

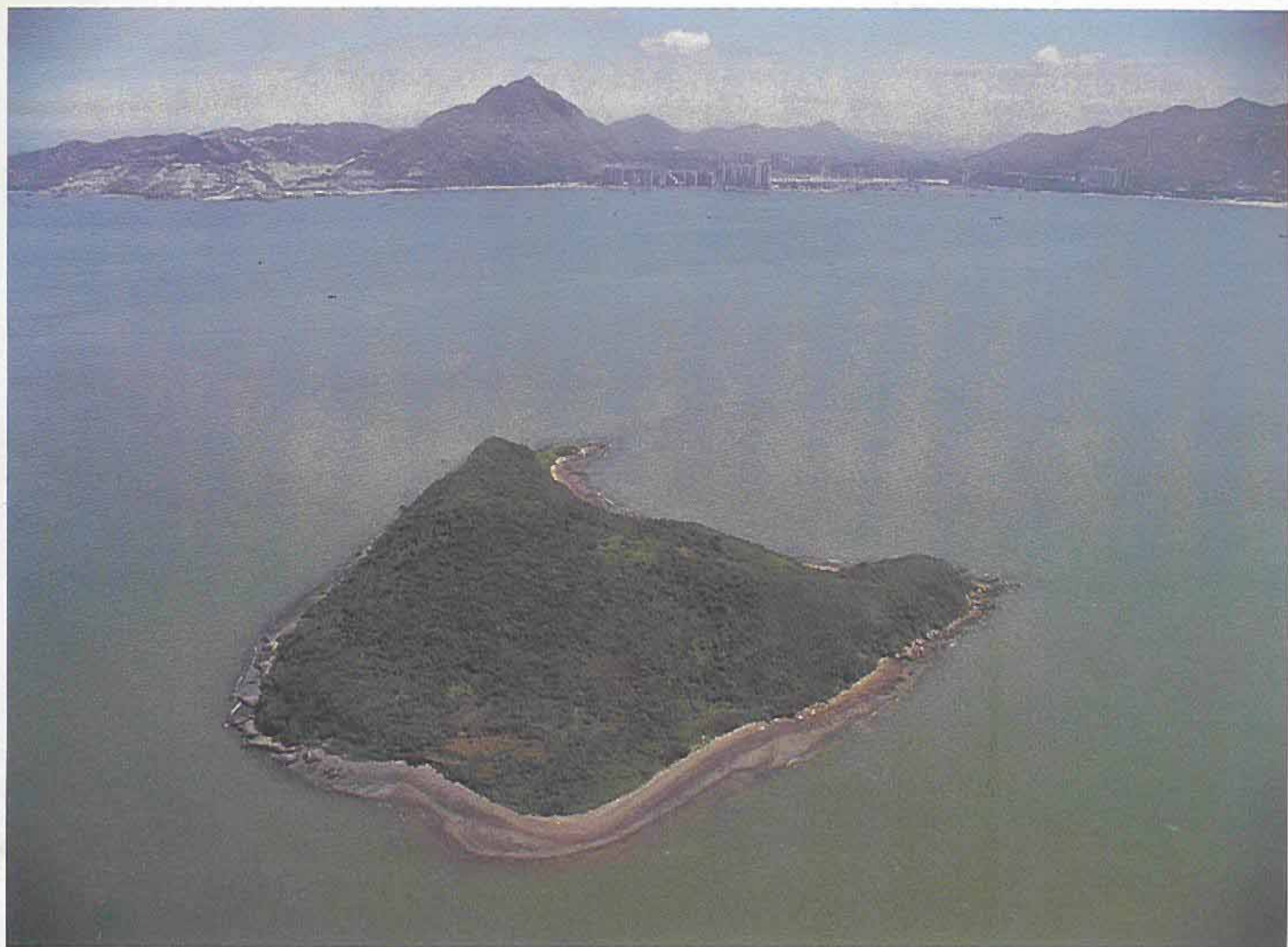
GEOLOGICAL SOCIETY OF HONG KONG
NEWSLETTER

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Geological Society of Hong Kong

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Geological Society of Hong Kong Newsletter

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EDITORIAL

First, I would like to remind all members that we have an excellent lecture series throughout the winter which we hope you will support. The lectures take place at the Mariner's Club in the heart of Tsim Sha Tsui, so you can attend the talk in pleasant surroundings and then retire to one of the many restaurants in the area. Please make a note of the dates in your diary.

We are also putting more emphasis on regular field excursions, and a provisional list for the whole of 1993 can be found on page 18.

On a more serious note, the economic development of the Territory brings mixed blessings. The archaeologists have come to terms with the destruction of many sites, gleaning what they can before the developers move in. The number

of geologically extraordinary sites in Hong Kong is comparatively few, and we hope that our proposed publication of a field guide to Hong Kong will record all the important ones.

Part of our image is the hammer, which we have now removed from our logo; the Geologist's Association in the UK did the same, not wishing to project an image of geologists as destroyers. Our hammers cannot compete with the engineer's drills and explosives when it comes to exposing new and interesting geology. We should follow in his footsteps, extracting maximum benefit from all temporary exposures. And if the scourge of the geologist, sprayed shotcrete, is also used less, so much the better for us.

REPORT ON THE WORKSHOP ON THE LOGGING AND INTERPRETATION OF TRANSPORTED SOILS IN OFFSHORE BOREHOLES

W W S Yim

Department of Geography & Geology, The University of Hong Kong

This workshop, attended by more than 130 registrants, was held at the University of Hong Kong on 27 June 1992. It was jointly organized by the Marine Studies Group, Geological Society of Hong Kong and the Department of Geography & Geology, The University of Hong Kong, with the support of the HKIE Geotechnical Division and the Marine Biological Association of Hong Kong.

The workshop was divided into two sessions with three papers each which were chaired respectively by P Blacker, Director of Fugro-McClelland (Hong Kong) Limited, and J B Massey, Government Geotechnical Engineer (Development) of the Civil Engineering Department, Hong Kong Government.

A summary of the introduction and six papers, together with a selection of illustrations, are given below:

INTRODUCTION - J B MASSEY

Mr Massey welcomed the registrants and introduced the engineering significance of the logging and interpretation of transported soils in offshore boreholes in Hong Kong.

The meeting was very well timed in view of major coastal engineering projects now underway including the Chek Lap Kok Airport, the West Kowloon Reclamation, the Fill Management Study Phase II, and the site investigation work for the Central Reclamation, Container Terminal No 9, etc.

The three important aims of offshore borehole logging are to assist engineering design, to identify sources of constructional fill and to obtain information useful for geological interpretation.

It is noteworthy that the Marine Studies Group of the Geological Society of Hong Kong was referred to in the Hong Kong Yearbook for its role in the recognition of major sources of constructional fill below the sea bed in spite of its small membership.

PAPER 1 - J A FYFE

Geotechnical Engineering Office, Civil Engineering Department, Hong Kong Government.

An overview of offshore borehole logging

One of the important long-term aims of offshore investigations is the development of a sedimentological model. Borehole logging is an important element in this development and, in order to be of most benefit, it is important that core be described as completely and consistently as possible.

Of particular use in developing a model are colour of the sediment, particle composition and sedimentary structures. Colour is influenced by original mineralogy and later geological and geochemical processes, and can give clues both to the syn-depositional chemical environment and to post-depositional diagenetic changes. Particle composition can provide evidence of the provenance of sediments as well as their textural maturity; sorting of the sediment, grain shape and roundness are all important environmental indicators.

Primary sedimentary structures include bedding features, sediment disturbance and bioturbation; plane-bedding, ripple lamination and cross-bedding are formed in distinct hydraulic regimes that can be used to discriminate the environment of deposition. Likewise sediment disturbance by slumping, faulting and bioturbation can add further useful information in developing a complete geological model.

PAPER 2 - D V SMYTH, T V McSWEENEY & T M YIU

Gammon Construction Limited

Evidence from the vibro-corer sampling method

The vibro-corer sampling technique developed by Gammon Construction Limited was described. A schematic layout of the wire line vibro-corer is shown in Figure 1. Some applications in the logging and interpretation of transported soils in Hong Kong were presented.

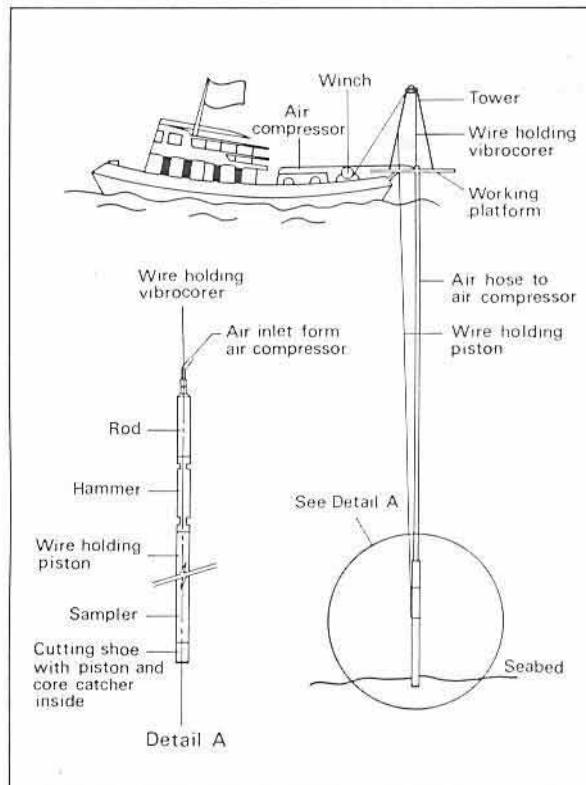


Figure 1 - The Gammon wire line vibro-corer

PAPER 3 - W W S YIM

Department of Geography & Geology, The University of Hong Kong
Evidence from stratigraphy, fossils and dating

The record of marine and terrestrial deposits determined through the study of offshore boreholes and sea-bed excavation in Hong Kong was highlighted. Important evidence from stratigraphy, fossils and dating were summarized in order to provide a geological model which takes

into account eustatic changes of sea level. Table 1 provides a suggested summary of the classification of offshore transported soils in Hong Kong, their estimated ages, equivalent oxygen isotope stages and estimated maximum thicknesses. Since the pattern of sea-level changes found is similar to other passive continental margins, the Hong Kong region is thought to have been relatively stable at least since the Middle Pleistocene.

PAPER 4 - J M PAISLEY

Fugro-McClelland (Hong Kong Limited)
Evidence from cone penetration testing

The cone penetration test (CPT) is regularly performed on marine development projects in Hong Kong. A summary of typical applications on recent projects was presented and included reference to case histories. Several charts exist to assist in the interpretation of soil types from CPT data. A summary of these charts was presented together with guidelines on their application. The interpretation of soil strength and consolidation characteristics from CPT data was described.

PAPER 5 - L J ENDICOTT

Maunsell Geotechnical Services Limited
Evidence from engineering properties

This paper described the assessment of field data from an investigation of a proposed area for reclamation. The ground comprises soft mud of the Hang Hau Formation, and sand with firm to stiff clays of the Chek Lap Kok Formation. The assessment of properties of strength and com-

Table 1 - Informal classification of offshore transported soils in Hong Kong, their estimated ages, equivalent oxygen-isotope stages and estimated maximum thicknesses. Note that discontinuities exist between the units and it is possible for one or more units to be absent due either to non-deposition and/or erosion.

Stratigraphic unit	Estimated age in years BP	Oxygen-isotope stage	Age	Estimated maximum thickness in metres
Upper Marine (UM)	< 8,100	1	Holocene/postglacial	13.2
Upper Terrestrial (UT)	8,100-30,000	2	Last glacial	6
Middle Marine (MM)	80,000-140,000	5	Last interglacial	11
Middle Terrestrial (MT)	140,000-180,000	6	Second last glacial	18.5
Lower Marine (LM)	190,000-240,000	7	Second last interglacial	> 10
Lower Terrestrial (LT)	> 240,000	>7	pre-Second last interglacial	uncertain

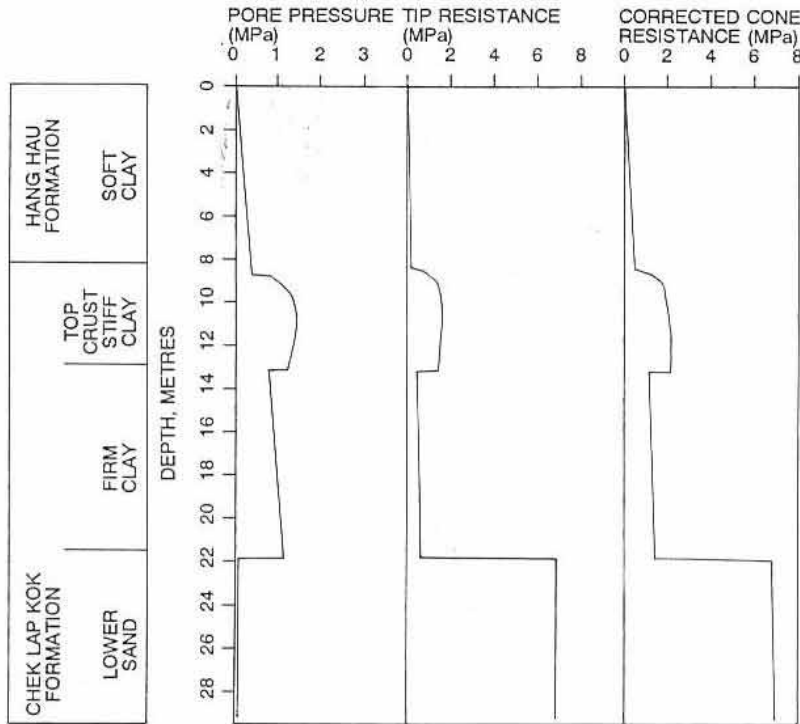


Figure 2 - Idealized cone penetration test baseline profiles for the Chek Lap Kok airport site

pressibility from CPT data depended upon a knowledge of the critical pressure or maximum past pressure. Figure 2 shows the idealized CPT profiles for the transported soils. Reference to geophysical survey identified zones with different properties probably arising from conditions prevailing at the time of their deposition and subsequently. Three characteristic material types were identified at the top of the Chek Lap Kok Formation and their properties were assessed. The presence of other zones at depth in the Formation was recognised but these zones were not investigated in detail.

PAPER 6 - N K TOVEY

School of Environmental Sciences, University of East Anglia, UK

Evidence from microfabric and mineralogy

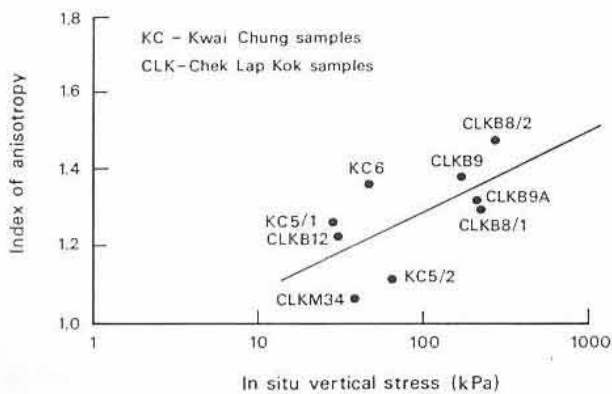


Figure 3 - Relationship between the index of anisotropy and stress level in the Hong Kong samples examined

Numerous boreholes are sunk each year throughout the world, but it is rare in geotechnical investigations that microfabric or mineralogical studies are made. Such microfabric and mineralogical investigations can provide additional information about the nature of the transported soils present, and also assist in the interpretation of their formation and diagenesis.

This paper outlined some of the techniques available, including some of the recent developments towards fabric quantification. Examples were given of the fabric from selected offshore sediments from Hong Kong. Figure 3 shows that there is an increase in alignment with stress level in the samples examined. Some recommendations were given for future site investigations,

including those where microfabric studies are not immediately envisaged.

SUMMARY

All six papers were discussed after each presentation. This was followed by an open forum in which numerous questions were raised from the floor.

R P MARTIN, Chief Geotechnical Engineer (Planning) of the Civil Engineering Department, Hong Kong Government, provided a summing up and proposed a vote of thanks to all the speakers for their presentations before the workshop came to a close.

PUBLICATION DETAILS

The 78-page workshop proceedings containing the six papers, a bibliography and other relevant information is published as a contribution to the Commission on Quaternary Shorelines, International Union for Quaternary Research and the International Geological Correlation Programme Project 274 Coastal Evolution in the Quaternary.

Copies of the abstracts are available from: The Secretary, Geological Society of Hong Kong, c/o Department of Geography & Geology, The University of Hong Kong, Pokfulam Road, Hong Kong. The cost inclusive of postage within Hong Kong is HK\$50 (Members HK\$40). Payments should be by crossed cheque payable to *Geological Society of Hong Kong*.

TOWARDS A QUATERNARY STRATIGRAPHY FOR HONG KONG

J A Fyfe

Hong Kong Geological Survey, Geotechnical Engineering Office

INTRODUCTION

The recent workshop on the logging and interpretation of transported soils from offshore boreholes (reported by Wyss Yim in this Newsletter, page 2) not only promoted discussion of logging principles and techniques, but also served as a useful forum for exchange of information on Quaternary stratigraphy in Hong Kong. The range of stratigraphic names used, however, points to the need for a more formal approach. This article aims to review the current understanding of Hong Kong Quaternary stratigraphy.

Geological procedure for stratigraphic classification (Bowen 1978) is a three-stage process involving:

- 1 local identification and description of units in sequence,
- 2 correlation of local sequences,
- 3 interpretation of the stratigraphic record in terms of earth history.

The first stage is usually arrived at through co-operative effort among workers in an area. Different researchers will work not only in different geographical areas but usually with different techniques. In offshore areas, these techniques include logging and analysis of boreholes, seismic interpretation and analysis of cone penetrometer tests. Thus, a multi-disciplinary effort leads to a diverse understanding of the geology. This scattered data is shared through publishing of results. The work in Hong Kong to date should allow us to achieve the first stage of this process.

The second stage will also be arrived at by co-operative effort. Workers must share their information and this will normally be achieved with lively debate. In Hong Kong, the imbalance in data coverage and lack of seismic profile

continuity makes this stage more difficult, but it is nevertheless necessary. Bowen (1978) warns that workers are often tempted to jump to stage three without the appropriate groundwork and says: "Despite the logical procedure outlined above, it is not always followed. Many continue in apparent ignorance of it." We must therefore ensure that we have a detailed knowledge of the Quaternary sequence in all areas of Hong Kong before attempting to interpret the data too deeply.

The difficulty is, of course, that the third stage is the most exciting. It involves comparison with other areas and correlation with interpreted global sea-level and climatic changes. It should be noted that Hong Kong is part of the much larger system of the Pearl River delta. The need to produce a formal stratigraphy for Hong Kong is justified not least because, in the long term, we must correlate our geology with that of southern China. Lithostratigraphy provides a systematic procedure for classifying geological sequences.

INITIAL WORK

The earliest offshore borehole descriptions in the Territory appear to divide the Quaternary into a basal *alluvium* or *colluvium* and an overlying *marine deposit* (Binnie & Partners 1974; Hong Kong Malayan Drillers & Engineers Ltd 1974) (Table 1).

This system had its merits in the early phase of exploration, but is now too simplistic to be of any great value. Despite this, it is surprising that this bipartite division is still used in many quarters to this day. Indeed, it should probably not be dismissed as a useful general outline of the Quaternary sequence, though in terms of formal stratigraphy it is of very little use.

Table 1

Age	Stratigraphy	Thickness	Description of sediments
no ages given	Marine Deposits	no figures given	Silty clay with shell fragments
	Alluvium (Colluvium)		Interbedded gravel, sand and mud

Table 2

Age	Stratigraphy	Thickness	Description of sediments
no ages given	Upper Marine	12m	Clay deposited during Holocene rise in sea level to the present day
	Upper Alluvial	8m	Clay with lenses and pockets (of sand) including desiccation of Lower Marine deposits and alluvial deposition
	Lower Marine	22m	Clay with occasional sand layers, deposited after the rise in sea level; stiff clays represent drying crusts
	Lower Alluvial	12m	Sand and gravel deposited in period of low sea level

One of the earliest published attempts at a more detailed stratigraphic division of the Quaternary was in the first study for the replacement airport at Chek Lap Kok (RMP Encon Ltd 1982) (Table 2). The authors divided the succession into four depositional stages.

This genetic classification was also used by Yim (1984) for the East Dam site at High Island

Reservoir (Table 3). Yim (1984) further divided the Upper Marine into Lower and Upper units and included a radiocarbon date originally published by Kendall (1975).

The descriptions are based on the sequence seen at High Island during excavation of the dam site in 1974.

Table 3

Age (yrs)	Stratigraphy	Thickness	Description of sediments	
5,980 ±180	Upper Marine	8.5m	Upper - shelly sand Lower - silty sand	Holocene marine deposits
no ages given	Upper Alluvial	3.6m	Moderately sorted fine sand with sandy silt, clay and gravel	
	Lower Marine	6.4m	Dark grey clayey silt with plant remains and shell fragments	
	Lower Alluvial	2.6m	Clast-supported gravel with some yellowish silt and clay	

Liu & Gammon (1984) recognized a simple three-fold division of the superficial deposits (Table 4), and ascribed ages to units based on tentative correlations with studies in China. Their stratigraphy was based on recognition of a variety of materials, essentially for engineering

purposes but also related to environments of deposition. Although the authors mentioned the possibility of the marine reported by Yim (1984), this was considered by Liu (1988) as being doubtful and in need of further study.

Table 4

Age (yrs)	Stratigraphy	Thickness	Description of sediments
Holocene <8,000	Q _{IV} Marine	7-20m	Grey sandy silty clay and clayey silty sand, with shells
Upper Pleistocene 8,000-40,000	Upper Q _{III} Lacustrine/ Alluvial	4-10m	Dark yellow silty clay with a trace of sand and gravel and lenses of gravel and cobbles
Lower Pleistocene >40,000	Lower Q _{III} Alluvial	4-10m	Yellow silty sand or sand and gravel, locally with dark grey organic clay

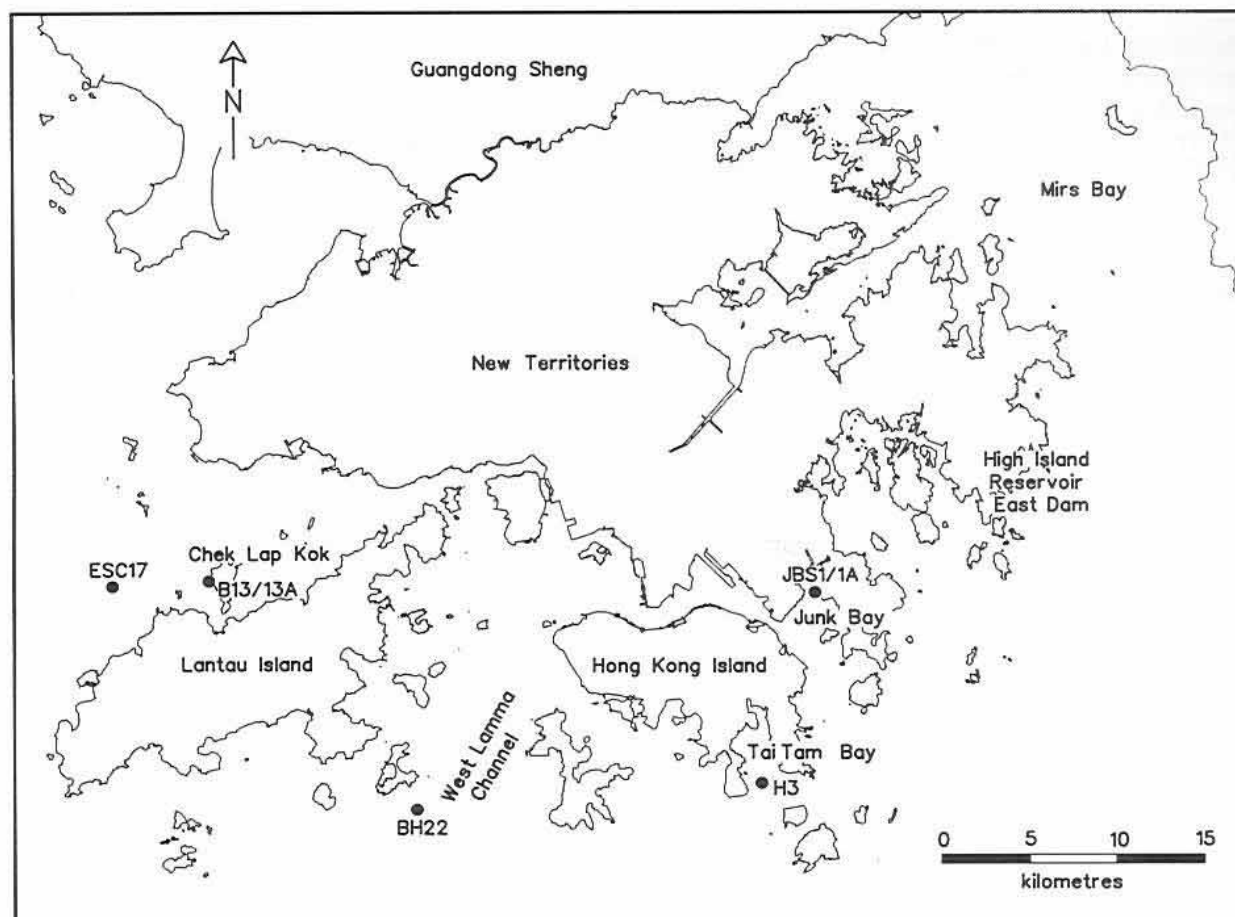


Figure 1 - Location map of places and boreholes mentioned in the text

FORMAL STRATIGRAPHY

The first attempt at a formal stratigraphy was published by Strange & Shaw (1986). They recognized two main lithostratigraphic units (Table 5), the Chek Lap Kok Formation and the Hang Hau Formation.

Significantly, this stratigraphy was based on interpretation of shallow seismic data. The work was carried out as part of the 1:20,000 mapping of Hong Kong, and the introduction of lithostratigraphic nomenclature was required at this stage. The reduction in the number of units identified (indeed, these formations were descri-

bed as being equivalent to the earlier terms *Alluvium* and *Marine Deposits*) may be attributed to the need to choose lithostratigraphic formations which must, by definition, be mappable across the region (Whittaker *et al* 1991). As the primary mapping tool was seismic data, this twofold division quite simply represented the limit of the information. The type borehole sections for these two formations, from which the above descriptions are summarized, are B13/13A for the Chek Lap Kok Formation and JBS1/1A in Junk Bay for the Hang Hau Formation.

Table 5

Age	Stratigraphy	Thickness	Description of sediments
<8,080	Hang Hau Formation	20m	Silty clay with shell fragments
16,420- >40,000	Chek Lap Kok Formation	36m	Interbedded gravel, sand and mud

Meanwhile, with further borehole information, Yim *et al* (1988) modified the earlier (Yim 1984) genetic classification to include a Middle Terrestrial and a Middle Marine unit (Table 6).

The primary evidence for this division was micropalaeontology from a total of sixteen boreholes across Hong Kong, but the authors included no lithological synopsis of the units

identified. The descriptions given in the Table 6 are based on the author's modification of boreholes described by Shaw (Langford *et al* 1989) and RMP Ençon (1982), though it should be noted that the original authors did not

necessarily recognize this stratigraphy. The entire six units were seen in only one borehole, H3 in Tai Tam Bay. These authors included maximum thicknesses for the units.

Table 6

Age(yrs)	Stratigraphy	Thickness	Description of sediments
<8,520	Upper Marine	21.5m	Soft silty clay, sandy silt and silty sand, with abundant shell fragments
8,520- <30,560	Upper Terrestrial	6m	Sandy gravel and silty clay with wood and shell fragments
30,560- 36,230	Middle Marine	15.3m	Pale grey, mottled silty clay with sand near the base
40,000- 50,000	Middle Terrestrial	6m	Very stiff silty clay with fine gravel
55,000- 65,000	Lower Marine	10.3m	no descriptions given
>65,000	Lower Terrestrial	14m	

Work by the Hong Kong Geological Survey has identified another formation which may be mapped (Table 7). Again, this is identified primarily on the grounds of seismic interpretation during 1:20,000 mapping and this unit is to be named the Sham Wat Formation (Langford & James, in prep).

On seismic profiles the unit has a characteristic signature and thickens considerably towards the

west. South of Lantau it is around 10 metres thick. It has also been recognized in the eastern part of the Territory, south of Mirs Bay.

The type section for the Sham Wat Formation is in borehole ESC17, north of Lantau Island. Work is currently in progress to investigate the micropalaeontology for this unit.

Table 7

Age(yrs)	Stratigraphy	Thickness	Description of sediments
<8,080	Hang Hau Formation	20m	Silty clay with shell fragments
?	Sham Wat Formation	15m	Silty clay with corroded shell fragments and diffuse light mottling
16,420- >40,000	Chek Lap Kok Formation	36m	Interbedded sand, silt and clay

In more recent work, Yim (1992) has slightly revised his earlier classification and descriptions (Table 6), pushing the Middle Terrestrial back to the last interglacial and the Lower Terrestrial back to the second last interglacial (Table 8). The sediment descriptions are based on a

borehole 22 from the West Lamma Channel. The age of the Middle Marine is based on Uranium-series dating of an oyster shell retrieved from Sheung Wan. Older dates are extrapolated from oceanic oxygen isotope stages.

Table 8

Age(yrs)	Stratigraphy	Thickness	Description of sediments
<8,100	Upper Marine	13.2m	Grey, very soft clayey silt with shell fragments
8,100-30,000	Upper Terrestrial	6m	Sandy gravel and silty clay with wood and shell fragments
80,000-140,000	Middle Marine	11m	Grey, soft clayey silt with few shell fragments, sandy and mottled near the base
140,000-180,000	Middle Terrestrial	18.5m	Very stiff silty clay, dense silty sand and gravel
190,000-240,000	Lower Marine	>10m	Grey, very stiff silty sand with oyster shells and plant fragments
>240,000	Lower Terrestrial	?	Grey, very dense fine to coarse sand with gravel

CONCLUSION

The information which has led to the stratigraphic definitions reviewed here is wide and varied. It should be stressed that these are only a selection and that other work has been carried out, much of it in the private sector and, regrettably, unpublished. However, we now have sufficient data to be able to move forward in the development of a Hong Kong Quaternary stratigraphy.

It is essential at this stage that workers collaborate in an attempt to produce a unified solution which can be accepted and used by the scientific and engineering communities in Hong Kong. In this effort, it is important that all researchers are aware of the stratigraphic method, and Whittaker *et al* (1991) is a useful reference on this subject. The stratigraphic seminars announced in this Newsletter (p 18) should provide a further forum for discussion.

ACKNOWLEDGMENTS

This paper is published with the permission of the Director of Civil Engineering, Hong Kong Government.

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NEW LOGO FOR THE GEOLOGICAL SOCIETY OF HONG KONG

R L Langford

Editor, GSHK

When the Society was founded in 1982 a logo was devised (Yim 1983) which has served us well for our first decade. The General Committee recently decided to adopt a suggestion by the Editor to upgrade the logo. This decision was based on the following design considerations:

- the ammonite on the old logo was chosen only as a close approximation to the unique *Hongkongites hongkongensis* Buchman
- the old logo included only the initials GSHK, which was believed to be too cryptic
- there was no Chinese text for the Society name on the old logo
- the year of founding was included (1982), but this could have been confused with the year of discovery of the ammonite (1924)
- the stylized hammer presents an image of geologists which today may be considered environmentally unacceptable (see Editorial)

The following additions and improvements have been made for the new logo:

- *Hongkongites hongkongensis* Buchman is used, even though the original is incomplete

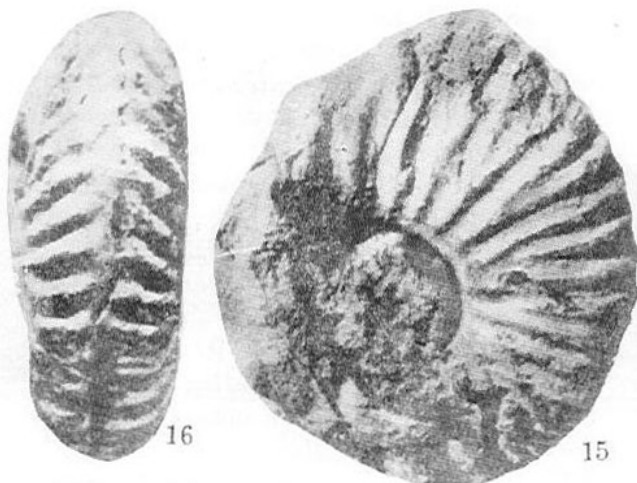


Plate 1 - *Hongkongites hongkongensis* Buchman x1

From p 9

YIM W W S (1984). A sedimentological study of sea-floor sediments exposed during excavation of the East Coast Dam Site, High Island, Sai Kung. *Geological Society of Hong Kong Bulletin* No 1 p 131-142

YIM W W S (1992). Evidence from stratigraphy and fossils. *Geological Society of Hong Kong Abstracts* No 8 p 19-30



(Plate 1); a careful reconstruction was recently commissioned for this purpose from C M Lee, Hong Kong Polytechnic

- to reflect the unique nature of the ammonite, its name is given
- the name of the Society is given in full, both in English and Chinese

The new logo appeared slightly ahead of schedule on the last issue of the Newsletter, and it will soon appear on all our stationary. We hope that you like the change.

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OCCURRENCE OF DOLOMITIC LIMESTONE IN TOLO HARBOUR AND SPECULATIONS ON THE AGE OF ITS SUBAERIAL EXPOSURE

W W S Yim & K F Yu

Department of Geography and Geology, University of Hong Kong

ABSTRACT

Dolomitic limestone underlying the sea bed in Tolo Harbour was identified by Wong & Ho (1986). In the present study, follow-up studies were undertaken on borehole specimens to determine the chemical composition of the dolomitic limestone and the probable age of its subaerial exposure.

A borehole rock specimen was found to contain 12.65% MgO, confirming that it is a dolomitic limestone. Three specimens from Ledge Point, Ma On Shan and Tin Shui Wai were also tested. While the Ledge Point specimen was slightly dolomitic (3.23% MgO), it also contained large amounts of silica (21.06%) and significant amounts of sulphur (0.34%) through the presence of iron sulphides. Both the Ma On Shan and Tin Shui Wai specimens were found to be

limestones of high purity with CaO contents exceeding 56%.

The sequence of superficial deposits overlying the dolomitic limestones in Tolo Harbour was studied with the aid of sedimentological and palynological methods. A sequence of marine-terrestrial-marine-terrestrial-marine-terrestrial deposits overlying residual soil was identified. Based on dating carried out in other parts of Hong Kong, the karst surface is concluded to have been subaerially exposed prior to the Late Pleistocene.

REFERENCE

WONG K M & HO S (1986). Dolomitic limestone in Tolo Harbour. *Geological Society of Hong Kong Newsletter* Vol 4 No 4 p 20-23

HONG KONG POLYTECHNIC LIBRARY

The Hong Kong Polytechnic Library is probably the best in Hong Kong and offers readerships to non-members of the Polytechnic. Details can be obtained from M J Atherton. Current periodicals in geology include:

Doklady Akademii Nauk SSSR (English)
GSHK Newsletter
Journal of Geotechnical Engineering ASCE
Annals of the Geographical, Geological & Archaeological Society of Hong Kong
AGE Refdex
Journal of the Soil Mechanics and Foundations Division of ASCE
Environmental Geology and Water Sciences
Geophysical Prospecting for Petroleum (Chinese)
Geological Review (Chinese)
Oil and Gas Geology (Chinese)
Seismology and Geology (Chinese)
Geotechnical Engineering SEASE
Acta Geologica Sinica (Chinese)

Acta Stratigraphica Sinica (Chinese)
Scientia Geologica Sinica (Chinese)
Environmental Geology
AGE News
Journal of the Geotechnical Engineering Division ASCE
Geotechnique
Quarterly Journal of Engineering Geology GS London
Engineering Geology (Elsevier)
Geological Magazine (CUP)
Journal of the Geological Society of London
Bulletin of the Geological Society of America
GIU News

The Library contains 566 items (including AV materials and books) in geology. Readerships only allow books to be consulted in the Library, and do not allow books to be taken out of the Library.

ABSTRACT OF THESIS ENTITLED:

THE TECTONIC FRAMEWORK OF HONG KONG AND VICINITY AND ITS RELATIONSHIP TO REGIONAL SEISMICITY

Submitted by LEE Cho Min

for the degree of Master of Philosophy at the University of Hong Kong July 1990

ABSTRACT

The focal chapters of this dissertation are Chapters IV, V and VI.

Firstly, based on previous workers' data and the author's own field work, geological, structural and fracture maps on the scale of 1:200,000 have been compiled. A systematic classification has been established for fold structures and fracture structures of Hong Kong. Three major sets of fractures have been differentiated: an ENE-trending set, believed to be oldest and what may be called the backbone fractures, a NNE-trending set and a NNW-trending set. Features of these fracture sets such as mechanical properties of the component faults and their length and distribution are discussed.

The structural framework of the Hong Kong area is complex, with fractures predominant and fold structures of secondary importance. In terms of major regional faults, Hong Kong is situated on a block bounded by four major features: ENE-trending faults on the north and south and NNW-trending faults on the east and west. The whole of the Hong Kong block is affected by a well developed and intensive system of subsidiary faults. There are two principal ENE-trending fracture subzones, viz Shenzhen-Lo Wu and Tolo Channel-Lei Muk Shue, and three NNE-trending fracture subzones, viz Tuen Mun, Shatin-Lai Chi Kok, and Lantau Island. There are numerous prominent NNW-trending fractures, many of which extend into Shenzhen.

The relationship of these local structures with the regional structure is considered in detail, and their mechanism of formation is discussed. A dynamothermal metamorphic zone in Hong Kong is described, and there is a brief description of a ductile shear belt which has been the subject of a preliminary study.

A series of ductile shear belts can be seen extending from Castle Peak and Tai Lam Chung east-northeastward to Yuen Long, Mai Po and Sha Tau Kok, and across the border into

Shenzhen. The Castle Peak ductile shear belt is a high-strain shear belt. The dislocation laps and arrays are cut by straight, free dislocation lines, suggesting a low-temperature deformation with a high strain rate.

In conclusion, the author points out that Hong Kong is underlain by a relatively stable fault-block structure.

Secondary, this dissertation includes a description of the seismogeological features of the South China area and the South China Sea, discussing seismic distribution regularities and intensity, the relationship between the seismicity and the geology and especially the present-day fault activity, and the impact of regional earthquakes on Hong Kong. The earthquake triggering structures in this region are mainly NNW-trending fractures toward the west and ENE-trending in the middle, and both ENE- and NNW-trending fractures, as well as fractures trending NE, towards the east. There have been about 15 recorded earthquakes of magnitude estimated at 6 or more within 500 km of Hong Kong in the past 1,000 years, but only one within 250 km. Several felt earthquakes were recorded in Hong Kong. These had local intensities ranging between II and VI.

Finally, the distribution characteristics and regularities of microseisms in Hong Kong and their relation with the Hong Kong fracture structures have been studied in detail. Seismic activity in Hong Kong is at a low level. No earthquakes in excess of magnitude 3.86 have been recorded. All are in the form of microearthquakes with low frequency and shallow focal depth (5-10 km). These small quakes show a certain regularity in spatial alignment and are closely related to faults. They are largely distributed along six NNW- and six ENE-trending fractures, displaying an 'X'-type conjugate pattern of distribution. There are concentrations at some fault intersections. No evidence has been obtained to suggest any level of seismic activity significantly greater than those recorded in historical time, in the recent geological past.

GEOLOGICAL SOCIETY OF HONG KONG

ANNUAL GENERAL MEETING 1991-92

The Annual General Meeting of the Society, held on Tuesday 12 May 1992 in the Geology Laboratory of Hong Kong Polytechnic, was attended by 17 members.

MINUTES OF LAST MEETING

Accepted

CHAIRMAN'S REPORT - Dr R SHAW

This year is the tenth anniversary of the founding of the Geological Society of Hong Kong. We are entering our tenth year with a substantial membership and an interesting programme. I am confident that the Society is strongly placed to grow and flourish during its second decade.

Over the past year the Society has organised a range of events for both the active field geologist and the armchair exponent of the subject. Local field trips have visited Ping Chau (September 1991 and March 1992), Double Island (October 1991), Ma On Shan (January 1992) and Lamma Island (February 1992).

During November the Marine Studies Group visited the Second Marine Brigade in Guangzhou touring the facilities at their base on the first day and sailing down the Pearl River on board their research vessel on the second.

A ten day Christmas field trip to West Guangdong had a programme as varied and interesting as the weather; the party languished in hot dry and dusty conditions for the first few days only to be plunged into wet and record breaking near freezing temperatures towards the close.

In October 1991 the Society organised and hosted a four day conference on Seismicity in East Asia. The event was attended by 102 participants, from seven countries, who were regaled with two keynote addresses and 46 papers on various aspects of seismicity. A one

day site visit to Daya Bay rounded off the week. Papers from this conference are being edited and will soon appear as Bulletin No. 5 of the Society.

Members were informed and entertained by six locally-based speakers in the monthly series of geological talks. Study areas ranged from New Zealand to Scotland, and Guangdong to East Africa. The quarterly Newsletter of the Society still thrives in an expanded and more professionally produced format, although somewhat delayed by the dearth of contributions. Inflation has unfortunately taken its toll on the Society with an increase in annual membership fees to meet the rising costs of printing and postage of both the Newsletter and general circulars and announcements.

The programme for next year is already filling up, with a field trip to Ledge Point at the end of May, a Marine Studies Group Talk in June and a continuing series of monthly talks beginning next October. A landmark 17 day field trip to Tibet is planned for the summer and a Tenth Anniversary Seminar Series on the Stratigraphy of Hong Kong is being considered.

In conclusion I would like to thank all the members of the Society for their enthusiasm and continuing support throughout the past year, and over the preceding years. The committee are always open to advice about ways to change and improve the programme to tailor it more to the needs and wishes of members, so I urge individuals to come forward to offer talks, site visits, field trips and Newsletter articles, and to write in with constructive suggestions about the programme.

Continued →

From p 12

From a geological point of view, the author has come to the conclusion that no moderate-strong active fractures pass through the Hong Kong in the recent period. This is a weak seismic area with relatively minor seismic activities, and the

probability of major earthquake occurrence in Hong Kong is very small.

SMALL-SCALE GEOLOGICAL MAP OF HONG KONG

Hong Kong Geological Survey, Geotechnical Engineering Office

The Geological Survey recently produced an updated simplified geological map of the onshore areas of Hong Kong. The map was intended for use in publications produced by the GEO, and has already been used in the *Guide to Cavern Engineering, Geoguide 4*, published in March 1992.

This sketch geological map gives the broad distribution of the major rock types, and shows areas of extensive onshore Quaternary deposits as well as reclaimed land. The Geological

Survey can make publication-quality copies of this map available to anyone who would find it useful, either for publication or internal use.

If you would like a copy, please contact Dr I R Basham, Senior Geotechnical Engineer/Geological Survey, Planning Division, Geotechnical Engineering Office, Civil Engineering Building, 101 Princess Margaret Road, Homantin, Kowloon, HONG KONG (Tel: 762-5380, Fax: 714-0247).

From p 13

TREASURER'S REPORT - C M LEE

Statement of income and expenditure for the year ended 31 December 1991.

	Income HK\$	Expenditure HK\$
Subscriptions	20,095.27	-
Bank interest	9,246.31	-
Publications	5,166.56	58,843.03 ¹
Conferences	84,732.06	60,400.49 ²
Local trips	6,630.00	5,280.00
China trips	55,637.00	53,308.00
Stamps, etc	199.09	6,359.45
Visit by GSGD	-	20,877.00
Total	181,706.29	205,067.97
Excess expenditure		23,361.97

Accumulated funds HK\$

	31.12.90	31.12.91	Income 1991
134,521.23	Bank deposit	143,767.54	9,246.31
84,617.50	Bank current	46,806.85	-37,810.65
808.72	Petty cash	6,011.09	5,202.37
219,947.45		196,585.48	-23,361.97

¹ \$37,350.00 of which is payment for Karst Bulletin

² Balance to be used for Seismicity Bulletin publication

A proposal to accept the Treasurer's report was made by M J Atherton, seconded by S H L Law and accepted unanimously.

EDITOR'S REPORT

In the absence of the Editor, Dr Shaw reported on the excellent improvements made to the Newsletter over the past year.

There followed some discussion on whether to upgrade the Newsletter either Magazine or Journal status, but it was resolved to continue

with a Newsletter approach at this time and to incorporate additional improvements proposed by the Editor, Dr Langford.

ELECTION OF EXECUTIVE AND GENERAL COMMITTEE

The following were elected unopposed to the Executive Committee:

Chairman	R Shaw (Geotechnical Engng Office)
Vice Chairman	C M Lee (H K Polytechnic)
Treasurer	K M Wong (Watson Hawksley)
Secretary	R J Neller (Chinese University)
Editor	R L Langford (GEO)
Membership	S T Gilbert (GEO)

Additional persons elected to the General Committee were:

M J Atherton (HK Polytechnic)
M Chan (Acer Consultants)
S H L Law (Education Dept)
R W Owen (HK Baptist College)
C H Tan
D R Workman (HK University)

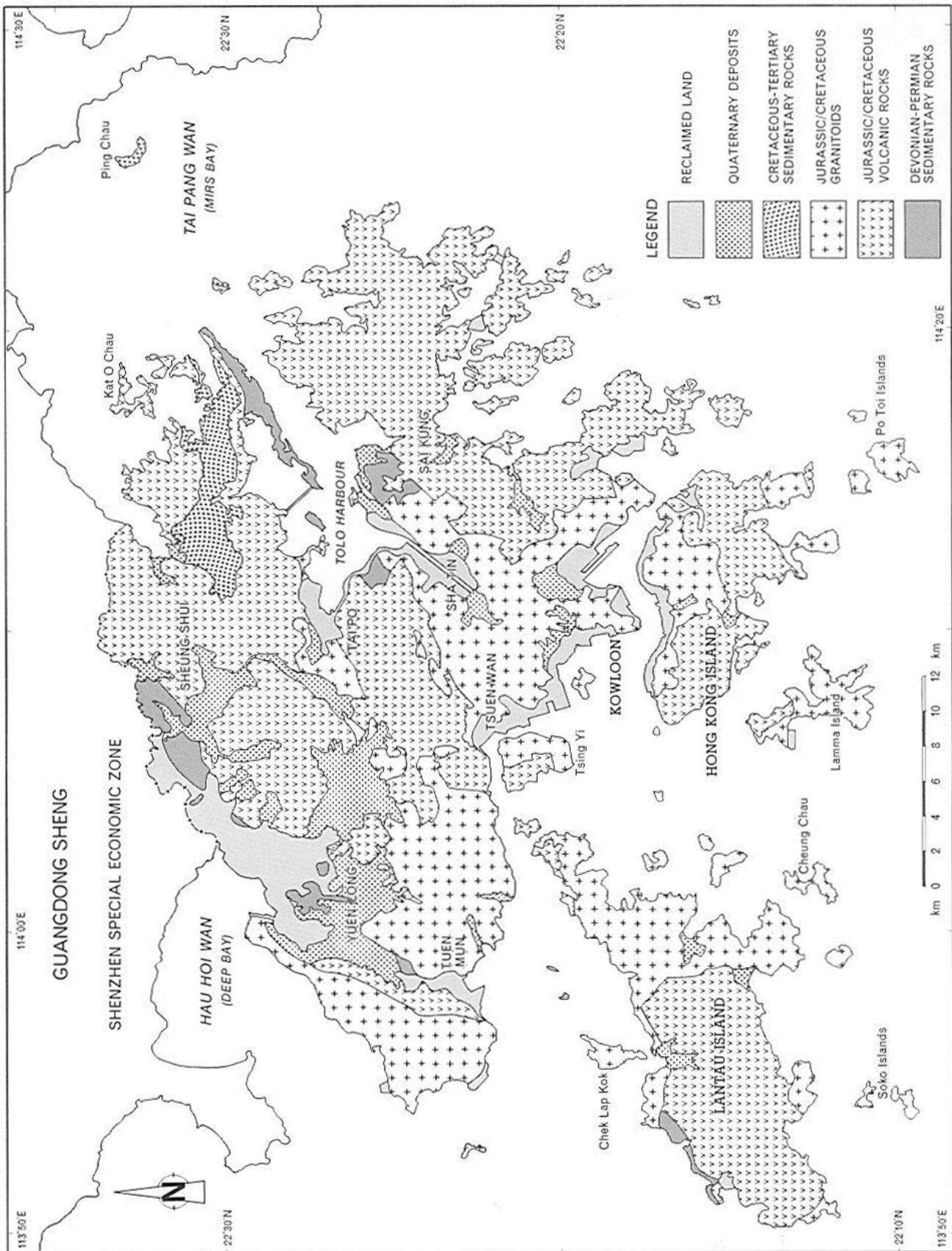
OTHER BUSINESS

The appointment of an Honorary Auditor was discussed.

POST-MEETING ENTERTAINMENT

The meeting was followed with short illustrated talks by M J Atherton (Philippine earthquakes), R Shaw (volcanic landforms in Hawaii) and R W Owen (British Columbian lakes)

After the talks the group retired for a meal at the Hong Kong Polytechnic Staff Club.



January 1992

ACKNOWLEDGMENT
 This map is reproduced with the permission of the Director of Civil Engineering, Hong Kong Government.

Hong Kong Geological Survey, Geotechnical Engineering Office

NOTICES

LANDPLAN IV

INTERNATIONAL CONFERENCE ON GEOSCIENCE IN URBAN DEVELOPMENT. AGID IAEG INQUA LANDPLAN IV, BEIJING, 11-15 AUGUST 1993

Urbanization is one of the most dominant aspects of human activity and social development. There is a series of problems connected with the rapid concentration of population and large scale urban reconstruction. A number of world megacities are faced with serious environmental deterioration and risk of disasters. In addition, in many cities the residential, recreational and urban areas are to be expanded. The reconstruction of a large number of cities is needed to improve systems of transport, water supply and waste disposal. Systematic and detailed geoscience study may play an essential part in the reconstruction of old cities and the development of new towns by providing a scientific basis for planning and reconstruction.

The main objective of the proposed International Conference is to offer an opportunity to meet geoscientists, engineering geologists, geotechnical and civil engineers working in the field of urbanization, focusing on the integrated consideration of geohazards, geo-environment and geotechnical conditions for urban planning and development.

POST-CONFERENCE TOURS

There are seven post-conference tours including ten major Chinese cities. Visits to construction and geo-environmental sites will be organized. The preliminary estimate for the post-conference tour is about US\$600-800.

EXHIBITION

As part of the conference there will be an exhibition of environmental maps of world megacities and systems of software used in landplan evaluation. In addition there will be a display of instrumentation for urban environmental management and equipment for geotechnical investigation.

SOCIAL PROGRAMME

A social programme will be organized for accompanying members, including visits to sites of historic interest and Chinese ancient cultural and scenic spots in Beijing.

DEADLINES

Abstract submission 31 July 1992
Notice of acceptance 31 August 1992
Full paper submission 31 December 1992
Conference 11-15 August 1993

CORRESPONDENCE

Prof Wang Sijing
Chairman LANDPLAN IV
Institute of Geology, Academia Sinica
PO Box 634, Beijing
China 100029
Tel: 86-1-2027766, Fax: 86-1-4919140

THE INTERNATIONAL CONFERENCE ON SOFT SOIL ENGINEERING

DONG FANG HOTEL, GUANGZHOU, 8-11 NOVEMBER 1993

The International Conference on Soft Soil Engineering (ICSSE) aims to promote the exchange of ideas and experiences, and to consolidate recent advances in soft soil engineering among engineers and scientists in the field.

TOPICS

Engineering properties of soft soil
Numerical methods
Constitutive relationships
Deep excavation
Stability of slopes and embankments
Deep and shallow foundations
Centrifugal and other models
Improvement of soft soil
Tall buildings on soft soil
Field monitoring and *in situ* measurements
Reclamation
Offshore engineering

CALL FOR PAPERS

Papers in the above or related fields are invited immediately, and prospective authors should submit a one or two page abstract to the Secretariat not later than 30 November 1992.

Please contact Dr Y Tsui, Secretary, The International Conference on Soft Soil Engineering (ICSSE), c/o Department of Civil and Structural Engineering, University of Hong Kong, HONG KONG

NOTICES

GUANGDONG GEOLOGY

Guangdong Geology is published quarterly by the Bureau of Geology and Mineral Resources of Guangdong Province. It covers important developments in earth sciences in the Guangdong region, a highly open area of China, and is distributed worldwide in March, June, September and December.

The subscription price for 1993 (Volume 8) is US\$25.00 (HK\$100), and for two years is US\$48.00 (HK\$200) inclusive of postage anywhere in China. Information on bulk subscriptions and back issues is available on request. Please contact C M Lee (Tel: 766-6039, Fax: 764-3374) at Hong Kong Polytechnic for an order form.

4TH MULTIDISCIPLINARY CONFERENCE ON SINKHOLES AND THE ENGINEERING AND ENVIRONMENTAL IMPACTS OF KARST

PANAMA CITY, FLORIDA, 25-27
JANUARY 1993

This highly successful conference brings together engineers, geologists, geographers, hydrologists, planners and other environmental specialists from all over the world to share their practical experience solving the unique engineering and environmental problems in karst terranes.

Papers are invited on all subjects related to applied karst geology and hydrology, but are particularly encouraged in the engineering field. All authors will be expected to present a 20 minute talk and a written manuscript for publication in a professionally published proceedings volume.

Abstract deadline 15 June 1992
Manuscript deadline 15 September 1992

For further information contact Dr Barry F Beck, Florida Sinkhole Research Institute, Research Building Alpha, University of Central Florida (Tel: 407-823-5645)

ACADEMIC ACHIEVEMENT - LEE Cho Min



C M Lee was recently awarded the degree of Master of Philosophy (MPhil) by the University of Hong Kong for his thesis *The tectonic framework of Hong Kong and vicinity in relationship to regional seismicity*.

Mr Lee spent 6 years on his research, and his work is a valuable contribution to our knowledge of the seismicity of southern China.

He will be presented to the Chancellor for conferment of his degree at the University Degree Congregation to be held in November or December 1992.

BOOK REVIEW

LONGMAN ENGLISH-CHINESE ILLUSTRATED DICTIONARY OF GEOLOGY

ISBN 962 359 362 7 (Hong Kong Edition),
1992, 198 pp

All the basic principles of geology are explained in this fully illustrated dictionary in which words are grouped by topic, and which has useful appendices and an easy-to-use index.

This is an ideal book for sixth formers, first year undergraduate and for anyone who needs a better understanding of geological terminology. It contains 350 colour illustrations and over 1,500 definitions.

This special Hong Kong edition was translated from English by Lee Cho Min of Hong Kong Polytechnic.

THIRD ANNUAL FRIDAY LECTURE SERIES 1992/1993

This is the third annual programme of slide illustrated lectures on geological topics from around the world. The variety of subjects and countries reflects the wide range of experience

and expertise resident in Hong Kong. You are encouraged to come along and avail yourself of this distilled knowledge, and to meet Hong Kong's community of geologists.

9 October 1992
URANIUM IN THE OLD RED SANDSTONE
OF NORTHERN SCOTLAND
Ian Basham
Hong Kong Geological Survey

12 February 1993
THE QUATERNARY GEOLOGY OF THE
NORTH CHINA LOESS PLAIN
Raynor Shaw
Geotechnical Engineering Office

20 November 1992
SALINE LAKES IN BRITISH COLUMBIA
Bernie Owen
Hong Kong Baptist College

12 March 1993
VOLCANOES IN INDONESIA
Lee Cho Min
Hong Kong Polytechnic

11 December 1992
THE CONTINENTAL SHELF OF SCOT-
LAND - A NEOLITHIC PERSPECTIVE
Alan Fyfe
Hong Kong Geological Survey

14 May 1993
ANNUAL GENERAL MEETING
To round off the series, members are invited to bring 10-20 slides on any geological subject from anywhere in the world. Presentations will follow the business of the AGM.

15 January 1993
THE EFFECTS OF SLOPE STABILITY ON
MINING DEVELOPMENT IN PAPUA-NEW
GUINEA
Jonathan King
Geotechnical Engineering Office

All the talks will be held in the Seven Seas Lounge, Mariner's Club, Tsim Sha Tsui, from 6 to 7.30 pm. After the meeting there is the option to retire to the bar or a local restaurant.

1993 FIELD TRIP PROGRAMME

The following basic programme for 1993 is an attempt to introduce regularity and predictability into our trips.

We intend to issue fliers about three weeks before each event, and may slot in extras or make changes.

However, please put these dates in your diary, and look out for future announcements.

Saturday 30 January South Lamma (1/2-2/3 day, public ferry)
Saturday 27 February Shenzhen
Saturday 27 March Bride's Pool (hired bus)

Saturday 24 April A site visit (to be announced)
Sunday 30 May Fan Lau (public ferry and kaido/sampan)
Sunday 27 June Ap Chau/Sai Ap Chau/Ledge Point, including beach stop at Tung Wan, Double Island (hired boat)
Sunday 26 September Port Island (hired boat)
Sunday 31 October Ping Chau (hired boat)
Saturday 27 November Nam Chung (Starling Inlet)-Kwai Tau Leng (hired bus)

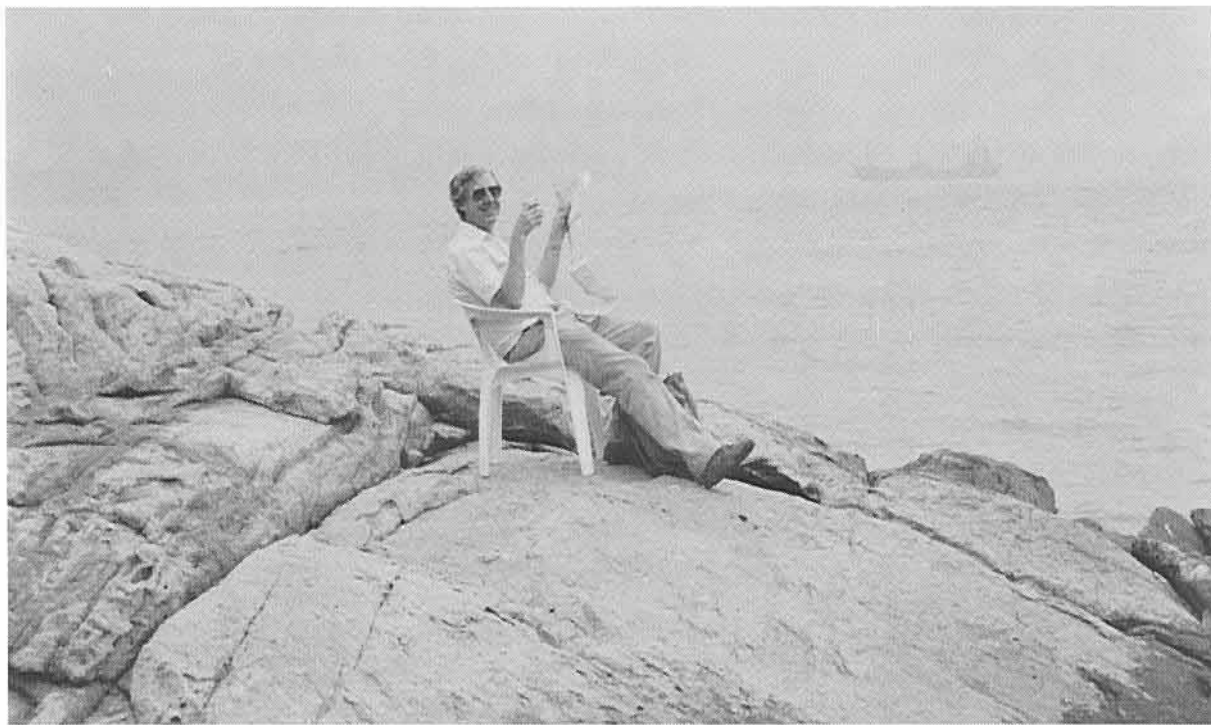
DO YOU HAVE A BETTER PHOTOGRAPH OF A FIELD GEOLOGIST AT WORK?

Poul Jens STRANGE left Hong Kong in June 1991 after 8 years with the Geological Survey to rejoin the British Geological Survey, Nottingham. A search through the extensive field photograph archives of over 5,000 colour slides held by the Hong Kong Geological Survey unearthed this excellent example of the field geologist at work.

Those not familiar with the polluted state of Hong Kong waters may not realize that Poul did not take the chair with him, but in typical field geologist's style made the best of available resources.

If any readers have interesting or amusing photographs with a geological theme we would like to reproduce them in forthcoming issues of the Newsletter.

Please send slides or prints to *The Editor, Geological Society of Hong Kong, c/o Hong Kong Geological Survey, Civil Engineering Building 11/F, 101 Princess Margaret Road, Homantin, Kowloon.*



TENTH ANNIVERSARY PUBLICATIONS

The General Committee are planning two special publications to commemorate the tenth anniversary of the Society; one on the stratigraphy of Hong Kong and the second as a field guide to the geology of Hong Kong.

Invited papers on the stratigraphy of Hong Kong will be delivered at a series of seminars and then published as a Bulletin of the Society. The publication will include written contributions as well as presented papers, and will also record the main points of discussion or contention at each of the topic sessions.

A field guide to the geology of Hong Kong is to be compiled as a special publication. It has long been realized that there is no concise and definitive guide to type sites and interesting exposures for the layman, student, professional or visiting geologist. The planned publication will remedy this deficiency, and it is expected to be marketed widely through retail outlets in Hong Kong.

EPHEMERA

Schofield's field notes - The Brothers, 15 December 1921

Schofield's notes on Chek Lap Kok were published in Vol 9 No 3 p 52, primarily because the island was scheduled to be demolished to make way for the new airport. The next islands to disappear are the Brothers, a few kilometres east of Chek Lap Kok. Schofield visited East Brother, West Brother and Reef Island late in

1921. Unfortunately, his notes are not as clearly understood as his later notes on Chek Lap Kok, so some of the cryptic abbreviations and grammatical omissions have been improved. His observation of a basic dyke is particularly interesting.

The Brothers 15-12-21

East Brother. Dip 78° E. of S., angle of 45° . Rock mostly massive sandstone; occasional beds of hard quartzite. Dip taken at N. point. Rock on W. shore nearly all well laminated. Many joints run E-W across N. end of islet: the specimen showing quartz & a black mineral shows what they are like. Specimens: 1 sp. & 1 chip massive-bedded sandstone, E. side, about middle: veined sandstone (joints), 2 pieces, N.E. shore: 1 chip hard quartzite E. side: 1 sp. laminated quartzite, N.W. shore.

West Brother. N.E. side of island: no bedding visible but hard ridges run NW-SE across bay. S. of E. point of West Brother is a dyke of fine-grained basic rock, seen principally as a narrow trench in sandstone, 1'3" wide & fading 75° S.W. One or two fragments of the dyke remain as a yellow clayey substance. The yellow is bright rusty, almost orange. No unrotted phenocrysts visible. Direction of dyke is 60° E of S. 1 sp. hard sandstone taken at X, with two chips.

Reef Is. S. end shows very coarse sandstone (quartzite), like a fine breccia, exceedingly hard if fresh, dips 20° or 25° E of N. Beds thick, 4 or 5 spp. taken. All pebbles seen are quartz. Island is a dumbbell at low water, as shown on map.

1 sp., 1 chip black quartzite, 2 spp. white quartzite (1 weathered) got at S. end of island. Collection of quartz pebbles from S. side of N. end.

GEOLOGICAL SOCIETY OF HONG KONG PUBLICATIONS

- Bulletin* No 1 (1984). Geology of surficial deposits in Hong Kong, 177 p.
YIM W W S (Editor)
- Bulletin* No 2 (1985). Geological aspects of site investigation, 236 p.
McFEAT-SMITH I (Editor)
- Bulletin* No 3 (1987). The role of geology in urban planning, 601 p.
WHITESIDE P G D (Editor)
- Bulletin* No 4 (1990). Karst geology in Hong Kong, 239 p.
LANGFORD R L, HANSEN A & SHAW R (Editors)
- Marine geology of Hong Kong and the Pearl River mouth* (1985), 96 p.
WHITESIDE P G D & ARTHURTON R S (Editors)
- Marine sand and gravel resources of Hong Kong* (1988), 221 p.
WHITESIDE P G D & WRAGGE-MORLEY N (Editors)
- Abstracts* No 1 (1983). Abstracts of papers presented at the meeting on "Geology of surficial deposits", September 1983, 79 p
- Abstracts* No 2 (1984). Abstracts of papers presented at the conference on "Geological aspects of site investigation", December 1984, 50 p
- Abstracts* No 3 (1986). Abstracts of papers presented a meeting on "Sea-level changes in Hong Kong during the last 40 000 years", May 1986, 51 p
- Abstracts* No 4 (1986). Abstracts of papers presented at the conference on "The role of geology in urban development", December 1986, 65 p
- Abstracts* No 5 (1988). Abstracts/Extended Abstracts of six papers presented at a meeting on "Future sea-level rise and coastal development", April 1988, 79 p
- Abstracts* No 6 (1990). Abstracts of papers presented at the conference on "Karst geology in Hong Kong", January 1990, 58 p
- Abstracts* No 7 (1991). Abstracts of papers presented at the international conference on "Seismicity in Eastern Asia", October 1991, 63 p
- Abstracts* No 8 (1992). The logging and interpretation of transported soils in offshore boreholes. Proceedings of a workshop organized by the Geological Society of Hong Kong and the University of Hong Kong, June 1992, 78 p

Newsletter

Vol 1 (7 issues) 1982-3	Vol 2 (6 issues) 1984	Vol 3 (6 issues) 1985
Vol 4 (4 issues) 1986	Vol 5 (4 issues) 1987	Vol 6 (1 issue) 1988
Vol 7 (4 issues) 1989	Vol 8 (4 issues) 1990	Vol 9 (4 issues) 1991
Vol 10 (2 issues) 1992		

Prices (including postage in Hong Kong):

Bulletin No 1	\$40 (\$60)	Newsletter, single issue	
Bulletin No 2	\$50 (\$70)	Vols 1-3	\$10 (\$20)
Bulletin No 3	\$100 (\$120)	Vols 4-6	\$20 (\$30)
Bulletin No 4	\$150 (\$180)	Vols 7-8	\$25 (\$40)
Marine geology..	\$30 (\$50)	Vols 9-10	\$30 (\$50)
Marine sand & gravel..	\$100 (\$120)		
Abstracts No 2	\$10 (\$20)		
Abstracts No 3	\$15 (\$30)		
Abstracts Nos 4-6	\$20 (\$40)		
Abstracts No 7	\$30 (\$50)		
Abstracts No 8	\$40 (\$50)		

Prices may increase without notice. Prices in parentheses are for non-members. Some publications may be temporarily out of stock. All prices and subscription include surface postage.

Annual Society subscription: \$150 (Students \$50)

Cover photograph: West Brother island from the south. A Pleistocene alluvial fan forms the southern part of the island, behind which can be seen the grey graphite spoil heaps of the old mine. Tsing Shan and Tuen Mun New Town are in the background. Photograph courtesy of Dr R L Langford (July 1988).

Publications are available from:

The Secretary
Geological Society of Hong Kong
c/o Department of Geography and Geology
University of Hong Kong
Pokfulam Road
HONG KONG

ISSN 1010-335X