PP 185/12/85 ISSN 0126-5539

PERSATUAN GEOLOGI MALAYSIA

WARTA GEOLOGI

NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MALAYSIA

Jil. 12, No. 4 (Vol. 12, No. 4) Jul-Ogos 1986

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CATATAN GEOLOGI
(GEOLOGICAL NOTES)

EVIDENCE FOR EAST-TILT OF THE BINTANG GRANITOID NEAR GRIK, PERAK

H.D. Tjia & Syed Sheikh Almashoor, Department of Geology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor.

Abstract

A conjugate pair of shear fractures transects a granitoid and displaces a pegmatite dyke and a quartz vein for a separation of 20 cm. The positions of the conjugate fractures as well as the inclination of the dyke and vein suggest that faulting occurred when the instrusive bodies were in horizontal position. Afterwards the entire granitoid body that is exposed in this extensive outcrop became tilted eastward at approx. 23 degrees. To our knowlege, this is the only known evidence of tilting of an igneous mass in the Peninsula.

GRANITOID INAS DEKAT GERIK, PERAK, DIMIRINGKAN KE TIMUR

H.D. Tjia & Syed Sheikh Almashoor, Jabatan Geologi, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor.

Abstrak

Sepasang retakan ricih dan jodoh memotong ke dalam granitoid dan menganjak sejauh 20 cm sebidang pegmatit serta telerang kuarza. Kedudukan retakan jodoh dan kemiringan pegmatit beserta telerang mencadangkan bahawa penyesaran berlaku ketika jasad rejahan berkedudukan mengufuk. Kemudian seluruh granitoid yang nampak pada singkapan luas itu telah dimiringkan ke timur sebesar 1.k. 23 darjah. Sepanjang pengetahuan penulis, inilah contoh tunggal mengenai pemiringan sebuah jasad granitoid yang dikenali dari Semenanjung.

Close to Kampung Baru Air Kala, at the kilometre post (275 to Kota Baru or 117 to Ipoh) along the trunk road from Kuala Kangsar to Grik is a moderately extensive outcrop of weathered porphyritic granitoid containing various dm to cm thick dykes and veins.

Although weathered, the rock's texture is still quite visible and the minerals recognizable. The porphyries are subhedral to euhedral alkali feldspar phenocrysts, commonly up to two cm in length and are embedded in a coarse-grained matrix of quartz, alkali feldspar and plagioclase. Muscovite is an accessory mineral. On visual estimate of the ratio of the essential minerals, the rock may be called granite according to the IUGS classification scheme (see Streckeisen, 1976). The texture and modal compositions are similar to that desribed by Jones (1970) on the Bintang Hills and Main Range granitoids to the northwest and northeast, respectively, of the outcrop locality.

Figure 1 (upper part), is a sketch of a portion in the western half of the outcrop. A 30-cm thick pegmatite dyke and a thin quartz vein strike 350° and dip 23° towards east. Two main fractures (170/90 and 170/44) cut across both host rock and intrusives. Both fractures displace in normal sense the

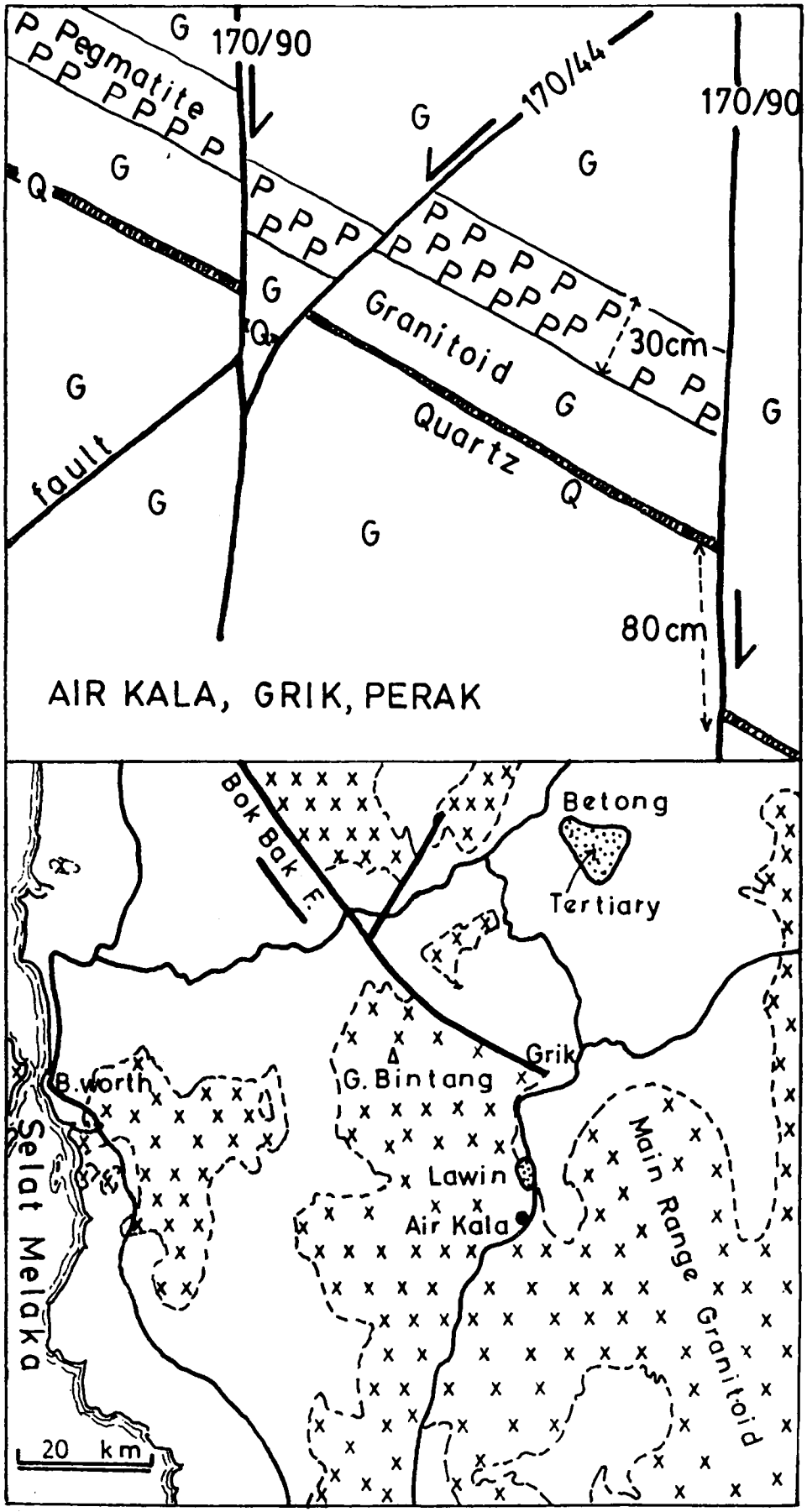

Figure 1. Upper part: the outcrop described in this note.
Lower part: distribution of granitoid massifs and the locality of the outcrop is between Air Kala and Lawin. Betong and Lawin are Tertiary basins.

intrusives by about 20 cm. The bisecting plane of the acute sector defined by these fractures is 170/67 and is normal to the pegmatite and the quartz vein. This perpendicular position and the similar dip slip values along the intersecting faults suggest the faults to represent conjugate shear faults. On the average the acute angle between conjugate shears ranges between 50 and 60 degrees (see Handin & Hager, 1957). In this outcrop the acute angle is rather smaller, 46 degrees, and implies a relatively higher degree of brittleness, very probably due to lower confining pressures at the time of fracturing. In other words, fracturing most probably occurred at shallow depth. This indication coupled with the fact that the bisecting plane (which also contains the maximum principal stress) is normal to the intrusions suggest the following:

1. The intersecting faults formed a graben when the maximum principal stress was vertical and the intrusions were horizontal. Fracturing takes place in brittle material, therefore, the rock at the outcrop was already solidified when fracturing occurred.
2. This was followed by tilting of 23 degrees towards the east.

The Bintang granitoid, to which this outcrop belongs, was probably emplaced during the major granitoid emplacement period of Late Triassic to Early Jurassic (see Jones, 1970; Bignell & Snelling, p. 38 etc., 1977). The Air Kala outcrop represents the southeast part of the Bintang massif and east tilting may be consistent with its position in the massif. However, early tilting seems precluded by the indication of fracturing at a shallow depth before tilting took place. Two episodes of post-granitoid tectonic movements have been interpreted for Peninsular Malaysia. Some grantioids display radiometric ages of Cretaceous-Tertiary. The general opinion is that these younger granitoids represent 'thermal events' only. Possibly Neogene continental deposits occur in a few places, such as near Betong and at Lawin (Fig. 1, lower part) and have been deformed into basinal structures with beds dipping up to 45 degrees. The steep dips seem to be associated with large fault zones, such as Bok Bak fault zone for the Lawin deposits and the Kuala Lumpur fault zone for the Batu Arang beds in Selangor. The basinal structures clearly indicate that no lateral compressive (or tectonic) stresses were involved in their development. It seems to us that the tilt exhibited by the Air Kala granitoid outcrop is best explained as result of a tectonic event at the Cretaceous-Tertiary boundary.

As far as we know, the reported evidence for post-consolidation tilt of a granitoid body is the only example of its kind in Peninsular Malaysia.

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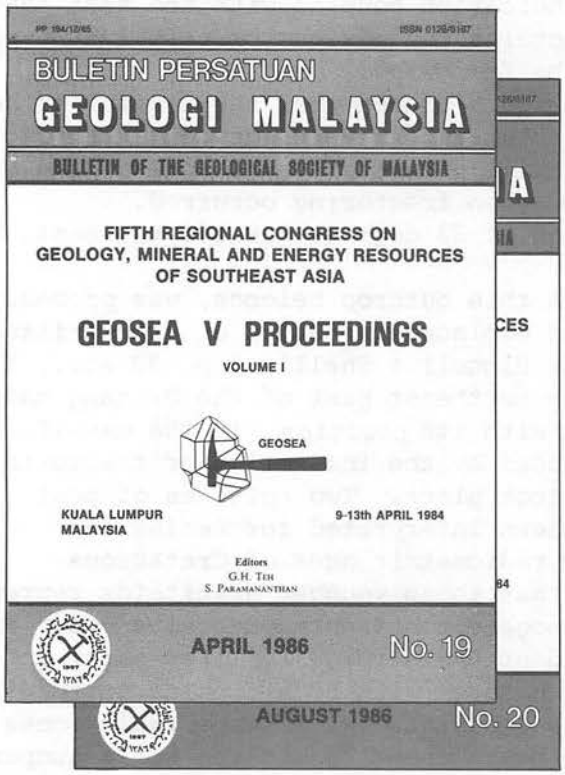

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PETROLOGY AND GEOCHEMICAL ANALYSIS OF COAL FROM THE SOUTH MUKAH-BALINGIAN REGION, SARAWAK

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

Abstract

The south Mukah-Balingian region is composed entirely of Late Cenozoic sedimentary rocks and surficial deposits. Seams and bands of coal were found contained within the Upper Miocene Balingian Formation and the Pliocene "Begrih-Liang" Formation. Petrologic analysis of the coal included petrographic and geochemical analysis. The rank was determined petrographically. The older, Balingian Coals are steinkohle *while the younger are mainly* braunkohle. *The interpretation of the macerals suggest a forest-swamp dominated by angiosperm plants. The geochemical analysis proved inconclusive, but indicated that the elemental abundances in the coal are the result of a combination of factors enhanced by the absorptive properties of the humus. It is concluded that the palaeoenvironment remained unchanged since the Late Miocene.*

PETROLOGI DAN ANALISA GEOKIMIA ARANGBATU DARI KAWASAN SELATAN MUKAH-BALINGIAN, SARAWAK

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Abstrak

Kawasan Selatan Mukah-Balingian terdiri daripada batuan enapan berumur dari akhir era Cenozoik yang diseliputi oleh lanar. Lipit-lipit arangbatu *didapati dalam Formasi Balingian (Miocene Lewat) dan Formasi "Begrih-Liang" (Pliocene). Analisa petrologik yang dijalankan ke atas* arangbatu *termasuk analisa petrografik dan geokimia. Analisa ini memberi taraf batuarang Formasi Balingian sebagai* steinkohle *dan* braunkohle *untuk* arangbatu *Formasi "Begrih-Liang". Tafsiran maseral kedua-dua jenis* arangbatu *mengusulkan lingkungan gambut paya berhutan dengan pokok-pokok angiosperma. Analisa geokimia hanya dapat menunjukkan bahawa penyerapan unsur-unsur dipengaruhi oleh banyak faktor. Kesimpulan yang dicapai dari analisa petrologik adalah bahawa alam sekeliling lingkungan gambut mungkin tidak berubah dari Miocene Lewat hingga sekarang.*

Introduction

The South Mukah-Balingian region (Fig. 1) is composed entirely of Cenozoic sedimentary rocks and surficial deposits. Two different periods of deposition have been identified - an older deep marine, turbidite succession and a younger, deltaic/paralic succession. It is within the latter formations that coal is found. The two formations involved are the Upper Miocene Balingian Formation and the Pliocene "Begrih-Liang" Formation, both of which show similarities in sedimentology typifying a paralic environment.

The coal from the two formations were analyzed petrographically and geochemically. It was attempted to determine the nature of the palaeo-environment as the coal represented plant debris and peat accumulations

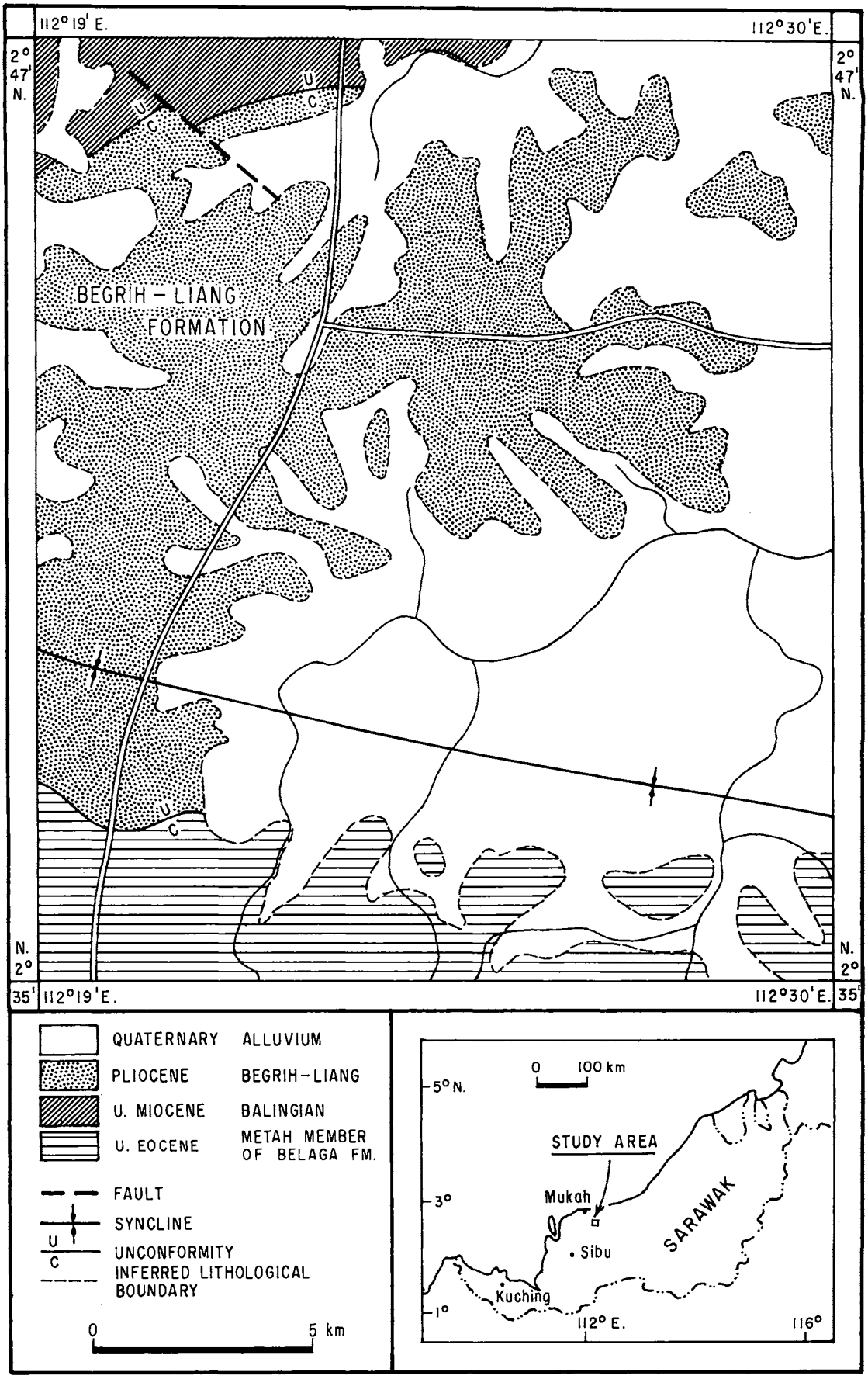

Fig. 1. Location map of the South Mukah-Balingian region.

of that period. The coal found was created either autochtohonously in swamps, or allochtonously as trapped debris behind a barrier.

The coal was analyzed petrographically using reflected light on polished sections. Geochemical analysis was carried out using Inductively Coupled Plasma and Neutron Activation Analysis. The latter was carried out by PUSPATI.

Coal Petrography

Coal, which is formed from the coalification of plant material, displays the vestiges of its precursors. These vestiges are described as "macerals" (Maria Stopes, 1935 *in* Stach, *et al.*, 1975). The term refers to microscopically recognizable constituents. There are three principal groups (Table 1):

1. Vitrinite
2. Exinite/liptinite
3. Inertinite.

Coal also contains inorganic admixtures, such as clay minerals and quartz, which when ashed make up the bulk of the incombustible residue.

Macerals seldom occur in isolation, and are usually found in association with other members. The association of maceral groups define the microlithotype of the coal, which can be (Table 2):

1. Monomaceral
2. Bimaceral
3. Trimaceral.

The Balingian Formation coal fractures conchoidally, and is black and lustrous. It is considered to be a *steinkohle* (bituminous). Microscopically, it is a bimacerite coal with bands of vitrite alternating with clarite v (Plate 1). The vitrite bands are composed of indistinguishable vitrinite resembling telocollinite. The clarite v is probably liptodetrinite in a groundmass of vitrinite. Exsudatinite (secondary resinite) is present as isolated globules.

The coal found in the "Begrih-Liang" Formation could be divided into two types - *braunkohle* (brown coal) and *steinkohle*. The *braunkohle* varieties present are the *hartbraunkohle* variety which are *mattbraunkohle* and *glanzbraunkohle* (Table 3). Each being differentiated by its physical appearance, that is, *mattbraunkohle* is dark brown and dull, while the latter is more lustrous. The *steinkohle* is rare and is a trimacerite duroclarite with the vitrinite dominating. Pyrite can be identified microscopically. Exinite is also present filling fissures and as exsudatinite (Plate 2). The *braunkohle* can be either bimacerite or trimacerite. In any case the vitrinite group macerals dominate (60% or more of total area). Pyrite is not common. The vitrinite is represented by telinite and telocollinite (Plate 3). Resinite is present as well as other members of the exinite group such as cutinite. This group never exceeds 30%. The inertinite macerals - fusinite and scleroctinite are present as discrete entities seldom exceeding 20% in all.

The individual macerals reflect the original part of the plant that was coalified. Vitrinite originates from the humic acid fraction i.e. the more solid material left behind of the decomposition, such as lignin and cellulose. This is then gelified to telocollinite (Teichmuller, *in* Stach, *et al.*, 1975). Resinite has its precursors in the resins and waxes in the original flora. Exsudatinite is "sweated out" after the first coalification jump (Teichmuller, *in* Stach, *et al.*, 1975). Liptodetrinite is concentrated under sub-aqueous conditions. The alternating

Table 1. Summary of macerals (from Stach *et al.*, 1975, Table 6, p. 58.)

Group maceral	Maceral	Submaceral*	Maceral variety*
Vitrinite	Telinite	Telinite 1	Cordaitotelinite
		Telinite 2	Fungotelinite
			Xylotelinite
		Telocollinite	Lepidophytotelinite
		Gelocollinite	Sigillariotelinite
	Collinite	Desmocollinite	
		Corpocollinite	
	Vitrodetrinite		
Exinite	Sporinite		Tenuisporinite
			Crassisporinite
			Microsporinite
			Macrosporinite
	Cutinite		
	Resinite		
	Alginite		*Pila*-Alginite
			Reinschia-Alginite
	Liptodetrinite		
Inertinite	Micrinite		
	Macrinite		
	Semifusinite		
	Fusinite	Pyrofusinite	
		Degradofusinite	
	Sclerotinite	Fungosclerotinite	Plectenchyminite
			Corposclerotinite
			Pseudocorposclerotinite
	Inertodetrinite		

* incomplete can be expanded as required.

Table 2. Summary of microlithotypes (from Stach *et al.*, 1975, Table 9, p. 110).

Maceral composition (mineral-free)		Microlithotype	Maceral-group composition (mineral-free)	Microlithotype group
Monomaceral				
Co	> 95 %	(Collite)*	V > 95 %	Vitrite
T	> 95 %	(Telite)*		
VD	> 95 %			
S	> 95 %	Sporite		
Cu	> 95 %	(Cutite)*		
R	> 95 %	(Resite)*	E (L) > 95 %	Liptite
A	> 95 %	Algite		
LD	> 95 %			
Sf	> 95 %	Semifusite		
F	> 95 %	Fusite	I > 95 %	Inertite
Sc	> 95 %	(Sclerotite)*		
ID	> 95 %	Inertodetrite		
M	> 95 %	(Macroite)*		
Bimaceral				
V + S	> 95 %	Sporoclarite		
V + Cu	> 95 %	Cuticoclarite	V + E (L) > 95 %	Clarite
V + R	> 95 %	(Resinoclarite)*		V, E(L)
V + LD	> 95 %			
V + M	> 95 %			
V + Sf	> 95 %			
V + F	> 95 %		V + I > 95 %	Vitrinertite
V + Sc	> 95 %			V, I
V + ID	> 95 %			
I + S	> 95 %	Sporodurite		
I + Cu	> 95 %	(Cuticodurite)*		
I + R	> 95 %	(Resinodurite)*	I + E (L) > 95 %	Durite
I + LD	> 95 %			I, E(L)
Trimaceral				
V, I, E	> 5 %	Duroclarite	V > I, E (L)	Trimacerite
		Vitrinertoliptite	E > I, V	V, I, E(L)
		Clarodurite	I > V, E (L)	

* The terms in parentheses are not at present in use.

Co = Collinite; T = Telinite; VD = Vitrodetrinite; S = Sporinite; Cu = Cutinite; R = Resinite; A = Alginite; LD = Liptodetrinite; M = Macrinite; Sf = Semifusinite; F = Fusinite; Sc = Sclerotinite; ID = Inertodetrinite; V = Vitrinite; F = Fusinite; L = Liptinite; I = Inertinite.

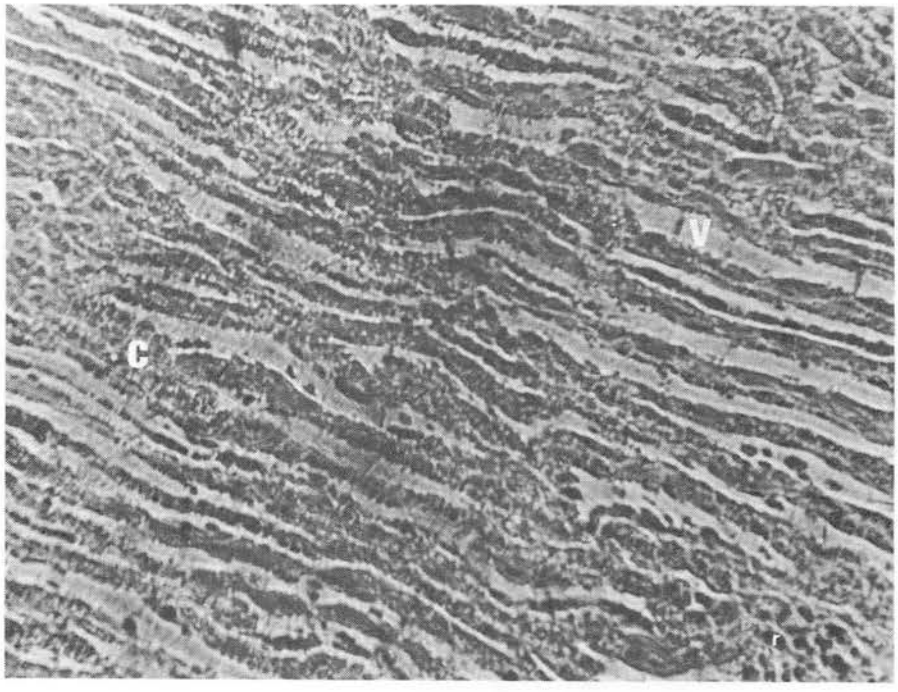

Plate 1. Photomicrograph of a polished section of Balingian coal. Note the banding of vitrite (v) and clarite (c). Resinite (r) is also present (reflected light, mag. 70x).

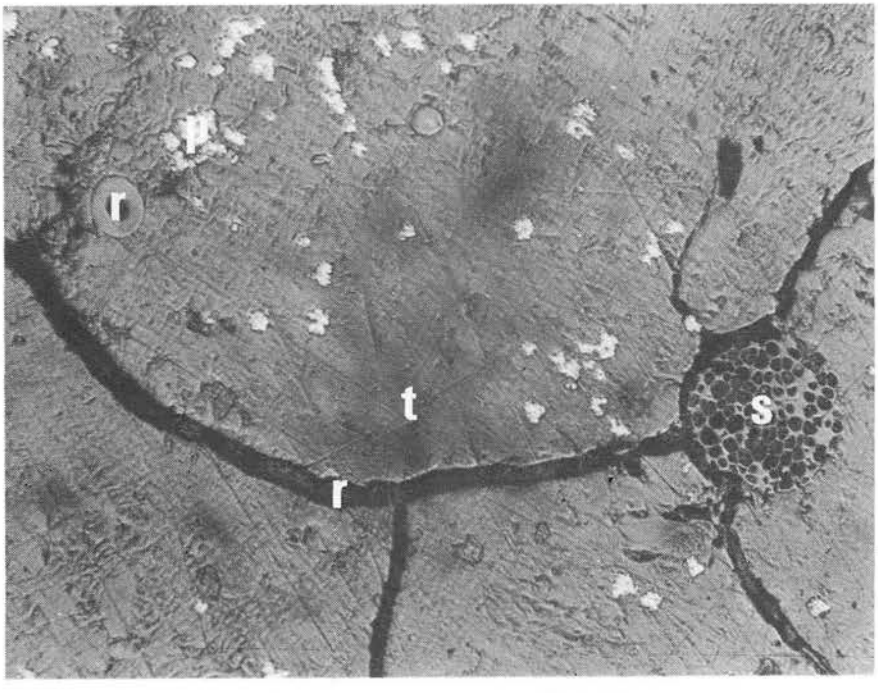

Plate 2. Photomicrograph of a polished section of 'Begrih-Liang' coal showing a duroclarite *steinkohle* with (i) isolated resinite (r) body, (ii) resinite (r) filling fissures, (iii) scleroctinite (s), (iv) pyrite (p) and (v) telinite (t) as groundmass. (reflected light, mag. 206.25x).

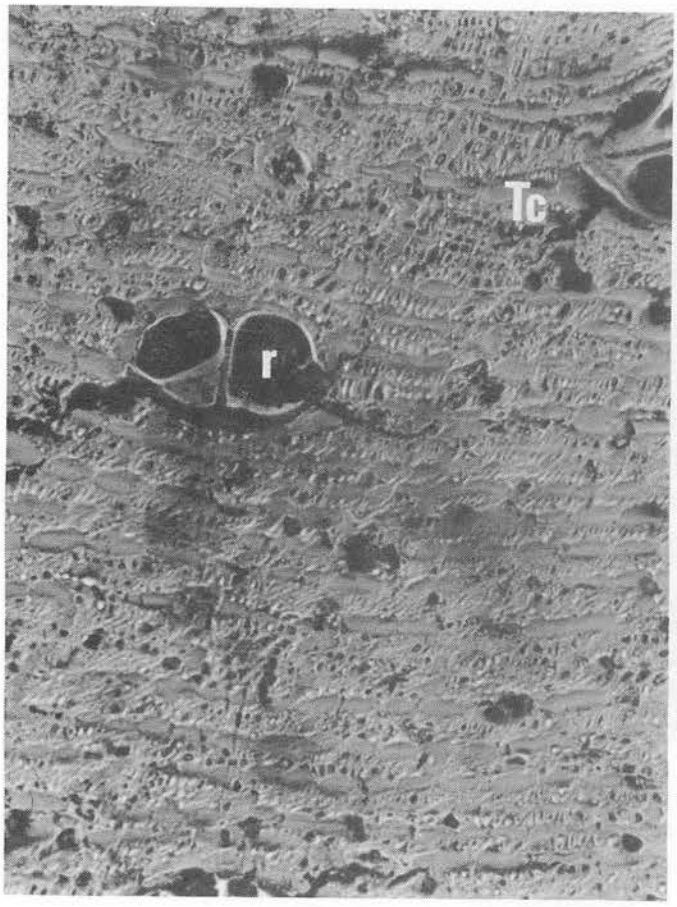

Plate 3. Photomicrograph of a polished section of a bimacerite clarite showing the preservation of parenchymatous tissue. Note that the cell walls are already gelified and voids between the cell walls are filled with either resin (dark) or phlobaphinite (light). Telocollinite (Tc) and isolated resin bodies (r) are also seen (reflected light, mag. 206.25x).

Table 3. Classification of coal according to German usage (from Stach *et al.*, 1975, Table 3, p. 36).

	Rank of coal	Megascopic	Microscopic	Chemical-Physical: Patteisky & M. Teichmüller (1960)	Chemical-Physical: Streak (Colour)	Chemical-Physical: Behaviour on boiling with KOH	Chemical-Physical: Behaviour with dilute HNO_3
Braunkohle (brown coal) Hartbraunkohle (hard brown coal)	Weichbraunkohle (soft brown coal)	brown, dull, partly earthy	large pore volume, gelification rare, open cell lumens (textinite)	75–35 % H_2O < 4000 kcal/kg[2] usually > 60 – < 70 % C[3]	brown, seldom black	brown solution	red solution
	Mattbraunkohle (dull brown coal)	dark brown to black, dull to low brightness	less pore volume, stronger gelification, open cell lumens (textinite) rare	35–25 % H_2O 4000–5500 kcal/kg[2] usually < 71 – *ca.* 71 % C[3] *ca.* 53–49 % VM[3]			
	Glanzbraunkohle (bright brown coal)	black, bright	gelification (vitrinitization) completed, micrinite not yet formed	usually > 8–10 % H_2O 5500–7000 kcal/kg[2] *ca.* 71–77 % C[3] *ca.* 49–42 % VM[3]			
	Steinkohle (bituminous coal)	black, bright	like Glanzbraunkohle, micrinite formed	usually < 8–10 % H_2O usually > 7000 kcal/kg[2] usually > 77 % C[3] usually < 42 % VM[3]	black, seldom brown	no colour	no colour

[1] for correlation with the ASTM classification see Table 4
[2] moist, ash-free
[3] dry, ash-free; VM = volatile matter

vitrite and clarite v bands of the Balingian coal represent forest- peat litter typical in angiosperm-dominated forest-swamps of the Tertiary (M. Teichmuller, *in* Stach, *et al.*, 1975, p. 230). The "Begrih-Liang" coal showing greater detail also indicate forest-swamp conditions (vitrinite rich trimacerite and bimacerite coal). The presence of angiosperms are interpreted by the relative lower percentage of resinite, as angiosperms contribute less resin. There is also palaeontological evidence in the form of poorly preserved angiosperm leaves. It would be logical to conclude that the palaeoenvironment did not alter drastically (if at all), after the Upper Mocene through the Pliocene.

Rank Determination

The term coalification denotes the development of coal, from peat through the successive stages, to anthracite (Stach, *et al.*, 1975). It can be regarded as a diagenetic process, involving physico-biochemical changes of peat. Peatification is the initial biochemical processes which alter the plant detritus to peat. Rank is a reflection of the sum of these processes. Rank is defined by various parameters-carbon and oxygen content; volatile matter; moisture and others. This is because coal reacts more sensitively to increasing temperatures and pressures which alter the molecular and physical nature of the macerals. Reflectance of the macerals depends on their physical state. There is a distinct relationship between the degree of aromatization with temperature (greater aromatization, greater reflectance). Of all the maceral groups, vitrinite shows the most consistent progressive increase of reflectance with rank.

Reflectance readings were taken using a digital Berek photometer (EEL Model 165, Digital Microphotometer, Evans Electroselenium Ltd.). The results are given in Table 4. The variation in the values can be ascribed to two basic causes:

1. variation in the condition of macerals,
2. variation caused by instrumentation.

The latter was overcome by frequent reference to the standard (NG 1). The former discrepancies can be attributed to:

i. slightly blemished surfaces
ii. different vitrinite macerals used
iii. the effect of neighbouring macerals.

In anticipation of these effects, a simple statistical analysis was employed so as to reduce any errors. Hence, the rank of the coal is given as a range.

The Balingian coal is seen to have a higher rank than the "Begrih-Liang" coal. This shows a direct relationship between age and rank of the coals involved. The influence of time is greater than temperature (Stach, *et al.*, 1975). The higher ranked Balingian coal-*gasflammsteinkohle* belongs to the Upper Miocene while the lower ranked "Begrih-Liang" coal, ranging from *flammsteinkohle* to *weichbraunkohle* belongs to the Pliocene.

The reflectance also indicates the approximate depth to which the sediments and peat were buried, discounting anomalous geothermal gradients. Based on the work of M. and R. Teichmuller (Stach, *et al.*, 1975, p. 53) the Balingian and "Begrih-Liang" Formations would have been buried to depths of a maximum of less than 2000 metres. The reflectance and rank of the coals also indicate that the Balingian coal is well within the zone of oil generation, while that of the "Begrih-Liang" only staddles the boundary between the zones of early diagenetic gas and oil generation (Stach, *et al.*, 1975, p. 52).

Table 4a. Relationship of rank with reflectance (from Stach *et al.*, 1975, Fig. 25, p. 52).

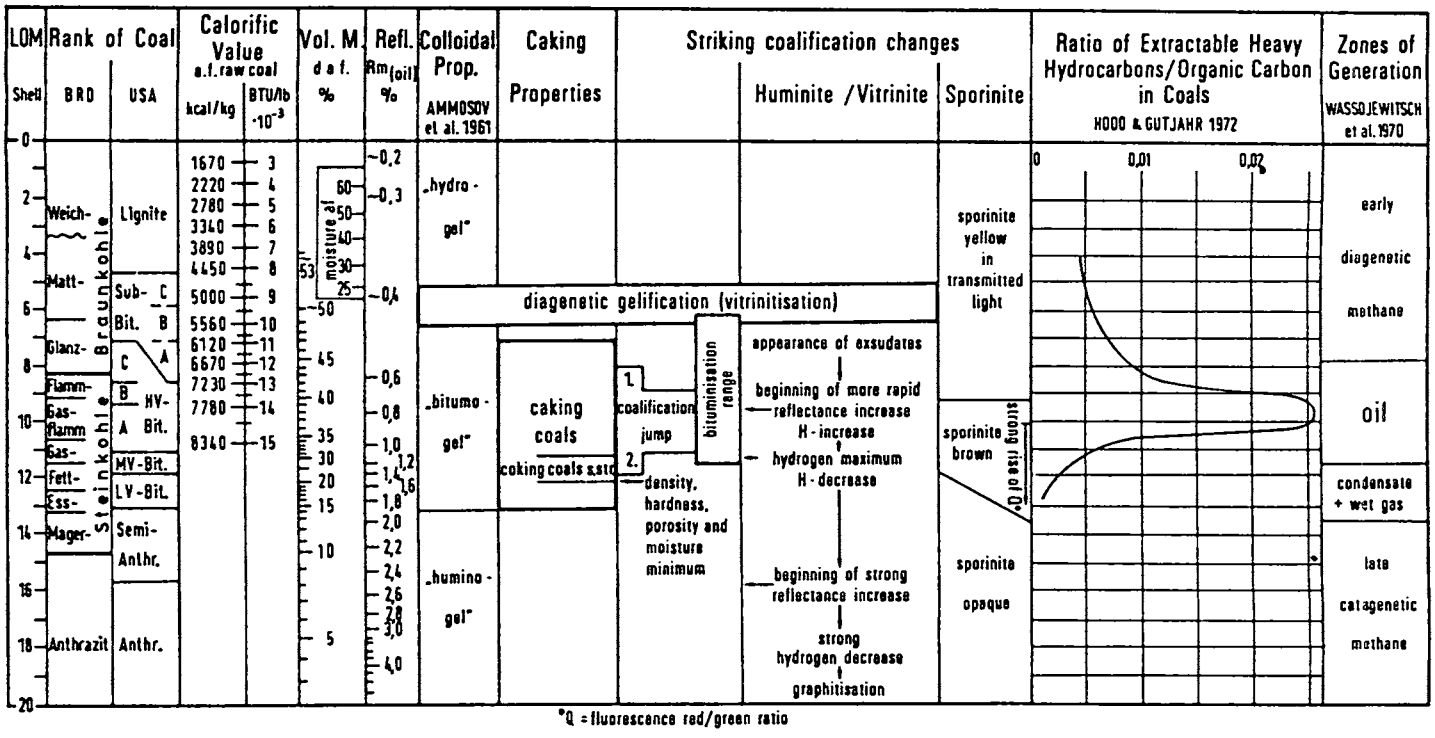

Table 4b. Interpretation of reflectance readings (based on rank).

FORMATION	SAMPLE NO.	RANGE[IN RANK]	MEAN[ASTM]	MEAN[GERMAN]
BALINGIAN	6.6.1	HIGH VOL. BIT.A->C	HIGH VOL.A	*STEINKOHLE*
"BEGRIH-LIANG"	4.6.4	SUB-BIT.-HIGH VOL.BIT.B	HIGH VOL.B	*STEINKOHLE*
"	4.6.4ii	LIGNITE-SUB-BIT.A	SUB-BIT.B	*BRAUNKOHLE*
"	6.5.3.	SUB-BIT.A-HIGH VOL.BIT.B	HIGH VOL.C	*BRAUNKOHLE*
"	9.5.6.	SUB-BIT.A-HIGH VOL.BIT.B	HIGH VOL.C	*BRAUNKOHLE*
"	20.5.1.	SUB-BIT.B-HIGH VOL.BIT.C	HIGH VOL.C	*BRAUNKOHLE*
"	25.5.5.	SUB.BIT.B-HIGH VOL.BIT.B	SUB-BIT.A	*BRAUNKOHLE*
"	27.5.2.	SUB-BIT.C-HIGH VOL.BIT.C	SUB-BIT.B	*BRAUNKOHLE*
"	28.5.3.	SUB-BIT.C-HIGH VOL.BIT.C	HIGH VOL.C	*BRAUNKOHLE*
"	29.5.2.	SUB-BIT.A-HIGH VOL.BIT.B	HIGH VOL.C	*BRAUNKOHLE*
"	29.5.4.	SUB-BIT.A-HIGH VOL.BIT.A	HIGH VOL.B	*STEINKOHLE*
"	1.6.1.	SUB-BIT.B-HIGH VOL.BIT.C	SUB-BIT.A	*BRAUNKOHLE*

Geochemical Analysis

Trace elements in coal originate from either the original plant matter itself (plants concentrate elements during their normal metabolic processes) or inorganic detritus strewn into the peat or enchancement during peatification and coalification. The relative concentrations or depletions of various trace elements depend on a number of factors such as (in part after Bouska, 1981)

1. the behaviour of the element in solution - pertaining to its solubility, mobility and adsorbent capabilities,
2. duration of supply,
3. possibility of solution circulation,
4. pH and Eh of the milieu,
5. concentration of supplied constituent,
6. degree of coalification,
7. type of prominent sorbents which depend on (5) and the type of coal (whether humic or sapropelic),
8. ash content
9. size and quality of the inner seam,
10. porosity of the neighbouring rocks,
11. the inherent plant material,
12. overall geological structure, recent and original depths of coal seam, alteration, grade and jointing.

Table 5 shows the results obtained using a modified method (de Silva, 1986, Appendix). It is in part a compilation of data obtained by the ICP and NAA (PUSPATI) methods.

The comparison of data of the coal with that of the average crustal abundances and to that of plants, show no relationship. This is a reflection on the complexity of the causes of concentration which is a plexus of contributing factors - biological, biochemical, geochemical and even temporal. Based on the current work, the influence of geological and petrological factors and their dependence on the geochemical environment is exemplified by:

1. The concentration of certain elements are enhanced with time such as uranium, vanadium and gallium.
2. The palaeoenvironment was a reducing milieu, as elements such as copper, molybdenum, uranium, iron, zinc and nickel were accumulated. And as such, concentrations are higher in the coal facies than in the crust or in plant material.
3. Phosphorus is said to be in greater concentration in dull coals *(braunkohle)* than in *steinkohle*. The Balingian coal *(steinkohle)* has a lower concentration than the *braunkohle* of the "Begrih-Liang" Formation.
4. The higher concentration of iodine in the Balingian coal may indicate marine influence.
5. The thin seams (average thickness is one metre) allow for greater surface area for postgenetic absorption. Hence, there is enrichment of molybdenum, arsenic, antimony, nickel and cobalt. The depletion of elements such as barium, manganese and strontium is related to their removal from the environment. The alkali elements - sodium, potassium and calcium are in concentrations which are lower than normal crustal values. This reduction may be ascribed to the removal of these elements for the authigenesis of cements (clay minerals and calcite) in the enveloping sedimentary rocks.

Table 5. Compilation of geochemical analysis of coal and elemental abundances for the earth's crust and plants.

ELEMENTS	SAMPLE			EARTH'S CRUST		PLANTS
	BALINGIAN	'BEGRIH-LIANG'		Average	SEDIMENTARY ROCKS	
		Minimum	Maximum			
Sodium	19.60	19.60	39.60	2.4%		200
Magnesium	55.7	39.28	268.58	2.3%		700
Aluminium	0.16%	0.15%	2.18%	8.2%		35
Phosphorous	61.93	62.53	234.63	1050	700	700
Chlorine	44.9	31.9	98.2	130	180	200
Calcium	38.5	162.1	0.18%	4.1%		0.45%
Scandium	20.0	0.27	0.29	22	13	
Titanium	68.50	18.90	92.50	5700	4600	3.5
Vanadium	284.4	45.5	166.75	135	130	2.5
Chromium	64.30	14.73	80.05	100	90	1.7
Manganese	2.83	6.23	173.05	950	350	30
Iron	0.10%	349	0.76%	5.6%		100
Cobalt	7.48	8.4	37.55	25	19	0.25
Nickel	32.13	31.13	97.05	70	68	0.9
Copper	175.83	5.4	21.05	55	45	4
Zinc	17.23	15.6	30.08	70	95	18
Gallium	29.5	0.12	0.45	15	19	13
Arsenic	63.78	98.375	377.78	5	13	0.5
Strontium	4.28	1.9	16.33	375	300	20
Molybdenum	10.5	10.5	16.7	2.3	2.6	0.01
Stannum	36.75	14.75	94		40	0.5
Antimony	15.20		0.6		1	
Iodine	9.7		1.9		2.2	0.35
Barium	9.1	5.08	61.93	425	580	430
Lanthanum	3.05	0.61	7.2	25		30
Samarium	3.2	0.07	0.7	7.3		
Dysporsium	2.11	0.36	0.54	5.2		
Uranium	16.76		0.1	4	3.7	0.003

Note: i) All values given in parts per million unless otherwise stated.
ii) Values for elemental abundances in plants after Zyka (in Bouska, 1981)
iii) Elemental abundances in earth's crust and in sedimentary rocks after Krauskopf (1979).

Conclusion

Geochemical and petrographic analysis show that the coals are humic in contrast to sapropelic. The coals were formed in swamps which were less reducing and more open. A forest-swamp dominated by angiosperms in a tropical climate is envisaged. Both the Balingian and the "Begrih-Liang" coals were formed in similar if not identical palaeoenvironments. The difference in age appears to be the main factor in the higher rank of the Balingian coal. This coal could well have contributed to the oil-seep found at the angular unconformity between the two formations.

Geochemical analyses show that the concentration of trace elements is attributed to a variety of reasons and that enrichment by living processes was negligible.

The most significant conclusion that can be formulated, is the similarity of the palaeoenvironment to that of the present day. Anderson (1964) described the present day peat swamps of northwest Sarawak as being:

1. coastal to deltaic
2. oligotrophic (low in minerals especially calcium and acid in reaction)
3. having awater-table close to the swamp surface and above it during the wet season
4. containing undercomposed and semi-composed woody material with abundant roots and tree stumps
5. having a clay sub-soil underneath the peats of the Rajang Delta and Mukah-Balingian area.

The above indicate faster growth in bays and sheltered localities where offshore currents are slack and deposition is fast.

The following conclusions procured by the present author concurs with that of Anderson (1964).

1. A paralic to deltaic depositional milieu
2. Low calcium content (Table 5)
3. High groundwater level required for the preservation of vitrinite
4. Woody nature of the coal is reflected by the dominance of vitrinite
5. The seatearth is a mudstone with rootlet remains (de Silva, 1986).

It is concluded that the forest-swamps of the Upper Miocene and Pliocene were formed in conditions that parallel the present day. Hence it is postulated that environment and geography of the area has remained unchanged since the Late Miocene.

Acknowledgements

This paper has been taken in part from my B.Sc. thesis. I am grateful to Dr. Azhar and Dr. Chakraborty for all their help. I would also like to thank Carigali for sponsoring me and PUSPATI for kindly working on some of my samples.

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Manuscript received: 9 July 1986

PERSATUAN GEOLOGI MALAYSIA
DAN
JABATAN GEOLOGI,
UNIVERSITI KEBANGSAAN MALAYSIA

PERSIDANGAN TAHUNAN GEOLOGI 1987
(Geological Annual Conference 1987)

Tempat
(Venue)
JABATAN GEOLOGI
UNIVERSITI KEBANGSAAN MALAYSIA

16 – 17 Mac, 1987

PERTEMUAN PERSATUAN
(MEETINGS OF THE SOCIETY)

CERAMAH TEKNIK - TECHNICAL TALKS

C. Vita-Finzi: Recent rectonics in Algeria, Greece and Iran

Abstrak (Abstract)

The study of structures and landforms produced during earthquakes is helpful in the interpretation of analogous *features in the geological record. It can also show how surface deformation is not invariably a reliable guide to the corresponding structure. In the El Asnam (Algeria) earthquake of 1980, for example, movement on a buried reverse fault led to folding at the surface, and earlier movement of this type on the fault can be detected in tilted slope deposits and an uplifted alluvial terrace of historical age.*

Surface folding and warping have subsequently helped to map the major faults in the Corinth area of Greece, and movement of the footwall on normal faults is found to explain the elevation of fossil beaches along the Gulf of Corinth. Shifts in the locus of seismicity explains why coasts can undergo uplift at one time and subsidence at another.

Besides aiding explanation of local phenomena the work can contribute to the testing and elaboration of crustal models. In Iran, Holocene rates of folding show that much of the rotation of Arabia produced by Red Sea spreading is accommodated by frontal fold growth. It also reveals marked pauses in the process. In the Makran the uplift of coastal blocks is powered by northward subduction. The increased rate of uplift to the east suggests that the process is propagating westwards.

Laporan (Report)

Ceramah teknik ini telah berlangsung dihadapan sekitar 50 orang ahli PGM termasuk 2 orang pakar dalam bidang tektonik iaitu Prof. H.D. Tjia dan Prof. Audley-Charles, pada July 23, 1986, pukul 5.00 petang, di Jabatan Geologi, Universiti Kebangsaan Malaysia, Bangi.

Dr. Finzi memulakan ceramah dengan memperkenalkan kawasan yang akan disentuh iaitu sepanjang jalur tektonik Eropah - Timur Tengah. Kawasan ini dipilih bukan sahaja disebabkan telah terbukti rantau ini mengalami kegiatan tektonik Resen yang aktif, tetapi beliau sendiri turut menjalankan penyelidikan di beberapa kawasan sepanjang jalur ini.

Dalam bahagian pengenalan, beliau menyentuh bahawa ahli geologi sememangnya aktif mengkaji kegiatan gempabumi, terutama merekod tanda-tanda sebelum kejadian gempabumi, dan menjelaskan hasil atau perubahan di permukaan bumi selepas gempa. Beliau turut menegaskan kajian mengenai gempabumi harus mengembeling tenaga, kedua-dua ahli seismologi dan ahli geologi.

Beliau turut menghuraikan kesan-kesan di permukaan bumi akibat kejadian gempabumi, di antaranya termasuk kewujudan tebing-tebing curam, kehadir-

an volkanc lumpur, peralihan kepada infrastruktur, pengwujudan tasik baru, penyesaran di permukaan bumi dan yang lebih ditekankan ialah perkembangan mekanisme lipatan akibat kegiatan gempabumi.

Huraian lanjut dalam ceramah yang beliau sampaikan melibatkan penjelasan contoh kajian mengenai tektonik Resen yang berlaku di beberapa tempat sepanjang jalur tektonik Eropah - Timur Tengah, terutamanya di kawasan sepanjang pantai yang berhadapan antara Oman dan Iran. Tumpuan diberikan kepada mekanisme dan penentuan kadar perlipatan yang berkaitan dengan kegiatan seismos (gempabumi) ini. Kadar-kadar pergerakan per tahun yang diperolehi walaupun sedikit lebih kecil tetapi ternyata bersesuaian dengan pergerakan tektonik keping.

Diakhir ceramah beliau membincangkan 'model' perlipatan dan penyesaran yang berkaitan dengan tektonik Resen, sambil memberikan kata-kata penutup berikut:

'the present is the unreliable key to the past'.

Ibrahim Komoo

*****

B.M. Hanson: Exploration Philosophy

Abstrak (Abstract)

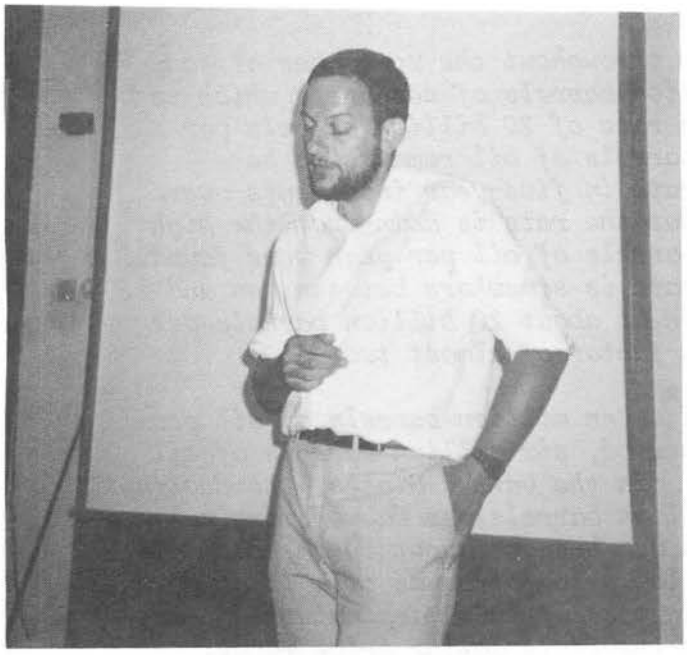
There are still areas of future recoverable oil in North and South America in the 20 - 100 billion-barrel range. Africa, Europe, and the Middle East contain the most exciting petroleum provinces in the world. Asia and the Far East are dominated by West Siberia and China. This vast region has an energy future, but is largely unexplored. Indonesia remains the pearl of South and Southeast Asia and has a tremendous potential for gas. Australia is coming into her own with recent discoveries.

Ten percent of the shallow oil fields in the world are less than 500 feet in depth; 19 percent are between 500 and 2,000; and 71 percent are between 2,000 and 5,000. Of the gas fields, nine percent are less than 500 feet in depth; 25 percent are between 500 and 2,000; and 66 percent are between 2,000 and 5,000.

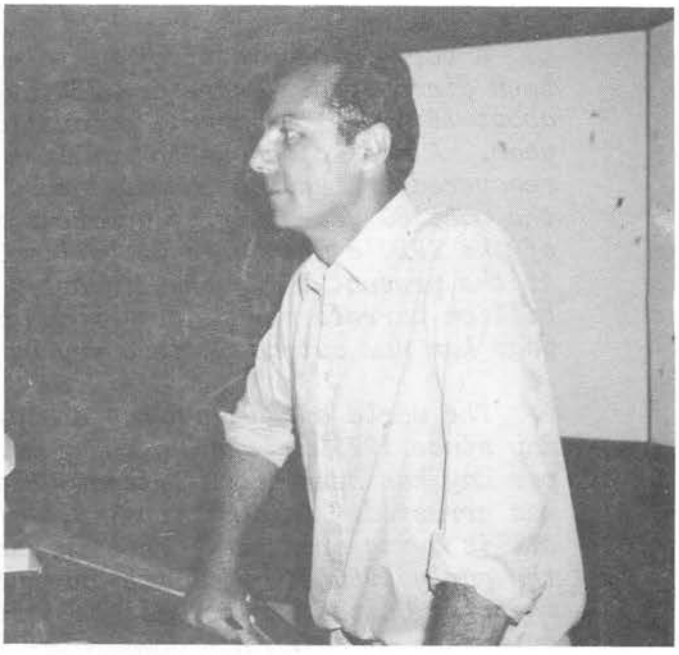
The continuous innovations in oil and gas exploration have been escalating since the inception of the anticlinal theory. In the future, by combining geophysics, geology, and organic geochemistry, forecasting efficiency will be increased. The ability to classify a basin will enable the geologist to predict the type of oil and gas fields that can be explored. There are five major basin types that are prevalent in the world.

Detailed study of diagenesis in various basins and the depositional mode of sediments will lead to a better understanding of the entrapment of hydrocarbons and help to better predict the aerial extent of oil and gas fields.

The Permian Basin of West Texas, which represents 23 percent of the oil and seven percent of the gas in the United States, is a mature basin in which detailed stratigraphic studies must be undertaken to better understand the reservoir for enhanced recovery.



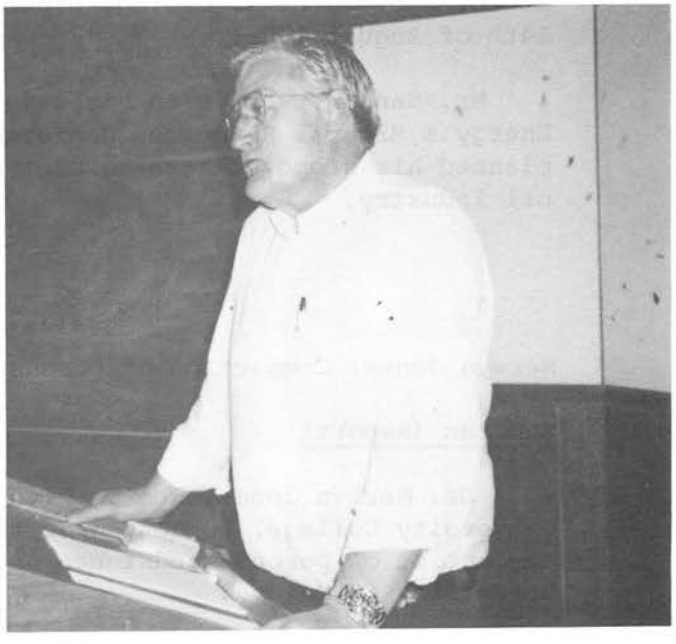
Mervyn Jones



Claudio Vita-Finzi

The large turnout at UKM, Bangi.

E.J. Cobbing



B.M. Hanson

A very large amount of petroleum throughout the world has already been discovered. There are 723 billion barrels of reserves, which is about 36 times the annual production rate of 20 billion barrels per year. A mode of about 550 billion barrels of oil remains to be recovered. Studying the discovery rate in five-year increments over the past 60 years, it is apparent that the rate is down from the high of the 1950's when some 35 billion barrels of oil per year were found. At the present time, the discovery rate is somewhere between ten and 15 billion barrels per year. Production at about 20 billion barrels per year has now outpaced discovery by a factor of almost two.

The world oil demand has dropped seven million barrels of oil per day since 1979 and during the same period, six million barrels of oil per day has been added outside OPEC. In the United States, the decline was arrested. An additional 2.5 million barrels per day of marginal oil is being produced. This in part was brought about by the boom of the early 1980's. With the current low price of crude oil, it appears that the United States will be losing most of this marginal resources by virtue of being non-commercial in the 13-14 dollar price range. The United States produces 30 percent of the world's oil, but has a 40 consumption.

The cost of producing a barrel of oil in the various regions of the world varies with the type of production. There are substantial amounts of oil and gas to be found. Economics and politics will govern how soon the additional reserves will be found, but by the use of modern concepts in exploration, the discovery rate will increase.

The 1960's and 1970's saw the revolution in seismic technique; the 1980's will be a decade of geochemistry, diagenesis, and structural revolution; and so by the 1990's, geologists should be in a position to delineate perspective areas and have less chances of drilling dry holes.

Laporan (Report)

Mr. B.M. Hanson, President of the American Association of Petroleum Geologists (AAPG), gave the above talk at a large turnout of about 60 at the Lecture Hall, Geology Department, University of Malaya on the 14th of August 1986.

Mr. Hanson, who is on his way to attend the AAPG Circum-Pacific Energy & Mineral Resources Conference in Singapore (18-22 August 1986), planned his stopover here to meet Society members and members of the oil industry.

G.H. Teh

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Mervyn Jones: Compaction of porous sandstones

Laporan (Report)

Dr. Mervyn Jones, who is with the Department of Geological Sciences, University College, London, gave the above talk on the latest findings on compaction of porous sandstones on 21 July 1986 at the Geology Department, University of Malaya.

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E.J. Cobbing: The granites of the Southeast Asian Tin Belt

Abstrak (Abstract)

Four granite provinces have been delineated each with its own distinctive pattern of mineralization.

1. *The Main Range Province. Endogenous greisen-bordered vein swarms of cassiterite and wolframite.*
2. *The Eastern Province. Magnetite-cassiterite skarns ± base metal sulphides with antimony in Thailand.*
3. *The Western (Peninsular Thailand-Burma) Province. Endogenous greisen-bordered vein swarms and pegmatites of cassiterite and wolframite.*
4. *The North Thailand Migmatitic Province. Endogenous vein and skarn replacement scheelite and fluorite deposits with some tin and local antimony.*

The granite provinces are clearly linked with different geological terrains which form three separate, and approximately parallel strips bounded by structural discontinuities at the western margin of the Sundaland craton.

In all provinces, but particularly in the Main Range, granitoids designated as two-phase variants have been recognized where xenocrysts and xenoliths of coarse, primary texture granite are enclosed in, and corroded by an invasive, equigranular quartzo-feldspathic matrix. These rocks form an essential part of the granite sequence in all provinces and have probably resulted from the infiltration and disruption of the host granite by late stage magmatic fluids.

Whole rock geochemistry from Peninsular Malaysia shows that the granites from the Main Range and Eastern Provinces comprise two contrasted suites which correspond approximately to the I and S-type categories advocated by Chappell & Wgite (1974). In addition it is shown that individual plutons within batholiths in the two provinces have distinctive geochemical parameters. Variation diagrams of plutons having the intrusive sequence primary texture granite - two-phase granite-microgranite show linear trends with increasing SiO_2, Na_2O, Rb, W, Sn and U, and decreasing Sr, Ba, Th and all other major elements.

Geochemical polarity for the granites of all provinces has been established which is chiefly characterised by a northward trend towards less differentiated granitoids. This is accompanied by a northerly decline in the importance of tin and a rise in the importance of tungsten, antimony and fluorite.

Laporan (Report)

Dr. E.J. Cobbing (British Geological Survey, Keyworth, Nottingham NG12 5GG, England) presented his talk to a very enthusiastic crowd of 56 at the Geology Department, University of Malaya, on 15 August 1986.

Dr. Cobbing spoke on the findings of the joint research between the British and Malaysian Geological Surveys and also his work in N. Thailand. His Malaysian counterpart, Teoh Lay Hock, specially came in from Kota Baru for the talk.

The Society is thankful to Prof. C.S. Hutchison for inviting Dr. Cobbing to present his talk here in K.L. first before later delivering it at the AAPG Circum-Pacific Energy and Mineral Resources Conference in Singapore.

G.H. Teh

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BERITA-BERITA PERSATUAN
(NEWS OF THE SOCIETY)

YOUNG GEOSCIENTIST AWARD 1985

The winner of this GSM award for 1985 is Mr. Lye Yue Hong, of Esso Production Malaysia Incorporated, for his article entitled "Studies of pegmatitic cassiterites from the Gunung Jerai (Kedah), Bakri (Johore) and Kathu Valley (Phuket) regions", which appeared in the Bulletin of the Geological Society of Malaysia No. 17, December 1984, p. 107-161.

This was announced by the Chairman of the award committee, Dr. Azhar Hj. Hussin, who added that Mr. Lye will be presented a scroll and $150 prize money at the Petroleum Geology Seminar 1986 in December.

*****

RESIGNATION OF 2-YEAR COUNCILLOR

The Council at its meeting in March 1986, regretfully accepted the resignation of Dr. Abdullah Hasbi Hj. Hassan as a 2-year councillor. Dr. Hasbi resigned as the first Director of SEATRAD Centre in October 1985 and has since joined the Heavy Industries Corporation of Malaysia Berhad (HICOM). The Council wishes him the very best in his new appointment.

*****

KEAHLIAN (MEMBERSHIP)

The following aaplications for membership were approved:

Institutional Membership: Statoil, Library, P.O. Box 300, N-4001, Stavanger, Norway.

Full Membership: (1) Anizan Isahak, Jabatan Geologi, Universiti Kebangsaan Malaysia, 436 UKM, Bangi, Selangor
(2) Yee Fook Loy, United Drillers, 23-A Jalan Kelang, Taman Oserseas Union, 58200 Kuala Lumpur

Student Membership: (1) M. Pathmavathy, Geology Department, University of Malaya, 59100 Kuala Lumpur
(2) Leong Chean Kean, Geology Department, University of Malaya, 59100 Kuala Lumpur
(3) Beng Teck Oh, Box 1535, Beloit College, Beloit, WI 53511, USA.

*****

PERTUKARAAN ALAMAT (CHANGE OF ADDRESS)

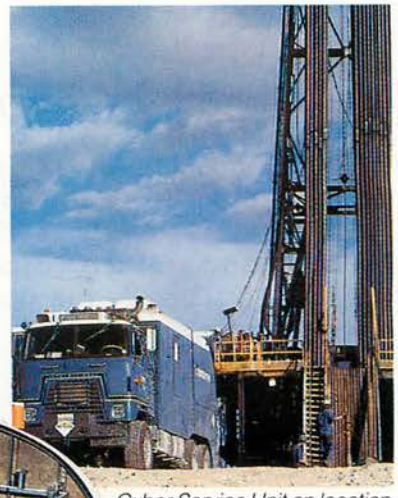
The following members have informed the Society of their new addresses:

1. Chai Ted Sing, c/o BHP Minerals Ltd., P.O. Box 1325, Kuching, Sarawak.

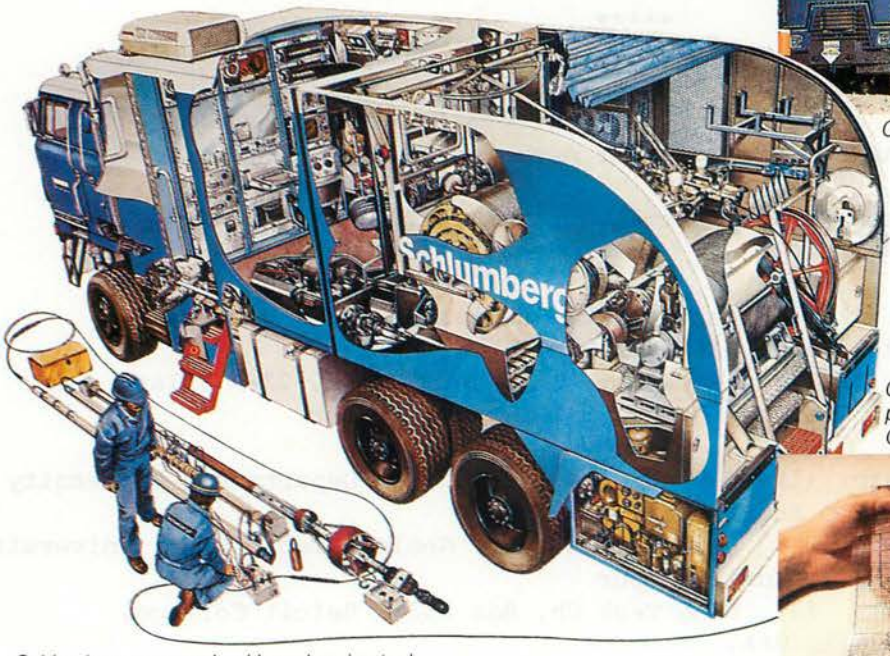
Schlumberger: services throughout Malaysia.

Schlumberger, the eyes of the oil industry, has provided services since the discovery of oil in Miri, Sarawak, several decades ago. Its commitment to high technology continues to provide the most cost effective results.

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

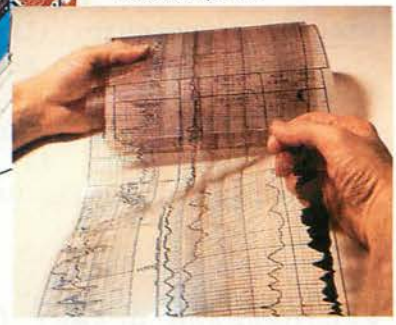


Cyber Service Unit on location.



Schlumberger crew checking a logging tool.

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



Schlumberger

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Cable: SCHLUMEAD.

2. Tuan Besar Tuan Sarif, Pusat Pengajian Kejuruteraan Haban dan Sumber Mineral, Universiti Sains Malaysia, Kampus Cawangan Perak, Jalan Bandaraya, 30000 Ipoh, Perak.
3. Lim Tow Ho, 4, Solok Scott, 10350 Pulau Pinang.
4. Frederick Newcomb, 2340 Hosp Way, Apt. 119, Carlsbad, Ca. 92008, USA.
5. T.R. Sweatman, 47 Repton Road, Somerton Park, S. Australia 5044.
6. Rohaiyah Ismail, 8 Ivy Street South, Spring Bank, Keighley, West Yorkshire BD21 BL, United Kingdom.
7. R. Vaeravan, 3/45 Taman Sri Segambut, Jinjang Selatan, 52000 Kuala Lumpur.
8. Roger T. Eubank, 74 'A' Queens Road, Singapore 1026.
9. Mohammed Hatta b. Abd. Karim, 33 Kg. Kelian Pauh Baru, Jalan Kemunting Lama, 34000 Taiping, Perak.
10. J.McGhee, 91 Headley Road, Liphook, Hants GU30 TPS, England.
11. Yoshio Akiyama, Mitsubishi Metal Corp., Ohtemachi 1-5-2, Chiyodaku, Tokyo, Japan.
12. Cheang Kok Keong, School of Materials & Mineral Resource Engineering, (Mineral Resource Div.), Universiti Sains Malaysia, Jalan Bandaraya, 30000 Ipoh, Perak.
13. J.K. Blake, Petroconsultants (Far East) Pte. Ltd., Suite 619, Orchard Plaza, 150 Orchard Road, Singapore 0923.
14. Robert L. Pile, 'White Lodge', 65 Barry Road, Oldland, Bristol BS15 6FA, England.

*****

Pertambahan Baru Perpustakaan (New Library Additions)

The following publications were added to the Library:

1. Centra de investigacion cientifica y educacion superior de ensenada, vols. 8 & 9, 1983 & 1984
2. Geophysical Research Bulletin, vol. 24, no. 2, 1986
3. AAPG Explorer, April & May, 1986
4. Geological Research & Development Centre (Indonesia), sp. pub. nos. 4 (1985) & 5 (1986)
5. Bulletin of the Geological Research & Development Centre, nos. 8 (1983) & 10 (1984)
6. Publication of the Geological Research & Development Centre, Palaeontology Series, nos 3 (1982) & 4 (1983)
7. Institution of Mining & Metallurgy, Bulletin, nos. 957 & 958, 1986
8. Transactions of the Institution of Mining & Metallurgy, Section A, Vol. 95, July 1986
9. Commonwealth Science Council, Newsletter, July-Aug. 1986.
10. National Library Singapore: adult refernce collections, accessions list, Aug. & Sept. 1986.
11. Oklahoma Geology Notes, vol. 46, nos. 1-3, 1986.
12. Journal of Geosciences, Oska City University, vol. 29, 1986
13. Journal of Stratigraphy, vol. 10, nos. 1 & 2, 1986.
14. Acta Palaeontologica Sinica, vol. 25, nos. 2 & 3, 1986.
15. Palaeontological abstracts, no. 1, 1986
16. Memoir of Nanjing Institute of Geology & Palaeontology, Academia Sinica, no. 22, 1986
17. Palaeontologia Sinica, no. 21, 1986
18. Petroleum geochemistry and basin evaluation edited by Gerard Demaison & Roelef J. Murris, 1984
19. Future petroleum provinces of the world edited by Michel T. Halbouty, 1986

20. Grondboor en Hamer, no. 6, 1985 & nos. 1-4, 1986
21. Sains Malaysiana, vol. 15, no. 1, 1986.
22. Chronique de la recherche no. 484, 1986
23. Journal of SE Asian Earth Sciences, vol. 1, no. 1, 1986
24. Bulletin, Science & Technology Malaysia, vol. 5, no. 2, 1986

*****

BERITA-BERITA LAIN
(OTHER NEWS)

New Director at SEATRAD Centre

Associate Professor Chadap Padmasuta assumed duties as Director of the SEATRAD Centre on 26 November 1985. Prior to this appointment, he was attached to the Chulalongkorn University, Thailand as Associate Professor and Head of the Department of Mining Engineering and Mining Geology.

Mr. Chadap holds a M.Eng. Sc. Degree in Mining which he obtained from the University of Queensland in 1962.

In an interview in SEATRAD Bulletin, vol. VI, no. 4, December 1985, Chadap pointed out that geologists, mining engineers and mineral processing engineers will have to work together to make use of the natural resources without or least affecting the other natural resources. Cost reduction together with higher value of the products and by-products will help tin miners to survive. He emphasised that better recovery and better efficiency of operation to lower cost of production will enable tin and associated minerals to compete effectively with their substitutes.

*****

$10,000 boost for research at UM from ESSO

At a simple ceremony on 22 August 1986, the Head of the Geology Department, University of Malaya, Associate Professor S.P. Sivam, received a M$10,000 contribution from Esso Production Malaysia Inc. (EPMI). The cheque was presented by Yeoh Gaik Chooi, Interpretation Supervisor, in EPMI's Exploration Department.

The contribution is to help the department carry out basic research on geology and geophysics relating to the petroleum industry.

Mr. Yeoh pointed out that EPMI has been making these yearly contributions to the Geology Department since 1979. In total, the Company has contributed more than $70,000 to the department and about $250,000 to the University of Malaya so far.

The money went towards research projects, library and computer facilities and students' activities like seminars and leadership training programmes. One of the research projects was a study on protection systems for structures such as buildings, oil storage tanks and oil rigs against direct lightning strikes.

Associate Professor S.P. Sivam receiving the cheque from EPMI's Mr. Yeoh.

*****

PETRONAS OFFERS THREE OFFSHORE AREAS UP FOR BIDDING

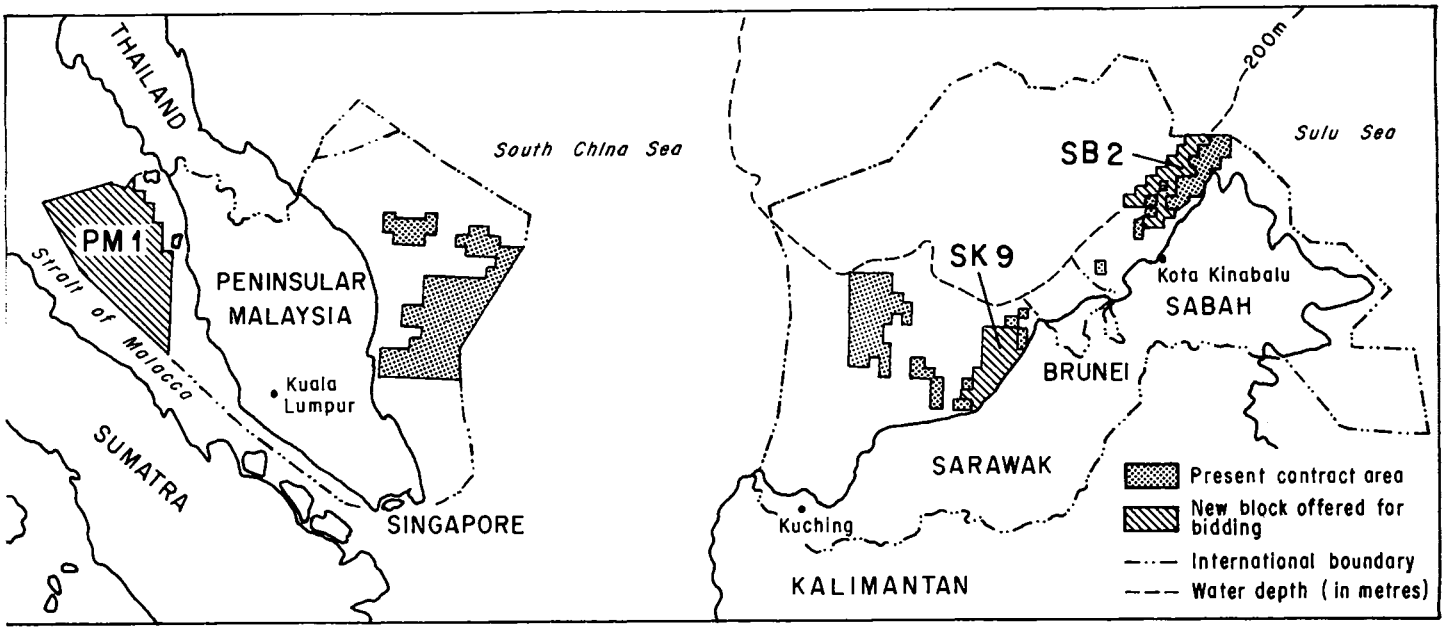
Petronas has offered three offshore areas in Peninsular Malaysia, Sabah and Sarawak for bidding. The areas are Block PM1 in Peninsular Malaysia, Block SB2 in Sabah and Block SK9 in Sarawak. Substantial oil and gas discoveries have been made in adjacent areas.

More than forty companies are currently inspecting the geophysical and geological data of the three blocks. The companies, which are part of the more than 80 international oil companies invited by Petronas in January this year, are from the United States, the United Kingdom, the Netherlands, Japan, Taiwan, Korea, Italy, France, Canada, Belgium, Spain and Australia.

This is the first time Petronas is offering the Peninsular Malaysia acreage for bidding. The Straits of Malacca PM1 Block, which is 37,500 sq. km in area, was earlier explored by Mobil Malaysia Exploration Company. The company relinquished it in 1974. Exploration activities in the Straits of Malacca resumed in 1983 when Petronas acquired about 2,376 line kilometres of new seismic data.

Block SB2 was previously explored by Sabah Shell Petroleum Company (SSPC) and Esso Production Malaysia Inc. (EPMI). EPMI relinquished its area in 1979 and SSPC in 1983. A total of 8,414 line kilometres of seismic data have been acquired in the 7,900-sq-km Block SB2 and a total of 12 wells were drilled.

The Sarawak acreage, Block SK9, which is located in the Balingian and Central Luconia Provinces where substantial quantities of oil and gas are being produced, was previously operated by Sarawak Shell Berhad (SSB). A total of about 5,721 line kilometres of seismic data were shot in the area. After drilling 7 wells SSB relinquished the 6,700-sq-km area in 1979.



Map showing the offshore contract areas of Malaysia

(Extracted from *Nada PETRONAS* Apr. 1986)

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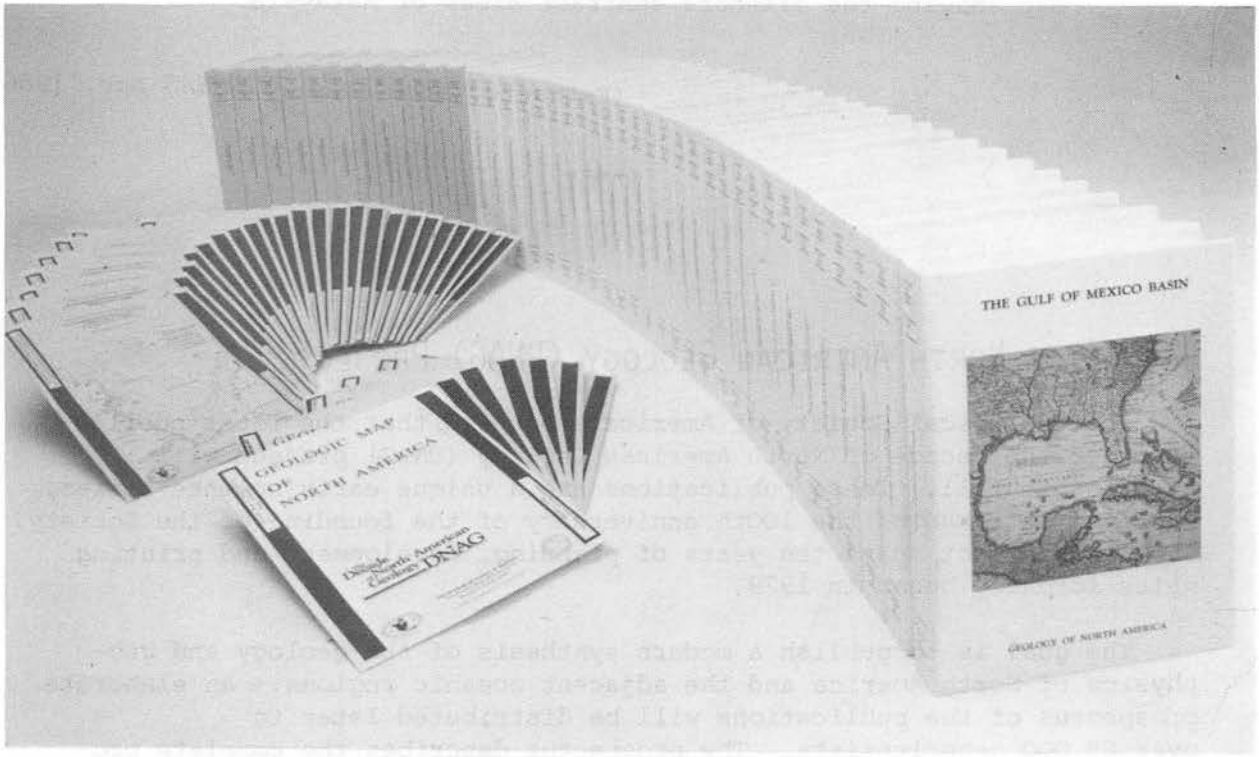
DECADE OF NORTH AMERICAN GEOLOGY (DNAG) PROJECT

The Geological Society of America announced that the first publications of the Decade of North American Geology (DNAG) project will appear this fall. These publications are a unique earth science series, produced in honour of the 100th anniversary of the founding of the Society. The DNAG project spans ten years of planning, development and printing which formally began in 1979.

The goal is to publish a modern synthesis of the geology and geophysics of North America and the adjacent oceanic regions. An elaborate prospectus of the publications will be distributed later to over 65,000 geoscientists. The prospectus describes the complete project, which will include 40 volumes, 23 continent-ocean transects, and seven continent-scale geologic or geophysical maps of North America. The 40 volumes include a 19-volume set of the Geology of North America (United States and Mexico), a nine-volume set of the Geology of Canada, six Centennial Field Guides for the United States and Canada, and four special topical titles. Copies of the prospectus are available from the Marketing Department of the Society, (303) 447-2020.

More than a thousand editors, authors and contributors have collaborated on the DNAG project. "From the beginning, leaders of the Society have been determined to make this modern synthesis available at prices so low that students could afford them," explains F. Michael Wahl, executive director of the Society. Through efforts of the Geological Society of America Foundation, generous contributions have been received from every sector - academia, government and industry - the cost for each of the forty volumes is remarkably low. The prospectus lists an average price of $26.35 to $30.38 per volume, depending upon which payment plan the buyer selects. A special prepayment plan and a unique 30-month time-payment plan have been designed just for the DNAG products.

Dallas L. Peck, director of the U.S. Geological Survey, maintains that "the DNAG publications will undoubtedly prove to be a standard reference work for North American geology for many decades to come". For further information about the DNAG project, contact the Geological Society of America, Marketing Department, P.O. Box 9140, Boulder, Colo. 80301.



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1st Sino-British Geological Conference, April 1987

Geotechnical Engineering and Hazard Assessment in Neotectonic Terraines

Taiwan is an island 394 km long with an area of 36,000 sq. km. (13,899.7 sq. miles), supporting a rapidly-growing population of around 19 million. It is highly mountainous, with hilltops exceeding 3,000 metres. This relief has been developed since the Pilocene, due to collision of an island arc on the Pacific plate with the Asian continental margin. Subduction of the Pacific plate beneath the Asian plate has since largely stopped, and motion on this boundary now appears to be dominantly strike/slip. Taiwan thus provides an exciting opportunity to investigate the geology and geomorphology of a new mountain chain where relief is often provided by comparatively weak geological materials. Understandably, the rate of geomorphological development in Taiwan is rapid, with a significant production of sediment due to slope and fluvial processes. Very steep hillsides, which are increasingly being populated under the pressure for additional living space, have thus become sites for potentially large-scale slope failures. This Conference is specifically aimed at the problems of engineering and hazard assessment in these regions of young, potentially unstable, mountain slopes.

Outline Programme

1st & 2nd April 1987	Conference
3rd to 8th April	Field Trip
10th April	Review Symposium (this may be extended to a second day)

Field Trip Itinerary

Friday, 3rd April: Leave Taipei. Visit the Chitan Landslip area and then proceed to the Feitsui Dam for lunch. In the afternoon drive to Taichung, where the party will spend the night.

Saturday, 4th April: Leave early to drive to the Miaoli Anticline, to examine the drilling there. Drive to Lishan (at 3,000 m high) along the Middle Cross-island Highway, examining the engineering of the road, the various associated hazards and dams along the way. Night at Lishan.

Sunday, 5th April: Leave Lishan for Hualien, completing the Cross-Island Highway to the east coast, driving via the Taroko Gorge.

Monday, 6th April: Leave Hualien for Taitung, examining coastal landslips in the Coastal Range, and the Lichi Melange. There will also be a stop to view the Taitung Longitudinal Valley, exhibiting the Pacific and Asian Plate boundary. Night at Taitung.

Tuesday, 7th April: In the morning visit the Chunchen Park in Taitung, to examine the basin resulting from the northward movement of the northward movement of the Coastal Range. A stop will also be made in the Yenwan area, to view the Pleistocene fault scarp cliff on the railway there. Then drive along the South Cross-Island Highway, examining slope failure in metamorphic rocks along the way, to Tainan. Spend night at Tainan.

Wednesday, 8th April: Leave Tainan to visit the Moon World area (Montmorillonite Clay outcrops). Dirve to Sun Moon Lake, viewing various sites of engineering interest on the way. Lunch at Sun Moon Lake. In the afternoon there will be a visit to the Tsaoling Landslip for those interested, or the period can be spent using the recreational facilities at Sun Moon Lake, where the party will spend the night.

Thursday, 9th April: Return to Taipei in the morning. Afternoon free for shopping or sight-seeing.

Preliminary List of Keynote Speakers

Professor Attewell, School of Engineering and Applied Science, University of Durham

Professor M. Audley-Charles, Dept. of Geological Sciences, University College London

Dr. N. Barton, Norwegian Geotechnical Institute, Oslo

Professor Denys Brunsden, Geography Dept., Kings College London

Dr. Paul Hancock, Dept. of Geology, Bristol University

Professor John Hutchinson, Dept. of Civil Engineering, Imperial College, London

Professor N.J. Price, Dept. of Geological Sciences, University College London

Dr. Taylor, School of Engineering and Applied Science, University of Durham

Dr. Claudio Vita-Finzi, Dept. of Geography, University College London

Professor J. Dewey, Dept. of Earth Sciences, University of Oxford

Dr. A.B. Hawkins, Dept. of Geology, University of Bristol.

The above list of speakers reflects the expertise in geotechnics and civil engineering in potentially hazardous terraines that is being gathered together for this Conference.

The Conference is sponsored by the National Taiwan University and in England, by University College London.

For further details contact: Dr. Mervyn Jones, Conference Organiser, or Dr. Judith Rowbotham, Conference Manager, Dept. of Geological Sciences, University College, Gower Street, London WC1.

*****

12TH INTERNATIONAL GEOCHEMICAL EXPLORATION SYMPOSIUM

4TH SYMPOSIUM ON METHODS OF GEOCHEMICAL PROSPECTING

12th I.G.E.S. - 4th S.M.G.P.

Under the sponsorship of the Association of Exploration Geochemists (A.E.G.) and the International Association of Geochemistry and Cosmochemistry (I.A.G.C.) working group 'Geochemical prospecting', the

implications and dealing with understanding of geochemical processes, upon which exploration techniques are based. Letters for acceptance will be mailed in January 1987. The proceedings of the Symposium will be published in English or in French in 1988 in a Special issue of the 'Journal of Geochemical Exploration'.

Workshops

Several one-day workshops will be organized on April 22. A number of topics are proposed below. Other proposals are welcome and should come out on the accompanying questionnaire. Each workshop will be limited to 30 participants. Final selection of workshop topics will depend on having sufficient interested participants.

Topics: 1) Data Processing
2) Tropical Geochemistry
3) Anomaly selection criteria
4) Geochemistry and Environment
5) Rock Geochemistry
6) Hydrogeochemistry
7) Geochemistry in semi-arid environment
8) Organo-metallic Geochemistry

Social Program and Tours

A wine and cheese party will be held on Thursday evening, April 23 at BRGM, Orleans, and a gala evening with cocktails, dinner and dancing will be organized on Saturday, April 25, at Cheverny, one of the most famous 'Chateaux de la Loire'. A program for accompanying members will include a tour in the Vallee de la Loire, with a visit to some Chateaux and a sight-seeing tour to Paris.

Field Trips

Pre and post-symposium field trips are planned. Attendance to a given field trip requires registering for the Symposium. The final program and cost will depend on the level of demand.

The proposed field trips are:

* Exploration case histories in Brittany (Western France)
* Salsigne gold deposit (South of Massif Central)
* Chessy Cu-Zn massive sulphide deposit (East of Massif Central)
* Granite-related U and Sn, W, Li mineralization in the Hercynian province North of Massif Central (Limoges region)
* Massive sulphide deposits in the South-Iberian belt (Spain and Portugal)
* Cover-rock type Pb-Zn deposits in Northern Tunisia

*****

Bureau de Recherches Geologiques et Minieres (BRGM) will organize the 12th International Geochemical Exploration Symposium and the 4th Symposium on Methods of Geochemical Prospecting at Orleans La Source, France, from April 23 to 26, 1987.

You are kindly invited to join us and enjoy both what should be a 'must' for anyone involved in exploration geochemistry and also spring-time at Orleans, a beautiful town located some 100 km south of Paris, in the 'Vallee de la Loire' with its famous 'Chateaux'.

The program will include:

* technical sessions with oral and poster presentations, on April 23, 24, 25, 26 (a.m.)
* workshops on April 22
* pre and post-symposium field trips (April 19-21; April 26-29)
* exhibitions
* A.E.G. and I.A.G.C. (working group 'Geochemical Prospecting') council meetings
* a social program.

Languages

The official languages of the Symposium will be French and English. Simultaneous translation will be available for oral presentations.

Address for correspondence

The Organizing Committee of the Geochemical Exploration Symposium
12th I.G.E.S. - 4th S.M.G.P.
BRGM
B.P. 6009
45060 Orleans Cedex 02
France
Telex: 780.258 F - Telephone: (33) 38.64.30.08

Technical Program

The technical sessions will be held at Orleans La Source on April 23, 24, 25 and 26 (a.m.). The program will include oral and poster presentations.

Topics

1. Integrated mineral exploration combining geochemical techniques and other approaches
2. Geochemical prospecting for precious metals
3. Geochemical exploration under extreme climatic conditions, from desert to tropical rainforest, with emphasis on weathering effects
4. Recent developments in analytical chemistry, data processing, expert systems, hydrogeochemistry, others....

Call for Papers

Proposals for papers and posters on any of the topics of the Symposium must be submitted in French or English as extended abstracts (up to 1000 words). The contributions must be detailed enough to enable the Technical Program Committee to reach an informed decision. First consideration for acceptance will be given to those papers with general

KALENDAR (CALENDAR)

1987

January 5 - 9, 1987
METEORITES AND THE EARLY SOLAR SYSTEM (Conference), Tucson, Arizona, USA. (Dr. J. Kerridge, Institute of Geophysics, University of California, Los Angeles, Ca. 90024, USA).

January 6 - 8, 1987
WATER FOR MANKIND (International Symposium), Cairo, Egypt. (MURS - France, 127 boulevard Saint-Michel, 75005 Paris, France).

January 7 - 23, 1987
GEOCHEMISTRY OF HYDROTHERMAL ORE-FORMING PROCESSES (NATO Advanced Study Institute), Madrid and Salamanca, Spain. (H.L. Barnes, 235 Deike Building, Pennsylvania State Univ., University Park, PA 16802, USA).

January 8 - 10, 1987
MAGMATISM IN THE OCEAN BASINS (Meeting), Leicester, U.K. (A.D. Saunders, Dept. of Geology, The University, Leicester LE1 7RH, U.K.).

January 9 - 14, 1987
THE PALAEOENVIRONMENT OF EAST ASIA (2nd International Conference), Hong Kong. (Dr. E.K.Y. Chen/Dr. R.O. Whyte, Centre of Asian Studies, Univ. of Hong Kong, Hong Kong).

January 19 - 23, 1987
HOW VOLCANOES WORK (Hawaii Symposium), Hilo, Hawaii. (Robert Decker, U.S. Geological Survey, MS-910, 345 Middlefield Road, Menlo Park, CA 94025, U.S.A.

January 21 - 31, 1987
GRANITES AND ASSOCIATED MINERALIZATIONS (International Symposium), Salvador, Bahai, Brazil. Languages: English, French and Protuguese. (ISGAM, Augusto J. Pedreira, SMECPM: Rua Ceara, 3-Pituba, 40,000, Salvador, Bahai Brazil)

January 27 - 30, 1987
CANADIAN REEF RESEARCH (Symposium), Banff, Alberta, Canada. (Canadian Reef Research Symposium, The University of Calgary, Conference Office, Faculty of Continuing Education, 2500 University Drive NW, Calgary, Alberta, Canada T2N 1N4)

February 2 - 4, 1987
PACIFIC RIM COAL (2nd International Conference), Hong Kong. (H. Baisden, Pasha Publications, 1401 Wilson Boulevard, Suite 910, Arlington, Va. 22207, USA).

February 2 - 6, 1987
DEFORMATION OF CRUSTAL ROCKS (International Conference), Mt. Buffalo, NE Victoria, Australia. (Dr. D. Gray, Department of Earth Sciences, Monash University, Clayton, Victoria 3168, Australia).

February 2 - 6, 1987
ASH: A NEW RESOURCE, (Symposium), Pretoria, South Africa. (Dr. R.A. Kruger, CSIR-Frd, POB 395, Pretoria 0001, South Africa)

February 9 - 11, 1987
SINKHOLES AND THE ENVIRONMENTAL IMPACTS OF KARST (2nd Multidisciplinary Conference and Field Trip), Orlando, Florida, USA. (Dr. B.F. Beck, Flordia Sinkhole Research Institute, University of Central Florida, Orlando, Fl. 32816, USA).

February 9 - 13, 1987
COMMISSION FOR THE GEOLOGICAL MAP OF THE WORLD (CGMW Plenary Assembly), Paris, France. (Secretary General, CGMW, 77 rue Claude-Bernard 75005 Paris, France).

February 13 - 21, 1987
LOESS (3rd International Symposium), New Zealand. (Dr. D.N. Eden, N.Z. Soil Bureau, DSIR, Private Bag, Lower Hutt, New Zealand).

February 16 - 20, 1987
INTERACTION BETWEEN SEDIMENTS AND WATER (4th International Symposium), Melbourne, Australia. (Dr. B.T. Hart, Water Sciences Center, Chisholm Institute of Technology, P.O. Box 197, Caulfield East, Victoria 3145, Australia).

February 23 - 26, 1987
URBAN HYDROGEOLOGY AND CONTAMINATION OF AQUIFERS (Latin American Conference), Cochabamba, Bolivia. Languages: Spanish and Portuguese, but papers in French and English accepted. (Secretaria de la Conferencia, c/o V. Ricaldi, Casilla 183, Cochabamba, Bolivia).

February 24 - 26, 1987
GEOSYNTHETICS '87 (Conference), New Orleans, Louisiana, USA. (IFAI, 345 Cedar Building, Suite 450, St. Paul, MN 55101, USA).

February 26 - 27, 1987
EROSION CONTROL ASSOCIATION (18th Annual Conference), Sparks, Nevada, USA. (International Erosion Control Association, P.O. Box 195, Pinole, Ca. 94564-0195, USA).

March 3 - 4, 1987
INVERSION TECTONICS (Meeting), London, U.K. (M. Cooper, British Petroleum, Britannic House, Moor Lane, London EC2Y 9BU, UK).

March 4 - 7, 1987
DETACHMENT AND SHEAR (77th Annual Meeting of the Geologische Vereinigung), Hasel, Switzerland. Sponsored by International Lithosphere Program. (Prof. D. Bernoulli, Geologisches Institut, Univ. Basel, Bernoullistrasse 32, CH-4056 Basel, Switzerland).

March 7 - 15, 1987
ESTIMATION OF NATHRAL RECHARGE OF GROUNDWATER (International Workshop), Antalya, Turkey. (Co-sponsored by IAH. Language: English. (Dr. I.E. Seyhan, Free University of Amsterdam, Department of Earth Sciences, P.O. Box 7161, 1007 MC Amsterdam, The Netherlands).

March 10 - 14, 1987
ORIGIN AND EVOLUTION OF PLANETARY AND SATELLITE ATMOSPHERES (Conference), Tucson, Arizona, USA. (S.K. Atreya, University of Michigan, Space Research Building, Ann Arbor, MI 48109-2143, USA).

March 11 - 12, 1987
MINERAL RESOURCES RESEARCH IN THE USGS (3rd Annual McKelvey Forum), Denver, Colorado, USA. (Buhler and Abraham, Inc., 10102 McKinney Avenue, Silver Springs, Maryland 20902, USA)

March 16 - 20, 1987

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

March 16 - 20, 1987

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

March 18 - 19, 1987
EARLY TERTIARY VOLCANISM AND THE OPENING OF THE NE ATLANTIC (Meeting), London, U.K. (A.C. Morton, British Geological Society, Keyworth, Notts. NG12 5GG, UK).

March 23 - 24, 1987
EXTRACTIVE INDUSTRY GEOLOGY '87 (Meeting), Keele, Staffordshire, U.K. (Conference Office, IMM, 44 Portland Place, London W1N 4BR, UK).

March 23 - 26, 1987
SMALL MINE ECONOMICS AND DEVELOPMENT (Conference) London, U.K. (Small mine economics and development conference, International Mining, Cii House, 31 Theobalds Road, London WC1, UK).

March 23 - 28, 1987
GROUNDWATER MONITORING AND MANAGEMENT (International Symposium), Desden, G.D.R. Languages: English and Russian. (Dr. P. Losel, Institut fur Wasserwurtschaft, Schnellerstrasse 140, DDR-1190 Berlin, German Democratic Republic).

March 26 - 27, 1987
THE PHYLOGENY AND CLASSIFICATION OF THE TETRAPODS (Special Meeting), London, U.K. (M. Benton, Department of Geology, The Queen's University of Belfast, Belfast, BT7 1NN, Northern Ireland).

March 29 - April 3, 1987
EROSION AND DEPOSITION WITH EMPHASIS ON SEMIARID AND ARID ENVIRONMENTS (Meeting), Jerusalem, Beersheba, Elat, Israel. Co-sponsored by INQUA. (Prof. A. Yair, Department of Physical Geography, Institute of Earth Sciences, Hebrew University, 91904 Jerusalem, Israel).

April 1987
GEOCHEMISTRY AND MONITORING IN REPRESENTATIVE BASINS (International Meeting), Prague, Czechoslovakia. (Dr. B. Molden, Geological Survey, Malostranskeran 19, 11821 Prague 1, Czechoslovakia).

April 1 - 3, 1987
SEDIMENTOLOGY (8th IAH Regional Meeting), Tunis, Tunisia. (Pr. Ali M'Rabet, Faculte des Sciences de Tunis, Departement des Sciences de la Terre, Campus Universitaire, 1060 Tunis, Tunisia).

April 1 - 10, 1987
GEOTECHNICAL ENGINEERING AND HAZARD ASSESSMENT IN NEOTECTONIC TERRAINS (Sino-British Conference), Taiwan. (Dr. J. Rowbotham, Department of Geological Sciences, University College, Gower Skreet, London WC1E 6BT, UK).

April 2 - 3, 1987
MICROPALAEONTOLOGY, PALYNOLOGY AND PETROLEUM EXPLORATION, ON- AND OFFSHORE EUROPE (Meeting), Aberdeen, Scotland, U.K. (Geological Society, Burlington House, Piccadilly, London W1V 0JU, UK).

April 6 - 12, 1987
LATE QUATERNARY SEA LEVEL: THE MARINE AND TERRESTRIAL RECORD (GSA Penrose Conference), Ferry Reach, Bermuda. (J.L. Carew, Department of Geology, College of Charleston, Charleston, SC. 29424, USA).

April 6 - 10, 1987
HYDROLOGY IN PERSPECTIVE (International Symposium), Rome, Italy. Co-sponsored by Unesco, WMO, and IAHS. (International Association of Hydrological Sciences, GIBI s.a.s. Studio Congressi, Via Marco Besso, 40, 0011 Rome, Italy)

April 7 - 8, 1987
PHANEROZOIC IRONSTONES AND RELATED DEPOSITS (International Symposium), Sheffield, U.K. (Dr. G. Taylor, Dept. Science, Luton, CHE, Park Square, Luton LU1 3JU, UK).

April 7 - 10, 1987
DRILLEX 87 (International Exhibition and Conference on Drilling), Stoneleigh, Warwickshire, UK. (The Conference Office, The Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, UK).

April 10 - 11, 1987
RECONSTRUCTION AND CORRELATION OF THE PHANEROZOIC LACUSTRINE RECORD (IGCP-219 Workshop), Lake Luzern, Switzerland. (Dr. K. Keits, EAWAG-Geology, CH-8600 Dubendorf ZH, Switzerland).

April 13 - 16, 1987
EUROPEAN UNION OF GEOSCIENCES (IV Biennial Conference), Strasbourg, France. (Prof. Dr. W. Lowrie, Inst. fur Geophysik, HPP P 5, ETH Honggerberg 8093 Zurich, Switzerland)

April 13 - 16, 1987
ENVIRONMENTAL RECORDS FROM LACUSTRINE BASINS (IGCP-219 Symposium at EGU) Strasbourg, France. (Dr. K. Kelts, EAWAG-Geology, CH-8600 Dubendorf ZH, Switzerland).

April 21 - 22, 1987
DELTAS: SITES AND TRAPS FOR FOSSIL FUELS (Geological Society Meeting), London, U.K. (Geological Society, Burlington House, Piccadilly, London W1V OJU, UK).

April 22 - 24, 1987
GEOLOGICAL KINEMATICS AND DYNAMICS, FROM MOLECULES TO MANTLE (International Meeting), Uppsala, Sweden. (The GKD Committee, Institute of Geology, Uppsala University, Box 555, S-751 22 Uppsala, Sweden).

April 23 - 26, 1987
INTERNATIONAL GEOCHEMICAL EXPLORATION (12th Symposium) and METHODS OF GEOCHEMICAL PROSPECTING (4th Symposium), Orleans La Source, France. (The Organizing Committee, 12th IGES - 4th SMGP, BRGM, B.P. 6009, 45060 Orleans Cedex, France)

April 26 - May 1, 1987
WORLD PETROLEUM CONGRESS (12th) Houston, Texas, USA. (12th WPC Association, c/o American Petroleum Institute, 1220 L Street NW, Washington, DC 20005, USA).

April 27 - May 1, 1987
DRILLEX '87 (International Conference and Exhibition on Drilling - The Mienrals Industry and Geotechnical Engineering), Stoneleigh, Warwickshire, U.K. (IMM, 44 Portland Place, London W1N 4BR, U.K.)

April 27 - 29, 1987
LATE CENOZOIC PALEOENVIRONMENTS AND GEOLOGY OF THE ARTIC (Workshop), Spidsbergseter Fjellstue, Norway. (Dr. A. Elverhoi, Norwegian Polar Research Institute, P.O. Box 158, 1330 Oslo Lufthavn, Norway).

April 28 - May 7, 1987
ZECHSTEIN: STRATIGRAPHY-PALEOGEOGRAPHY-GEOCHEMISTRY (International Symposium), Hannover/Kassel, F.R.G. (J. Lepper, Niedersachsisches Landesamt fur Bodenforschung, P.O. Box 51 01 53, D-3000 Hannover 51, F.R.G.)

May 1987
EXPOSED CROSS SECTIONS OF THE CONTINENTAL CRUST (GSA Penrose Conference), southeastern Ontario, Canada. (D.M. Fountain, Dept. of Geology and Geophysics, University of Wyoming, Laramie, WY 82071, USA).

May 3 - 8, 1987
THE CONSTRUCTION OF GEOLOGICAL CROSS SECTIONS: TECHNIQUES, ASSUMPTIONS AND METHODS (GSA Penrose Conference), New Paltz, New York, USA. (P.A. Geiser, Dept. of Geology and Geophysics, University of Connecticut, Storrs, CT 06268, USA).

May 3 - 7, 1987
ENGINEERING GEOLOGICAL ENVIRONMENT IN MOUNTAINOUS AREAS (International Symposium), Beijing, P.R. China. (Geological Society of China, Ministry of Geology, Pai Wan Chung, Fuchengmenwai, Beijing, P.R. China)

May 12 - 14, 1987
COASTAL SEDIMENTS '87 (Conference), New Orleans, Louisiana, USA. (Dr. N.C. Kraus, USAE Waterways Experiment Station, P.O. Box 631, Attn: WESCE-P, Vicksburg, MS 39180-0631, USA).

May 15 - 17, 1987
HYDROLOGY, SEDIMENTOLOGY AND GEOMORPHOLOGICAL IMPLICATIONS OF FLOODS (Conference), Lancaster, U.K. (P.A. Carling, Freshwater Biological Association, The Ferry House, Far Sawrey, Ambleside, Cumbria LA22 OLP, UK).

May 16 - 24, 1987
PALAEOECOLOGICAL - PALAEOHYDROLOGICAL STUDIES BASED ON STRATIGRAPHICAL RESEARCH IN LAKES AND MIRES AND FLUVIAL ENVIRONMENTS (IGCP-158 Symposium), Sweden. (B.E. Berglund, Dept. of Quaternary Geology, Tornav. 13, S-223 63 Lund, Sweden).

May 18 - 22, 1987
GEOMATHEMATICS AND GEOSTATISTICS APPLIED TO SPACE- AND TIME-DEPENDENT DATA (International Conference and Course), Wroclaw, Poland. Sponsored by CODATA, IAMG, IUGS, and Unesco. (Dr. J.J. Royer, C.R.P.G., B.P. 20, 15 rue Nd des Pauvres, 54501 Vandoeuvres-les-Nancy Cedex, France).

May 18 - 22, 1987
AMERICAN GEOPHYSICAL UNION (Spring Meeting), Baltimore, Maryland, U.S.A. (AGU Meetings, 2000 Florida Avenue NW, Washington, DC 20009, U.S.A.)

May 21 - June 5, 1987
WORLD MINING CONGRESS (13th), Stockholm, Sweden. (Organizing Secretary, 13th World Mining Congress, University of Lulea, S-951 87 Lulea, Sweden)

May 25 - 27, 1987
COASTAL LOWLANDS: GEOLOGY AND GEOTECHNOLOGY (International Symposium), The Hague, The Netherlands. (Dr. H.J.W.G. Schalke, P.O. Box 85947, 2508 CP The Hague, The Netherlands)

May 25 - 27, 1987
GEOLOGICAL, MINERALOGICAL ASSOCIATIONS OF CANADA (Joint Annual Meeting), Saskatoon, Canada. (Dr. W.O. Kupsch, Department of Geological Sciences, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N OWO)

May 27 - 28, 1987
ALPINE TECTONICS (Geological Society, The Fermor Lecture Meeting), London, U.K. (Prof. M.P. Coward, Dept. of Geology, Royal School of Mines, Imperial College, Prince Consort Road, London SW7 2BP, UK).

May 28 - 30, 1987
PERMANENT SEISMOGRAPHIC OBSERVATORIES AND NETWORKS (Centennial Anniversary Symposium), Berkeley, California, U.S.A. (Prof. B.A. Bolt, Seismographic Stations, University of California, Berkeley, CA 97420, U.S.A.)

May 31 - June 5, 1987
WORLD MINING CONGRESS (13th), Stockholm, Sweden. (Organizing Secretary, 13th World Mining Congress, University of Lulea, S-951 87 Lulea, Sweden).

June 1987
INTERNATIONAL MINING AND EXPLORATION EXHIBITION '87 (Meeting), Sydney, Australia. (Thomson Exhibitions, 47 Chippen Street, Chippendale, NSW 2008, Australia)

June 3 - 6, 1987
PROTEROZOIC GEOCHEMISTRY (International Symposium), Lund, Sweden. Sponsored by IGCP-217. (Prof. R. Gorbatschev, Geological Institute, Lund University Solvegatan 13, S-223 62 Lund, Sweden).

June 7 - 10, 1987
AAPG and SEPM (Annual Meeting), Los Angeles, Calif., U.S.A. (AAPG Headquarters, Box 979, Tulsa, OK 74101, U.S.A.)

June 9 - 12, 1987
EUROPEAN ASSOCIATION OF EXPLORATION GEOPHYSICISTS (49th Annual Meeting and Technical Exhibition), Belgrade, Yugoslavia. (EAEG, Wassenaarseqeg 22, 2596 CH The Hague, The Netherlands).

June 11 - 12, 1987
FAN-DELTAS: SEDIMENTOLOGY AND TECTONIC SETTINGS (International Symposium), Bergen, Norway. Sponsored by Norsk Hydro, Univ. of Bergen and Norwegian Petroleum Society. (R.J. Steel, Norsk Hydro Research Centre, P.O. Box 4314, 5013 Bergen, Norway).

June 21 - 25, 1987
HYDROGEOLOGY (4th Canadian/American Conference), Banff, Alberta, Canada. (Dr. B. Hitchon, Alberta Research Council, P.O. Box 8330, Station F, Edmonton, Alberta, Canada T6H 5X2).

June 30 - July 6, 1987
CHEMISTRY OF THE EARTH AND THE UNIVERSE (IAGC 20th Anniversary Congress), Paris, France. (Dr. B. Hitchon, Alberta Research Council, P.O. Box 8330, Station F, Edmonton, Alberta, Canada T6H 5X2).

July 6 - 10, 1987
CRYPTOEXPLOSIONS AND CATASTROPHES IN THE GEOLOGICAL RECORD (International Workshop), Parys, South Africa. Co-sponsored by IUGS. (L.O. Nicolaysen, Geophysics Department, Witwatersrand University, Johannesburg, South Africa 2001).

July 6 - 11, 1987
CONTINENTAL AND OCEANIC LITHOSPHERE: SIMILARITIES AND DIFFERENCES (Workshop), London, U.K. (M.A. Menzies, Dept. of Geology, University of London, RHBNC, Egham, Surrey TW20 OEX, UK).

July 6 - 11, 1987
FOSSIL ALGAE (4th International Symposium), Cardiff, Wales, UK. (Dr. R. Riding, Dept. of Geology, University College, Cardiff CF1 1XL, Wales, UK).

July 6 - 12, 1987
SIXTH REGIONAL CONGRESS ON GEOLOGY, MINERAL AND HYDROCARBON RESOURCES OF SOUTHEAST ASIA (GEOSEA VI), Jakarta, Indonesia. (Rudy Phoa, Trend Energy, Five Pillars Office Park, P.O. Box 209, Jl. M.T. Haryono No. 58, Jakarta, Indonesia).

July 7 - 10, 1987
APPLIED MINERALOGY (3rd International Congress), Orleans, France. (P. Alain, ICAM 87, Laboratoire de Mineralogie Appliquee, Ecole Sup. de PEnergie et des Materiaux, Domaine Universitaire de la Source, B.P. 6749, 45067 Orleans, Cedex 2, France).

July 23 - 25, 1987
SOUTH ATLANTIC EVOLUTION (2nd Symposium), Rio de Janeiro, Brazil. (D. Dias-Brito, PETROBRAS/CENPES, 11ha do Fundaq, Quadra 7, Rio de Janeiro 21.910, Brazil).

July 29 - 31, 1987
PACIFIC NEOGENE STRATIGRAPHY (4th International Congress of Regional Committee and Meeting of IGCP 246), Berkeley, Calif., USA. (Dr. C. Brunner Dept of Paleontology, University of California, Berkeley, Ca. 94720, USA).

July 31 - August 9, 1987
INTERNATIONAL UNION FOR QUATERNARY RESEARCH (12th Congress), Ottawa, Ontario, Canada. (Dr. Alan V. Morgan, Department of Earth Sciences, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1)

August 1987
PACIFIC NEOGENE PALAEOCEANOGRAPHIC AND BIOSTRATIGRAPHIC EVENTS (Meeting), Berkeley, Calif., U.S.A. (Dr. C. Brunner Department of Paleontology, University of California, Berkeley, CA 94720, U.S.A.)

August 1 - 12, 1987
LANDSLIDES (5th International Conference/Workshop), Australia and New Zealand. (5th ICFL-Anzslide '87, P.O. Box 56, Rosny Park, Tasmania 7018, Australia).

August 3 - 7, 1987
EROSION AND SEDIMENT TRANSPORT IN PACIFIC RIM MOUNTAINOUS LANDS (International Symposium and IAHS/IUGG Meeting), Corvallis, Oregon, USA. (Conference Coordinator, College of Forestry, Oregon State University, Corvallis, OR 97331, USA).

August 3 - 13, 1987
MAGMATIC SULPHIDES (5th International Sulphides Conference), Harare, Zimbabwe. (Secretary, 5th International Sulphides Conference, Box 1795, Harare, Zimbabwe).

August 9 - 11, 1987
TRACE FOSSILS, SMALL SHELLY FOSSILS, AND THE PRECAMBRIAN-CAMBRIAN BOUNDARY, ST. JOHN'S, NEWFOUNDLAND (IUGS Commission on Stratigraphy Conference and Fieldtrip), eastern Newfoundland. (Dr. G.M. Narbonne, Dept. of Geological Sciences, Queen's University, Kingston, Ontario, Canada K7L 3N6).

August 9 - 18, 1987
PRECAMBRIAN-CAMBRIAN BOUNDARY WORKING GROUP (Meeting), St. John's, Newfoundland, Canada (Dr. G. Narbonne, Dept. of Geological Sciences, Queen's University, Kingston, Ont., Canada K7L 3N6).

August 9 - 22, 1987
IUGG (XIX General Assembly), Vancouver, Canada. (R.D. Russell, Department of Geophysics and Astronomy, University of British Columbia, Vancouver, B.C., Canada V6T 1W5)

August 12 - 20, 1987
INTERNATIONAL UNION OF CRYSTALLOGRAPHY (Congress), Perth, Western Australia. (E.N. Masien, Crystallography Centre, University of Western Australia, Nedlands, 6009, Australia)

August 12 - 13, 1987
GEOTECHNICAL ENGINEERING ON SOFT SOILS (International Symposium), Mexico City. (M. Mendoza, Chairman, Organizing Committee, Instituto de Ingeniera - UNAM, Apdo. Postal 70-472, 04510 Mexico, D.F., Mexico).

August 17 - 21, 1987
BASEMENT TECTONICS (7th International Conference), Kingston, Ontario, Canada. (Bob Mason, c/o Events Management Inc., 4 Cataraqui Street, Suite 209, Kingston, Ontario, Canada K7K 1Z7).

August 17 - 20, 1987
DEVONIAN SYSTEM (CSPG 2nd International Symposium), Calgary, Alberta, Canada. (Devonian Symposium, Canadian Society of Petroleum Geologists, 505-206 7th Avenue SW, Calgary, Alberta, Canada T2P 0W7)

August 18 - 22, 1987
AFRICAN GEOLOGY (14th Colloquium), Berlin (West). (G. Matheis, Technical University of Berlin, SRP/69, Ackerstrasse 71-76, D-1000 Berlin 65, F.R.G.).

August 20 - 22, 1987
X-RAY POWDER DIFFRACTOMETRY (Meeting with 14th Congress of the International Union of Crystallography), Perth, Western Australia. (Dr. E.H. Nickel, Division of Minerals & Geochemistry, CSIRO, Private Bag P.O., Wembley, W.A. Australia 6014).

August 20 - 30, 1987
PACIFIC SCIENCE ASSOCIATION (16th Congress), Seoul, South Korea. Section B: Solid Earth Seiences (Prof. Bong Kyun Kim, Department of Geological Sciences, College of Natural Sciences, Seoul National Univ., Seoul, South Korea)

August 21 - 22, 1987
DEVONIAN SUBCOMMISSION (Open Meeting), Calgary, Alberta, Canada. (Dr. W.A. Oliver, Jr., U.S. Geological Survey, E-305 Natural History Building, Smithsonian Institution, Washington, DC. 20560, USA).

August 24 - 28, 1987
ANTARCTIC EARTH SCIENCES (5th International Symposium), Cambridge, U.K. (Dr. M.R.A. Thomson, British Antarctic Survey, High Cross, Madingley Road, Cambridge, U.K. CB3 0ET)

August 26 - 29, 1987
PACIFIC RIM CONGRESS 87 (International Congress), Gold Coast, Southern Queensland, Australia. (Aus. IMM Congress Secretariat, P.O. Box 731 Toowong, 4066 Queensland, Australia).

August 26 - September 0, 1987
CRETACEOUS SYMPOSIUM (3rd International Symposium), Tubingen, F.R.G. (Prof. Dr. J. Wiedmann, Institut und Museum fur Geologie und Palaontologie, Sigwartstrasse 10, 7400 Tubingen 1, Federal Republic of Germany).

August 30 - September 4, 1987
INTERNATIONAL SOCIETY FOR ROCK MECHANICS (6th International Congress), Montreal, Canada. (Prof. B. Ladanyi, Dept. Civil Engineering, Ecole Polytechnique, Box 6079, Stn. A, Montreal, Canada H3C 3A7)

August 31 - September 3, 1987
SOIL MECHANICS AND FOUNDATION ENGINEERING (9th European Conference), Dublin, Ireland. Languages: English and French. (Dr. Trevor Orr, Civil Engineering Department, Trinity College, Dublin 2, Ireland)

August 31 - September 2, 1987
AFRICAN MINING (International Conference), Harare, Zimbabwe. (The Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, UK).

August 31 - September 4, 1987
CARBONIFEROUS STRATIGRAPHY AND GEOLOGY (11th International Congress), Beijing, P.R. China. Languages: Chinese and English. (Prof. Yang Jing-zhi, Nanjing Institute of Geology and Palaeontology, 39 East Beijing Road, Chi-Ming-Ssu, Nanjing, P.R. China).

August 31 - September 5, 1987
YELLOWKNIFE '87 (GAC Field Meeting), Yellowknife, NWT, Canada. (W.A. Padgham, Geological Surveys, Bag 9100, Yellowknife, NWT, Canada X1A 2R3).

September 1 - 5, 1987
AFRICAN GEOLOGY (14th Colloquium), Berlin, (West), F.R.G. (Dr. G. Matheis, Technical University of Berlin, SFB 69, Ackerstrasse 71, D-1000 Berlin 65, F.R.G.)

September 6 - 12, 1987
BASIN ANALYSIS (GOGEODATA Workshop), Budapest, Hungary. (Dr. G. Gabert, Federal Institute for Geosciences and Natural Resources, P.O. Box 51 01 53, D-3000 Hannover 51, Federal Republic of Germany).

September 7 - 9, 1987
DEFORMATION AND PLATE TECTONICS (International Conference), Oviedo, Spain. Language: English. (A. Perez-Estaun, Dpto de Geologia, Universidad de Oviedo, 33005 Oviedo, Spain).

September 7 - 11, 1987
CARBONIFEROUS STRATIGRAPHY AND GEOLOGY (11th International Congress), Beijing, P.R. China. (Prof. Yang Jing-zhi, Nanjing Institute of Geology and Palaeontology, Chi-Ming-Ssu, Nanjing, P.R. China)

September 7 - 12, 1987
ANTARCTIC GLACIOLOGY (4th International SCAR Symposium), Bremerhaven, F.R.G. (Heinz Kohnen, Alfred Wegener Institute for Polar Research, Columbus Center, D-2850 Bremerhaven, F.R.G.)

September 7 - 12, 1987
COMPUTERIZED BASIN ANALYSIS (COGEODATA International Workshop), Szeged, Hungary. Language: English. (Dr. L. Somos, Geological Survey of Hungary, Ph. 106, H-1442, Budapest, Hungary).

September 8 - 14, 1987
TERMINAL PRECAMBRIAN AND CAMBRIAN GEOLOGY (International Symposium), Yichang, China. Languages: Chinese and English. (Dr. Wang Xiao-feng, Terminal Precambrian and Cambrian Geology, Yichang Institute of Geology and Mineral Resources, P.O. Box 502, Yichang City, Hubei Province, People's Republic of China).

September 11 - 14, 1987
SEPM (4th Annual Midyear Meeting), Austin, Texas. (SEPM, P.O. Box 4756, Tulsa, OK 74159, U.S.A.)

September 11 - 17, 1987
PALEOENVIRONMENTAL INTERPRETATION OF PALEOZOLS (GSA Penrose Conference), Warm Spring Indian Reservation, Oregon, USA. (G.J. Retallack, Dept. of Geology, Univ. of Oregon, Eugene, OR 97403, USA).

September 12 - 23, 1987
COMPUTER APPLICATIONS AND MANAGEMENT OF PETROLOGICAL DATA BASES (Workshop), Kuwait. Co-sponsors include IUGS and IGCP-239. (Dr. Ali T. Al-Mishwt, Geology Dept. Kuwait University, P.O. Box 5969, Safat, Kuwait).

September 14 - 16, 1987
THE ORIGIN OF GRANITES (Symposium), Edinburgh, Scotland, U.K. (The Meetings Secretary, The Royal Society of Edinburgh, 22-24 George Street, Edinburgh EH2 2PQ, Scotland, UK).

September 14 - 18, 1987
ANDEAN VOLCANISM SYMPOSIUM (10th Argentine Geological Congress), San Salvador de Jujuy, Argentina. Co-sponsors include IAVCEI and IGCP-249. (Dr. B. Coira, CONICET-Univ. Nac de Jujuy, Casilla de Correo No. 258, 4600 San Salvador de Jujuy, Argentina).

September 14 - 18, 1987
CIRCUM-PACIFIC PHANEROZOIC GRANITES (International Symposium), Tucuman, Argentina. Jointly with 10th Argentine Geological Congress. Languages: English and Spanish. (Dr. Carlos W. Rapela, Centro de Investigaciones Geologicas, Universidad Nacional de La Plata, Calle 1 no 644, 1900 La Plata, Argentina)

September 14 - 18, 1987
NEOTECTONICS AND SEISMICITY OF THE ANDES (Regional Symposium) San Miguel de Tucuman, Argentina. (Dr. V. Ramos, Dept. of Geology, University of Buenos Aires, Pabellon 2 - City University 1428, Nunez, Buenos Aires, Argentina).

September 14 - 18, 1987
HYDROGEOLOGY OF COAL BASINS (IUGS/IAH Symposium), Katowice, Poland. (Dr. A. Rozkowski, Geological Institute, Bialego 1, 41-200 Sosnowiee, Poland).

September 17 - 27, 1987
EVOLUTION OF METAMORPHIC BELTS (Geological Society and IGCP-235 Joint Meeting), Dublin, Ireland. (J.S. Daly, Dept. of Geology, University College, Belfield Campus, Dublin 4, Ireland).

September 21 - 25, 1987
NATURAL GLASSES (Meeting), Prague, Czechoslovakia. Language: English. (V. Bouska, Faculty of Science, Charles University, Albertov 6, 128 43 Prague 2, Czechoslovakia).

September 21 - 25, 1987
METALS AND METALLOIDS IN THE HYDROSPHERE: IMPACT THROUGH MINING AND INDUSTRY AND PREVENTION TECHNOLOGY (Unesco/IHP International Workshop), Bochum, F.R.G. (IHP/OHP Sekretariat, c/o Bundesanstalt fur Gewasserkunde, Postfach 309, D-5400 Koblenz, F.R.G.).

September 24 - October 1, 1987
FOSSILS, ROCKS AND HISTORY (13th INHIGEO Symposium), Pisa, Italy. (Prof. G. Giglia, Dip. Scienze della Terra, Via S. Maria 53, 56100 Pisa, Italy).

September 25 - 27, 1987
CATASTROPHIC FLOODING (18th Annual Geomorphology Symposium), Oxford, Ohio, USA. (Dr. Larry Mayer, Dept. of Geology, Miami University, Oxford, Ohio 45056, USA).

September 27 - October 1, 1987
EXPLORATION '87 (3rd Decennial) Conference on Geophysical and Geochemical Exploration for Minerals and Groundwater (3rd Decennial Conference), Toronto, Canada. (Exploration '87, c/o 222 Snidercroft Road, Conford, Ontario L4K 1B5, Canada).

October 6 - 9, 1987
OROGENY, MAGMATISM AND METALLOGENY IN EUROPE (European Geological Societies 5th Meeting), Dubrovnik, Yugoslavia. Languages: English and French. (European Centre for Peace and Development, Secretariat MEGS 5, Sava-Centre, P.O. Box 5, 11000 Beograd, Yugoslavia).

October 11 - 15, 1987
SOCIETY OF EXPLORATION GEOPHYSICISTS (57th Annual Meeting), New Orleans, La., U.S.A. (Marvin R. Hewitt, Amoco Production Co., Box 591, Tulsa, OK 74102, U.S.A.)

October 12 - 16, 1987
MATHEMATICAL METHODS IN GEOLOGY (16th Annual Geochautauqua), Pribram, Czechoslovakia. Co-sponsored by IAMG. (A. Ryel, The Mining Pribram, Box 41, 261 02 Pribram, Czechoslovakia).

October 19 - 23, 1987
APPLICATION OF COMPUTERS AND MATHEMATICS IN THE MINERAL INDUSTRIES (20th International Symposium), Johannesburg, South Africa. (The Conference Secretary (C.31), Mintek, Private Bag X3015, Randburg, 2125 South Africa).

October 26 - 29, 1987
GEOLOGICAL SOCIETY OF AMERICA (Aenual Meeting), Phoenix, Arizona, U.S.A. (Meetings Department, GSA Headquarters, Box 9140, Boulder, CO 80301, U.S.A.)

December 7 - 11, 1987
AMERICAN GEOPHYSICAL UNION (Fall Meeting), San Francisco, California, U.S.A. (AGU Meetings, 2000 Florida Avenue NW, Washington, DC 20009, U.S.A.)

December 7 - 10, 1987
TECTONOTHERMAL EVOLUTION OF WEST AFRICAN OROGENS (IGCP-233 International Conference), Nouakehott, Mauritania. (R.D. Dallmeyer, Dept. of Geology, University of Georgia, Athens, Georgia 30602, USA).

December 7 - 11, 1987
SOUTHEAST ASIAN GEOTECHNICAL CONFERENCE (9th) Bangkok, Thailand. Language: English. (The Hon. Secretary, 9th SEAGC, c/o Division of Geotechnical & Transportation Engineering, Asian Institute of Technology, P.O. Box 2754, Bangkok 10501, Thailand).

1988

January 31 - February 5, 1988
ACHIEVEMENTS IN AUSTRALIAN GEOSCIENCE (9th Australian Geological Convention), Brishane, Australia. (Dr. G.W. Hoffmann, Geological Survey of Queensland, GPO Box 194, Brisbane, Queensland 4001, Australia).

March 8 - 11, 1988
ASIAN MINING 88 (3rd International Conference and Exhibition), Kuala Lumpur, Malaysia. (The Conference Office, The Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, U.K.)

March 20 - 23, 1988
AAPG/SEPM (Annual Meeting), Houston, Texas, U.S.A. (Convention Department, AAPG Headquarters, Box 979, Tulsa, OK 74101, U.S.A.)

May 16 - 20, 1988
BICENTENNIAL GOLD 88 (Conference), Melbourne, Australia. Cosponsored by Society of Economic Geologists. (Dr. R.R. Keays, Department of Geology, University of Melbourne, Parkville Vic 3052, Australia)

May 16 - 20, 1988
AMERICAN GEOPHYSICAL UNION (Spring Meeting), Baltimore, Maryland, U.S.A. (AGU Meetings, 2000 Florida Avenue NW, Washington, DC 20009, U.S.A.)

May 16 - 20, 1988
HYDROLOGICAL PROCESSES AND WATER MANAGEMENT IN URBAN AREAS (IAHS/IUGG-IAH/IUGS-Unesco Meeting), Duisburg, F.R.G. (Dr. E. Romijn, Provincial Waterboard of Gelderland, Markstraat 1, P.O. Box 9090, 6800 GX Arnhem, The Netherlands).

May 22 - 25, 1988
GAC/MAC/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, Ontario, Canada. (P.J. Reynolds, President, Canadian Committee - International Water Resources Association, 3 Valley View Road, Ottawa, Ontario, Canada K2H 5Y6).

July 1988
APPLIED GEOCHEMISTRY OF THE CONTINENTAL CRUST (IAGC Conference), Sao Paulo, Brazil. (Dr. A.J. Melfi, Institute of Astronomy and Geophysics, University of Sao Paulo, C.P. 30627, Sao Paulo 01000, Brazil).

July 1988
THERMODYNAMICS OF NATURAL PROCESSES (International Symposium), Strasbourg, France. Co-sponsored by IAGC, IGCP, IMA, CODATA. (Dr. B. Fritz, Centre de Sedimentologie et de Geochimie de la Surface, 1 rue Blessig, F-67084 Strasbourg Cedex, France).

July - August 1988
OSTRACODA AND GLOBAL EVENTS (10th International Symposium), Aberystwyth, Wales, U.K. Supported by IPA. (Dr. R.C. Whatley, Dept. of Geology, University College of Wales, Aberystwyth, Dyfed SY23 3DH, Wales).

July 1 - 8, 1988
SEISMIC PROBING OF THE CONTINENTS AND THEIR MARGINS (Symposium), Canberra, Australia. (Dr. J. Leven, BMR, P.O. Box 378, Canberra, ACT 2601, Australia).

June 7 - 10, 1988
EUROPEAN ASSOCIATION OF EXPLORATION GEOPHYSICISTS (50th Congress), Den Haag, The Netherlands. (E. van der Gaag, European Association of Exploration Geophysicists, P.O. Box 162, NL-2501 AN The Hague, The Netherlands)

June 20 - July 9, 1988
SEISMIC PROBING OF THE CONTINENTS AND THEIR MARGINS (Meeting), Canberra, Australia. (Dr. J.H. Leven, BMR, Box 378, Canberra, ACT 2601, Australia)

July 25 - 29, 1988
FOSSIL CNIDARIA (5th International Symposium), Brisbane, Australia. (Dr. J.S. Jell, Department of Geology and Mineralogy, University of Queensland, St. Lucia, Queensland 4067, Australia).

August 14 - 21, 1988
PEAT (8th International Congress), Leningrad, U.S.S.R. (Peat Congress, Ministry of Fuel Industry of the RSFSR, Sadovaya-Chernogryazskaya 8, Moscow 107813, U.S.S.R.).

August 20 - 27, 1988
INTERNATIONAL PALAEOBOTANICAL CONGRESS (3rd) Melbourne, Australia. (Secretary, 3rd IOP Conference, Conventions Department, P.O. Box 1901R, GPO Melbourne 3001, Australia).

August 22 - 26, 1988
GEOGRAPHICAL CONGRESS (IGU 26th International), Sydney, Australia. (Prof. B. Thom, Department of Geography, Institute Building, Universityof Sydney, Sydney, Australia 2006).

August 28 - September 2, 1988
INTERNATIONAL PALYNOLOGICAL CONGRESS (7th), Brisbane, Australia. (Dr. John Rigby, Conventions Department, P.O. Box 489, G.P.O., Sydney NSW 2001, Australia).

September 1988
ENGINEERING GEOLOGY AS RELATED TO THE STUDY, PRESERVATION OF ANCIENT WORKS, MONUMENTS AND HISTORICAL SITES (IAEG International Symposium), Athens, Greece. (Dr. L. Primel, IAEG, Lab. Central des Ponts et Chaussees, 58 Boulevard Lefebvre, 75732 Paris Cedex 15, France).

October 1988
COAL RESEARCH (International Conference), Tokyo, Japan. (Dr. W.G. Jensen, International Committee for Coal Resrarch, Bte 11, B-1150 Brussels, Belgium)

October 30 - November 1988
SOCIETY OF EXPLORATION GEOPHYSICISTS (Annual Meeting), Anaheim, California, U.S.A. (Convention Assistant, Society of Exploration Geophysicists, P.O. Box 3098, Tulsa, OK 74101, U.S.A.)

October 31 - November 3, 1988
GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Denver, Colorado, U.S.A. (Meetings Department, Geological Society of America, P.O. Box 9140, Boulder, CO 80301, U.S.A.)

December 5 - 9, 1988
AMERICAN GEOPHYSICAL UNION (Fall Meeting), San Francisco, California, U.S.A. (AGU Meetings, 2000 Florida Avenue NW, Washington, DC 20009, U.S.A.)

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July 9 - 19, 1989
INTERNATIONAL GEOLOGICAL CONGRESS (28th), Washington, D.C., U.S.A. (International Geological Congress, P.O. Box 1001, Herndon, VA 22070, U.S.A.)

October 29 - November 2, 1989
SOCIETY OF EXPLORATION GEOPHYSICISTS (Annual Meeting), Dallas, Texas, U.S.A. (Convention Assistant, Society of Exploration Geophysicists, P.O. Box 3098, Tulsa, OK 74101, U.S.A.)

November 9 - 12, 1989
GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), St. Louis, Missouri, U.S.A. (Meetings Department, Geological Society of America, P.O. Box 9140, Boulder, CO 80301, U.S.A.)

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

1987

January 1987 - April 1987
DIGITAL IMAGE PROCESSING (Enschede, The Netherlands). Certificate courses on techniques for national resources surveys, organized annually by the International Institute of Aerial Surveys and Earth Sciences (ITC). Sponsored by Unesco. Language: English. For information: ITC Student Affairs Office, P.O. Box 6, 7500 AA Enschede, The Netherlands.

February 1987
METALLOGENY (Quito, Ecuador). Annual 3-week training course for Latin Americans organized by Central University of Quito, the Autonomous University of Madrid (Spain) and Unesco. Language: Spanish. For Information: Director, Curso Internacional de Metalogenia, Escuela de Geologia, Minas y Petroleos, Division de Post-grado, Universidad Central, Apartado Postal 8779, Quito, Ecuador.

February 1987 - March 1987
GEOCHEMICAL PROSPECTING TECHNIQUES (Tervuren, Belgium), Annual course sponsored by the Royal Museum of Central Africa and UNDP. Language: French. For information: Musee royal de PAfrique centrale, Steenveg op Leuven, 13, B-1980 Tervuren, Belgium).

February 1987 - June 1987
MINERAL EXPLORATION (Leoben, Austria). Diploma course organized annually by the University of Mining and Metallurgy in Leoben and sponsored by Unesco. Language: English. For information: University for Mining and Metallurgy, Postgraduate course on mineral exploration, Montanuniversitat, Leoben, A-8700, Austria.

March 1987 - November 1987
PHOTOINTERPRETATION APPLIED TO GEOLOGY AND GEOTECHNICS (Bogota, Colombia). Annual post-graduate diploma courses organized by the Government of Colombia, Centro Interamericano de Fotointerpretacion, International Institute for Aerial Survey and Earth Sciences and Unesco. Language: Spanish. For information: Academic Secretariat of the CIAF, Apartado Aereo 53754, Bogota 2, Colombia.

March 1987 - April 1987
MINERAL EXPLORATION (Paris, France). A 4-week annual course organized annually by the Ecole Nationale Superieure des Mines and sponsored by Unesco. Language: French. For information: Prof. H. Pelissonnier, Ecole des Mines, 60 Bd Saint Michel, 75272 Paris, Cedex 06, France.

Spring 1987
LOCAL BUILDING MATERIALS (Cameroun). One-week seminar for African practicing geologists to show the value of local construction materials. For information: International Center for Training and Exchanges in Geosciences, 103 rue de Lille, 75007 Paris, France.

April 1987 - July 1987
RURAL GROUNDWATER DEVELOPMENT (Loughborough, U.K.). A 10-week diploma course organized annually by WEDC. For information: WEDC, University of Technology, Loughborough, Leics, LE11 3TU, UK.

April 1987 - July 1987
ENVIRONMENTAL EVALUATION MANAGEMENT AND CONTROL (Liverpool, UK). Annual 12-week training course for administrators, consultants and professionals. For information: Dr. H.W. Pearson, Environmental Management Course, Dept. of Botany, University of Liverpool, P.O. Box 147, Liverpool L69 3BX, UK.

May 1987 - November 1987
GENERAL HYDROLOGY with emphasis on groundwater (Argentina). Post-graduate course organized every other year and sponsored by Unesco. Language: Spanish. For Information: Comite Nacional para el Programa Hidrologico Internacional de la Republica Argentina, Av 9 de Julio 1925 - 15° piso, 1332 Buenos Aires, Argentina.

May 1987 - June 1987
GEOPHYSICS APPLIED TO GEOTHERMAL PROSPECTION (Manizales, Colombia). Annual course organized for Latin Americans by the Latin American Organization for Energy with financial assistance from Unesco. Language: Spanish. For information: Organizacion Latinoamericana de Energia (OLADE), P.O. Box 119, Quito, Ecuador.

June 1987
MARINE GEOLOGY (Moss Landing, California, USA). 2½-week course organized by the U.S. Geological Survey. For information: Training Section, Office of International Geology, U.S. Geological Survey, 917 National Center, Reston, VA 22092, USA.

June 1987 - August 1987
TECHNIQUES OF HYDROLOGIC INVESTIGATIONS (Washington, D.C. and Denver, Colorado, USA). Annual training course for international participants. For information: Office of International Hydrology, Water Resources Division, U.S. Geological Survey, 470 National Center, Reston, Virginia 22092, USA.

July 1987
GEOLOGICAL COMPARISON OF WEST AFRICA AND BRAZIL (Bahia, Brazil). Course organized by the Geological Society of Brazil for African and Brazilian investigators of the correlationsand mineralizations of the two continents. For information: International Center for Training and Exchanges in Geosciences, 103 rue de Lille, 75007 Paris, France.

July 1987 - August 1987
SUMMER COURSE ON EARTH SCIENCES: CRYSTALLOGRAPHY, MINERALOGY, METALLOGENY (Madrid, Spain). Annual course organized by the Department of Geology and Geochemistry of the Universidad Autonoma de Madrid and sponsored by Unesco. Language: Spanish. For information: Prof. T. Monseur, Departamento de Geologia y Geoquimica, Facultad de Ciencias, Universidad Autonoma de Madrid, Canto Blanco, Madrid 34, Spain.

July 1987 - September 1987
VOLCANOLOGY (Quito, Ecuador). Annual 10-week course organized for Latin Americans by the Latin American Organization for Energy with financial assistance from Unesco. Language: Spanish. For information: Organizacion Latinoamericana de Energia (OLADE), P.O. Box 119, Quito, Ecuador.

August 1987 - June 1989
SOIL SCIENCE AND WATER MANAGEMENT (Wageningen, The Netherlands). A 2-year M.Sc. course organized by Agricultural University Wageningen. Course starts every other year. Language: English. For information: The Director of Studies of the M.Sc. Course in Soil Science and Water Management, P.O. Box 37, 6700 AA Wageningen, The Netherlands.

August 1987 - October 1987
REMOTE SENSING AND DIGITAL IMAGE ANALYSIS, International Workshop. (Sioux Falls, South Dakota, USA). Program of training workshops organized by the U.S. Geological Survey for non-U.S. scientists, engineers, and resources managers. For information: Training Section, Office of International Geology, U.S. Geological Survey, 917 National Center, Reston, VA 22092, USA.

August 1987 - October 1987
GEOCHEMICAL PROSPECTING METHODS (Prague, Czechoslovakia). Certificate course organized every second year by the Geological Survey of Czechoslovakia and sponsored by Unesco, IAGC and Czechoslovakia. Language: English. For Information: GEOCHIM Unesco CSSR, Geological Survey of Prague, Malostranske nam. 19, 11821 Prague 1, Czechoslovakia.

September 1987 - October 1987
GROUNDWATER TRACING TECHNIQUES (Graz, Austria). Five-week course organized every other year by the Institute of Technical Geology, Petrography and Mineralogy and sponsored by Unesco. Language: English. For Information: Institute of Technical Geology, Petrography and Mineralogy of the University of Technology, A-8010 Graz, Austria.

September 1987 - November 1987
DRILLING OF GEOTHERMAL WELLS (Mexicali, Mexico). Annual 12-week seminar organized for Latin Americans by the Latin American Organization for Energy with financial assistance from Unesco. Language: Spanish. For information: Organizacion Latinoamericano de Energia (OLADE), P.O. Box 199, Quito, Ecuador.

September 1987 - November 1987
GEOTHERMAL RESERVOIR ENGINEERING (Mexicali, Mexico). Annual 9-week course organized for Latin Americans by the Latin American Organization for Energy with financial assistance from Unesco. Language: Spanish. For information: Organizacion Latinoamericana de Energia (OLADE), P.O. Box 119, Quito, Ecuador.

September 1987 - November 1987
GEOTHERMAL ENERGY (Kyushu, Japan). Annual short course organized by the Government of Japan and sponsored by Unesco. Language: English. For information: Japan International Cooperation Agency (2nd Training Division, Training Affairs Dept.), P.O. Box 216, Shinjuku Mitsui Building, 2-1, Nishi-shinjuku, Shinkuku-ku, Tokyo, 160, Japan.

September 1987 - June 1988
REMOTE SENSING TRAINING (Toulouse, France). A diploma course with options for geoscientists sponsored by the French Aerospace Remote Sensing Development Organization (GDTA), BRGM, IFP and other French institutions. Language: French. For information: GDTA-Formation, 18 Avenue Edouard-Belin, 31055 Toulouse Cedex, France.

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

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

October 1987 - November 1987
TECTONICS, SEISMOLOGY AND SEISMIC RISK ASSESSMENTS (Potsdam, East Germany). One-month training course organized annually by East German Academy of Sciences in collaboration with Unesco. Language: English. For information: Prof. Dr. H. Kautzleben, Director, Central Earth's Physics Institute, Academy of Sciences of the German Democratic Republic, Telegraphenberg, DDR 1500 Postdam, German Democratic Republic.

October 1987 - July 1988
ENGINEERING HYDROLOGY (Galway, Ireland). Annual diploma and post-graduate courses organized by the Dept. of Engineering Hydrology, University College Galway, Ireland. Sponsored by Unesco-IHP and the World Meteorological Organization. For information: Prof. J.E. Nash, Dept. of Engineering Hydrology, University College Galway, Galway, Ireland,

October 1987 - September 1988
WATER AND WASTE ENGINEERING FOR DEVELOPING COUNTRIES (Loughborough, England, UK). Twelve-month M.Sc. programme organized annually for engineers and scientists from developing countries by WEDC. For information: John Pickford, WEDC Group Leader, University of Technology, Loughborough, Leics. LE11 3TU, UK.

October 1987 - September 1988
HYDRAULIC ENGINEERING AND HYDROLOGY (Delft, The Netherlands). Diploma courses organized annually the international Institute for Hydraulic and Environmental Engineering and sponsored by Unesco for professionals from developing countries. Language: English. For information: International Institute for Hydraulic and Environmental Engineering (IHE), Oude Delft 95, P.O. Box 3015, 2601 DA Delft, The Netherlands.

October 1987 - September 1989
FUNDAMENTAL AND APPLIED QUATERNARY GEOLOGY (Brussels, Belgium). Annually organized training course leading to a Master's degree in Quaternary Geology by the Vrije Universiteit Brussel (IFAQ) and sponsored by Unesco. Language: English. For information: Prof. Dr. R. Paepe, Director of IFAQ, Kwartairgeologie, Vrije Universiteit Brussel, Pleinlaan 2, B-1050, Brussels, Belgium.

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I declare that the information given above is true and accurate and also, if elected, will observe the Constitution and By-Laws of the Society.

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Particulars

1. Completed application form should be sent to the Hon. Secretary, Geological Society of Malaysia, c/o Dept. of Geology, University of Malaya, 59100 Kuala Lumpur, Malaysia.

2. **Article III, Constitution of Society**

   Candidates for Full Member shall be persons who have a Bachelors degree in geology or equivalent qualifications in a related science or an equivalent training through practical experience.

   Section 6

   Any person who is enrolled as a student in geology or related science in an institution of higher learning is eligible for Student Membership.

   Student Members shall enjoy all the privileges of Corporate Membership save that they shall not hold office or vote. The Council may advance to Corporate Membership upon application those Student Members in good standing who have subsequent to election fulfilled the requirements therefore. Student membership shall be limited to a maximum of five years. Any Student Member who has (1) not applied for transfer to another class of membership or (2) whose application for such transfer has not been approved prior to the termination of five years of membership shall be considered as having resigned. At the discretion of the Council the five years period may be extended upon application to the Council.

   Section 7

   Any person who is interested in geology, but who does not meet the requirements of other classes of membership, shall be eligible for Associate membership. Associate Members shall enjoy all the privileges of Corporate membership in the Society except that they shall not be eligible to vote or hold office. The Council upon application may transfer to Corporate membership, those Associate Members in good standing who have subsequent to election, fulfilled the requirements therefore.

3. **By-Laws 1, Section 2, Constitution of Society**

   The annual dues of Full, Associate and Professional Members shall be 40.00 ringgit. An entrance fee of 20.00 ringgit shall be payable on election.

   The annual dues of student members shall be 10.00 ringgit. No entrance fee shall be payable by persons elected as Student Members, nor by Student Members promoted to Corporated Membership provided they have been student members for at least two years.

   Section 3

   Upon the payment of 400.00 ringgit, any Full or Associate Member in good standing may be elected to Life membership.

Butir-butir

1. Borang permohonan yang telah dipenuhi hendaklah dikirimkan kepada Setiausaha Kehormat, Persatuan Geologi Malaysia, d/a Jabatan Geologi, Universiti Malaya, 59100 Kuala Lumpur, Malaysia.

2. **Artikel III, Perlembagaan Persatuan**

   Calun-calun untuk menjadi Ahli Penuh adalah seseorang yang mempunyai Ijazah didalam bidang geologi atau kelulusan yang sama di dalam bidang sains berhubungan atau mempunyai latihan yang sama menerusi pengalaman amali.

   Seksyen 6

   Seseorang yang berdaftar sebagai seorang penuntut di dalam geologi atau sains yang berhubungan didalam mana-mana satu institusi pengajian tinggi adalah layak menjadi seorang Ahli Penuntut.

   Ahli-ahli penuntut adalah layak menikmati keistimewaan-keistimewaan yang sama seperti Ahli Sekutu tertakluk kepada bahawa mereka tidak memegang apa-apa jawatan atau hak mengundi. Pihak Majlis boleh memajukan permohonan Ahli Penuntut menjadi Ahli Sekutu dengan syarat permohon mempunyai kedudukan baik dan setelah dilantik memenuhi keperluan-keperluan yang ada. Tempoh maksima keahlian bagi Ahli Penuntut ialah lima tahun. Seseorang Ahli Penuntut yang (1) belum membuat permohonan pemindahan kepada kelas ahli yang lain, atau (2) permohonannya untuk pemindahan belum lagi diluluskan sebelum keahlian selama lima tahun tamat; adalah dianggap telah berhenti. Tertakluk kepada budibicara dan pertimbangan Majlis, jangka masa lima tahun boleh dilanjutkan semasa membuat permohonan kepada Majlis.

   Seksyen 7

   Seseorang yang berminat dalam bidang geologi akan tetapi tidak memenuhi keperluan seperti diperlukan didalam kelas-kelas keahlian yang lain adalah layak untuk memohon menjadi Ahli Gabungan.

3. **Undang-undang 1, Fasal 2, Perlembagaan Persatuan**

   Yuran tahunan bagi Ahli-ahli Penuh, Sekutu dan Profesyenal adalah sebanyak 40.00 ringgit. Yuran masuk adalah 20.00 ringgit dan hendaklah dibayar apabila permohonan diluluskan.

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General Information

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

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

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

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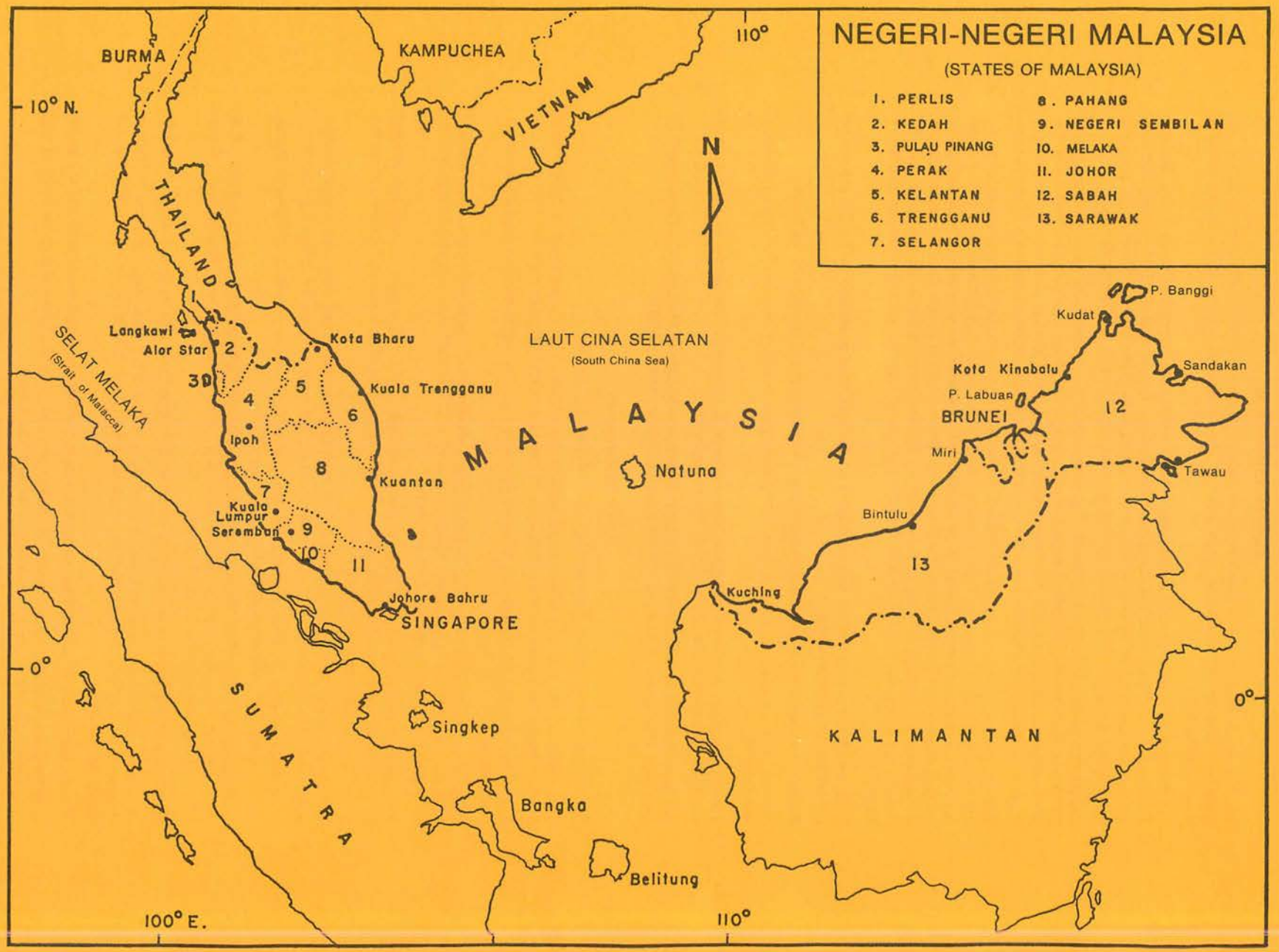
NEGERI-NEGERI MALAYSIA
(STATES OF MALAYSIA)
1. PERLIS
2. KEDAH
3. PULAU PINANG
4. PERAK
5. KELANTAN
6. TRENGGANU
7. SELANGOR
8. PAHANG
9. NEGERI SEMBILAN
10. MELAKA
11. JOHOR
12. SABAH
13. SARAWAK
BURMA
KAMPUCHEA
VIETNAM
THAILAND
10° N.
110°
N
LAUT CINA SELATAN
(South China Sea)
MALAYSIA
SELAT MELAKA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