PP 188/12/89 ISSN 0126-5539

PERSATUAN GEOLOGI MALAYSIA

WARTA GEOLOGI

NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MALAYSIA

Jil. 16, No. 4 (Vol. 16, No. 4) Jul-Ogos 1990

KANDUNGAN (Contents)

DIKELUARKAN DWIBULANAN
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Published by the Geological Society of Malaysia, Department of Geology, University of Malaya, 59100 Kuala Lumpur (Tel. 03-7577036).

Printed by Art Printing Works Sdn. Bhd., 29 Jalan Riong, 59100 Kuala Lumpur.

CATATAN GEOLOGI
(GEOLOGICAL NOTES)

CLAY MINERALS IN HOLOCENE MARINE SEDIMENTS OF THE SUNGEI MUAR FLOOD PLAIN, JOHORE

J.K. Raj,
Jabatan Geologi, Universiti Malaya, 59100 Kuala Lumpur.

Abstract

Detailed logging of continuous core samples from two recent boreholes show that the Sungei Muar flood-plain is underlain by a sequence of greenish-grey silty clays that can be subdivided into an Upper Unit (some 5.5 m thick) and a Lower Unit (some 7 to 8 m thick). Carbon-14 dating shows these silty clays to be of a Holocene age, while abundant shells and shell fragments indicate deposition in a marine environment. X-ray diffraction analyses show that kaolinite and montmorillonite are the main clay minerals present in the Upper Unit, while kaolinite is the main clay mineral present in the Lower Unit.

Introduction

Several boreholes have been drilled in the Sungei Muar flood-plain at a lay-by between Chainages 106.500 and 107.300 of the North-South Toll Expressway (Fig. 1). These boreholes were drilled as this site was selected for the assessment of the cost effectiveness of different methods of ground improvement for supporting embankments over weak sub-soils. The site is located within a flat, swampy area that has an elevation of some 2.3 m above mean sea-level.

Borehole descriptions

The boreholes (LLM, 1987) show that the site is entirely underlain by soft, greenish grey silty clays, some 16.5 to 17.5 m thick, with a topmost weathering crust (some 1.75 m thick). These silty clays contain abundant shells and shell fragments and overlie a thin layer of peat (some 0.15 m thick) that is underlain by a soft, grey silty clay (some 1 m thick). This soft, grey silty clay overlies a loose, grey, fine to medium grained sand layer (some 1.7 to 2.2 m thick) which in turn overlies a dense, dark grey, gravelly, medium to coarse grained sand layer (> 1.8 m thick) in which the boreholes end. The thin peat layer has been dated to be some 10,000 years BP by the Carbon-14 method (C.T. Toh, pers. comm.) and thus shows that the soft, greenish grey silty clays are of a Holocene age.

Continuous core samples of two recent boreholes drilled in the selected site after construction of the embankments were made available

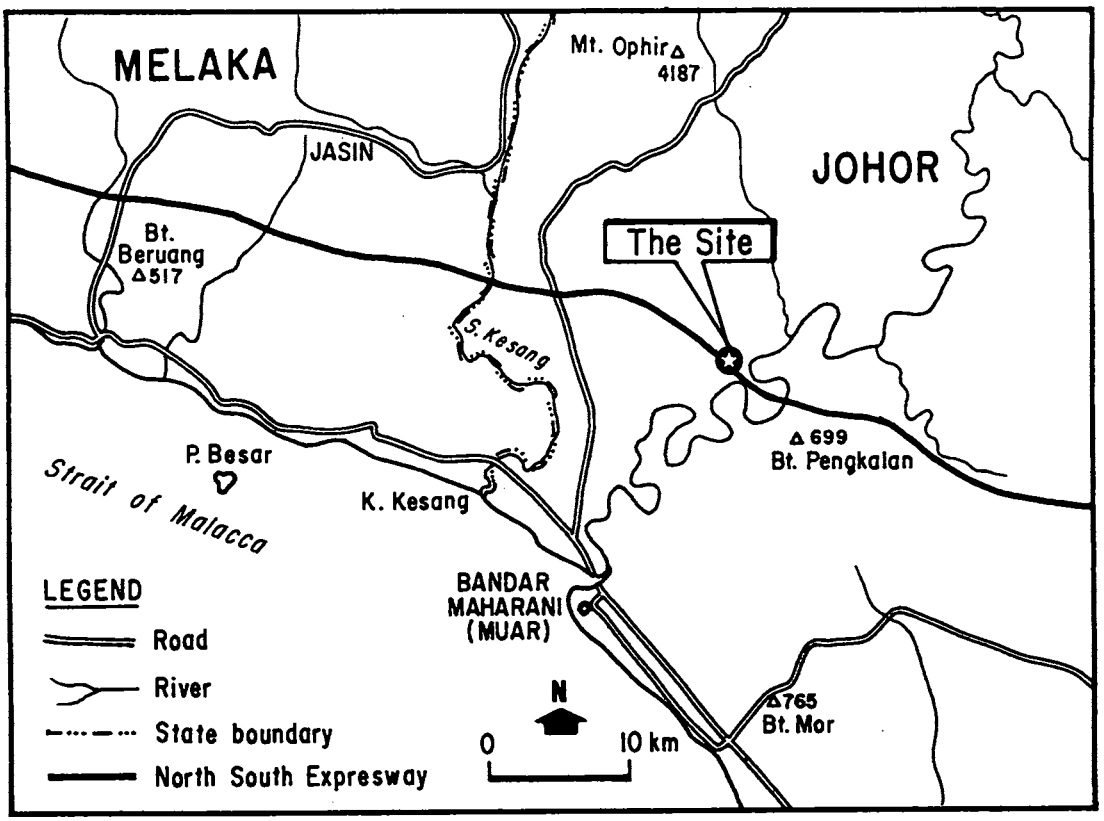

Fig. 1. Location Map.

to the writer and provided more details on the soft, greenish grey, Holocene silty clays. It is to be noted, however, that there has been some reduction in the total thickness of these clays (i.e. thickness before, and after, embankment construction) largely due to consolidation. Detailed logging of the core samples shows that the Holocene silty clays can be subdivided into two distinct units, an upper one (some 5.5 m thick) of greenish grey silty clays with thin, fine sand partings and a lower one (some 7 to 8 m thick) of almost entirely greenish grey silty clays. The greenish grey colour is interesting for it suggests that the clays have been in a reducing environment as the samples (after extrusion from sampling tubes) change to a brownish colour within a few days of exposure, indicating oxidation. Shells and shell fragments of marine organisms (including an echnoid shell) are found within the samples, particularly in those from the Upper Unit, with a 0.15 m thick layer of shell fragments separating the Upper and Lower Units in one borehole. The top-most 0.5 to 0.8 m of the Upper Unit is, however, grey coloured, with white, orange and red mottles and represents a weathering crust. Narrow, vertical tubes, often coated with secondary iron oxides and hydroxides, are also found in this weathering crust and mark former root channels.

Methodology

In view of the continuous core samples available, it was decided to determine the clay minerals present at different depths within the Upper and Lower Units of the Holocene silty clays. Samples from different depths were first air dried and then ground gently with a mortar and pestle before being quartered. Exactly similar weights (4 gm) of samples from the different depths were then placed in 30 ml capacity test tubes, filled with 20 ml of distilled water and shaken up by hand for 2 minutes. These suspensions were then allowed to stand overnight, following which some 2 ml of the top 1 cm of the suspensions was collected with a glass dropper and placed on glass slides to air dry. It should be noted that no dispersing agent was added to the suspensions, nor was any pretreatment carried out on the samples, as preliminary work (Raj, in prep.) showed that certain dispersing agents affected the structure of some of the clay minerals present. The samples on the glass slides were then scanned using a Copper tube at 2^{o} (2θ) per minute from 2^{o} to 40^{o} (2θ), following which representative samples were glycolated and scanned from 2^{o} to mostly 30^{o} (2θ). These representative samples were then heated to 500^{o}C for an hour and then scanned from 2^{o} to mostly 30^{o} (2θ). Exactly similar instrument settings were used for all the samples, except for the range which had to be changed in case of one or two samples.

Discussion

The resulting diffractograms (Figs. 2 to 5) show the presence of three different clay minerals; these clay minerals being present in variable amounts throughout the Holocene silty clays. This is shown by differences in the heights of the peaks for the basal (001) reflections. The presence of kaolinite in all the samples is shown by the basal (001) reflection at 12.2^{o} (2θ) (corresponding to a d-spacing of about 7.2 Angstroms) on the untreated diffractograms (Figs. 2 & 3); this reflection being unaffected by glycolation (Fig. 4) but disappearing on heating to 500^{o}C (Fig. 5). Illite is also present in all the samples and is identified from the basal (001) reflection at 8.7^{o} (2θ) (corresponding to a d-spacing of about 10.2 Angstroms) on the untreated diffractograms (Figs. 2 & 3); this reflection being unaffected by glycolation (Fig. 4) and on heating to 500^{o}C (Fig. 5). Montmorillonite is present in almost all the samples and is identified from the basal (001) reflection at about 5.8^{o} (2θ) (corresponding to a d-spacing of about 15.2 Angstroms) on the untreated diffractograms (Figs. 2 & 3); this reflection shifting to about 4.9^{o} (2θ) on glycolation (Fig. 4) and dropping to 8.7^{o} (2θ) on heating to 500^{o}C (Fig. 5). A small amount of randomly inter-stratified illite-montmorillonite is also present in some of the samples and is identified from the broad, asymmetrical basal plane reflections of both illite and montmorillonite on the untreated (Figs. 2 & 3), and glycolated (Fig. 4), diffractograms, as well as from the high background and asymmetrical 8.7^{o} (2θ) reflection on heating to 500^{o}C (Fig. 5). Clay-sized quartz is also seen to be present in most of the samples and is identified from the reflection at 26.6^{o} (2θ) (corresponding to a d-spacing of 3.35 Angstroms) on the untreated diffractograms (Figs. 2 & 3); this reflection being unaffected by glycolation (Fig. 4) and on heating to 500^{o}C (Fig. 5).

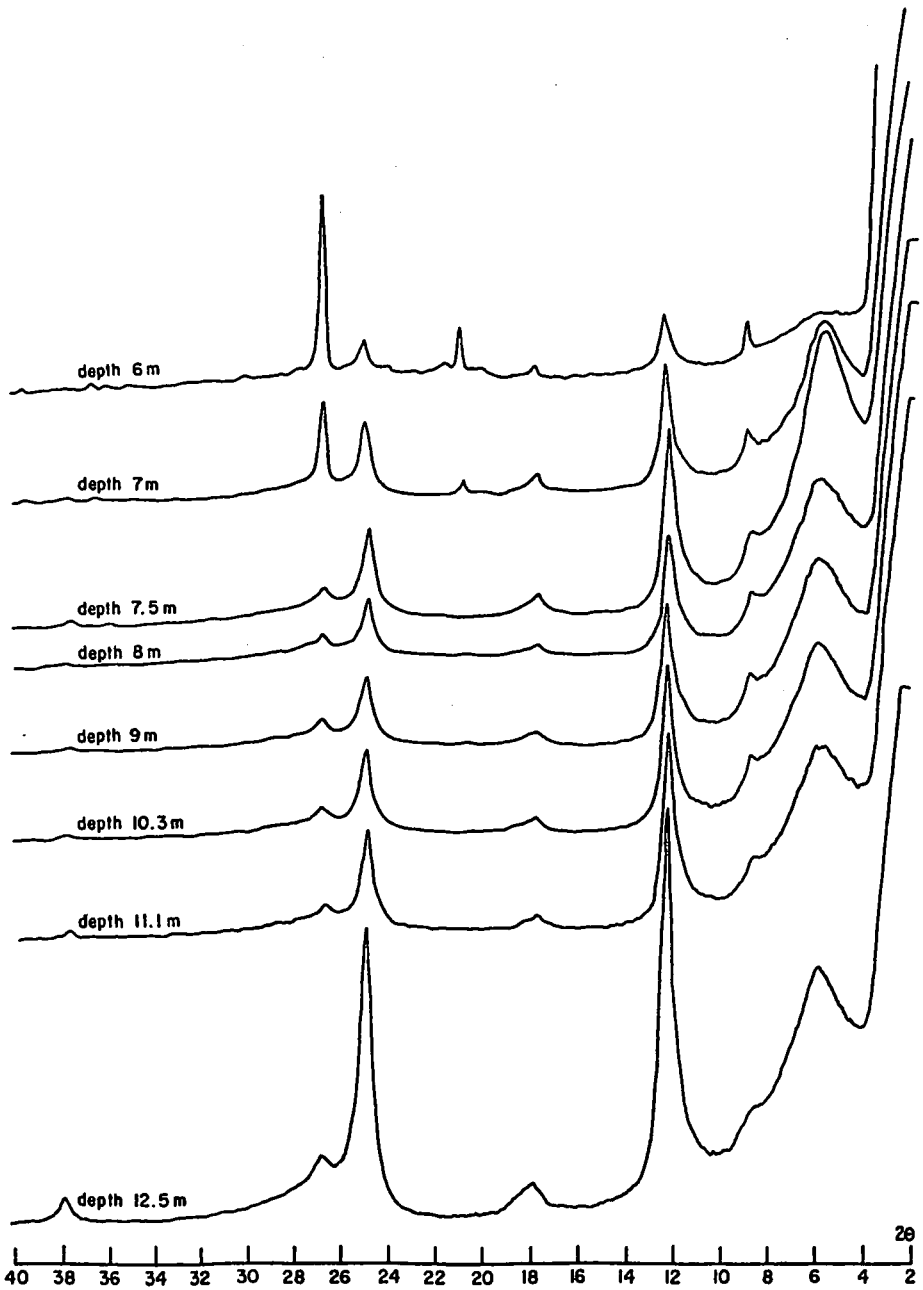

Fig. 2a: X-ray diffractograms of untreated clay samples from Borehole 6/1.

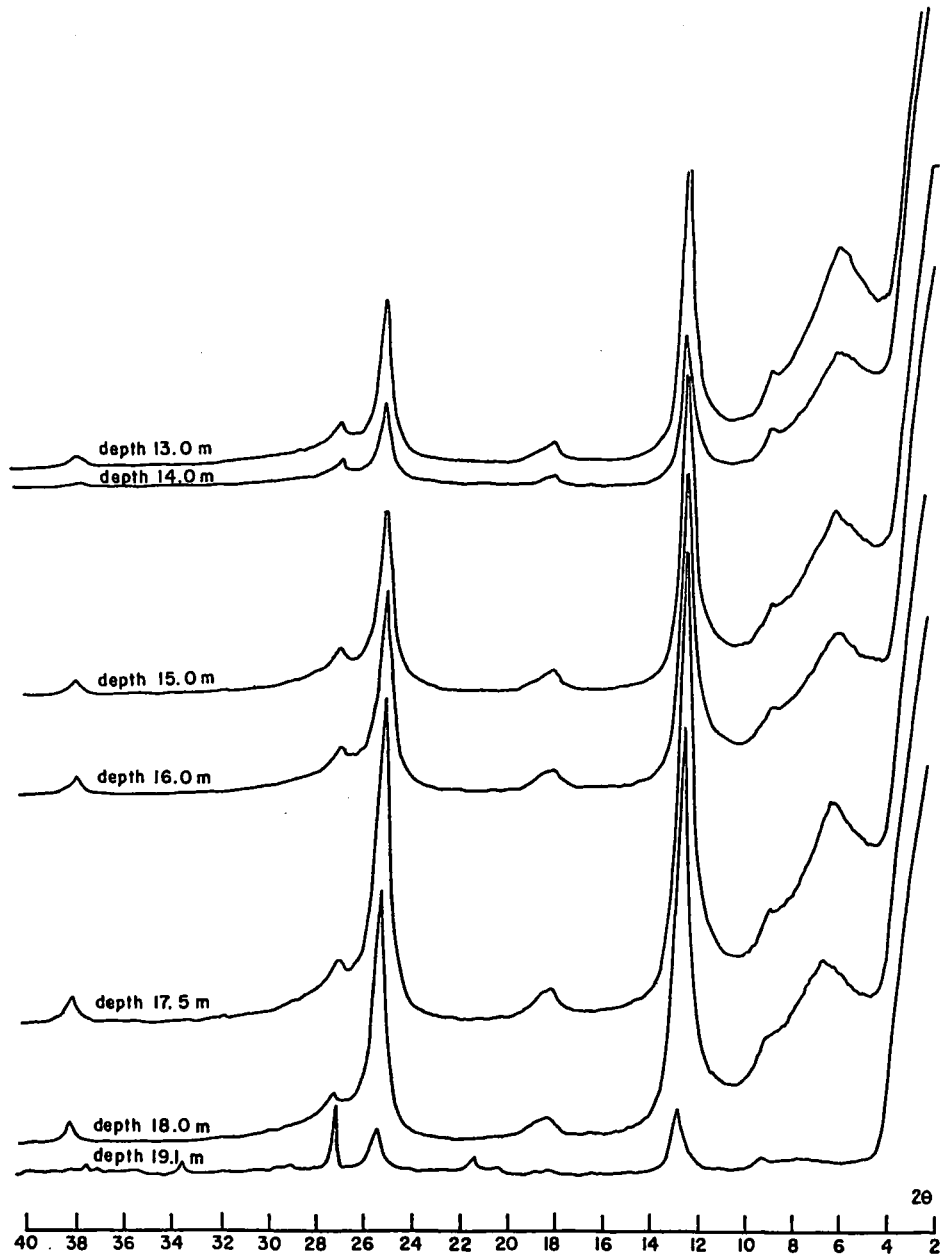

Fig. 2b: X-ray diffractograms of untreated clay samples from Borehole 6/1.

Fig. 2. X-ray diffractograms of untreated clay samples from Borehole 6/1.

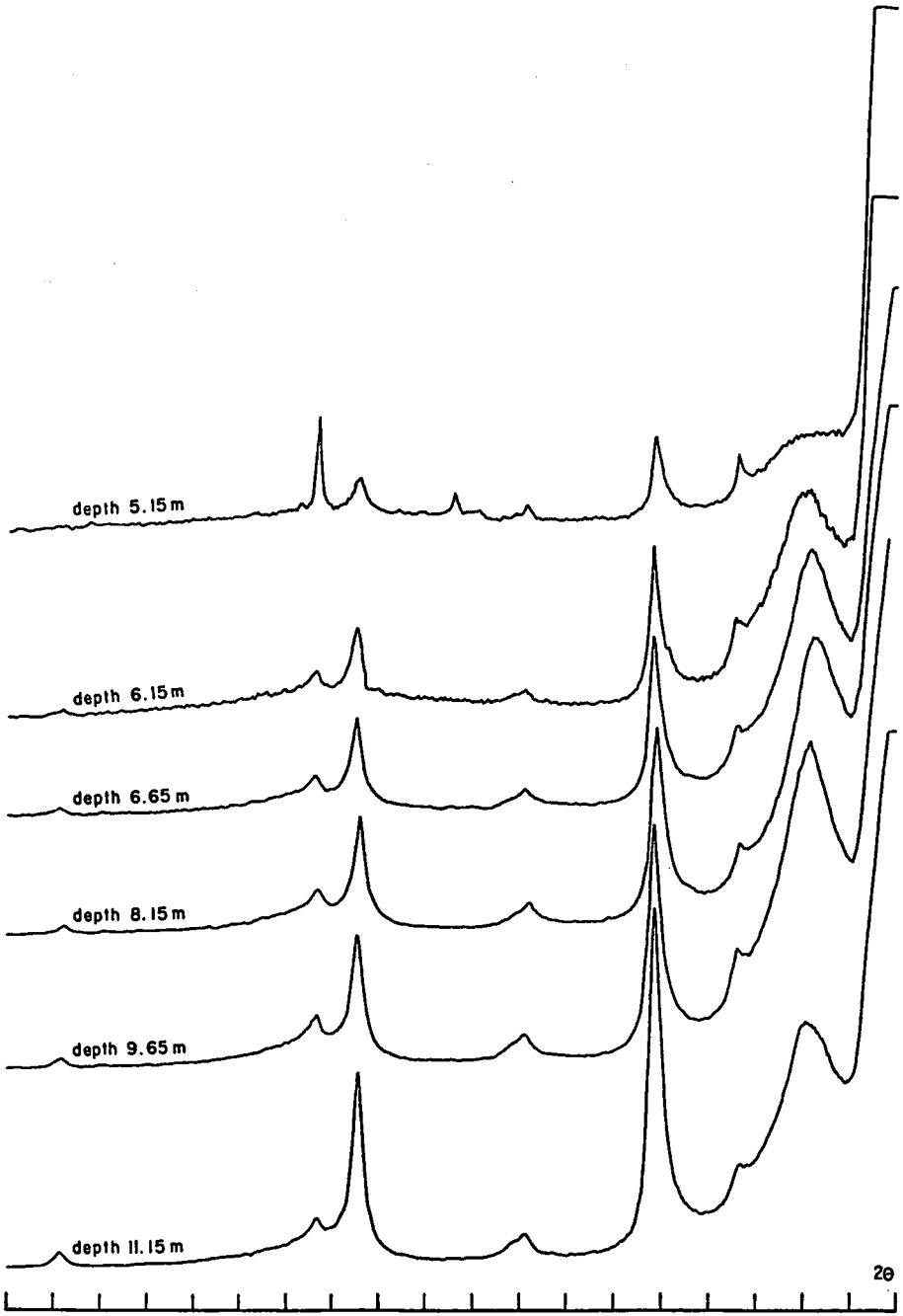

Fig. 3a: X-ray diffractograms of untreated clay samples from Borehole 6/2.

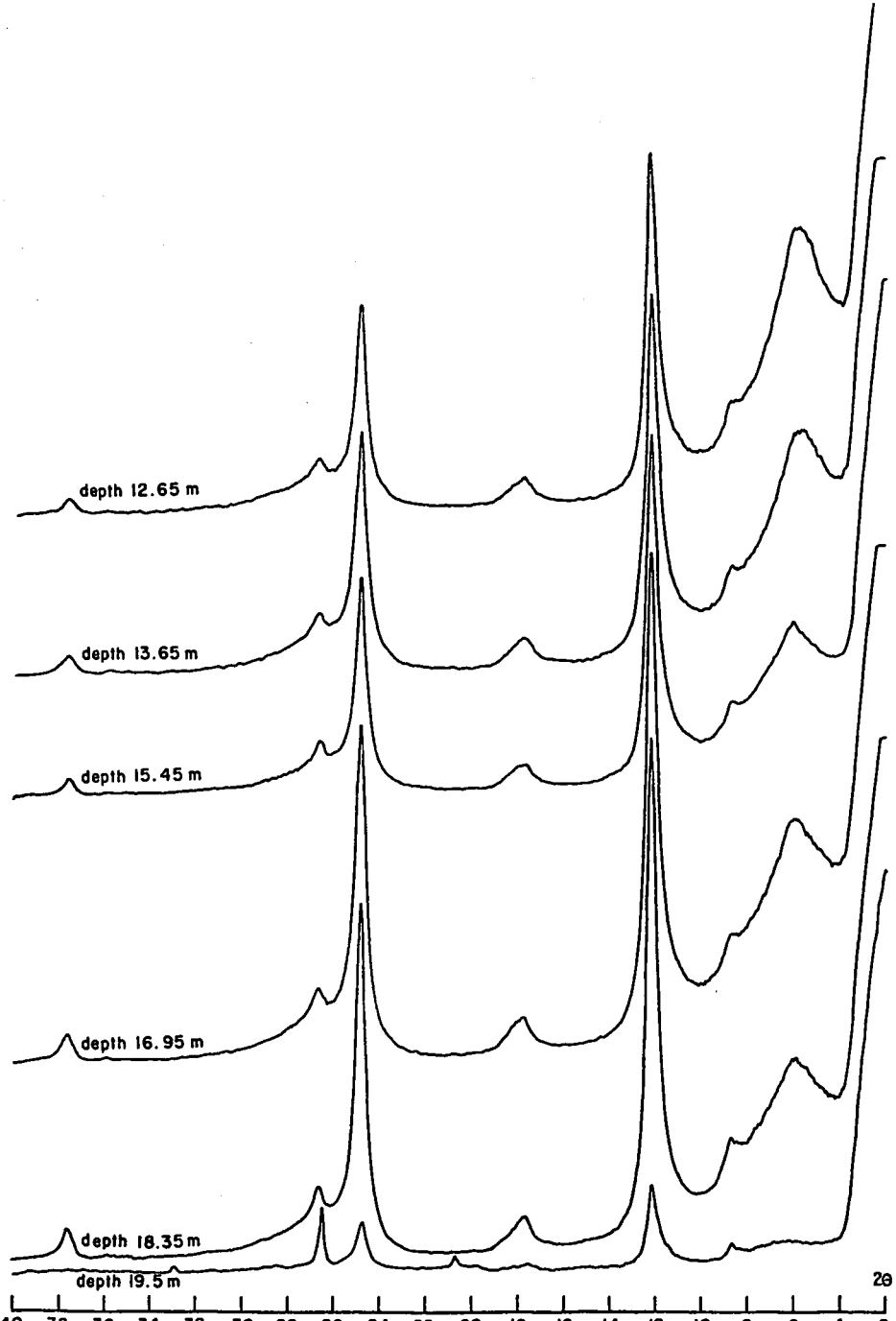

Fig. 3b: X-ray diffractograms of untreated clay samples from Borehole 6/2.

Fig. 3. X-ray diffractograms of untreated clay samples from Borehole 6/2.

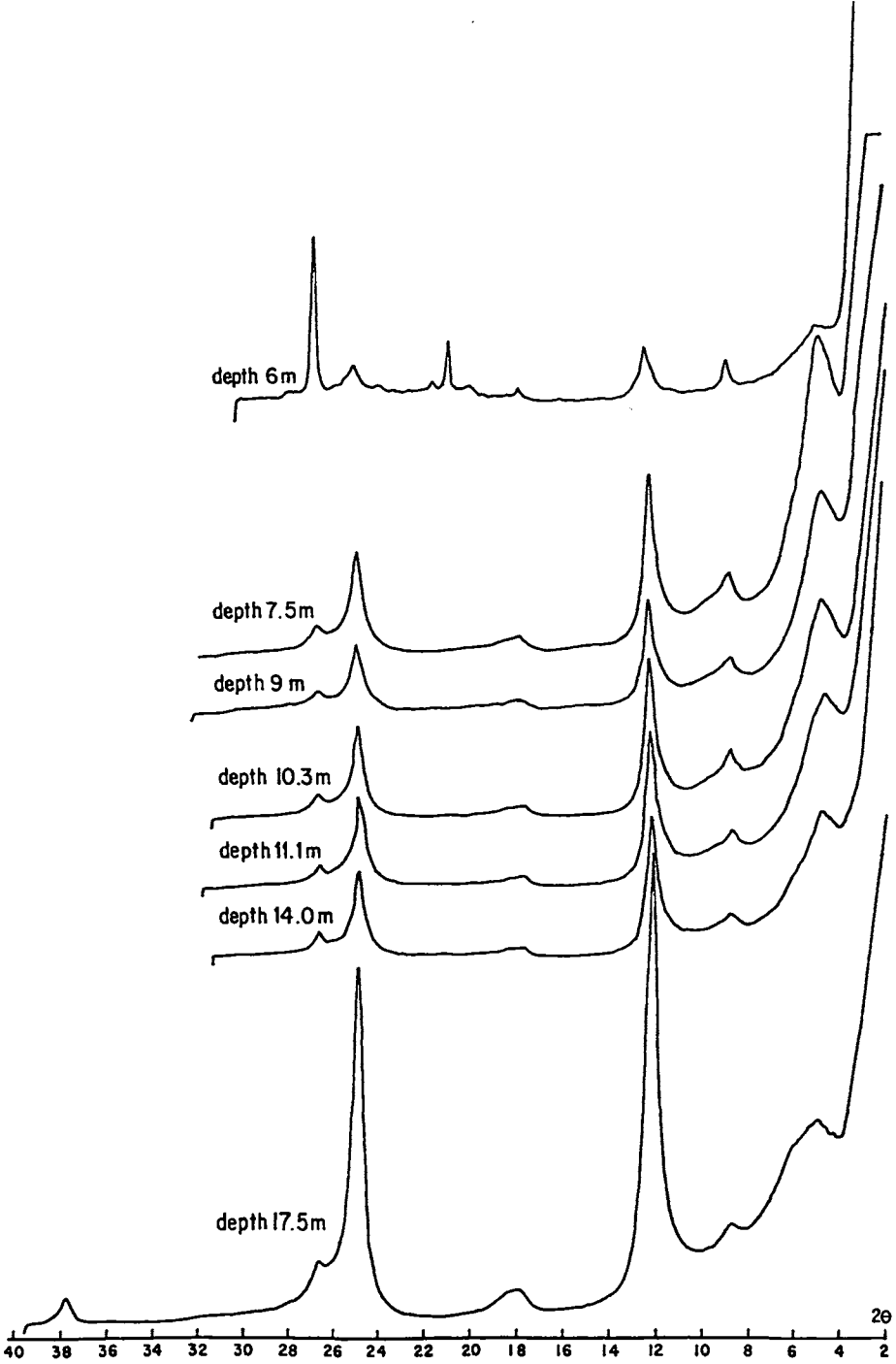

Fig. 4a: X-ray diffractograms of glycolated clay samples from Borehole 6/1.

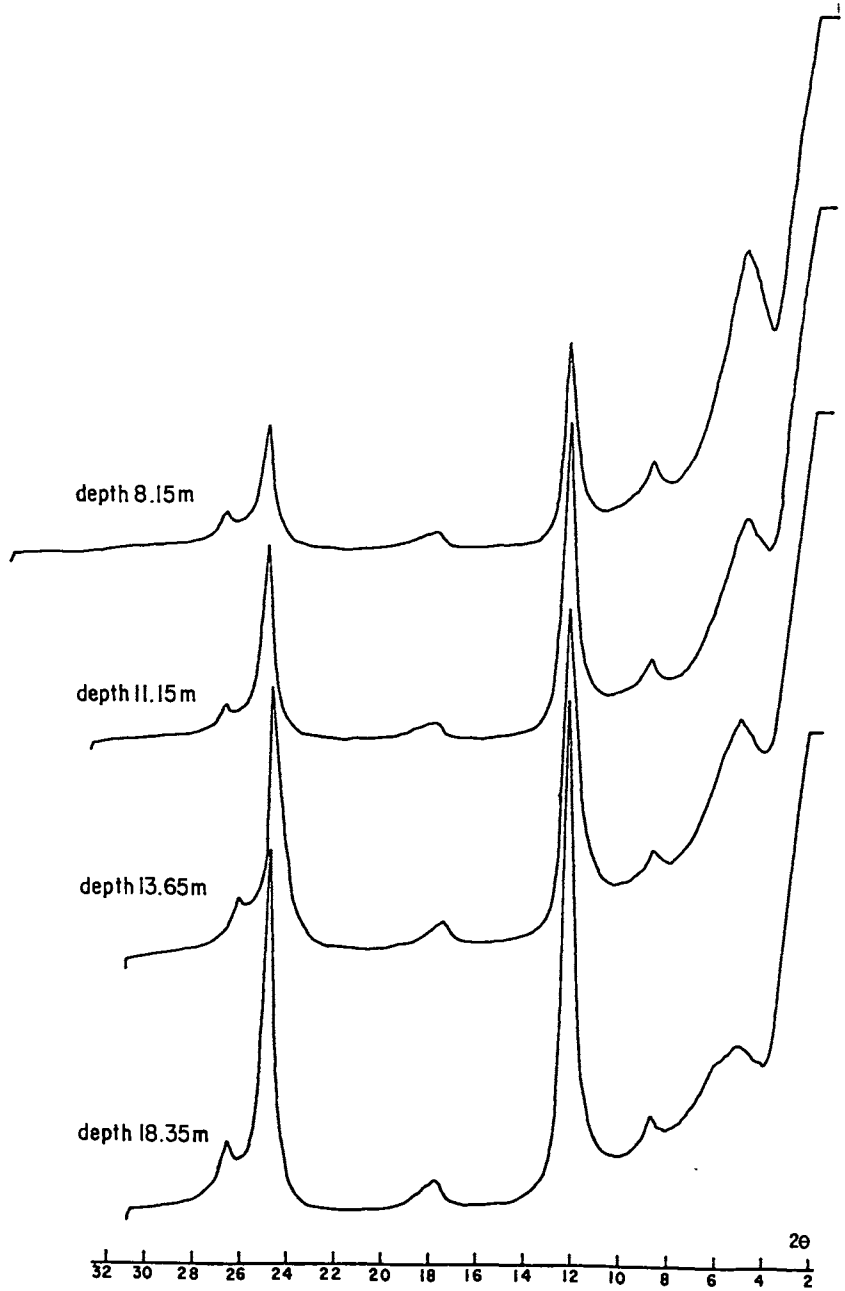

Fig. 4b: X-ray diffractograms of glycolated clay samples from Borehole 6/2.

Fig. 4. X-ray diffractograms of glycolated clay samples from Borehole 6/1

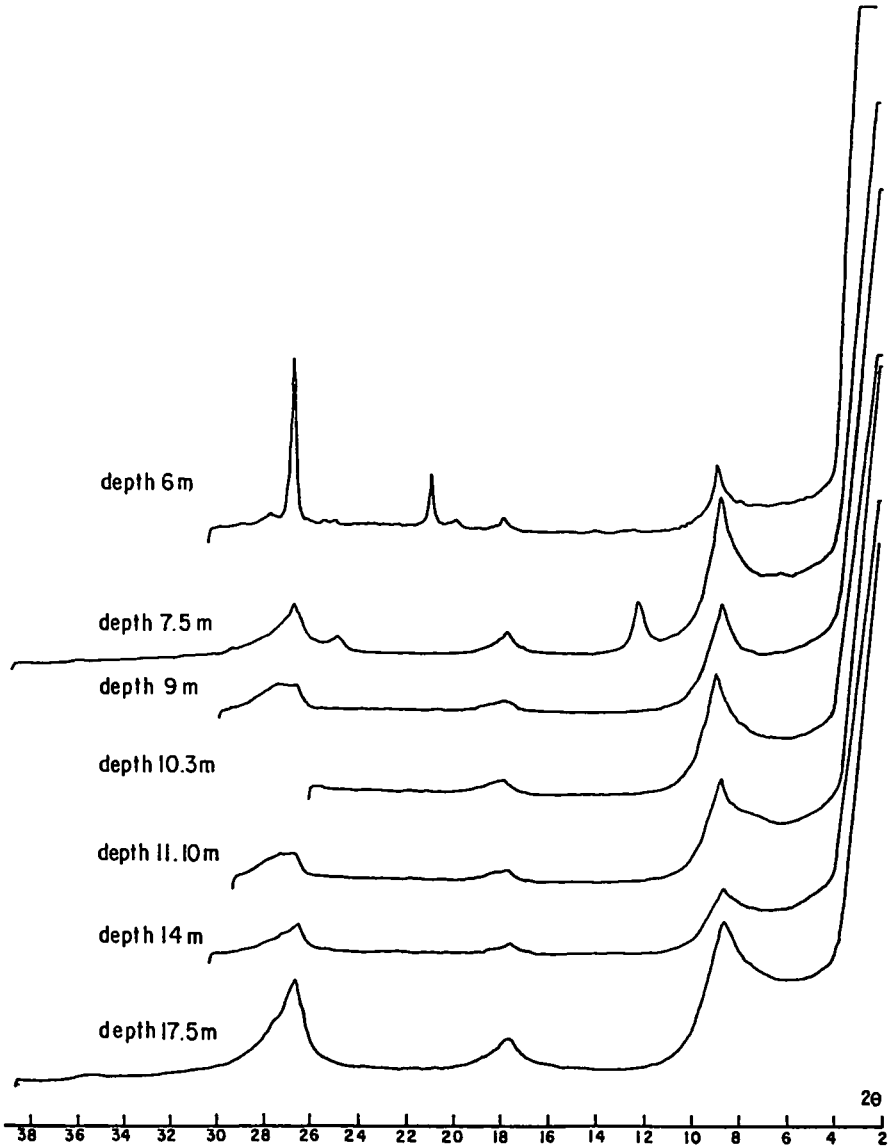

Fig. 5a: X-ray diffractograms of clay samples from Borehole 6/1 heated to 500°C.

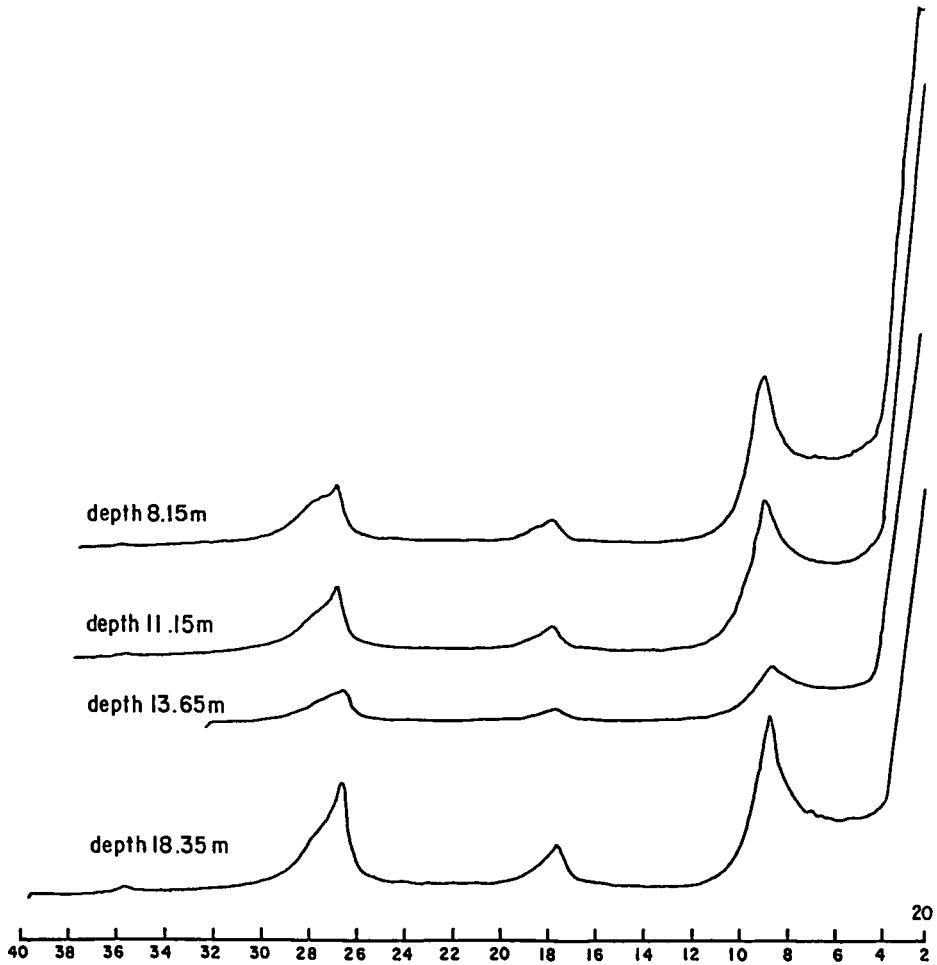

Fig. 5b: X-ray diffractograms of clay samples from Borehole 6/2 heated to 500°C.

Fig. 5. X-ray diffractograms of clay samples from Borehole 6/1 heated to 500°C.

In view of the exactly similar methods of sample preparation and operating conditions, it is possible to semi-quantitatively assess the relative percentages of the different clay minerals present at various depths within the Holocene silty clays. This has been done by comparing the relative heights, above background values, of the basal (001) reflections on the untreated diffractograms (Figs. 2 & 3). Results of this semi-quantitative assessment (Tables 1 & 2) are interesting for they show that both montmorillonite and kaolinite are the dominant clay minerals in the Upper Unit, whereas only kaolinite is the dominant clay mineral in the Lower Unit. Kaolinite is furthermore, the main clay mineral found in the weathering crust, and in the peat layer.

X-ray fluorescence (XRF) analyses of major elements present in total samples (Table 3 & 4) throughout the Holocene silty clays also point to this subdivision of an Upper, and an Lower, Unit, for relatively large magnesium, and low sodium, contents are present in the Upper Unit in comparison with the Lower Unit.

Inferences

The occurrence of large amounts of montmorillonite in these Holocene silty clays, particularly within the Upper Unit, is rather an unexpected one for published literature dealing with similar sediments have reported the dominance of illite and kaolinite with minor montmorillonite (Suntharalingam and Teoh, 1985; Suntharalingam, 1987). Published, as well as unpublished, literature dealing with soil surveys in the western coastal plain of Peninsular Malaysia have, however, emphasized the occurrence of montmorillonite in soils developed over marine sediments (Ng, 1968; Allbrook, 1974; Azmi, 1982; Paramananthan & Eswaran, 1984; Paramananthan, 1989). The origin of the montmorillonites within the Holocene silty clays furthermore, poses an interesting problem of origin though this will only be treated in a later paper.

Acknowledgements

Mr. Chong Boon Leong is thanked for carrying out the X-ray diffractions and X-ray fluoresence analyses. Mr. Chin Yu Hay, En. Roslin and En. Roshdy are thanked for drafting the figures. This study has been supported by a F-vote Research Grant from the University of Malaya.

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Table 1. Semi-quantitative percentages of main clay minerals in borehole 6/1.

SAMPLE NUMBER	BOREHOLE DEPTH (metres)	MONTMORILLONITE* (%)	ILLITE* (%)	KAOLINITE* (%)	UNIT
1	6.00	0.0	41.3	58.7	CRUST
30	7.00	38.3	17.3	44.4	U
2	7.50	42.5	15.8	41.7	P
35	8.00	41.3	16.8	41.9	P
36	9.00	39.8	16.4	43.9	E
32	10.20	36.1	17.0	46.9	R
33	11.10	32.2	15.1	52.7	
4	12.50	33.4	14.0	52.5	
31	13.00	27.6	13.4	59.0	L
37	14.00	31.4	15.7	52.8	O
39	15.00	23.4	14.1	62.4	W
34	16.00	20.9	12.5	66.6	E
6	17.50	21.1	3.2	75.7	R
38	18.00	21.0	2.5	76.4	
40	19.10	0.0	16.3	83.7	PEAT

Note: *Percentages based on relative height ratios (above background) of basal reflections on untreated diffractograms.

Table 2. Semi-quantitative percentages of main clay minerals in borehole 6/2.

SAMPLE NUMBER	BOREHOLE DEPTH (metres)	MONTMORILLONITE* (%)	ILLITE* (%)	KAOLINITE* (%)	UNIT
7	5.15	27.3	20.3	52.4	U
8	6.15	46.5	19.0	34.5	P
9	6.65	51.2	15.2	33.6	P
10	8.15	53.9	14.3	31.7	E
11	9.65	48.5	16.1	35.4	R
12	11.15	34.9	13.3	51.8	
13	12.65	37.9	13.7	48.4	L
14	13.65	33.3	13.9	52.8	O
15	15.45	27.2	14.1	58.7	W
16	16.95	27.4	13.3	59.3	E
17	18.35	23.0	13.2	63.8	R
19	19.50	18.2	15.2	66.7	

Note: *Percentages based on relative height ratios (above background) of basal reflections on untreated diffractograms.

Table 3. X-ray fluorescence analyses of total samples from borehole 6/1.

Sample Number	Borehole Depth (metres)	Reduced Level (metres)	Si Content %	Al Content %	Fe Content %	Mg Content %	Ca Content %	K Content %	Na Content %	Mn Content %	Ti Content %	UNIT
1	6.00	-1.027	75.715	26.739	4.318	1.953	0.000	1.828	0.231	0.024	1.109	CRUST
2	7.50	-2.527	62.174	20.472	6.093	4.522	0.147	2.037	0.300	0.062	1.001	UPP
36	9.00	-4.027	60.068	21.045	6.725	4.478	0.205	1.999	0.473	0.073	0.930	-ER
33	11.10	-6.127	65.846	20.222	4.834	3.444	0.152	1.451	0.473	0.044	0.996	
4	12.50	-7.527	69.246	28.191	6.150	3.404	0.183	1.541	0.482	0.059	1.029	L
37	14.00	-9.027	61.061	22.935	5.683	3.368	0.040	1.550	0.584	0.046	1.081	O
39	15.00	-10.027	75.050	26.556	4.546	2.624	0.032	1.333	0.580	0.034	0.937	W
34	16.00	-11.027	73.344	26.898	5.071	0.533	0.000	1.298	0.533	0.035	1.146	E
6	17.50	-12.527	70.939	28.484	5.480	2.334	0.086	1.431	0.468	0.042	1.164	R
38	18.00	-13.027	68.966	29.832	5.992	2.620	0.183	1.394	0.594	0.040	1.120	
40	19.10	-14.127	54.575	28.946	10.311	1.811	0.050	1.284	0.719	0.063	0.854	PEAT

Table 4. X-ray fluorescence analyses of total samples from borehole 6/2.

Sample Number	Borehole Depth (metres)	Reduced Level (metres)	Si Content %	Al Content %	Fe Content %	Mg Content %	Ca Content %	K Content %	Na Content %	Mn Content %	Ti Content %	UNIT
7	5.15	-0.211	73.764	27.040	4.798	1.942	0.000	1.839	0.207	0.028	1.201	U
8	6.15	-1.211	72.854	25.240	6.648	3.782	0.070	1.947	0.398	0.091	1.019	P
9	6.65	-1.711	73.647	24.356	6.118	4.337	0.104	1.941	0.259	0.062	0.976	P
10	8.15	-3.211	61.275	20.611	6.584	4.330	0.123	2.023	0.394	0.063	0.930	E
11	9.65	-4.711	69.267	26.316	7.238	4.729	0.160	2.132	0.617	0.069	1.040	R
12	11.15	-6.211	59.713	22.758	6.055	3.669	0.240	1.783	0.524	0.056	0.923	
13	12.65	-7.711	74.792	25.303	5.135	3.626	0.240	1.631	0.449	0.048	0.990	L
14	13.65	-8.711	59.929	23.133	5.824	3.223	0.108	1.537	0.594	0.047	1.058	O
15	15.45	-10.511	72.838	25.739	4.481	2.911	1.218	1.324	0.594	0.048	1.173	W
16	16.95	-12.011	69.653	26.691	6.387	2.664	0.383	1.390	0.612	0.082	0.999	E
17	18.35	-13.411	65.423	28.148	8.781	3.230	0.568	1.342	0.589	0.116	1.212	R
19	19.50	-14.561	59.135	29.680	9.149	2.131	0.026	1.393	0.757	0.072	0.886	

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Manuscript received 7th June 1990.

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PP 170/12/87 ISSN 0126/6187

BULETIN PERSATUAN GEOLOGI MALAYSIA

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SPECIAL ISSUE ON PETROLEUM GEOLOGY VOL IV

KANDUNGAN (CONTENTS)

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PERTEMUAN PERSATUAN
(MEETINGS OF THE SOCIETY)

CERAMAH TEKNIK (TECHNICAL TALKS)

John B. Sangree: Exploration applications of sequence stratigraphy to lowstand deep-water sands

Laporan (Report)

Dr. John B. Sangree, consultant in sequence stratigraphy and president of Sangree Expl. Incorp., Houston USA, with more than 30 years of experience in the oil industry gave an interesting talk to about 20 members of our society at the Geology Department, University of Malaya on 9 August 1990.

In his talk on stratigraphic traps in deep-water sands, he presented studies on the two major potentials provided by such sands namely sequence stratigraphic traps and levee channel portions of slope-fan units. He described briefly the interplay between eustatic sea-level changes and subsidence rate variations and sediment supply rate variations as causes of stratigraphic cycles in basin fills.

Large volumes of often clean well-sorted sands are transported out to the deep water basin floor during lowstands and these make good reservoirs when sealed by the high-stand deposited clays which underlie and overlie them.

In his discussion on basin floor fans he gave the criteria for recognising the various types, mostly as mounds, on seismic and also discussed their variations in morphology and pointed out the pitfalls in interpretation caused by structures such as "turtle structures", slumped clinoforms, gravity slide-slump mounds and slope fan mounds.

He cited examples where oil has been successfully produced from often thin-bedded deep-water sands and suggested that greater efforts be expanded in looking for such traps or testing for them in wells which had already been drilled through such horizons enroute to thicker sands.

C.P. Lee

******

David Bell: Surface engineering geology - a review

Laporan (Report)

Dr. David H. Bell, Senior Lecturer in Engineering Geology, University of Canterbury, Christchurch, New Zealand, gave a talk entitled: "Surface Engineering Geology - A review" to the Society on Monday, 20 August 1990, at the Dept. of Geology, Univ. of Malaya. The talk was attended by about 30 persons, including several engineers from the Public Works Department.

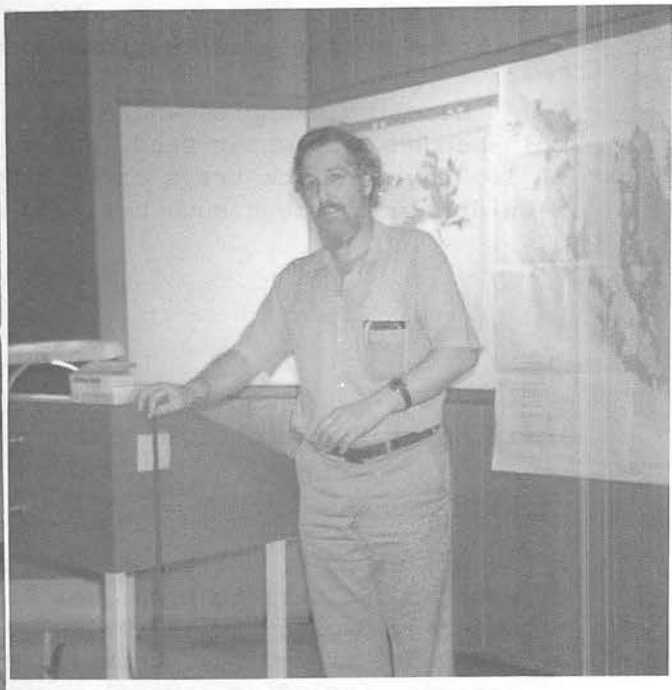
The talk covered a wide spectrum of topics in engineering geology and was well illustrated by numerous case studies drawn from the Speaker's personal experiences. The major topic of discussion was on "landslides", involving problematic schist materials (soils & rocks), volcanic soils, marine soils, montmorillonitic clays, etc. Engineering projects discussed include canals, dams, urban planning (housing, hotels & condominiums, etc.), and coastal cliff stability. One particular case study on a dam (the Clyde Dam) sited on young and active faults as well as several old landslide masses was most interesting indeed. In this particular project, the cost of landslide stabilizations and additional measures required (including consultancy fees) exceeded the cost of building the dam!

The speaker ended the talk by emphasising the need for engineering geologists to be more quantitative in their presentations of findings, maps and reports, and to be more pragmatic in their approach. Some lively discussions followed, and the evening turned out to be a most enlightening one for those who turned up for the talk.

The Society records its sincere thanks to Dr. Bell for taking time off to share some of his professional experiences and views with members of the Society.

Footnote: The talk "Surface Engineering Geology - A review", was in fact delivered as a keynote lecture at the Sixth IAEG Congress held in Amsterdam, 6-10 August, 1990. The interested reader can refer to the Proceedings of the Congress mentioned for details of the paper.

Tan Boon Kong



DAVID BELL

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The following applications for membership were approved:

Full Members

1. Yeap Ee Beng, Dept. of Geology, University of Malaya, 59100 K. Lumpur.
2. Zelanie Zulkifi Alymann, 1, Jalan 22/57, 46300 Petaling Jaya.
3. Robert Brendon Stokes, School of Geological Sciences, Kingston Polytechnic, Penrhyn Road, Kingston-upon-Thames, Surrey KT1 2EE, UK.
4. Nicholas Jacob, GEM Exploration, 56, Jalan Bunga Melur, Taman Canning, 31400 Ipoh.
5. Lim Hock Kuang, Geoservices, 54 Loyang Way, Singapore 1750.
6. Ngui Chee Keong, Ground Engineering, P.O. Box 13828, 88844 Kota Kinabalu, Sabah.
7. Izuru Watanabe, Idemitsu Oil Exploration, 26 Floor, Letter Box No. 51, UBN Tower, 10 Jalan P. Ramlee, 50250 Kuala Lumpur.
8. Aristeo M. Mantaring, Idemitsu Oil Exploration, 26 Floor, UBN Tower, 10 Jalan P. Ramlee, 50250 Kuala Lumpur.

Student Member

1. Liau Boon Leong, Dept. of Geology, University of Malaya, 59100 Kuala Lumpur.

******

PERTUKARAN ALAMAT (CHANGE OF ADDRESS)

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

1. P. Yeo, 24 Bland St., Ashfield, NSW 2131, Australia.
2. Juhari bin Mat Akhir, Jabatan Geologi, Universiti Kebangsaan Malaysia, 43600 Bangi, Malaysia.
3. Adi Suprapto, Division Development Geologist, Virginia Indonesia Company, 8th Floor Kuningan Plaza, P.O. Box 2828, Jakarta, Indonesia.
4. Gleen L. Shepherd, 477 South Alu Road, Wailuku, Hawaii 96793, U.S.A.
5. Liew Kit Kong, 81, Jalan Midah Besar, Taman Midah, 56000 Kuala Lumpur.
6. Cheang Kok Keong, 32, Jalan Usj 2/4A, 47500 Subang Jaya.
7. Ngui Chee Keong, Kretam Management Sdn. Bhd., P.O. Box 81, 90007 Sandakan, Sabah.
8. William C. Ade, Far East Joint Venture Group, 19-C Mount Sianai Rise, Singapore 1027.
9. Goh Cheok Weng, 65, Jalan 17/22, 46400 Petaling Jaya, Selangor.

******

NEW ADDRESS WANTED

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

1. Mohd. Badzran Mat Taib

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PERTAMBAHAN BARU PERPUSTAKAAN (NEW LIBRARY ADDITIONS)

The Society has received the following publications:

1. U.S.G.S. Bulletin (1990): 1866, 1674-C, 1933, 1918, 1757-H, 1787-O, 1757-G, 1904-A, 1808-H, 1737-C, 1701-G, 1859, 1874, 1674-D, 1787-M, 1848. (1989): 1781, 1858, 1857-D, 1857-G, 1901, 1886, 1866-E, 1866-B, 1683-B, 1589-D, 1636, 1866-C, 1787-J, K, 1755-B, 1702-C, 1889, 1572. (1988): 1814.
2. U.S.G.S. Circular (1990): 1039, 1055, 1047, 1041, 1066. (1989): 1044, 1040.
3. U.S.G.S. Prof. Paper (1990): 1495, 1493, 1437, 1370-D. (1989): 1464, 1489, 1403-I, 1462, 1401-D, 1386-H.
4. Persidangan Sains Bumi dan Masyarakat, Prosiding 1990.
5. AAPG Explorer, July & August 1990.
6. Commonwealth Science Council, Newsletter, no. 2, 1990.
7. Bulletin, Centre Rech. Exploration - Production, Elf Aquitaine, vol. 14, no. 1, 1990.
8. Pump performance by Vichit Boonrasri & Others, 1990.
9. Journal of the Faculty of Science, The University of Tokyo, vol. 22, no. 1, 1989.
10. Bulletin of the National Science Museum, vol. 15, nos. 3 & 4 (1989) & vol. 16, nos. 1 & 2 (1990).
11. AGID News, nos. 61/62, 1990.
12. IMM Bulletin no. 994, 1990.
13. Records of the Geological Survey of New South Wales, vol. 23, pt. 1, 1990 (text & Plates).
14. Journal of Hebei College of Geology, vol. 12, nos. 1-4, 1989, & vol. 13, no. 1, 1990.
15. Bulletin of the Chinese Academy of Geological Sciences, no. 19, 1989.
16. Seatrad Bulletin vol. XI, no. 1, 1990.
17. Journal of Science of the Hiroshima Univ., vol. 9, no. 2, 1990.
18. Proceedings of the 18th session: South Pacific, Applied Geoscience Commission, 1989.
19. Scripta Geologica, nos. 90 & 91, 1989.
20. USGS Circular (1989): 1029, 1045, 1034; (1990): 1043, 1060.
21. USGS Prof. Paper (1989): 1472, 1381, 1370-E, 1496, 1490, 1336-B.

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BERITA-BERITA LAIN
(OTHER NEWS)

NEW & ONGOING IGCP PROJECTS 1990

No. Title, Project Leader(s), Duration

165. Regional stratigraphic correlation of the Caribbean
J.L. Yparraguirre, 1983-1989, O.E.T. in 1990

211. Late Paleozoic of South America
A.J. Amos, S. Archangelsky, 1984-1989, O.E.T. in 1990

215. Proterozoic fold belts
R. Caby, 1984-1989, O.E.T. in 1990

216. Global biological events in Earth history
O.H. Walliser, 1984-1991

217. Proterozoic geochemistry
K.C. Condie, 1984-1990

219. Comparative lacustrine sedimentology through space and time
K. Kelts, 1984-1990

224. Pre-Jurassic evolution of eastern Asia
K. Ichikawa, 1985-1990

226. Correlation of manganese deposits to paleoenvironments
S. Roy, B.R. Bolton, 1986-1990

227. Magmatism and evolution of extensional regions of the African plate
A.B. Kampunzu, R.T. Lubala, 1985-1989, O.E.T. in 1990

233. Terranes in the Circum-Atlantic Paleozoic orogens
J.D. Keppie, R.D. Dallmeyer, 1985-1990

234. Precambrian volcano-sedimentary complexes in West Africa
I. Yacé, 1989-1994

235. Metamorphism and geodynamics
L.L. Perchuk, M. Brown, 1985-1989, O.E.T. in 1990

237. Floras of the Gondwanic continents
O. Rösler, 1986-1990

239. Exploitation of IGBADAT (Igneous Rocks Database)
J. Frizado, 1985-1990

242. Cretaceous of Latin America
W. Volkheimer, J.A. Salfity, 1986-1990

245. Non-marine Cretaceous correlations
N.J. Mateer, Chen Pei-ji, 1986-1991

246. Pacific Neogene events in time and space
R. Tsuchi, 1986-1991

247. Precambrian ore deposits related to tectonic styles
G. Gaál, S.C. Sarkar, 1986-1990

249. Andean magmatism and its tectonic settings
M.A. Prada, C. Rapela, 1986-1990

250. Regional crustal stability and geological hazards
Chen Qingxuan, 1986-1989, O.E.T. in 1990

252. Past and future evolution of deserts
N. Petit-maire, 1987-1991

253. Termination of the Pleistocene
J. Lundqvist, 1989-1994

254. Metalliferous black shales
J. Pasava, 1987-1991

255. Kibaran metallogeny
W. Pohl, A. Ntungicimpaye and D.P.N. Hadoto, 1987-1991

256. Ophiolite genesis and evolution of oceanic lithosphere
N. Bogdanov, L. Beccaluva, 1988-1992

257. Precambrian dyke swarms
H.S. Halls, 1987-1991

259. International geochemical mapping
A.G. Darnley, 1988-1992

260. Earth glacial record
M. Deynoux, 1987-1991

261. Stromatolites
S. Awramik, 1987-1991

262. Tethyan Cretaceous correlation
G. Császár, H.A. Kollmann, 1987-1991

264. Remote sensing spectral properties
G.L. Raines, 1987-1991

267. Paleozoic terranes in the Circum-Pacific Orogens
M.J. Rickard, Guo Lingzhai, 1989-1993

269. A global database in sedimentary petrology
N. Nishiwaki-Nakajima, 1988-1992

270. Early Paleozoic events in Latin America for the Gondwana genesis
G.F. Acenolaza, O.L. Bordonaro, 1988-1992

271. South American Paleozoic conodontology
M.A. Hünicken, M. Suarez Riglos, 1988-1992

272. Late Paleozoic and early Mesozoic Circum-Pacific events
J.M. Dickins, Yang Zunyi, 1988-1992.

273. The Archean rocks of the Kasai craton
B.T. Rumvegeri, D. Kapenda, 1988-1992

274. Coastal evolution in the Quaternary
O. Van de Plassche, 1988-1992

275. Deep geology of the Baltic Shield
F.P. Mitrofanov and R. Gorbatschev, 1989-1993

276. Paleozoic of the Tethys
D. Papanikolaou, F.P. Sassi, 1988-1992

277. Phanerozoic oolitic ironstones
J. Petrének, 1988-1990

279. Terranes in Latin America
G.F. Toussaint, F. Hervé, 1988-1992

280. The oldest rocks on Earth
A. Kröner, 1988-1992

281. Quaternary climates of South America
J. Argollo B., 1989-1993

282. Rare metal granitoids
P.J. Pollard, Zhu Jinchu, 1989-1993

283. Evolution of the Paleoasian ocean
Xiao Xuchang, N.L. Dobretsov, R.G. Coleman, 1989-1993

285. Metamorphism in Eastern Asia (NEW)
Cheng Yuqi, Dong Shenbao, provisionally for 1990

286. Early Paleogene benthos (NEW)
L. Hottinger, K. Drobne, E. Caus, 1990-1994

287. Tethyan bauxites
A. Dangić, A. Mindszenty, L. Simone, 1989-1993

288. Gondwanaland sutures and fold belts (NEW)
R. Unrug, G.R. Sadowski, 1990-1994

290. Anorthosites and related rocks (NEW)
M. Higgins, J.-C. Duchesne, 1990-1994

291. Metamorphic fluids and mineral deposits
W. Frank, W. Prohaska, 1989-1993

293. Geochemical event markers in the Phanerozoic (NEW)
Sun Shu, 1990-1993

294. Very low grade metamorphism
R.E. Bevins, D. Robinson, 1989-1993

296. Quaternary in the Asia/Pacific region
J.L. Rau, 1989-1993

297. Geocryology of the Americas
A.E. Corte, 1989-1993

299. Geology, climate, hydrology and karst formation (NEW)
Yuan Daoxian, 1990-1994

302. The structure and metallogenesis of Central African late Proterozoic belts (NEW)
M. Wendorff, 1990-1994

303. Precambrian/Cambrian event stratigraphy (NEW)
M. Brasier, K.J. Hsü, 1990-1993

304. Lower crustal processes (NEW)
L.Ya. Aranovich, B.J. Hensen, 1990-1994

308. Paleocene/Eocene boundary events (NEW)
M.P. Aubry, 1990-1994

Altogether 61 projects: 55 active (45 ongoing, 10 new)
6 O.E.T. (without funding)

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INTRODUCTION TO THE NEW IGCP PROJECTS ACCEPTED AND STARTING IN 1990

285. Metamorphism in Eastern Asia

Proposers: Prof. Cheng Yuqi and Dong Shenbao
c/o Chinese Academy of Geological Sciences,
Baiwangzhuang,
Beijing 100036,
P.R. of China.

Description

The project aims to promote the comprehensive, detailed correlative investigation of some of the metamorphic complexes of Eastern Asia, especially in the Precambrian terrains. It aims at the characterization of the types of metamorphism of important metamorphic terrains, their implication of recrystallization and deformation events, the P-T-t paths through the metamorphic history, the protolithic characteristics of sequences and their initial tectonic setting as well as the evolution of metamorphism through the geological history, especially in the Early Precambrian terrains. The methodological achievements of IGCP Project 235 will be taken into consideration. New insights are expected in the Archean high grade metamorphism and the glaucophane-schist metamorphism or paired metamorphic belts in a number of regions as well as concerning their relation with the global tectonics. A schedule for correlation with relevant metamorphic events in other regions of Eurasia is also provided, as a forum of international discussion.

The IGCP Board accepted the proposal provisionally for 1990, requesting some precisions (clear focus, integration of scientists from adjacent countries, work plan.)

286. Early Paleogene Benthos

(Early Paleogene benthic organisms of shallow water environment, their stratigraphic, ecologic and paleogeographic distribution and their significance for paleooceanography.)

Proposers: Prof. L. Hottinger, K. Drobne, E. Caus
c/o Prof. L. Hottinger
Geologisch-Paläontologisches Institut der Universität Basel
Bernoullistr. 32,
4056 Basel
Switzerland

Description

The project intends to revise and to compare selected neritic index microfossils in order to establish a standard zonation bridging facies and province boundaries during Early Paleogene time-span characterized by the reconstitution of the nenthic diversity after its C/T boundary breakdown. (Faunal recovery following the major late Cretaceous crisis).

The IGCP Board accepted the proposal for five years (1990-1994).

GEOLOGICAL SOCIETY OF MALAYSIA PUBLICATIONS

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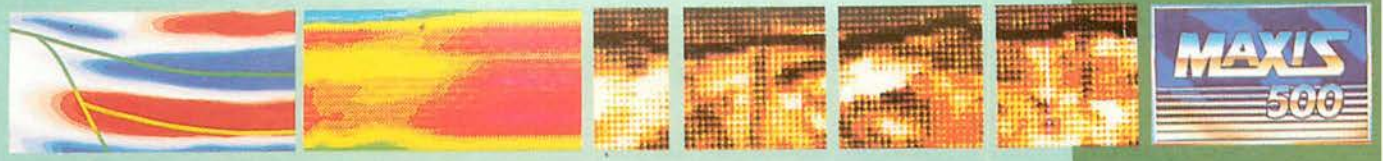

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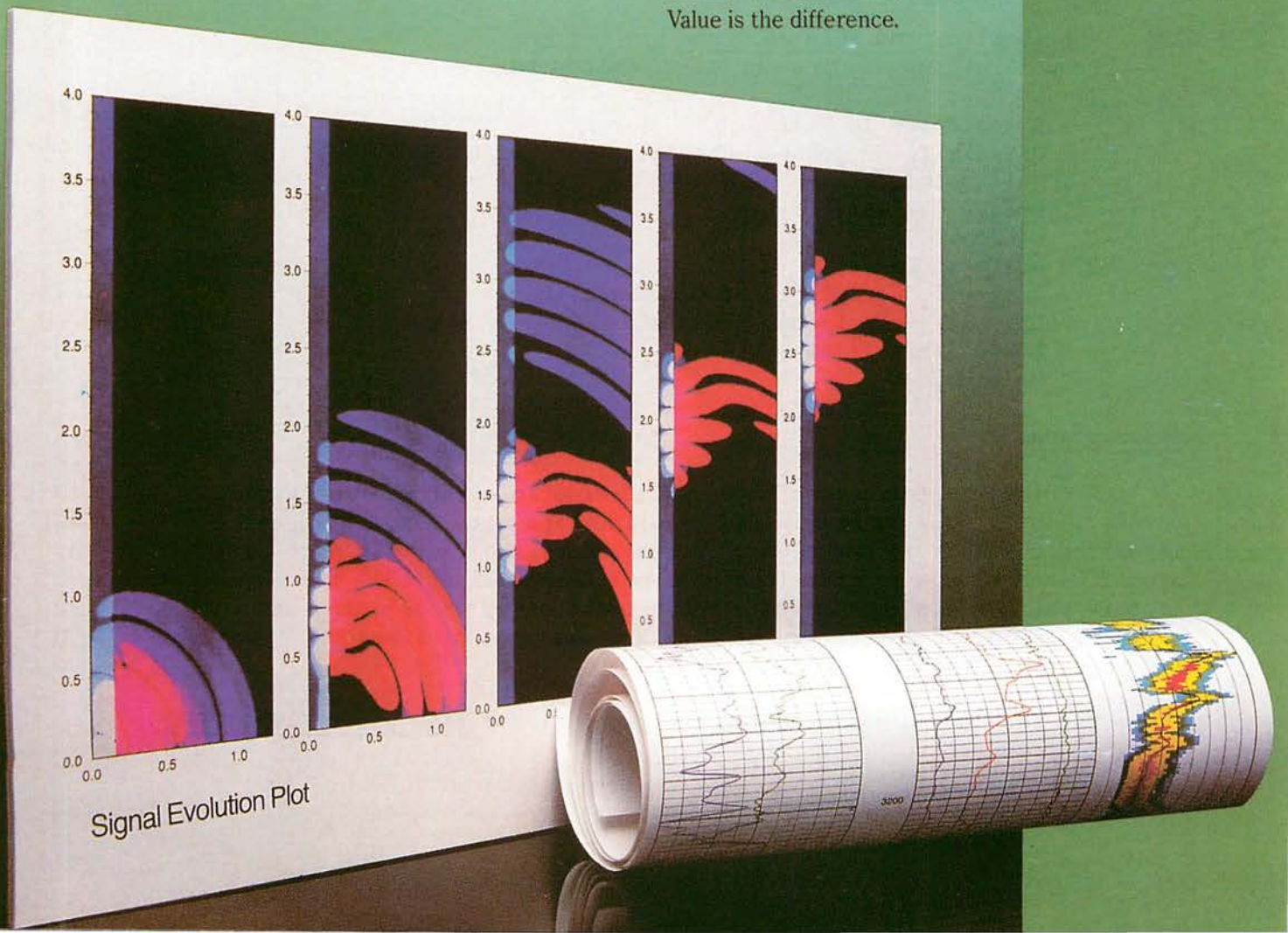

Signal Evolution Plot

288. Gondwanaland Sutures and Fold Belts

Proposers: Prof. R. Unrug and G.R. Sadowski

1. Prof. Raphael Unrug,
   Department of Geological Sciences,
   Wright State University,
   Dayton, Ohio 45435,
   U.S.A.
2. Georg Robert Sadowski,
   Instituto de Geociências,
   Universidade de Sao Paulo,
   Sao Paulo,
   Brasil.

Description

The project aims at obtaining an improved understanding of the geometry, kinematics and history of processes involved in the accretion of constituent cratons which assembled during several Proterozoic tectonothermal events to form the Gondwana Supercontinent. The project is process-oriented and regionally focused on a single unit of major importance in the geological history of the Earth. The mobile belts that weld together the cratons will be studied and correlated in the ex-Gondwanaland present continents. From the knowledge of the nature of craton margins and the intervening mobile belts a better understanding of Precambrian geodynamics will follow.

The IGCP Board accepted the proposal for five years (1990-1994).

290. Anorthosites and Related Rocks

Proposers: M. Higgins and J.-C. Chicoutimi

1. M. Higgins
   Sciences de la Terre,
   Université du Québec, Chicoutimi,
   Chicoutimi,
   Québec G7H 2B1,
   Canada.
2. J.-C. Duchesne,
   Géologie, Pétrologie et Géochimie,
   Université de Liège,
   B 4000 Sart Tilman, Liège,
   Belgium.

Description

Anorthosite intrusions occur world-wide in a range of settings. However, their mode of origin and relationships with associated rocks and metamorphic events is not clear. Furthermore, the tectonic setting and significance of age restrictions have not been delineated. The objectives of this project are to elucidate these problems by encouraging and coordinating field and laboratory studies and exchange of ideas on a world-wide basis.

The IGCP Board has accepted the proposal for five years (1990-1994).

293. Geochemical Event Markers in the Phanerozoic
(Geochemical event markers and their global correlations to time-stratigraphical boundaries)

Proposer: Prof. Sun Shu
Institute of Geology,
Academia Sinica,
P.O. Box 634,
Beijing 100011,
P.R. of China.

Description

Extraordinary events of very short duration may have occurred a number of times in the Earth's history, such as the catastrophic events leaving event markers such as trace element anomalies (Ir, Os, Pt, Au), isotope anomalies (C-13, O-18), shock minerals (quartz, plagioclase), microspherules, carbon shoots, etc. These markers could be correlated globally. These events seems to have been related to mass mortality and mass extinction of biota. The reducing environments consequent upon such events could further lead to unusual contentrations of elements and even to the formation of valuable mineral deposits. The timing of these events coincides with major geological boundaries.

These event markers have been considered a record of extraterrestrial events. If this interpretation is correct, impact event markers should provide accurate worldwide stratigraphic correlation. The objective of the project is to facilitate international and interdisciplinary cooperation in the study of boundary events.

The IGCP Board has accepted the proposal for four years (1990-1993).

299. Geology, Climate, Hydrology and Karst Formation

Proposer: Prof. Yuan Daoxian
Institute of Karst Geology,
Chinese Academy of Geological Sciences,
541004 Guilin,
Guangxi,
P.R. of China.

Description

The objectives of the project are:

(1) to identify the global differences in surface and subsurface karst forms, and to clarify the regularities of their distribution;
(2) to study the relationships between karstification processes and the geological, climatical and hydrological conditions;
(3) to identify geological evidence (paleokarst features, fossils, isotope prints, etc.) preserved in the geological record in different karst regions thus contributing to paleogeographic (in particular, paleoclimatic) reconstruction;
(4) to apply the results to prediction, evaluation and exploitation of mineral resources and to environment protection in various karst areas.

The IGCP Board accepted the proposal for five years (1990-1994).

302. The Structure and Metallogenesis of Central African Late Proterozoic Belts

(Comparative study of the Late Proterozoic mobile belts of Central Africa with emphasis on the factors controlling metallogenesis)

Proposer: M. Wendorff
Geology Department,
University of Zambia,
P.O. Box 32379,
Lusaka,
Zambia.

Description

The late Proterozoic mobile belts of Central Africa are renowned metallogenic provinces which contain a great variety of metalliferous ore deposits. It has been established that each belt has its own characteristic pattern of mineralization. It is therefore the aim of the project to establish inter-relationships between mineralisation and the sedimentary, igneous, metamorphic and tectonic evolution of the Belts, and to propose genetic models.

The IGCP Board accepted the proposal for five years (1990-1994).

303. Precambrian/Cambrian Event Stratigraphy

(Event stratigraphy of the Precambrian/Cambrian boundary sections and their global correlations)

Proposers: M. Brasier and K.J. Hsü
1. Dr. Martin Brasier,
Department of Earth Sciences,
University of Oxford,
Parks Road,
Oxford OX1 3PR,
United Kingdom.
2. Prof. Kenneth J. Hsü,
Geological Institute,
ETH-Zentrum,
Sonneggstrasse 5,
CH-8092 Zürich,
Switzerland.

Description

The Precambrian/Cambrian boundary interval spans an episode of dramatic change in the biosphere. Considerable difficulties have been encountered with biostratigraphic correlation because of the sporadic nature of the earliest skeletal assemblages. The aim of this project is therefore to develop an integrated and refined global biostratigraphy, chemostratigraphy and event stratigraphy for the Precambrian/Cambrian boundary interval:

(a) Establishment of stable isotope stratigraphy across the Precambrian/Cambrian boundary interval.
(b) Identification and verification of geochemical event markers.
(c) Integration of these with biostratigraphic data and sequence stratigraphy.

(d) Global correlation of these event markets with global biological events and formulation of a theory to explain their origin.

The IGCP Board has accepted the proposal for four years (1990-1993).

304. Lower Crustal Processes
(The tectonic and thermal history of the continental lower crust)
Proposers: L.Ya Aranovich and B.J. Hensen
1. Dr. L.Ya. Aranovich,
Institute of Experimental Mineralogy,
USSR Academy of Sciences,
142432 Chernogolovka,
Moscow District,
USSR.
2. Dr. B.J. Hensen,
Department of Applied Geology,
University of NSW,
Kensington 2033,
Australia.

Description

The project aims to improve our understanding of the tectonic and thermal evolution of the lower continental crust through integrated studies of amphibolite granulite facies metamorphic terrains. This objective is to be realized by combining a number of individual approaches including:

(1) Comparison of high grade metamorphic terrains of different inferred origins and different ages.
(2) Testing of theoretical, geophysically based, tectono-thermal models with detialed field studies.
(3) Refinement of radiometric dating techniques to determine the timing of specific metamophic events, and improvement of geobarometric-thermometric techniques to derive reliable pressure-temperature estimates.
(4) Correlation with geophysical and petrological information on the properties of present-day lower crust.

Some of the main activities of the project will take place in developing countries and will provide stimulus for scientific research and international collaboration.

The IGCP Board has accepted the proposal for five years (1990-1994).

308. Palaeocene/Eocene Boundary Events
Proposer: M.P. Aubry
Department of Geology and Geophysics,
Woods Hole Oceanographic Institute,
Woods Hole, MA 02543,
U.S.A.

Description

The projects intends to investigate stratigraphic sections suitable for a more precise definition and characterization of the Paleocene/Eocene boundary.

A methodological approach integrating classical and quantitative biostratigraphy, magnetostratigraphy, chemostratigraphy and isotopic data will be utilized in determining the most suitable stratotype section and point (GSSP) within a Lyellian stratigraphic framework. Close cooperation with the competent subcommisions of the International Commission on Stratigraphy is envisaged.

The IGCP Board has accepted the proposal for five years (1990-1994).

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LAPORAN PERSIDANGAN SAINS BUMI DAN MASYARAKAT

9-10 Julai 1990, Bangi, Selangor Darul Ehsan

Sempena menyambut dua puluh tahun Universiti Kebangsaan Malaysia, satu persidangan rantau Sains Bumi dan Masyarakat telah dianjurkan oleh Jabatan Geologi Universiti Kebangsaan Malaysia. Persidangan ini mendapat sambutan yang baik daripada masyarakat geologi di Malaysia dan Indonesia.

Matlamat persidangan ini ialah untuk membuktikan kepada masyarakat bahawa bahasa Malaysia telah matang dan mampu untuk dijadikan bahasa perantaraan dalam bidang sains, khasnya dalam sains bumi. Sejumlah 28 kertas kerja berbagai aspek geologi telah dibentangkan. Kertas kerja tersebut telah diterbitkan sebagai prosidang.

Prosidang persidangan ini boleh dibeli daripada:

Dr. Kamal Roslan Mohamed
Bendahari
Jawatankuasa Persidangan Sains Bumi dan Masyarakat
Jabatan Geologi
Universiti Kebangsaan Malaysia
43600 Bangi, Selangor Darul Ehsan

Harga senaskah $20.00 (termasuk bayaran pos). Cek pembayaran hendaklah dibayar kepada "Dr. Kamal Roslan Mohamed".

Basir Jasin

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TRAINING COURSE ON CONSTRUCTION MATERIALS

Laporan (Report)

The Training Course on Construction Materials was held from 20 to 23 July, 1990 at the Department of Geology, University of Malaya. It was jointly organized by the United Nations Economic Commission for Asia and Pacific (ESCAP), the United Nation Development Programme and the University of Malaya and was conducted by two trainers from the University of New South Wales (Key Centre for Mines). A total of 22 participants from Lao PDR, Nepal and Vietnam in addition to Malaysia took part in the Training Course.

The emphasis on the Training Course was on large scale extractive operations which require geological and other professional skills. The optimum use of existing quarries and the use of upgraded substandard materials are important in order to minimize further landscape degradation and to extend the life of the limited reserve of superior materials. It was also emphasized that quarrying is only a temporary use of land and that reclamation of mined-out land should be planned well before abandonment. The four day intensive Training Course provide an introduction to the location, assessment, mining and processing of soil and rock materials from a geological point of view. The construction materials covered include rock aggregates and prepared road base, natural sands and gravels, natural pavement materials, brick clays, limestone and cementitious materials, and 'alternative materials'.

Processing and upgrading techniques, particularly blasting, crushing, screening and blending were briefly described. The Training Course also touched on the environment problems associated with extractive industries and their engineering palliatives and remedies and methods of quarry site restoration were suggested. Methods of testing and specification of construction materials were also discussed.

Ng Tham Fatt

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COURSE ON GEOLOGICAL ASSESSMENT AND EVALUATION OF CONSTRUCTION MATERIALS IN LAND DEVELOPMENT

Laporan (Report)

The above course was held on 24 to 26 July 1990 in Bangi, Selangor and Kuala Lumpur. It was jointly organized by the Ministry of Primary Industries (Malaysia) and the United Nations Economic and Social Commission for Asia and Pacific (ESCAP).

The Course was participated by town planners, engineers and geologists from Malaysia, Lao PDR, Nepal and Vietnam. Keynote papers were presented by trainers from the University of New South Wales (Keys Centre for Mines). Six resource papers were presented on geological assessment, evaluation and various aspects of land use planning with regard to construction materials in Malaysia and Australia. Three country papers were presented by speakers from Nepal, Vietnam and Sabah on the availability, development and use of construction materials in the various countries.

It was recognized that construction materials are important to national development and deserved serious consideration. Adequate supply of these materials (mainly derived from rock outcrops, alluvial deposits and pedogenic materials) is necessary to sustain the growth of industrial and newly industrial countries. Albeit such materials are widespread,

most of them are located far from urban centers, rendering exploitation uneconomical. On the other hand many valuable deposits near urban centers were being sterilized by encroaching development. Thus it is important that the town planners, engineers, geologists and various government agencies should work in close co-operation in order to develop a mechanism for the joint consideration of effective long term land use and resource management.

The meeting was ended by a one-day field excursion to a limestone quarry (Sungei Way Quarry) and a limestone hill/cave (Batu Caves) both situated in the vicinity of Kuala Lumpur; and a visit to the City Hall of Kuala Lumpur for briefing on future on future development plans of Kuala Lumpur.

Ng Tham Fatt

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PROJECT CONTINENTAL ANSWER - CORRELATION OF CONTINENTAL ANCIENT SURFACES AND THEIR WEATHERING RECORD

General objectives

The general objectives of the project are:

- to bring together geoscientists involved in the interpretation of paleoenvironments in ancient (pre-Quaternary) weathering complexes and paleosurfaces;
- to gather geologic evidence for major weathering events through time and compile occurrences of the corresponding "fossilized" paleosurfaces;
- to examine processes and criteria, and encourage application of soil science techniques, for reconstructing weathering paleoenvironments;
- to infer global changes in climate and paleoenvironment;
- and to identify paleoweathering phenomena having special econimic potential.

Interests

Study of paleoweathering is not only the transposition to geological deposits of results established by pedologists in recent soils. The geological approach to ancient weatherings features, involves description and study of complete formations, rather than just surficial levels, and frequently reveals weathering profiles that are much thicker than those described in present landscapes and also have unusual geochemical signatures. Thus, studies of paleoweathering can lead to concepts of processes and models that are novel to pedologists.

1) Continental paleolandscapes

Continental paleolandscape reconstructions are an important aspect of global paleogeographic reconstitutions. Paleoweathering profiles are indeed a significant part of the geological record, they are present on continents during almost every geological period, with some periods characterized by intense weathering on extensive paleosurfaces.

Most of the inputs in sedimentary basins are directly dependent on continental areas and their morphology. But the reconstruction of these ancient continental areas, which in most cases have suffered a very long evolution, is not easy. The deposits are often sparse, and may be totally missing.

In this context, paleosurface markers are limited to paleoweathering profiles, and most frequently to the deepest horizons of these profiles, the upper ones having been stripped off.

While the composition of weathering products gives an indication of the composition of the material feeding the basins, careful studies of the downcutting of successive paleosurfaces allow a quantitative approach to the mass balance between continental erosion and basin deposits.

2) General correlations in azoic continental deposits

The global record shows a series of specific time intervals in earth history during which deep weathering profiles were established, and have been widely preserved. These periods are closely related to major phases of low tectonic activity, and in this way the paleoweathering record can help to place limits on tectonics processes and timing.

The intense weathering acting on stable continents marks the landscapes with heavy mineralogical and geochemical prints in the form of bauxites, laterites, ferricretes, silcretes, calcretes, ... These geochemical signals recorded in paleoweathering profiles and in correlative continental deposits as well can provide the basis for large scale correlation in azoic sequences.

3) Record of global changes

Paleoweathering features constitute a direct recording of paleoclimates, through the mineralogical composition, geochemistry, and geometric assemblage of weathering products. The recognition of ancient continental relief also contributes to the knowledge of waterflow and runoff regimes and therefore of paleoclimate.

In other respects, the geometric disposition of the different surfaces, and the periods of landscape downcutting, for example, also reflect base level changes and thus can record on the continent the eustatic variations of the sea level.

4) Economic potential of regoliths

Numerous metallic resources are bound to regoliths. Deep weathering encompasses powerful geochemical systems which lead to leaching, mobili-

sation and differential accumulation of the elements. Mineral concentrations develop according to two different mechanisms: either by synchronous concentration of elements in specific conditions (as in duricrusts, water-table interface or discharge zones, euxinic lagoons, a.s.o.), or by development of a specific geochemical environment, printed on a landscape or a whole continent, which will act later as a geochemical trap for metallogenic brines.

Main research orientations

1) Regional syntheses and global correlation of events

In order to approach a global correlation of events, a first aim of the project will be to compile the geological record of paleoweathering during successive time intervals and place it in the global paleogeographic framework. Regional syntheses in continental areas will be established, using the experience in methods of continental correlation and paleoclimate investigations, with differentiation of ancient weathered surfaces into paleoenvironmental categories defined through paleomorphology, paleoprecipitation, and paleotemperature.

2) Relations to tectonic hsitory

Regional scale relationships of paleoweathering featuers with the tectonic framework will be examined, and focused on the link between the preservation of paleoweathering features and the tectonic regime within foreland basins.

3) Global paleoenvironmental changes

The paleoenvironments indicated by paleoweathering records will be tentatively interpreted in terms of global changes for the different geologic periods. Guidelines and criteria will be formulated, and process studies recommended for defining types of weathering paleoenvironments in terms of paleoclimate, paleohydrology and paleogeography.

4) Developments and applications of specific tools

The complete exploitation of the geological record of paleoweathering occurrences will necessitate considerable efforts in developing better tools for correlation of paleoweathering features and for reading geochemical signals with greater precision in terms of environment changes. It will need the use of modern techniques such as remote sensing, paleomagnetism, radiochronology and stable isotope studies at all scales of investigation, going from the landscape to the crystal and the molecule.

Working targets

1. Constitution of a structure based on an executive council, on thematic and regional leaders, and encouragement of systematic contacts through networks of national correspondents. Periodic information of the members (books and meetings of interest to paleoweathering, coordination and stimulation of projects, ...) will be ensured through a newsletter.

2. Annual meeting of members, during a major international conference, coupled with a field seminar. Special meetings emphasizing the interpretation of geochemical signals in terms of paleoenvironment will be organized and will lead to special publications.

3. Organization of short courses dealing with paleoenvironments including, for example, weathering petrography, stable isotopes geochemistry, paleoclimate reconstruction ....

4. A monograph on Geological Record of Paleoweathering and Associated Paleosurfaces will be a general target and the scientific keystone of an international correlation program.

For further information:

M. Thiry of J.M. Schmitt,
Project "Continental Answer",
Ecole des Mines de Paris,
35, rue Saint Honoré,
77305 Fontainebleau, FRANCE.

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IACMAG 91

INTERNATIONAL CONFERENCE - COMPUTER METHODS AND ADVANCES IN GEOMECHANICS

May 6-10, 1991
Cairns, Queensland, Australia.

Objective

Computer Methods have become powerful tools for solving many problems in geomechanics and geotechnology. The importance of constitutive modelling and testing for geomaterials and discontinuities is recognized as a vital ingredient for robust and reliable computer software.

In mining and civil engineering for example computer methods have lead to improvements in design. Computer Methods are now applied to such diverse problems as rock mechanics, geophysics, geological engineering, ice mechanics, blasting and environmental geotechnology.

The field is expanding at such a rate that this has prompted the foundation of an international Association for Computer Methods and Advances in Geomechanics. This is the first conference of the new association but continues the popular series of conferences on Numerical Methods in Geomechanics (ICONMIG) with a wider scope.

The emphasis of the conference will be the interaction of computer modelling and field measurement. This will include advances in computer hardware and software and the formulation of constitutive laws for geomaterials using laboratory experiments. In addition the verification by field measurements will be an important topic of the conference.

Because of Australia's richness in natural resources, resource geotechnology will be one of the main themes of the conference.

Topics

1. Constitutive modelling of Geomaterials

2. Numerical methods for solving problems in:
   - Rock Mechanics
   - Soil Mechanics
   - Dynamics (including earthquake and blasting problems)
   - Ice Mechanics
   - Rock Hydraulics
   - Environmental Geotechnology

3. Analytical methods in geomechanics

4. Hardware and software
   - CAD systems
   - User interfaces; pre- and post-processing; design codes (codes of practice)
   - New developments in hardware, supercomputers, microcomputers and associated software

5. Verification by field and laboratory measurement
   - Advances in measurement techniques
   - Back analysis
   - Comparison of computer models and measurement.

Papers are invited on the above topics and other topics within the general scope of the Conference. Abstracts should be no more than 300 words and should be submitted to the Conference Secretariat as soon as possible but not later than the deadline shown below.

Abstracts should state clearly the purpose and conclusions of the final paper. Both abstracts and papers will be reviewed.

Submit reply forms	as soon as possible
Submit abstracts	February 10, 1990
Preliminary acceptance	May 10, 1990
Submit full papers	October 10, 1990
Final acceptance	December 10, 1990

Location

Previous conferences in the series were held in Vicksburg, USA (1972), Blacksburg, USA (1976), Aachen, West Germany (1979), Edmonton, Canada (1982), Nagoya, Japan (1985) and Innsbruck, Austria (1988). The seventh conference will take place at Cairns, Australia. Cairns is located on the famous Barrier Reef and is the major tourist resort in Australia. The conference will be held at the recently c-mpleted modern Parkroyal Hotel which has excellent convention facilities.

Cairns is easily reached by air and several airlines fly directly there from Europe, Asia and U.S.A.

Special airface concessions will be available for groups travelling to the conference from key centres.

Financial support for students

Limited funds will be available to support full time students and junior researchers, who show exceptional merit, to enable them to attend the conference.

Excursions

It is planned to organise post conference tours to one of the largest underground mines in the world and to dam and tunnel sites in Australia which will also give participants the opportunity to see the Australian outback.

All correspondence concerning the conference organisation should be addressed to:

IACMAG 1991
GPO BOX 853, Brisbane, Qld 4001, Australia.
Tel: (61) (07) 221 2762; Fax: (61) (07) 220 0231

Scientific Enquiries should be addressed to the conference chairman:

Dr. G. Beer, CSIRO,
P.O. BOX 63,
St. Lucia,
Qld 4067. AUSTRALIA

Tel: (61)(07) 377 7822
Fax: (61)(07) 371 7435

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FOURTH INTERNATIONAL SYMPOSIUM ON LAND SUBSIDENCE

May 12-17, 1991
Houston, Texas, USA.

Organization and purpose of symposium

The Fourth International Symposium on Land Subsidence (FISOLS) is jointly convened by the International Association of Hydrological Sciences' (IAHS) Commission on Ground Water, and the United Nations Educational, Scientific, and Cultural Organization (UNESCO). The Symposium will be cosponsored by the United Nations Environment Program (UNEP), U.S. Geological Survey (USGS), and Harris-Galveston Coastal Subsidence District (HGCSD), with cooperation from the Association of Geoscientists for International Development (AGID), International Association of Hydrogeologists (IAH), the International Society for Mine Surveying (ISMS), International Society of Soil Mechanics and Foundation Engineers (ISSMFE), and other cosponsors and cooperators from international and national organizations that will be announced in the final program.

The problems related to land subsidence have been among those included in the research subjects recommended for study during the 25 years of UNESCO's International Hydrological Decade (IHD) and International Hydrological Program (IHP), and the U.S. National Committee for the IHP program is expected to be a cosponsoring organization of this Symposium. The members of the program committee also serve as members of a UNESCO/IHP Working Group related to the subject of this Symposium. This relation to IHD/IHP programs resulted in organization of the first IAHS/UNESCO jointly sponsored International Symposium on Land Subsidence held in Tokyo, Japan in 1969, the second in Anaheim, California, USA in 1976, and third in Venice, Italy in 1984. The papers presented in the three earlier symposia were published as IAHS Publications 88-89, 121, and 151, respectively.

Because of man's continuing heavy impact on the surface and subsurface environment, the subjects of this Symposium have become increasingly critical over the years since 1969. Therefore, the purpose of this Symposium is to:

- bring together interdisciplinary and international scientists and engineers specializing in fields related to land subsidence; (based on the provisional registration, attendees from at least 30 countries are expected);
- present results of research and practice in the subject;
- exchange experiences related to cause, effect, control, and remediation of land subsidence;
- promote technology transfer between the various disciplines and countries represented; and
- evaluate the advance of knowledge taking place on this subject since 1984 and develop guidelines for future research needs.

Date and place of Symposium

Registration will start on 12 May (Sunday) and the Symposium sessions will be held during 13-17 May, 1991 at Houston, Texas, USA. Session and sleeping rooms have been reserved at the beautiful Doubletree Hotel at Post Oak Road, near the huge Galleria Shopping Mall of Houston.

Scope of the program

Papers will be presented orally and by poster all day Monday, Tuesday, Thursday and on Friday morning of the week of 12 May 1991. Wednesday all day and Friday afternoon will be devoted to interesting technical tours. The technical program for the Symposium will relate primarily to man's activities in changing the natural regime. Papers will discuss subsidence as related to the following topics:

- Fluid withdrawal (water, oil, gas)
- Mining of coal, sulphur, and other products
- Dewatering of organic deposits
- Sinkhole formation in karstic terrain
- Theory, modeling, and prediction
- Environmental, social, economic, and legal factors
- Earth fissures
- Coastal and inland flooding
- Tectonic movement and sea level rise
- Techniques and instruments for detection, measurement, and prediction (i.e. global positioning systems and remote sensing)
- Control and remediation

Information

For further information about the Symposium, please contact:

A. Ivan Johnson, Chairman, FISOLS
7474 Upham Court, Arvada, CO 80003
(Ph: 303/425-5610)

Or

Carole Baker, Local Arrangement Committee
Harris-Galveston Coastal Subsidence District
1660 W. Bay Area Blv. Friendswood, Texas 77546
(Ph: 713/486-1105 - Fax: 713/488-6510)

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XVII PACIFIC SCIENCE CONGRESS
TOWARDS THE PACIFIC CENTURY: THE CHALLENGE OF CHANGE

May 27 - June 2, 1991
Sheraton Waikiki Hotel, Honolulu, Hawaii.
Sponsored by the University of Hawaii, East-West Center, Bishop Museum, Pacific Science Association.

Keynote addresses on topics such as:

- The Composition and Evolution of the Earth
- Chaos Theory-Implications for the Physical and Biological Sciences
- The Dawning of the Age of Biology
- Astronomy, Cosmology and Astrophysics - The Missing 99% of the Universe
- Hazards and Hazard Reduction in the 21st Century
- Scientific Change in the Pacific

Also meetings arranged by the 19 Scientific Committees: Agricultural Sciences; Botany; Coral Reefs; Ecology, Conservation and Environmental Protection; Economics; Entomology; Forestry; Fresh Water Sciences; Geography; Information Sciences and Technology; Marine Sciences; Material Sciences and Technology; Meteorology and Atmospheric Sciences; Museums and Similar Institutions; Nutrition; Public Health and Medical Sciences; Science Communication and Education; Social Sciences and Humanities; Solid Earth Sciences.

Additional meetings are being organized by international and regional organizations.

Scientific excursions are planned for islands in the Hawaiian chain, Fiji and other Pacific locations.

To receive the First Circular, please write to:

XVII Pacific Science,
Congress Secretariat,
2424 Maile Way, Fourth Floor,
Honolulu, HI 96822 U.S.A.

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

1990

March 1990 - November 1990
PHOTOINTERPRETATION APPLIED TO GEOLOGY AND GEOTECHNICS (Bogota, Colombia). Annual post-graduate diploma courses organized by the Government of Colombia, Centro Interamericano de Fotointerpretacion, International Institute for Aerial Survey and Earth Sciences and Unesco. Language: Spanish. For Information: Academic Secretariat of the CIAF, Apartado Aereo 53754, Bogota 2, Colombia.

April 1990 - July 1990
RURAL GROUNDWATER DEVELOPMENT (Loughborough, U.K.). A 10-week diploma course organized annually by WEDC. For Information: WEDC, University of Technology, Loughborough, Leics. LE11 3TU, U.K.

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

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

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

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

July 1990 - August 1990
CRYSTALLOGRAPHY, MINERALOGY, METALLOGENY (Madrid, Spain). Annual course organized by the Department of Geology and Geochemistry of the Universidad Autonoma de Madrid and sponsored by Unesco. Language: Spanish. For Information: Departamento de Geologia y Geoquimica, Facultad de Ciencias, Universidad Autonoma de Madrid, Canto Blanco, Madrid 34, Spain.

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

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

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

1991

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

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

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

August 1991 - October 1991
GEOCHEMICAL PROSPECTING METHODS (Prague, Czechoslovakia). Certificate course organized every second year by the Geological Survey of Czechoslovakia and sponsored by Unesco, IAGC and Czechoslovakia. Language: English. For Information: GEOCHIM Unesco CSSR, Geological Survey of Prague, Malostranské nam. 19, 11821 Prague 1, Czechoslovakia.

KALENDAR (CALENDAR)

1990

July 9-13, 1990
GROUNDWATER IN LARGE SEDIMENTARY ABSINS (International Conference), Perth, Western Australia. (Groundwater Conference, University of Western Australia, Nedlands, Western Australia 6009).

July 29 - August 3, 1990
CIRCUM-PACIFIC ENERGY AND MINERALS RESOURCES (Conference), Honolulu, Hawaii. (Mary Steward, Circum-Pacific Council on Energy and Mineral Resources, 5100 Westheimer Road, Houston TX 77056, USA).

August 1990
IGES (13th International Geochemical Exploration Symposium), Rio de Janeiro, Brazil. Sponsored by AEG. (Sherman Marsh, USGS, Federal Center MS 973, Denver, CO 80309-0250, USA).

August 6-10, 1990
INTERNATIONAL ASSOCIATION OF ENGINEERING GEOLOGY (IAEG/AIGI)(6th International Congress), Amsterdam. (QLT/CONGREX, Keisersgracht 782, 1017 EC Amsterdam, The Netherlands).

August 12-18, 1990
INTERNATIONAL ASSOCIATION ON THE GENESIS OF ORE DEPOSITS (8th Symposium), Ottawa, Canada. (Dr. R.W. Boyle, 601 Booth Street, Ottawa, Canada K1A OE8)

August 20-24, 1990
GEOTHERMAL ENERGY (International Symposium), 14th Annual Meeting of the Geothermal Resources Council, Kailua-Kona, Hawaii (GRC Hawaii, P.O. Box 1350, Davis CA 95617-1350, USA).

August 25-31, 1990
GEOCHEMICAL PROSPECTING (International Symposium), Prague, Czechoslovakia, including the 5th IAGC Symposium on Methods of Geochemical Prospecting and the 14th AEG International Geochemical Exploration Symposium. (Dr. Frantisek Mrna, Geological Survey/UUG, Symposium on Geochemical Prospecting, Malostranske nam 19, 118 21 Prague 1, Czechoslovakia).

August 26 - September 1, 1990
SEDIMENTOLOGY (13th International Congress), Nottingham, UK. (Dr. I.N. McCave, Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge CB2 3EQ, UK).

August 26 - September 8, 1990
LATIN AMERICAN CONODONT SYMPOSIUM, La Paz, Bolivia and San Juan, Argentina. (M. ..unicken, Academia Nacional de Ciencias, Casilla Correo 36, 5000 Cordoba, Argentina).

August 27 - September 1, 1990
WATER RESOURCES IN MOUNTAINOUS REGIONS (IAH and IAHS International Symposium) and IAH (22nd Congress), Lausanne, Switzerland. (Dr. A. Parriaux, Laboratory of Geology EPFL (GEOLEP), CH-1015 Lausanne, Switzerland).

August 28-31, 1990
ADVANCES IN GEOLOGICAL ENGINEERING (International Symposium), Beijing, Peoples' Republic of China (Secretariat: Dr. Yang Zhifa, Institute of Geology, Academia Sinica, P.O. Box 634, Beijing, PRC).

September 10-13, 1990
AFRICAN GEOLOGY (15th Colloquium), organised at the Universite de Nancy with the support of CIFEG and CNRS. (Prof. G. Rocci, Laboratoire de Petrologie, Universite de Nancy 1, BP 239, 54506 Vandoeuvre-les-Nancy, Cedex, France).

September 17-21, 1990
THIRD INTERNATIONAL ARCHAEAN SYMPOSIUM, organised by the University of Western Australia. (Dr. Susan Ho, Third International Archaean Symposium, P.O. Box 435, Nedlands 6009, Western Australia).

September 20-24, 1990
ANDEAN MAGMATISM AND ITS TECTONIC SETTING (International Meeting of IGCP Project 249 with XI Argentinian Geological Congress), San Juan, Argentina. (Dr. C.W. Repela, Centro de Investigationes Geologicas, Calle 1 No. 644, 1900 La Plata, Argentina).

September 24-28, 1990
PAST AND PRESENT CLIMATE DYNAMICS: RECONSTRUCTION OF RATES OF CHANGE (International Conference), Canton of Ticino, Switzerland. Sponsored by the Swiss Academy of Sciences (K. Kelts, ProClim 90, Posfach 7613, CH3001 Bern, Switzerland).

October 7-13, 1990
COAL DEVELOPMENT IN ASIA/PACIFIC (International Symposium), Hanoi, Viet-Nam. Sponsored by United Nations Economic and Social Commission for Asia and the Pacific (UN-ESCAP). (Dr. Do Huu Hao, General Department of Mines and Geology, 6 Pham Ngu Lao, Hanoi, Viet-Nam).

October 20-25, 1990
GEODYNAMICS OF THE ARABIAN PLATE (International Conference), Kuwait. (Dr. Waris E.K. Warsi, Department of Geology, University of Kuwait, P.O. Box 5969, Safat 13060, Kuwait).

October 20-25, 1990
HYDROLOGICAL BASIS FOR WATER RESOURCES MANAGEMENT (International Symposium), Beijing, People's Republic of China. (Dr. Chen Jiaqi, P.O. Box 366, IWHR, Beijing, PRC).

October 28 - November 1, 1990
MONOCYCLIC VS. POLYCYCLIC EVOLUTION IN BRAZILIAN/PAN AFRICAN FOLD BELTS (Symposium in conjunction with the 36th Brazilian Geological Congress), Natal, Rio Grande del Norte, Brazil. (Emanuel Ferraz Jardim de Sa, Departamento de Geologia - UFRN-Campus, 59.071 Natal RN, Brazil).

November 19-23, 1990
UNITED NATIONS GLOBAL SEMINAR ON URBAN GEOLOGY (International Symposium organized by UN-ESCAP, HABITAT, UNEP and UNESCO), Bangkok, Thailand.

1991

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1992

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

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

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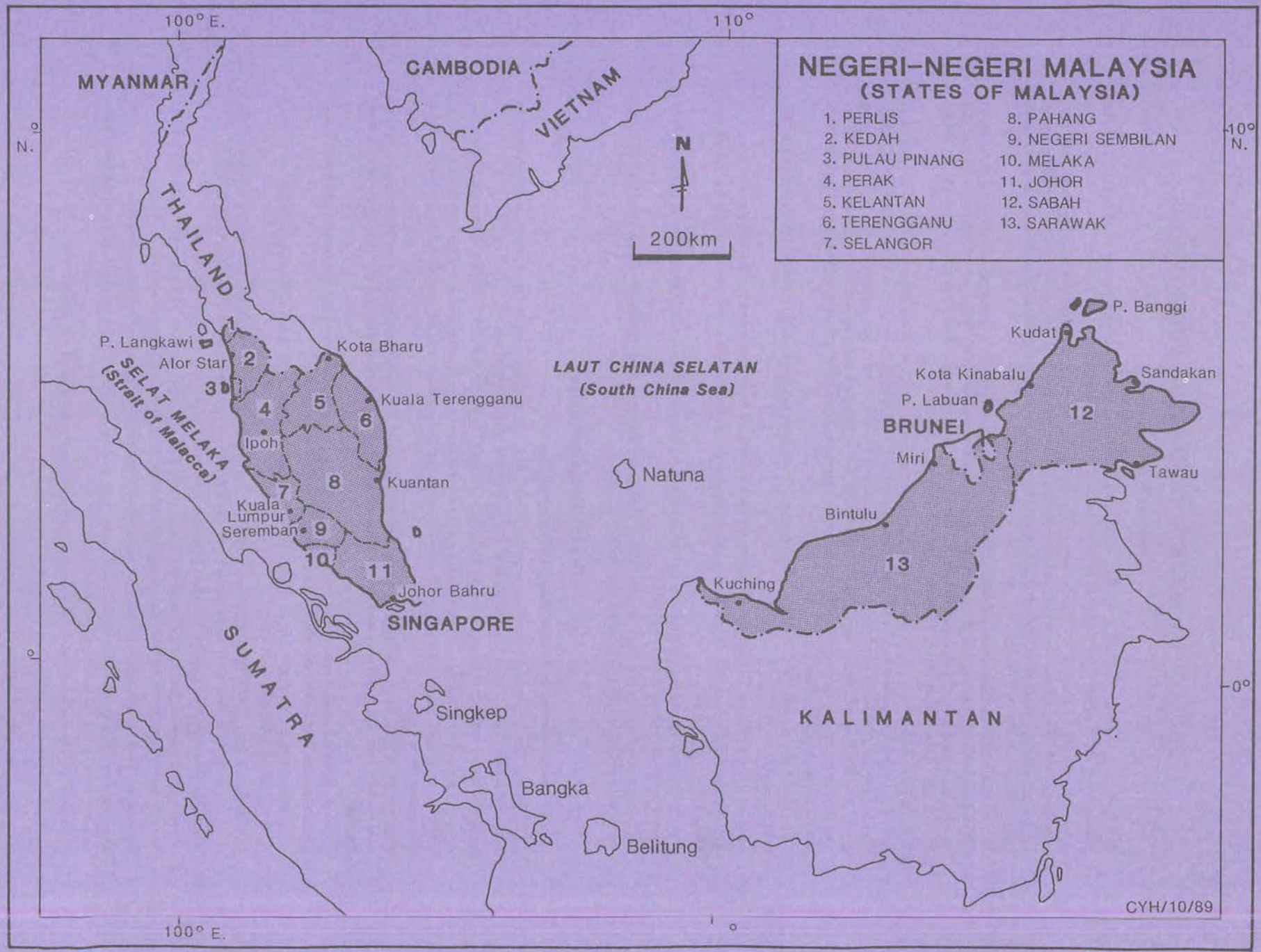
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3. PULAU PINANG
4. PERAK
5. KELANTAN
6. TERENGGANU
7. SELANGOR
8. PAHANG
9. NEGERI SEMBILAN
10. MELAKA
11. JOHOR
12. SABAH
13. SARAWAK
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110°
10° N.
0°
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CAMBODIA
VIETNAM
THAILAND
N
200km
P. Langkawi
Alor Star
Kota Bharu
Kuala Terengganu
Ipoh
Kuantan
Kuala Lumpur
Seremban
Johor Bahru
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