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GEOLOGICAL NOTES

Spinel lherzolite inclusion in limburgite from Kuantan, Peninsular Malaysia.

K.R. Chakraborty, Jabatan Geologi, Universiti Malaya, Kuala Lumpur.

Inclusions of mantle-derived ultramafic xenoliths are quite common in undersaturated alkaline mafic lavas of both continental and oceanic regions (see, for example, Forbes and Kuno, 1965). Such xenoliths have also been reported from the Late Cenozoic alkaline basaltic province of Southeast Asia that covers Thailand, Kampuchea, Laos and Vietnam (Barr and MacDonald, 1978). But ultramafic xenoliths have not hitherto been reported from the alkaline basaltic lavas of Kuantan which also probably belong to this basaltic province.

Alkaline lavas of Kuantan comprise three distinct types, namely, alkali olivine basalt, limburgite (basanite) and olivine nephelinite (Chakraborty, 1977). These rocks are now under investigation by the writer. The study began in 1977. Recently, several new thin sections of all the three lava types have been studied. One of the examined limburgite specimens contains a weathered (soils the finger) pale yellowish inclusion (2.5 cm x 2 cm x 0.8 cm). On microscopic examination, this inclusion was found to be a spinel lherzolite consisting of olivine, two pyroxenes and greenish brown spinel. This inclusion is somewhat deformed and highly carbonatized. This is the first recorded occurrence of spinel lherzolite in the Kuantan lavas. As yet, no ultramafic xenolith has been found in the alkali olivine basalt and the olivine nephelinite.

Spinel lherzolite xenoliths from alkaline basaltic lavas have been extensively studied by many workers. Phase chemistry and high pressure equilibria studies suggest equilibration of spinel lherzolith xenoliths at 800 - 1100°C in the minimum pressure range of 8 to 15 kb, implying that they are, in all probability, of mantle origin (Green and Hibberson, 1970; Ringwood, 1975, p. 109). From cumulative evidence of isotopes, REE and trace element geochemistry and textural features, most workers believe that spinel lherzolite xenoliths are accidental and not cognate (cf. O'Hara, 1968), and that they probably represent modified samples of the Upper mantle (see, for example, Frey and Green, 1974).

The presence of a dense spinel lherzolite xenolith suggests that the limburgitic (basanitic) magma of Kuantan has ascended directly and rapidly from a depth of $\geq$ 30 km without signficant modification by crystal fractionation processes at shallower depths. (Incidentally, Kushiro, et al., 1976, have inferred, from viscosity data, that basalts carrying peridotite nodules would have to ascend from a depth of 50 km in less than 60 h.). This implies that the limburgitic magma is either primary (i.e. an unmodified partial melt of mantle peridotite) or a high pressure derivative liquid formed in mantle environment from a primary melt by crystal fractionation or other processes. Resolution of these two genetic

alternatives is not possible with the data currently available. However, the chemical composition may throw some light on this problem. Three chemical analyses of the limburgites and their CIPW norms are presented in Table 1.

On theoretical grounds, primary melts in equilibrium with mantle peridotite should characteristically have high Mg-values i.e. $Mg/(Mg + Fe^{++})$. In the absence of other more definitive evidence, this Mg-value has been used by some workers to identify primary magma. According to Frey, et al. (1978), primary basaltic magmas formed by partial melting (up to 30%) of mantle peridotite should have Mg-values between 68 and 75. Irving and Green (1976) put the lower limit of the Mg-value at 66 for primary liquids in equilibrium with mantle olivines of composition Fo_{86} to Fo_{90}, assuming $K_D^{oliv/liq} = 0.33$. The Mg-values of the analysed limburgites are between 65 and 68 (Table 1). It is thus tempting to infer that they may represent a primary magma. However, the Mg-values have been calculated on the basis of an assumed Fe_2O_3/FeO ratio of 0.25. If the pre-eruptive Fe_2O_3/FeO ratio were less, then the Mg-values would also be somewhat lower. Moreover, the MgO contents of these limburgites appear to be less than those of the spinel lherzolite-bearing basanites (considered as primary) of other areas. Thus some fractionation of the limburgitic magma prior to entrainment of spinel lherzolite inclusion cannot be discounted.

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Table 1. Chemical analyses of limburgites

Oxide	1	2	3
SiO_2	44.88	45.59	45.38
TiO_2	2.02	1.93	1.96
Al_2O_5	14.02	13.42	13.65
FeO*	10.92	11.03	10.89
MnO	0.20	0.20	0.19
MgO	9.67	9.88	10.59
CaO	9.46	9.08	9.20
Na_2O	3.60	3.91	3.78
K_2O	1.95	1.77	1.79
P_2O_5	0.89	0.88	0.85
L.I.	2.10	1.83	1.14
Total	99.71	99.52	99.42
$\frac{100\ Mg}{Mg+Fe^{++}}$	65.92	66.17	67.96

*Total iron as FeO. L.I. = Loss on ignition. All analyses by XRF. Analysis no. 3 is from the spinel lherzolite-bearing specimen.

CIPW Norm **			
Or	11.77	10.68	10.73
Ab	12.30	15.49	13.43
An	16.69	14.13	15.21
Ne	10.19	9.91	10.31
Di	20.47	21.02	20.55
Ol	19.19	19.58	20.69
Mt	3.30	3.33	3.27
Il	3.92	3.74	3.78
Ap	2.15	2.13	2.04

** Based on $Fe_2O_3/FeO = 0.25$.

The nature of the contact between the 'quartz porphyry' and the Jerai Formation in the Rest House[1] area, Kedah Peak[2], Kedah.

Lim Beng Kung, Jabatan Geologi, Universiti Malaya, Kuala Lumpur.

Introduction

The origin of the quartz porphyry body in the vicinity of the Kedah Peak Rest House has been a subject of much speculation since it was first noted by Willbourn (1926), who believed it to be genetically related to the Jerai Granite. Paramanathan (1964) mapped it as an intrusive body. It was later referred to as an aplite dyke by Rao (1972). Minor sedimentary characteristics of the rock led Bradford (1972) to speculate a possible metasomatised arenaceous origin, while Almashoor (1974) is more inclined towards a tuffaceous origin.

The purpose of this note is to present some new data on the relation between the 'quartz porphyry' and the Jerai Formation obtained during a recent study involving detailed geological and ground magnetic survey of the Rest House area (Fig. 1).

Stratigraphy

The major part of the area is underlain by regionally metamorphosed metasediments of the Jerai Formation. Though they grade into one another, 3 lithological units, J_1, J_2 and J_3, can be differentiated based on texture, colour and mineralogy (Fig. 2). Cross-bedding shows that there is no overturning.

J_3, the youngest unit, is an uninterrupted sequence of 'clean' light grey to white quartzite with very little mica. Thin sections show that it is composed mainly of medium-sized, equigranoblastic polygonal quartz.

J_2 which underlies unit J_3 is predominantly made up of beds of grey to dark green quartz-mica schist. These rocks often show black laminae composed of rich concentrations of mafic minerals, epidote and biotite. They easily break along schistose planes, exposing platy white mica and tourmaline prisms. Occasional bands of large quartz grains are present in the unit.

Unit J_1 is a sequence of rock with predominant beds of quartzite, often iron-stained. Increase in argillaceous content in the lower parts of this unit give rise to beds of quartz-mica schists similar to those in unit J_2 but with greater amount of epidote. The schist here grades into coarse-grained metamorphosed schist.

'Quartz porphyry'

Of special interest is the magnetite-veined quartz porphyry which typically consists of large crystals of relict quartz and alkali

1 Rumah Persinggahan
2 Gunung Jerai

Fig.1 Location of the area surveyed

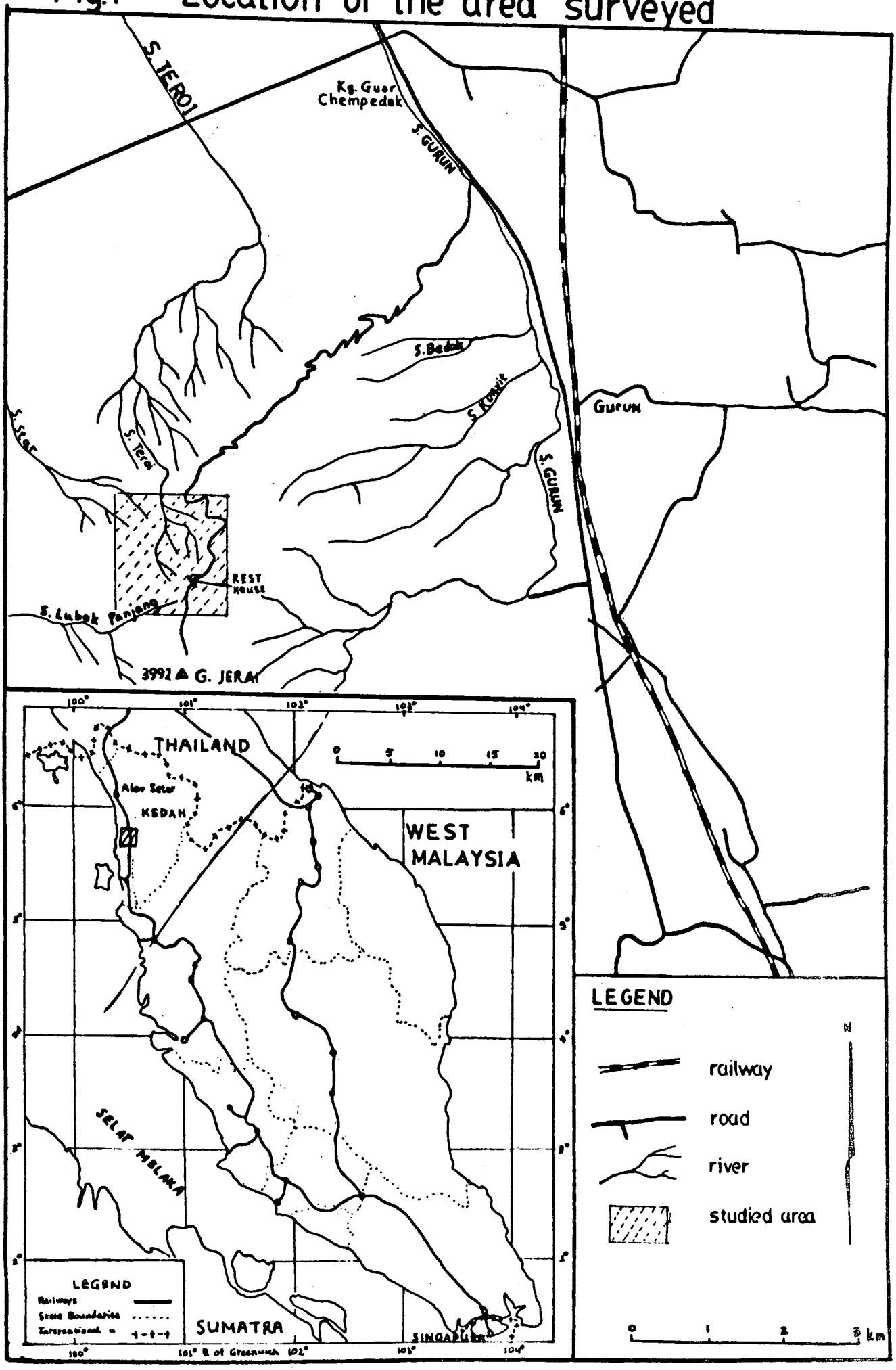
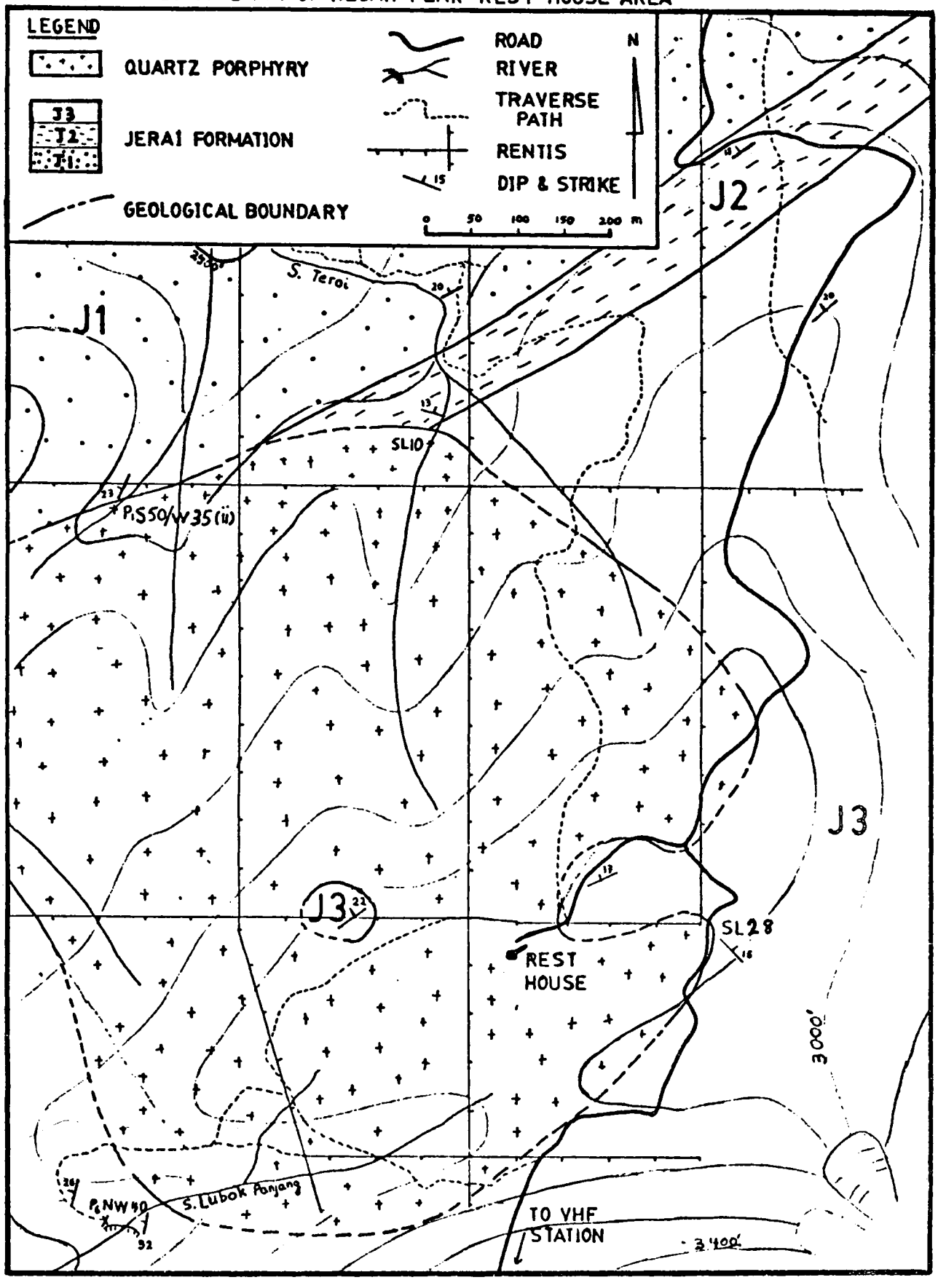


FIG. 2 GEOLOGICAL MAP OF KEDAH PEAK REST HOUSE AREA



feldspar (microcline) in a groundmass of quartz and mica. In the magnetite mineralised area, there is notable increase in magnetite grains, biotite and tourmaline in the rock. The large quartz grains often show embayed features and in large handspecimens alignment of the mica is evident.

The 'quartz porphyry' bears some resemblance to the metamorphosed grit of unit J_1. However, the metamorphosed grit is notably devoid of large crystals of alkali feldspar and the larger quartz grains invariably have sutured boundaries while those in the 'quartz porphyry' are euhedral.

Nature of the 'quartz porphyry'/Jerai Formation contact

It is interesting to note that Paramanathan (1964) and Rao (1972) mapped the 'quartz porphyry' at the Rest House as an igneous body with a lenticular outcrop and Almashoor (1974) mapped it as part of an extensive conformable bed within the Jerai Formation. However in the present detailed study, it has been found that the outcrop is not elongated but circular in outline, cutting the metasediments (Fig. 2). At location SL28 (Fig. 2), the intrusive contact can be seen in the outcrop (Plate 1).

Generally, the beds dip gently towards the north-west. Detailed mapping, however, showed that some beds near the contact do not follow the regional trend. At location P_6NW40, the quartzite beds are distorted, possibly due either to forceful intrusion or later deformation accompanying regional metamorphism.

The metamorphosed 'quartz porphyry' at the contact with the Jerai Formation has a different composition from the rock more than 30 m away from the contact. In contact with the quartzite of unit J_3 at SL28, the metamorphosed 'quartz porphyry' lacks biotite and muscovite. But the rocks at the contact with the schists of unit J_2 at P_1S50/W35 (ii) and SL10 are darker because of the presence of abundant biotite and muscovite. This may be due to either contact contamination before metamorphism or to metasomatism.

Ground magnetic survey

Magnetite veins were observed to occur mainly in the 'quartz porphyry' and were rarely found in the metasediments. Ground magnetic measurements reflect very well these near-surface magnetic bodies, some of which are exposed, yielding localized intense and steep-gradient anomalies. These local, intense anomalies do not die out beyond the boundary of the outcrop but continue as less intense and broader anomalies, an indication of similar but deeper magnetite veins. As there appear to be no mineralisation of any significance in the metasediments, these broader anomalies can be interpreted to indicate extensions of the 'quartz porphyry' beneath the metasediments. This interpretation is in line with the intrusive nature of the 'quartz porphyry'.

Outside the study area, about 2 km downhill from the Rest House, similar 'quartz porphyry' is exposed and probably emplaced in rocks which are likely to be older than unit J_1, judging from the inclination

of the beds. This 'quartz porphyry' could well be an extension of the 'quartz porphyry' at the Rest House, or it could be a separate body of the same nature. Interestingly, over the area of this lower outcrop, the airborne magnetometer survey by Agocs, et al. (1958) also shows an anomaly (No. 9). They interpreted the anomaly to have been caused by sources similar to the anomaly over the presently studied (Rest House) area.

Conclusion

Field and ground magnetic studies show that the 'quartz porphyry' at the Rest House area of Kedah Peak is intrusive into the Jerai Formation and is not conformable to the bedding of the Jerai Formation rocks.

Acknowledgement

I am indebted to Dr. T.T. Khoo for his guidance and encouragement in this project. I would also like to express my thanks to Universiti Malaya for support from the F-vote grant of Dr. T.T. Khoo. Thanks are also due to Prof. C.L. Samz of Universiti Sains Malaysia and Dr. B.K. Tan of Universiti Malaya for advice and assistance and Mr. Chow Kok Tho for his close cooperation and help in the field and laboratory.

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Plate 1. Intrusive contact between bedded quartzite (J_3) and quartz porphyry (QP).
Location: SL28.

MEETINGS OF THE SOCIETY

GSM Geotechnical Engineering Seminar, 1979

The Seminar, the first of its kind in Malaysia, was held on Saturday, 6th October 1979 at Rumah Universiti, University of Malaya.

12 papers were presented and these were grouped under soil mechanics, rock mechanics, engineering geology and special techniques.

Abstracts of papers

Stability of cut slopes on granitic residual soils.

J.K. Raj., Dept. of Geology, University of Malaya.

The characteristics of a typical residual soil profile developed on a granitic bedrock are first described as these features influence the stability of slopes cut thereupon. The types and causes of actual failtures are then described and conclusions reached on the short and long term stability of cut slopes on granitic residual soils.

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Soil stabilization with natural rubber latex emulsion - an anti-soil erosion measure for exposed soil surfaces.

Soong Ngin Kwi, Rubber Research Institute of Malaysia.

Experimental investigations have shown that NR latex emulsion sprayed onto exposed soil surfaces gave effective protection against soil erosion. On highly erodible soils, like Serdang and Sungei Buloh series, application of emulsions containing 10 - 15% dry rubber and 2 - 8% aromatic oil reduced soil losses by 70 - 87% when compared with the control. Within a period of five months, soil losses equivalent to 288.6 tonnes per hectare were obtained on untreated soil surfaces, whereas those soils treated with emulsions had losses in the range of 36.7 - 86.6 tonnes per hectare. Treatment with latex-oil emulsions also resulted in reduced runoff and increased infiltration of water. When NR latex emulsion and grass cover were used together, soil losses through erosion were almost completely checked.

The technique is being used commercially as an anti-erosion measure for the three major highways in Sabah. It will also be adopted for establishing landfills in the construction of the proposed Kuala Lipis - Gua Musang Highway in Peninsular Malaysia.

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A need for better seismic monitoring in Malaysia

Leong Lap Sau, School of Physics, Universiti Sains Malaysia, Penang.

A need arises for a better and more far-sighted seismic monitoring program in Malaysia. The present seismological network

coverage is inadequate. Earthquakes with M_L < 4 cannot be located. Thus minor active zones outside the main belts are not indicated. Although Peninsular Malaysia is not situated in a seismic area, it is not immune to shock waves from earthquakes in adjacent regions. Magnitude versus acceleration and attenuation with distance plots should be used at least to define acceleration levels to anchor design response spectra of high rise buildings and expensive structures.

No effort has been made so far to monitor possible induced seismicity by reservoir loading in recent large expensive hydroelectric projects in Malaysia. Artificial loads causing stresses at or near the surface of the earth can engender earthquakes. Adequate monitoring should be made long before, during and after loading is initiated. Induced seismicity at the Manic 3 reservoir in Quebec affors an important case history. Six weeks after the start of filling of the Manic 3 reservoir, a long sequence of induced earthquakes began. The main shock, m_{bLg} = 4.1, was preceded by 1 month of foreshock activity and followed by more than 1,000 aftershocks in the next 4 months. After 2 years, the activity still persists. The activity appeared to have been triggered by water percolating through joint systems and along orientated planes. The presence of regional stresses and local inhomogeneities, structural and lithological, are suggested as principal causes, and not the dimensions of the reservoir and the water height.

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Engineering properties and bearing capacity of Malaysian rocks.

Chan Sin Fatt, Dept. of Civil Engineering, University of Malaya.

The engineering properties of Malaysian Limestone and Granite as determined from Unconfined Uniaxial Compression Tests are presented. The properties dealt with are the stress-strain relation, compressive strength, deformation modulus, and Poisson's ratio. A comparison is made between the above properties in the three orthogonal directions x, y, z.

The two common problems in the design of pile foundations in limestone areas: namely, bearing capacity of the rock and presence of cavities, are also discussed.

*****

Preliminary studies on the correlation of index properties and engineering properties of some Malaysian rocks.

Tan Boon Kong, Dept. of Geology, National University of Malaysia & Chan Sin Fatt, Dept. of Civil Engineering, University of Malaya.

Ten different rocks obtained as drill cores from various localities in Malaysia were tested in the laboratory for their index and engineering properties. The rock properties investigated include the dry density, the Shore scleroscope hardness, the point load strength index and the unconfined compressive strength. An attempt was made to correlate these properties so as to enable one to predict the unconfined compressive strengths of rocks based on results of the more easily carried out index tests (such as the Shore hardness and/or

to 55° NE, spaced 0.03 m to 1.0 m with an average spacing of 0.2 m to 0.5 m.

Diamond drilling up to a depth of 75.0 m in the damsite indicated average joint spacings to vary from 0.1 m to 3.0 m, with most lying between 0.5 m to 1.0 m. These joints are not normally continuous over long distances. A number of rehealed, sheared and brecciated zones have been intersected by drilling.

Principal dimensions of project

Kenyir Dam:	*Type:*	*Earth and rockfill*
	Crest Level:	*EL 155 m*
	Dam Crest Length:	*800 m*
	Height of Dam:	*150 m*
	Volume of Dam Embankment:	*15.2 x 10^6 m^3*
Storage Reservoir:	*Full Supply Level:*	*EL 145 m*
	Minimum Operating Level:	*EL 120 m*
	Maximum Flood Level:	*EL 153 m*
	Gross Storage Volume at F.S.L.:	*13,600 x 10^6 m^3*
	Live Storage Volume:	*7,400 x 10^6 m^3*
	Surface Area at F.S.L.:	*36,900 hectares.*

Power Station: Number and Rated Capacity of Units: 4 x 100 MW.

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Some observations on blasting practices in Malaysia.

Tan Boon Kong, Dept. of Geology, National University of Malaysia, Kuala Lumpur.

The paper is based on the author's observations of blasting practices in quarries and road cuts in Malaysia. Some common blasting problems are identified and discussed, such as the problems of over-break, toe problem, flyrock, insufficient fragmentation resulting in oversized boulders, safety, etc. Many of the problems discussed are attributed mainly to the fact that most personnels (blasters and project engineers) involved in blasting operations unfortunately lack the basic training and understanding in the basic principles of explosives engineering. Blasting is therefore carried out in an ad hoc manner guided by practical experience only.

The basic properties of explosives, influence of geological factors and the general principles for the design of blasting rounds are also discussed.

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Rehabilitation of mining land at Conzino Rintinto Malaysia Sdn. Bhd. Kuala Langat, Selangor.

Choy Kam Wai, Conzino Riotinto Malaysia Sdn. Bhd., Kajang, Selangor.

Dredge tailings and land disturbed by mining are returned to

point load tests).

Various test methods are also briefly discussed, including the effect of variation of sample length/diameter ratio in the point load test.

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The brittle failure behaviour of two isotropic granitic rocks.

Ibrahim Komoo, Dept. of Geology, National University of Malaysia.

Brittle failure behaviour of two granite rocks, having more or less the same mineralogy, but differing in grain size, were investigated under uniaxial compressive loading. White, medium-grained granite behaved as a purely elastic material during initial loading, becoming plastic before final brittle failure. Pink, coarse-grained granite showed the same characteristics as the white granite during initial loading, however, during the advance stage of loading, it showed strain hardening behaviour before brittle failure.

Furthermore, the white granite showed a negative volumetric strain during maximum compressive stress, whereas, the pink granite indicated a zero volumetric strain during maximum compressive stress.

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Engineering geology of the Kenyir Damsite, Trengganu.

Chow Weng Sum, Geological Survey of Malaysia, Ipoh, Perak.

The Trengganu River Basin Development Project is undertaken jointly by the Malaysian Government and the Snowy Mountains Engineering Corporation of Australia for the construction of a multi-purpose rock-fill dam.

The proposed dam is located along Sungai Trengganu just below the confluence of Sungai Trengganu - Sungai Kenyir. The damsite is underlain by a medium to coarse grained biotite granite. Numerous outcrops are particularly prevalent below the flood level on the right bank. These outcrops are also found along many of the minor creeks on either banks. Large landslides on the valley slopes have left many exposed rock faces. Landslide debris in the form of large accumulations of earth and boulders are common on both banks, expecially on the left bank. Dolerite dykes, ranging from a few centimetres to several metres in width, are common and strike generally from 035° to 070° and dip 70° SE through vertical to 80° NW.

Open sheet joints are commonly observed along rock faces. Apart from sheet joints, there are another 2 major sets of joints. They are:

i) striking from 030° to 070°; dipping 70° SE through vertical to 75° NW, spaced 0.6 m to 1.6 m and form rock faces up to 100 m long;

ii) striking from 110° to 160°; dipping 65° SW through vertical

productive agricultural land-use as part of Company policy. Disturbed land was classified. Topography was re-shaped to one conducive to agriculture and drainage was improved. Experiments were carried out successfully and the best adapted agricultural species were identified for further planting. Soil analysis was the basis by which the ground was ameliorated to produce a suitable soil. The plan involves the introduction of ruminants which will increase soil fertility by completing a beneficial nutrient cycle. Thus, from a fresh-water swamp, the land is transformed to productive agricultural use after mining.

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Sequential aerial photography in coastal dynamics.

J.K. Raj, Dept. of Geology, University of Malaya, Kuala Lumpur.

The importance of sequential aerial photographs as a tool of monitoring coastal changes is discussed, with a study of the shoreline changes of Kelantan State as an example.

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The application of photoelastic coating technique in rock mechanics research.

Ibrahim Komoo, Dept. of Geology, National University of Malaysia, Kuala Lumpur.

In the past three decades or so, the classical photoelastic technique was used intensively in rock mechanics research. However, the technique was limited to model analysis. The question here is whether the model represented the actual rock or not?

In recent years, the photoelastic coating technique was developed in the field of experimental stress analysis. The application to rock mechanics, so far, is still very limited. In this paper, the author wishes to discuss some potential and advantages of this technique in rock mechanics research.

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Use of the finite element method in geomechanics.

Tan Boon Kong, Dept. of Geology, National University of Malaysia, Kuala Lumpur.

The finite element method is a powerful numerical method useful in solving a wide spectrum of problems in geomechanics. Its use, in fact, is not limited to geomechanics only. It has also been used extensively in structural analysis, groundwater flow, heat flow problems, etc.

The principle of the method, its limitations and potentials are briefly discussed and illustrated by several practical applications.

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NEWS OF THE SOCIETY

New Library Additions

The following publications were added to the Library of the Society:

1. Oklahoma Geological Survey, B127, 1979.
2. The University of Kansas, Palaeontological contributions, article 64 and 65, 1979.
3. World data Center A for Solid Earth Geophysics, Rep. SE-20, 1979.
4. AGID News, no. 21, 1979.
5. Commonwealth Geological Liaison Office, no. 9, 1979.
6. SEATRAD Centre: Seminar on drilling and sampling 6-8th Sept. 1979 - 9 papers.
7. Acta Palaeontologica Sinica, v. 18, no. 4, 1979.
8. Palaeontologica Sinica, new series B, no. 13, 1979.
9. Geological Report of the Hiroshima University, no. 22, 1979.
10. IMM Transactions/Sect. C, v. 88, June 1979.
11. National Library of Singapore, adult reference collections, accessions list, Aug, 1979.
12. IMM Bulletin 874 & 875, 1979.
13. Oklahoma Geology notes, v. 39, nos. 1-3, 1979.
14. National Library of Singapore, Senarai Tokoh - Tokoh Kenamaan.
15. Geological Survey of New South Wales, nos. 40, 44, & 38, 1979.
16. Mine data sheets to accompany metallogenic map Cootamundra, 1:250,000 sheet S155-11, 1979.
17. Exploration geophysics, 1979 by T.N. Crook.

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The following persons have joined the Society:

Full Members

1. Mohd. Zuhudi Muda, Geology Dept., University of Malaya, Kuala Lumpur.
2. Mohd. Zain Hj. Yusuf, Dept. of Soil Mechanics & Geology, Fac. of Civil Engineering, Universiti Teknoloji Malaysia, Kuala Lumpur.

Associate Member

1. Mrs. Leong Sau Heng, Dept. of History, Arts Faculty, University of Malaya, Kuala Lumpur.

Institutional Member

1. Amdex Mining Ltd., P.O. Box 147, North Sydney, NSW 2060, Australia.

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Change of Address

The following members have informed the Society of new addresses as indicated:

Ahmad Tajuddin, 27 Highbury Place, Leeds 6, England.

K. Kawada, No. 305, Higashi I Chome 1-3, Yatabe-cho, Tsukuba-gun, Ibaragi-Ken, Japan.

Teh Guan Hoe, Dept. of Geology, University of Malaya, Kuala Lumpur.

Shunso Ishihara, Geological Survey of Japan, Higashi 1-1-3, Yatabe-Cho, Tsukuba-gun, Ibaraki, Japan 305.

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O T H E R N E W S

Ninth Annual Convention of the Indonesian Petroleum Association

The Ninth Annual Convention of the Indonesian Petroleum Association will be held on May 27th - 28th, 1980 at the Borobudur Intercontinental Hotel.

Lecture presentations to be given at the Technical Sessions of the Convention will deal with exploration, production, operations and economics. Members with presentations that would be of significant interest and importance to the petroleum industry in Indonesia should write to

Indonesian Petroleum Association
Lecture Committee
Jalan Menteng Raya 3
Jakarta, Indonesia.

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New and forthcoming books in Earth Sciences from Pergamon Press Ltd.

Members interested in the literature of these publications can write for details to

Marketing Assistant
Pergamon Press Ltd
Headington Hill Hall, Oxford OX3 OBW
England.

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Travel grants for geoscientists

The Regional Office for Science and Technology for Southeast Asia (ROSTSEA) of UNESCO, within the framework of the "Regional Network for Geosciences in Southeast Asia", and with the financial assistance of the "Association of Geoscientists for International Development" (AGID), is giving three travel grants to geoscientists to carry out study or exchange visits, for periods of one to three months, to institutions and projects in the field of the earth sciences in Asia.

Each travel grant, consisting of an air ticket and a lump sum living allowance, is limited to a monetary value not exceeding US$1800. The actual grant will be made on the basis of the cost of

the air ticket and the planned length of the visit.

Each candidate for a grant must have worked out his own detailed programme for a study visit. The visit must be completed before 1 September 1980. At the conclusion of the visit the candidate must submit a detailed report to Unesco.

Candidates wishing to apply for these travel grants must submit to the Director of Unesco, ROSTSEA, the following documents:

a) summary of education accomplishments and work experience;
b) detailed statement of the purpose and programme of the proposed study visits;
c) evidence that the host institutions or project agrees to the proposed programme.

Unesco will accept applications on a first come first served basis but only up to 31 March 1980.

For further information, please write to:

Dr. V. Prakash
Director, ROSTSEA
Jl. Thamrin 14
Tromolpos 273/JKT
Jakarta, Indonesia.

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Calendar

Under this column the Society will note coming events on meetings, courses and symposia of interest to members. Date in parenthesis gives the issue of Newsletter containing more information pertaining to the events:

Other events

1979

1979 : 14th Congress of the Pacific Science Association USSR. B.G. Gafurov, Chairman of the Soviet National Pacific Committee, Academy of Sciences of the USSR, Moscow. (Jul-Aug, 1977).

Sep 17 - 22 : AAPG - SEG stratigraphic interpretation of seismic data. AAPG Education Dept., P.O. Box 979, Tulsa, Oklahoma 74101, USA.

Sep 18 - 21 : CCOP/SOPAC Symposium on 'Petroleum Potential in Island Arcs, Small Ocean Basins, Submerged Margins, and Related Areas, Suva, Fiji'. CCOP/SOPAC Technical Secretariat, c/o Mineral Resources Dept., Private Main Bag, GPO, Suva, Fiji. (Jan-Feb, 1979).

Oct 15 - 18 : Law of the Sea Institute: Thirteenth Annual Conference. Law of the Sea Institute, University of Hawaii, 2540 Dole Street, Holmes 401, Honolulu, HI 96822. (Mar-Apr 1979).

Oct 28 - Nov 2 : ICOLD XIII Congress on Large Dams, New Delhi. C.V. J. Varma, Organizing Secretary, XIII Congress on Large D.ms, c/o Central Board of Irrigation and Power, Kasturba Ghandi Marg, New Delhi, 110001, India.

Oct 29 - Nov 1 : AAPG Diagenetic controls on carbonate porosity evolution. AAPG Education Dept., P.O. Box 979, Tulsa, Oklahoma 74101, USA.

Nov 17 - 21 : X World Mining Congress, Istanbul. The Turkish National Committee of the World Mining Congress, Ziya Gokalp Caddesi, No. 17, Kat 8, Ankara, Turkey.

Nov 20 - 21 : National Symposium on the availability of strategic minerals, London, U.K. The Secretary, Institute of Mining and Metallurgy, 44, Portland Place, London, W1N 4BR. (May-Jun 1979).

Dec 13 - 16 : Problems of mineralisation associated with acid magmatism, Exeter, U.K. (M. Stone, Dept. of Geology, University of Exeter, North Park Road, Exeter, England).

Dec 17 - 19 : Evolution of India-Pacific plate boundaries, (workshop and symposium), Sydney, Australia. (Convenors, Dept. of Geology & Geophysics, University of Sydney, Sydney, NSW 2006, Australia).

1980

Jan 7 - 10 : International Conference on Engineering for Protection from Natural Disasters, Bangkok, Thailand. Conference Secretary, ICEPND, Div. of Geotechnical and Transportation Engineering, AIT, P.O. Box 2754, Bangkok, Thailand.

Feb 11 - 16 : Fifth Gondwana Symposium, Wellington, New Zealand. Symposium and field trips. C.J. Burgess, Fifth Gondwana Symposium, Victoria University of Wellington, Private Bag, Wellington, New Zealand. (May-Jun 1978).

Feb 14 - 17 : Interdisciplinary Conference on Earthquake Prediction Research in the North Anatolian Fault Zone, Instanbul, Turkey. A. Vogel, Instit fur Geophysikalische Wissenschaften, Freie Universitat Berlin, Rheinbabenalle 49, 1000 Berlin 33, F.R.G.

Feb 25 - 26 : Time Scale Symposium, London, U.K. Secretary, Geological Society, Burlington House, Piccadilly, London, W1, U.K.

Mar 4 - 6 : Petroleum Geology of the Continental Shelf of North-West Europe, London, U.K. Miss I. McCann, Conference Officer, London, W1M 8AR, U.K.

Mar 24 - 28 : AAPG Petroleum Reservoir Fundamentals School. AAPG Education Dept., P.O. Box 979, Tulsa, Okla. 74101, USA.

Apr 7 - 11 : International symposium on landslides 'ISL 1980', New Delhi. Dr. R.K. Bhandari, Organising Secretary, ISL 1980, P.O. Central Road Research Inst., New Delhi, 110002, India.

Apr 10 - 15 : 8th International Geochemical Exploration Symposium, Hannover, Fed. Rep. Germany. Dr. H. Gundlach, Organising Committee, 8th International Geochemical Exploration Symposium, P.O. Box 51 01 53, D-3000 Hannover 51, F.R.G. (Jul-Aug 1978).

May 12 - 14 : Conference on Soil Science and Agricultural Development in Malaysia. Secretary, Executive Committee, Conference on Soil Science and Agricultural Development, P.O. Box 2644, Kuala Lumpur, Malaysia. (Jul-Aug 1979).

May 12 - 16 : International Archaean Symposium, Perth, Australia. Sponsored by IGCP Archaean Geochemistry project and Geological Society of Australia. (J.A. Hallberg, Archaean Symposium, CSIRO, Division of Mineralogy, Private Bag, Wembly, Australia 6014).

May 27 - 30 : National and International Management of Mineral Resources. The Secretary, Institute of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, U.K. (Mar-Apr 1979).

Jun 25 - 27 : Fore-Arc Sedimentation and Tectonics in Modern and Ancient Subduction Zones, London, U.K. J.K. Leggett, Department of Geology, Imperial College, Prince Consort Road, London, SW7 2AZ, U.K.

Jun 29 - Jul 6 : Fifth International Palynological Conference, Cambridge, England, U.K. Conference with field excursions. (Mrs. G.E. Drewry, Dept. of Geology, Sedgwick Museum, Downing Street, Cambridge, CB2 3EQ, England).

Jul 4 - 7 : General meeting of the International Mineralogical Association (IMA), Orleans, France. Scientific & poster sessions, field excursions. (Secretariat de la 12eme Assemblee Generale de I'IMA, B.R.G.M., BP 6009, 45018, Orleans, Cedex, France).

Jul 7 - 17 : 26th International Geological Congress, Paris, France. Paul Sangnier, Secretaire General du 26eme C.G.I., Maison de la Geologie, 77-79 rue Claude-Bernard, 75005, France. (Nov-Dec 1977).

Jul 14 - 24 : International Symposium on water-rock interaction, Edmonton, Alberta, Canada. Sponsored by IAGC and the Alberta Research Council. (B. Hitchon, Alberta Research Council, 11315, 87th Avenue, Edmonton, Alberta, Canada T6G 2C2).

Jul 29 - Aug 10 : Second European Conodont Symposium (ECOS II), Austria and Czeckoslovakia. Symposium with pre- and post symposium field trips co-sponsored by the Geological Survey of Austria and Geological Survey of Czechoslovakia. (ECOS II, Geological Survey of Austria, P.O. Box 154, Rasumofskygasse 23, A-1031, Vienna, Austria.).

Sep 8 - 13 : World Conference on Earthquake Engineering, Istanbul, Turkey. A. Gurpinar, Secretary, 7 WCEE, Yuksel Caddesi 7/B, Ankara, Turkey.

Sep 17 - 19 : Eurotunnel '80, Basle, Switzerland. Conference on Tunnelling in Europe. (Secretary, Institute of Mining and Metallurgy, 44 Portland Place, London, W1N 4BR, U.K.).

Oct 5 - 8 : Complex sulphide ores, Rome, Italy. Organised by IMM in association with Consiglio Nazionale delle Ricerche (Laboratorio per il Trattamento del Minerals). The Secretary, IMM, 44 Portland Place, London W1N 1BR, U.K.).

Sometime in 1980: Workshop on Fission Track Dating by the Geoscience Network. Prof. B.K. Kim, Executive Secretary, Geoscience Network, Seoul National University, Seoul, South Korea.

1981

Mar 29 - Apr 4 : International Conference on Arid Soils - Properties, Genesis and Management, Jerusalem, Israel. International Conference on Arid Soils- Properties, Genesis and Management, P.O. Box 3054, 122 Hayarkon St., Tel Aviv, Israel. (May-Jun 1979).

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