, 30820
Ipoh, Perak
10. Foo Wah Yang, No. 494, Lorong 9, Krokop, Miri, Sarawak
11. Racal Survey (M) Sdn. Bhd., 14th Floor, Bena Tower, 160 Jalan
Ampang, 50450 Kuala Lumpur
12. Australian Mineral Ventures Library, P.O. Box 1328, Fremantle,
Western Australia 6160

PERTAMBAHAN BARU PERPUSTAKAAN (NEW LIBRARY ADDITIONS)

The Society has received the following publications:

1. Relationship between Sn mineralization and geochemical anomalies in non-residual overburden at Tebrong area, Belitung, Indonesia by S. Johari. 1986
2. Evaluation of tin & columbium-tantalum in tin shed products of Patana Muang Rae tin mine, Kanchanaburi, Thailand by Kit Watanavorakikul. 1986
3. Pump performance test at experimental station, Puga (Malim Nawar) by Vichit Boonrasri & Md. Muzayin bin Alimon & Nasharuddin bin Isa. 1986
4. Chronique de la recherche miniere, no. 486, 1987
5. Zentralinstitut fur Physik der Erde, no. 79, 1986
6. Science Reports of the Institute of Geoscience, University of Tsukuba, vol. 8, 1987
7. Bulletin of the National Science Museum, vol. 12, no. 4 (1986) and vol. 13, no. 1 (1987)
8. Annales Academiae Scientiarum Fennicae, nos. 143 & 144, 1987
9. Geophysical Research Institute Bulletin vol. 25, no. 1, 1987
10. Mineralogica Polonica, vol. 14, Nos. 1-2, 1983 and vol. 15, nos. 1-2, 1984
11. Notes on the limestones of Bukit Southern Peninsula of Bali Island (Indonesia) by Elio Robba et al., 1986
12. Mathematical model of the migration of Cenozoic Benthic molluscs in the Tethyan Belt by G. Piccoli et al., 1986
13. Geological notes on the stratigraphy of the island of Natuna, Indonesia by A. Franchino & P. Liechti, 1983.
14. South Pacific Marine Geological notes, vol. 3, nos. 2-3, 1986
15. SOPAC News, vol. 4, nos. 3 & 4, 1986
16. Seatrads Bulletin, vol. viii, no. 1, 1987
17. Palaeontological abstracts, vol. 2, no. 1, 1987.

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Tarikh:

T.T.:

'CONDITIONS FOR STUDENT LOANS'

1. Eligibility and purpose of loans

Student Members in Year 3 or 4 who are in urgent need of money, especially for projects required in the University course, and in certain circumstances, the outstanding tuition fees.

2. Amount

A maximum amount of \$300.00 can be considered for project/field work or a full-year fees. Any sum of money borrowed must be repaid in full before the student can reapply for a further loan. However, all loans must be repaid within 1 year upon termination or completion of his undergraduate studies.

3. Failure to repay

The Society will send reminder 3 months after termination or completion of borrower's studies. If no repayment is made, then the Society will (i) publish in Warta Geologi the name of the borrower; (ii) seek to inform the employer of the borrower of outstanding loan; and (iii) seek legal action to recover the loan.

4. Guarantors

Three (3) guarantors who are full members of the Society or any other persons approved by the Council are required for any sum of \$300.00 or less. Five (5) (as above) guarantors for any loan to cover full tuition fees.

5. General

All the above conditions can be reviewed or amended by the Council.

PERSATUAN GEOLOGI MALAYSIA
(GEOLOGICAL SOCIETY OF MALAYSIA)

PINJAMAN PELAJAR

- 1. Nama
- 2. Tempat Pengajian(3)Tahun Pengajian
(Jabatan, Universiti)

4. Sebab-sebab permohonan pinjaman

5. Penjamin-penjamin yang telah bersetuju memberi jaminan.

	<u>Nama</u>	<u>Ahli PGM</u>	<u>Tandatangan</u>
1.	Ya/tidak
2.	Ya/tidak
3.	Ya/tidak
4.	Ya/tidak
5.	Ya/tidak

6. Adakah pinjaman yang belum di-bayar semula? Ya/Tidak.



Keputusan: Diluluskan/Tidak

Jumlah pinjaman yang diluluskan

.....
(Pengerusi)

.....
(Setiausaha)

STUDENT'S LOAN AGREEMENT

This AGREEMENT is made on the
 day of 19 between

 of
 (hereinafter called "The Student") of the of the second part
 and
 of
 and
 of
 and
 of
 and
 of
 and
 of

Whereas:

- (1) The Student is pursuing the course of training for
 at the

Now it is hereby agreed as follows:

- 1. The Society at the request of the student and with the approval
 of and consent of the Sureties hereby agrees to allow the
 Student to borrow a loan from the Society a sum of \$
 for the period of or such longer time as the Society
 may approve commencing from 19... and the
 Student hereby agrees that on the completion of the said
 course or on the abandoning of or in the event he/she fails

to complete the said course or in the event the said course is terminated for any reasons whatsoever, he/she be required to repay the loan with a period of 1 year on completion or termination of his/her studies.

2. It is hereby agreed and declared that if at any time during the currency of this Agreement either of the Sureties shall die or cease to reside within Malaysia or remain out of Malaysia for more than twelve consecutive months or shall be adjudged a bankrupt or obtain a wage earner's administration order then and so often the other of the parties of the third part shall find or the Student may find another surety who shall be to the satisfaction of the Council and who shall be ready and willing to be substituted in the place of the surety so dead, or ceasing to reside as aforesaid or remaining out as aforesaid or being adjudged bankrupt or obtaining a wage-earner's administration order: Provided that in the event of another surety of the satisfaction of the Society not being found or in the event of such other surety refusing to enter into an agreement whereby he/she agrees to be bound by the terms and conditions of this Agreement relating to the Sureties, the Society may at its option at any time thereafter require the Student to repay the loan immediately
3. It is thereby agreed and declared that if the student:-
 - i) Having completed or having abandoned the said course or having failed in the said course or in the event the said course is terminated for any reason whatsoever fails to repay the loan.
 - ii) having been required by the University to terminate the said course
 - iii) is dismissed from the University.

iv) refuses or by his/her own misconduct renders himself/
herself unsuitable to comply in accordance with the
provisions of Clause 1 hereof:

and in any such case the Student and the Sureties shall be
jointly and severally liable for themselves, their heirs,
executors of assigns to refund to the Society on demand the
amount borrowed or unpaid.

4. It is hereby agreed and declared that anything herein before
continued to the contrary notwithstanding, the Society may by
one month's notice in writing to the student cancel this Agreement
at any time, without assigning any reason therefore and thereupon
all benefits to and liabilities of the Student or the Sureties
under this Agreement shall cease.

In witness whereof the parties hereto have hereunto set their hands
and seals the day and year first above written.

Signed, sealed and delivered by the said

(student) in the presence of

Name of Witness (print)

Address

Occupation

Signature of Witness

Signed, sealed and delivered by the said

(guarantor) in the presence of

Name of Witness (print)

Address

Occupation

Signature of Witness

Signed, sealed and delivered by the said

(guarantor) in the presence of

Name of Witness (print)

Address

Occupation

Signature of Witness

Signed, sealed and delivered by the said

(guarantor) in the presence of

Name of Witness (print)

Address

Occupation

Signature of Witness

Signed, sealed and delivered by the said

(guarantor) in the presence of

Name of Witness (print)

Address

Occupation

Signature of Witness

Signed, sealed and delivered by the said

(guarantor) in the presence of

Name of Witness (print)

Address

Occupation

Signature of Witness

BERITA - BERITA LAIN

(OTHER NEWS)

TUNNELLING 88

Fifth international symposium, 18-21 April 1988, London, England.

The Institution of Mining and Metallurgy, with the cooperation of the British Tunnelling Society, the Institution of Mining Engineers and the Transport and Road Research Laboratory, Department of Transport, is pleased to announce the fifth international symposium, Tunnelling '88, to be held at the Novotel London, England, from 18 to 21 April 1988.

Theme

The theme of the symposium is the design and construction of tunnels in the fields of civil and mining engineering worldwide.

Papers

Papers are invited on practical developments in safety, technology and cost-effectiveness of all types of tunnelling. The programme of technical sessions will include the following topics:

Machines and methods - shields, roadheaders, full-facers, drill/blast, automation and robotics, pipe-jacking, cut and cover, immersed tube and research and development.

Geotechnical topics - site investigation, ground treatment (e.g. by dewatering, grouting or freezing) lining and support, ground movements and measurements.

Services - planning, surveying, contractual and legal aspects, materials supply and handling, safety and health.

Complete projects design and construction of underground excavations for mining and civil purposes; management and control of time, cost and quality.

Abstracts (250 - 300 words) should be submitted to the Conference Office, Tunnelling '88, The Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, England.

Preprints of papers selected for presentation at the symposium will be distributed to all registrants from January 1988.

Technical Tour

During the week beginning on 24 April, 1988, a technical tour that will include visits to major tunnelling operations in the United Kingdom and France will be held. Those who may wish to participate in the tour, full details of which will be given in the Second Circular.

industries internationally.

Full details may be obtained from Mack-Brooks Exhibitions Ltd.,
Forum Place, Hatfield, Hertfordshire, England (telephone, 07072 75641;
telex 266350 MACBEX G; fax, 07072 75544).

Enquiries

All enquiries in connection with Tunnelling '88 should be addressed
to the Conference Office, The Institution of Mining and Metallurgy, 44
Portland Place, London W1N 4BR, England (telephone, 01-580 3802; telex,
261410 IMM G).

AUSTRALIAN MINERAL FOUNDATION - COURSES FOR THE MINERAL INDUSTRY, JAKARTA, 1988

Presented by PT Radiant Utama in association with Australian Mineral
Foundation

Exploration Geochemistry - with an emphasis on gold (6 days)
Course leader: Dr. A.S. Joyce. Date: 11-16 April

Geophysical Exploration for Alluvial Deposits
(immediately following SEATRAD Seminar 'Geophysics in the Tin Industry')
Course leader: Mr. Hugh Rutter. Date: 1-3 June

Economic Guidelines for Gold Exploration
Course leader: Professor Brian Mackenzie. Date: 20-24 June

Coal Exploration and Mining Geology
Course leader: Dr. Colin R. Ward. Date: 25-29 July

Ore Reserve Estimation: Techniques and Problems
Course leader: Mr. Daniel Guibal. Date: 8-12 August

Prospect and Project Evaluation for the Mineral Industry
Course leader: Dr. Andrew H. White. Date: 19-23 September

Epithermal Gold - Geology & Exploration (including fieldtrip)
Course leader: Dr. Gregg W. Morrison. Date: 10-18 October (tentative)

Geology & Exploration Techniques
Course leader: Dr. A.S. Joyce. Date: 7-11 November

Geophysical Exploration in Tropical Environments
Course leader: Mr. Hugh Rutter. Date: 5-9 December

Further enquiries to:

Mr. Maher Sungkat
Training Coordinator
PT Radiant Utama
Utama Building
Jl. Warung Buncit Raya No. 61
Jakarta, Indonesia
Telephone: 7992620, 7990950,
7995633, 7995675
Telex: 47310 JKT

Mr. David Linn
Manager, Overseas Operations
Australian Mineral Foundation
63 Conyngham Street
Glenside, South Australia 5065
Australia
Telephone: +618 379 0444
Telex: AA87437 AMFINC
Fax: +618 79 4634

SEMINAR ON APPLICATION OF GEOPHYSICS IN THE TIN MINING INDUSTRY, JAKARTA, INDONESIA, 30-31 MAY 1988

Organized jointly by:

Southeast Asia Tin Research and Development (SEATRAD) Centre,
PT Tambang Timah (PERSERO), Indonesia
Indonesian Association of Geophysicist (HAGI)

Objective

The aim of this seminar is to create a forum for discussion and the exchange of experiences in the application of geophysics in the member countries among geophysicists, geologists and miners from government institutions, research institutes, industry, universities and related organizations. Geophysical techniques for exploration of tin and other heavy minerals in fieldworks and data processing would be discussed with the aim of achieving higher reliability and improvement in data interpretation.

Call for Papers

The Organizing Committee invites the submission of abstract of proposed papers in the following areas:

- * Status report of member countries
- * Ground survey techniques
- * Offshore survey techniques
- * Airborne survey techniques
- * Computer application.
- * Application of geophysics in Mining Geotechnics.

Papers on related topics will also be considered. Some of the authors presenting the selected papers will be sponsored by SEATRAD Centre.

The official language of seminar is English. Abstracts of papers should be submitted to the Organizing Committee, PT Tambang Timah (PERSERO), Divisi Eksplorasi, J. Jenderal Gatot Subroto, Jakarta, Indonesia, P.O. Box 2016 & 2078. Attn: Mr. Sutedjo Sujitno.

*The completed manuscript of selected papers will be required not later than 1 April 1988.

Registration Fee

The registration fee for the seminar is US\$80.00. Payment should be made in bank draft, payable to: PT Tambang Timah (PERSERO), Jl. Jenderal Gatot Subroto, Jakarta, Indonesia, Bank Bumi Daya, Cabang Jakarta Kota, Acc. no. 0514-05390.

- ** Payment of the fee will entitle registrants to
- * receive a volume of papers covering the seminar topics
- * attend the seminar sessions
- * lunches during the two-day sessions
- * tea/coffee during the breaks.

A SHORT TERM COURSE ON MINERAL PROCESS ENGINEERING THEORY
AND PRACTICE FOR MINERS, PROSPECTORS, PLANT OPERATORS,
GEOLOGISTS, ENGINEERS AND METALLURGISTS OF MALAYSIA,
MAY 23 - JUNE 4, 1988, IPOH, PERAK

Objectives

The main objectives of this short term course are to update knowledge, provide the participants with a review of the common physical ore processing techniques utilized in mining industry, and give an opportunity to exchange ideas and experience on various mineral processing operations. This program will interest prospects, small miners, plant operators, practising engineers, geologists and metallurgists working in the mining industry with responsibility for process design and performance. The program will also highlight various current studies of significance to the processing of minerals of gold, tin, iron and other base metals and non-metallic minerals. Practical case studies will be used as worked examples to illustrate both the problems that can arise and the benefits of a systematic approach based on a sound understanding of mineral processing techniques.

Participants

The operational sequences designed in this mineral processing course are especially suitable for the induction of novice personnel to production routine and for demonstrating the importance of operational consistency, coordinated materials handling and preventive maintenance. The plant operators, small miners, engineers, geologists and metallurgists working in various mining industries will also benefit from this course. English proficiency is required since the program will be conducted in English.

Programme Content

The program is divided into following groups of topics.

1. Introduction to the course
2. Mineral resources of Malaysia
3. Mineral economics
4. Mineralogical examinations of ores and minerals
5. Role of Scanning Electron Microscopy and Electron Microprobe in the mineral industry
6. Materials balance
7. Comminution
8. Design of crushing and grinding plants
9. Screening and classification
10. Gravity separation
11. Heavy media separation
12. Froth flotation
13. Magnetic and high tension separation
14. Dewatering and tailing disposal
15. Hydrometallurgical processing of ore
16. High temperature mineral processing
17. Processing of gold - principles, problems and prospects
18. Production of tin and other related metals in Southeast Asia

19. Application of beneficiation processes for industrial and construction materials
20. Beneficiation of amang
21. Processing of complex sulphide ores with special reference to gold, Cu, Zn and Pb
22. Recent development in the fields of mineral processing.

The Method

The Programme will use a combination of lectures, tutorials, laboratory exercises, syndicate study and case study to contribute to the achievement of the Programme objectives. Syndicate method involves group discussion and interchange of views based on the participant's practical experience. This enables them to develop more confidence to extend and enhance their knowledge in the field of mineral processing, and to modify and improve the existing processing techniques in order to increase productivity and reduce the cost of production.

The Faculty

The faculty comprises of distinguished academics, professional and managers. The faculty will be from the School of Materials and Mineral Resources Engineering, Universiti Sains Malaysia, who will design and present the program. They are well trained in U.K., Canada, U.S.A., and Australia and experienced in University and Industry. This faculty will be augmented by invited speakers from local mining, public and private, organisations (viz. SEATRAD, M.R.I., G.S.M., MMC, etc.)

General Information

- a) Program Fee is M\$600.00 per participant.
Applications received on or before 30th March, 1988 will be entitled to a special early bird discounted fee of only M\$540.00 per participant (about 10% discount). The fee covers tuition, program materials, coffee on meeting days, and a closing banquet.
- b) Class Size: Participation in the program is limited to not more than 60 participants and will be based on a first-come-first-served basis.
- c) Closing Date: The closing date for registration is 15th April, 1988. Early bird registration with payment must be received not later than 30th March 1988 for the special discounted fee.

Registration

Attendance for the short term course is by prior registration only. Registration should be completed on a Registration Form obtainable from Cik Wan Fadzillah Wan Abdul Rahman, The School of Materials and Mineral Resources Engineering, Universiti Sains Malaysia, Kampus Cawangan Perak, Jalan Bandaraya, 30000 Ipoh, Perak, Malaysia.

Ph. 05-503131 extn. 2317

Enquiries and further information may be obtained from the Program Coordinators (Attn: Dr. V.N. Misra), School of Materials and Mineral Resources Engineering, USM, Ipoh Campus, Perak.

Ph. 05-503131 extn. 2326

XVI INTERNATIONAL MINERAL PROCESSING CONGRESS

Stockholm, Sweden, June 5-10, 1988

The XVIth IMPC will cover all aspects of mineral processing within the general theme '*The expanding world of mineral processing*'.

Scientific Program

Some of the papers to be presented during the Congress and printed in the proceedings (as per October 1, 1987).

Plenary/Review Papers

Marston Fleming Memorial Lecture - Future of mineral processing - M.J. Astier, France

Environmental management issues in Swedish mining, past, present and future, P.G. Broman, Sweden

Advanced computer methods for mineral processing: Their function and potential impact on engineering practices - A. Broussaud, France

Developments in autogenous grinding - M. Digre, Norway

The Mario Carta Lecture - Highlights of sulphide flotation development - D.W. Fuerstenau, USA

New flotation reagents for sulphide and non-sulphide ores in the USSR - A.V. Glembotsky, *et al.*, USSR

Reprocessing of industrial waste - A. Kollwentz, U Haidlen, FRG

We really need revolution in comminution - V.I. Revnivitsev, USSR

Recent developments in the extraction of gold - J.T. Woodcock, Australia

Comminution

A study of ultrafine grinding based on fracture mechanics - Y. Kanda *et al.*, Japan

High pressure comminution with roller presses in mineral processing - H. Kellerwessel, FRG

Alteration of mineral properties during grinding through mechanical reactions - I.J. Lin, S. Nadiv, Israel

Relations between mineralogical texture and comminution characteristics for rocks and ores - T. Malvik, Norway

Grinding of minerals with high compression roller mills - K. Schonert, FRG

Enhancement of mineral liberation - B.A. Wills, Great Britain

Dewatering and Classification

Optimum choice of unit processes for dewatering of mineral slurries - M. Carlsson, Sweden

Continuous pressure filtration in the mineral industry - M. Dosoudil, Netherlands

The role of mechanical agitation in flocculation and dispersion of mineral particles - R. Hogg, USA

Influence of surfactants and flocculants on the filtration of iron ore concentrates - K.V.S. Sastry, USA

Flotation; Equipment and Systems

- Studies on the optimization and design of multistage flotation processes: example of extremely finest-grained tin ore slimes - U Bilsing *et al.*, GDR
- Use of sulphite/air oxidation for removal of xanthate and MIBC from flotation products for cyanidation/CIP treatment for gold recovery - M.H. Jones, J.T. Woodcock, Australia
- The treatment of tin-bearing slimes by two-liquid flotation - K.I. Marinakis, H.L. Shergold, Netherlands
- Eh/Ph control in sulphide flotation - J.H. Mourao Gomes, Portugal
- Improvement of the technical feasibility of mineral processing projects using a mobile flotation pilot plant - J. Predali, France
- The influence of mineral locking on flotation behaviour - D.N. Sutherland *et al.*, Australia
- The present status and potential development of the flotation cell - T.R. Twidle, USA
- Separation of sulfide and non-sulfide minerals by the 'Gamma flotation process' - B. Yarar, USA

Flotation Fundamentals

- Selective flotation of sulfidic complex ores with special reference to the interaction of specific surface, redox potential and oxygen content - A.N. Beyzavi, L.P. Kitschen, FRG
- Sulfur enrichment at sulfide mineral surfaces - A.N. Buckley, G.W. Walker, USA
- Particle dispersion in fine mineral flotation - M.C. Fuerstenau *et al.*, USA
- Structural studies on adsorption of collectors on mineral surfaces - O. Lindqvist, K. Stridh, Sweden
- Improvement of the flotation process by modification of the froth system - H. Obers *et al.*, FRG
- The role of complexing and dispersing properties of reagents on the stability of suspensions in the presence of divalent metal ions: quartz and cassiterite suspensions in the presence of Cu (II) and Fe (II) - P. Parsonage, A. Marsden, Great Britain
- Surface chemical studies on sulphide suspensions - R.J. Pugh, Sweden
- Activated aqueous dispersions of air and their application to intensifying the flotation method of mineral dressing - P.M. Solozhenkin *et al.*, USSR
- A study of particle entrainment in flotation with different frothers - the case of copper ore - T.V. Subrahmanyam, E. Forssberg, Sweden

Magnetic, Electric and Gravimetric Separation

- Progress in triboelectric separation of minerals - G. Alfano *et al.*, Italy
- Prospects for magnetic beneficiation of weakly magnetic ores - L.K. Antonenko *et al.*, USSR

Study on reasonable mineral processing technology for no 91 rich ore-body in Dachang Mine, Guangxi, China - Tiansong Dong, Jiang Robin, People's Rep. of China

Design criteria and control strategies for dynamic dense media separation processes treating fine ores - G. Ferrara, G.D. Schena, Italy

Separation of particles in hydrocyclone using magnetic fluids - I.J. Lin *et al.*, Israel

The centrifugal gravity concentration of fine alluvial gold - V.M. Mankov *et al.*, USSR

Advances in technology of magnetic separation - G.I. Mathieu, Canada

A study of wet magnetic separation on Batu Besi alluvial/primary deposit, Belitung, Indonesia - D. Sumardi Karsidi, Malaysia

Studies on vibrating high gradient magnetic separation of mixed sulphide flotation concentrates - Xuemin Yuan *et al.*, People's Rep. of China

Continuous high-gradient magnetic separator for kaolin treatment - V. Zezulka, F. Zurek, Czechoslovakia

Nonferrous and Precious Metals

Chemical-metallurgical process in the enrichment of rebellious raw materials - D.N. Abishev, USSR

Silver recovery by cyanidation a refractory lead-zinc ore from Bolkardag, Southern Turkey - N. Acarkan, G. Onal, Turkey

The spherical agglomeration of cassiterite - R.P. Allen, C.J. Veal, Great Britain

Recovery of silver from refractory ores - A. Bahr, Th Priesemann, FRG

Development of intensive methods for pulp preparation and selective flotation of copper-zinc ores - V.A. Bocharov *et al.*, USSR

Flotation of sulphide finest grains from copper ore pulps containing clay minerals - R. Bortel, Poland

Influence of some ions and reagents on cassiterite flotation - C. Ek, N. Kalenga, Belgium

The reactivity and flotation behaviour of the oxide minerals at Tsumeb - P.J. Harris, RSA

Flotation of fine chalcocite by means of long chain xanthates - W. Janusz *et al.*, Poland

Reagent schemes for cost effective optimization of plant performance - G. Kasumpa *et al.*, Zambia

Recent advances in new frother and collector chemistry for sulfide mineral flotation - R. Klimpel *et al.*, USA

Development of cyanide-free flotation of Cu-Pb-Zn ore - Hanzhao Liu, People's Rep. of China

New synthetic collectors for selective flotation of zinc and lead oxidized minerals - A.M. Marabini *et al.*, Italy

Polymetallic ore from Chessy: Is it some times possible to obtain good metallurgical results by flotation of complex sulfide ore? - G. Morizot *et al.*, France

- New sulfide and precious metals collectors: For acid, neutral and mildly alkaline circuits - D.R. Nagaraj *et al.*, USA
- Use of chelating agent as a depressant for the separation of oxidized copper mineral from calcite by flotation - M Niinae *et al.*, Japan
- The effect of temperature on the flotation of pyrite from ores of varying particle size distributions and mineral composition - C. T. O'Connor *et al.*, USA
- The utilization of a corn starch derivative as a gangue depressant in sulphide copper flotation - C.E. Pereira *et al.*, Brazil
- Studies on the beneficiation of copper oxide minerals - S. Prabhakar *et al.*, India
- Rampura - Agucha: The largest complex deposit in India: The fascinating story of development of an ore dressing flow sheet - K. Ravindranath, H.V. Paliwal, India

Ferrous Metals

- Concentration of chromite gravity tailings by wet high intensity magnetic separation - U. Atalay *et al.*, Turkey
- Hydrometallurgical processing of polish serpentinites - W.A. Charewicz *et al.*, Poland
- Concentration of titaniferous sands: A case study - L. Cortez, Portugal
- Beneficiation of lean manganese carbonate ore in Zunyi mine in China - Yao Liu *et al.*, People's Rep. of China
- Introduction of new technologies for beneficiation of Indian hematite ores, reduction of losses and increase in their quality - N. Prasad *et al.*, India
- Mechanisms of combining reaction of high polymers and surfactants in the selective flocculation of hematite - Hongen Zhang *et al.*, People's Rep. of China.

Industrial Minerals

- Beneficiation studies, production and current interest of barite, celestite and fluorite ores in Canada - P. Andrews, R.K. Collings, Canada
- Methods for feldspar beneficiation - A.I. Gorshkov *et al.*, USSR
- Dressing of bauxite ores by means of micro-organisms - V.I. Groudeva, S.N. Groudev, Bulgaria
- A new acidless and fluorless flotation method of silica sand - Tang Jiaying *et al.*, People's Rep. of China
- Concentration of mining chemical raw materials in suspensions - A.O. Kozhevnikov, USSR
- The influence of mechanical pretreatment and chemical conditioning in the flotation of feldspar from rocks of different paragenesis - D Uhlig, GDR

Modelling, Simulation and Control

- Physical and chemical modelling and optimization of reagent action during sulphide ore flotation - A.A. Abramov *et al.*, USSR

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

1988

February 1988

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

February 1988 - March 1988

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

February 1988 - June 1988

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

March 1988

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

March 1988 - November 1988

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

March 1988 - April 1988

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

June 1988

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

June 1988 - August 1988

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

July 1988 - August 1988

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

September 1988 - July 1989

PETROLEUM EXPLORATION GEOLOGY (Headington, Oxford, UK). An annual diploma course designed by Oxford Polytechnic to prepare post-graduate geologists for the duties of geologists in oil exploration teams. For information: M. Hoggins, Department of Geology and Physical Sciences, Oxford Polytechnic, Headington, Oxford OX3 0BP, U.K.

September 1988 - August 1989

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

October 1988 - November 1988

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

October 1988 - July 1989

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

October 1988 - September 1989

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

October 1988 - September 1990

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

October 1988 - September 1990

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

KALENDAR (CALENDAR)

1987

November 9-18, 1987

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

December 7-10, 1987

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

December 7-11, 1987

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

December 7-19, 1987

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

1988

January 6-8, 1988

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

February 2-5, 1988

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

February 24-27, 1988

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

March 8-11, 1988

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

March 17-18, 1988

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

March 20-23, 1988

AAPG/SEPM (Annual Meeting), Houston, Texas, USA. (Convention Department AAPG, Box 979, Tulsa, Ok. 74101, USA).

March 21-23, 1988

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

March 23-25, 1988

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

March 28-30, 1988

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

April 6-8, 1988

THE CADOMIAN OROGENY (Meeting), Oxford, U.K., Co-sponsored by IGCP-233, (R. D'Lemos, Dept. of Geology, Oxford Polytechnic, Headington, Oxford OX3 0BP, U.K.).

April 7-9, 1988

EXPERIMENTAL MINERALOGY, PETROLOGY AND GEOCHEMISTRY (2nd International Symposium), Bochum, F.R.G. Co-sponsored in part by IUGS. (Bochum Symposium, Institut für Mineralogie, Ruhr-Universität, Postfach 10 21 48, D-4630 Bochum 1, F.R.G.).

April 10-15, 1988

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

April 18-21, 1988

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

April 24-27, 1988

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

May 11-12, 1988

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

May 11-20, 1988

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

May 16-20, 1988

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

May 16-20, 1988

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

May 16-20, 1988

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

May 22-25, 1988

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

May 29 - June 3, 1988

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

May 30 - June 3, 1988

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

May 31 - June 4, 1988

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

June 1-5, 1988

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

June 5-10, 1988

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

June 21-24, 1988

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

July 9-15, 1988

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

July 10-15, 1988

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

July 11-16, 1988

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

July 18-20, 1988

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

July 18-22, 1988

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

July 25-29, 1988

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

July 25-29, 1988

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

July 30 - August 4, 1988

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

August 1988

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

August 9-12, 1988

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

August 14-19, 1988

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

August 28 - September 2, 1988

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

August 28 - September 2, 1988

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

August 29 - September 2, 1988

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

September 5-9, 1988

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

September 5-9, 1988

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

September 5-9, 1988

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

September 5-10, 1988

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

September 6-10, 1988

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

September 7-10, 1988

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

September 19-23, 1988

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

September 20-22, 1988

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

September 20-23, 1988

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

September 25-28, 1988

MEDITERRANEAN BASINS (AAPG European Geological Conference & Exhibition), Nice, France. (AAPG Convention Department, Box 979, Tulsa, Ok 74101, USA).

September 26-29, 1988

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

October 1988

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

October 1-3, 1988

NEOTECTONICS (INQUA Colloquium), Orleans, France. (J. Fourniquet, BRGM/SGN, B.P. 6009, 45060 Orleans Cedex 2, France).

October 11-17, 1988

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

October 12, 1988

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

October 23-28, 1988

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

October 30 - November 3, 1988

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

October 31 - November 3, 1988

GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Denver, Colorado, USA. (Meetings Department, GSA, P.O. Box 9140, Boulder, Co. 80301, USA).

November 1988

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

November 10-14, 1988

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

November 21-24, 1988

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

1989

January 1989

SOIL MECHANICS AND FOUNDATION ENGINEERING (12th International Conference), Rio de Janeiro, Brazil. (XII ICSMFE, Caixa Postal 1559, 20000 Rio de Janeiro, RJ, Brazil).

January 15-27, 1989

OMAN OPHIOLITE-STRUCTURE-PETROLOGY-STRATIGRAPHY (International Symposium), Muscat, Sultanate of Oman. (Secretary, Hilal Azry, Ministry of Petroleum and Minerals, P.O. Box 551, Muscat, Oman).

February 8-11, 1989

MODEL OPTIMIZATION IN EXPLORATION GEOPHYSICS (7th International Seminar), Berlin. (Institut für Geophysikalische Wissenschaften, Mathematische Geophysik, Freie Universität Berlin, Podbielskiallee 60, D-1000 Berlin 33, Federal Republic of Germany).

February 28-March 3, 1989

APPLICATION OF COMPUTERS AND OPERATIONS RESEARCH IN THE MINERAL INDUSTRY (21st International Symposium), Las Vegas, Nev., USA. (Society of Mining Engineers, Caller No. D, Littleton, Co. 80162-5002, USA).

March 28 - April 9, 1989

SILURIAN SYSTEM (International 'Murchison' Symposium), Keele, Staffs., U.K. Co-sponsored by the IUGS Subcommittee on Silurian Stratigraphy. (Dr. M.G. Bassett, National Museum of Wales, Cathays Park, Cardiff CF1 3NP, Wales, UK).

May 17-18, 1989

GOLD IN EUROPE (International Conference), Toulouse, France. (R.P. Foster, Department of Geology, University of Southampton, Hants, SO9 5NH, U.K.).

June 26-29, 1989

ENGINEERING GEOLOGY IN TROPICAL TERRAINS (International Conference), Selangor Darul Ehsan, Malaysia. Co-sponsored by IAEG. (Secretariat, International Conference, Dept. of Geology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor Darul Ehsan, Malaysia).

July 9-19, 1989

INTERNATIONAL GEOLOGICAL CONGRESS (28th), Washington, D.C., USA. (International Geological Congress, P.O. Box 1001, Herndon, Va. 22070, USA).

July 27-August 1, 1989

WATER-ROCK INTERACTION (6th International Symposium), Bath, U.K. (Dr. W.M. Edmunds, Hydrogeology Group, BGS, Maclean Building, Crowmarsh Gifford, Wallingford, Oxfordshire, OX10 8BB, U.K.).

August 14-16, 1989

PRECAMBRIAN GRANITOIDS: PETROGENESIS, GEOCHEMISTRY AND METALLOGENY (IGCP 217 and 247 Symposium), Helsinki, Finland. (Precambrian Granitoids Symposium, Department of Geology, University of Helsinki, P.O. Box 115, SF-00171 Helsinki, Finland).

September 3-9, 1989

GEOMORPHOLOGY (2nd International Conference), Frankfurt/Main, F.R.G. (Prof. Dr. Arno Semmel, Institut für Physische Geographie, Universität Frankfurt, Senckenberganlage 36, Postfach 11 19 32, D-6000 Frankfurt/Main, F.R. Germany).

September 4-8, 1989

NON-METALLIC MINERALS (2nd World Congress), Beijing, P.R. China. (Prof. Xu Changyou, Wuhan University of Technology, Wuhan, Hubei Province, P.R. China).

September 14-19, 1989

EDITING IN THE 90'S (Joint CBE, EASE, AESE Meeting), Ottawa, Ontario, Canada. (Barbara Drew, Research Journals, National Research Council of Canada, Ottawa, Ontario, Canada K1A 0R6).

September 17-24, 1989

ENERGY (14th World Congress), Montreal, Quebec, Canada. (World Energy Conf., 34th St. James's Street, London SW1A 1HD, UK).

October 2-4, 1989

GEOCHEMICAL EXPLORATION (13th International Symposium), Rio de Janeiro, Brazil. Co-sponsored by AEG. (Organizing Committee, 13th IGES, P.O. Box 2432, 20010 Rio de Janeiro, Brazil).

October 2-4, 1989

FLUVIAL SEDIMENTOLOGY (4th International Conference), Barcelona, Spain. (C. Puigdefabregas, Servei Geològic de Catalunya, carrer Diputació 92, 08015 Barcelona, Spain).

October 29 - November 2, 1989

SOCIETY OF EXPLORATION GEOPHYSICISTS (Annual Meeting), Dallas, Texas, USA. (Convention Assistant, SEG, P.O. Box 3098, Tulsa, Ok. 74101, USA).

November 9-12, 1989

GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), St. Louis, Missouri, USA. (Meetings Department, GSA, P.O. Box 9140, Boulder, Co. 80301, USA).

1990

August 1990

INTERNATIONAL ASSOCIATION ON THE GENESIS OF ORE DEPOSITS (8th Symposium), Ottawa, Canada. (Dr. R.W. Boyle, Geological Survey of Canada, 601 Booth Street, Ottawa, Canada K1A 0E8).

August 12-18, 1990

INTERNATIONAL MINERALOGICAL ASSOCIATION (15th Meeting), Beijing, China. (Prof. Huang Yunhui, Institute of Mineral Deposits, Chinese Academy of Geological Sciences, Baiwanzhuang Rd. 26, Fuchengmenwai, Beijing, China).

