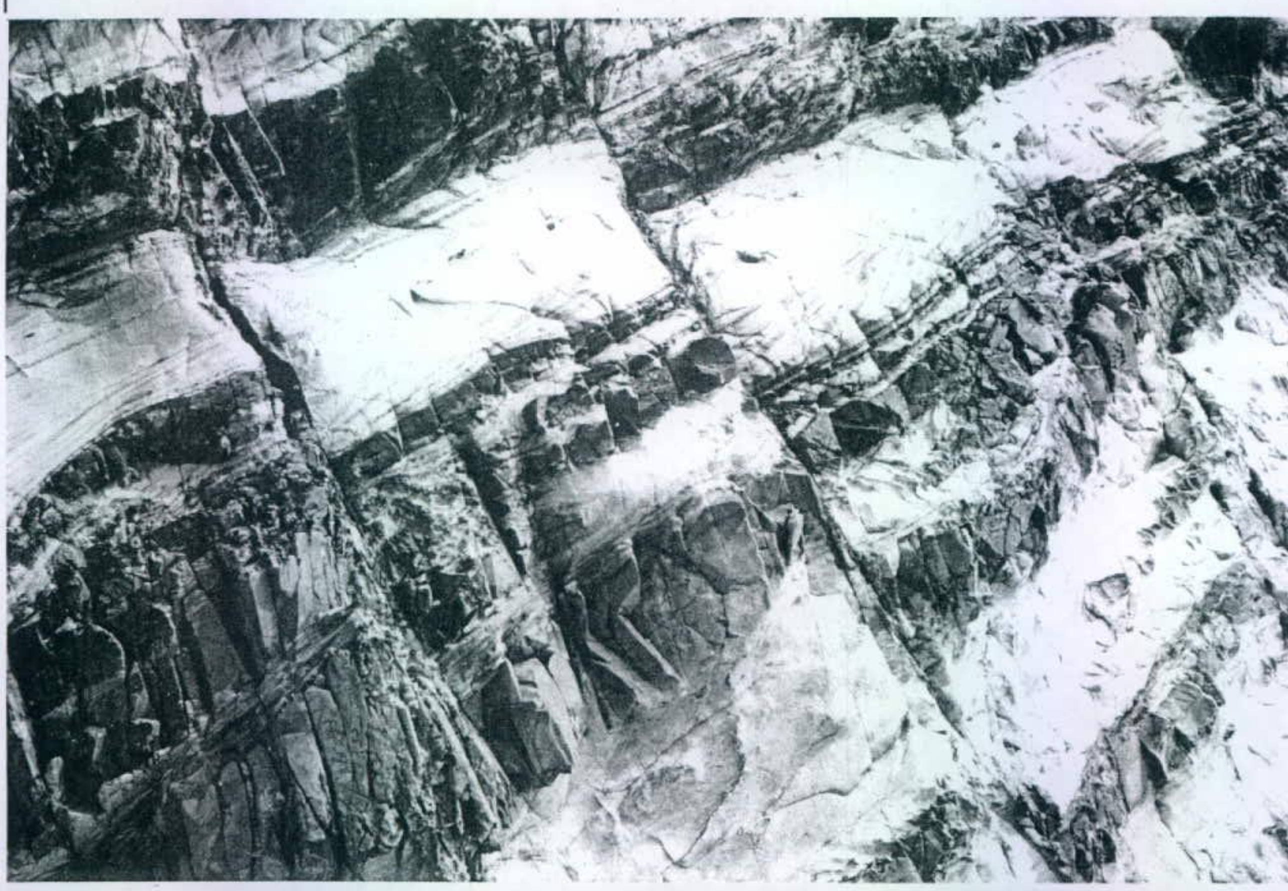
geological society of hong kong

NEWSLETTER

C H Tam
6-6-86

CONTENTS

Vol. 4 No. 1 March 1986



GEOLOGICAL SOCIETY OF HONG KONG

NOTES FOR THE GUIDANCE OF CONTRIBUTORS TO THE NEWSLETTER

General : Typescripts, enquiries and all correspondence should be addressed to the Secretary, Geological Society of Hong Kong, c/o Dept. of Geography and Geology, University of Hong Kong. The Society does not assume copyright of material published in the Newsletter. Any other previous, current or expected future use of such material by the author must be stated at the time of submission.

Articles of a technical nature, as well as reports of interesting events, reviews and other topical items are welcome. Contributions must be short. 1,200 words is regarded as the normal acceptable length, although exceptions may be made at the discretion of the Society. Figures, tables and half-tone plates must be kept to a minimum and must all be on separate sheets.

Typescripts must be accurate and in their final form. Two complete copies should be sent to the Secretary. Typescripts should be double-spaced, including references, on one side of the paper only with a 2.5 cm margin on each side. A4 paper is preferred. All pages should bear the author's name and be numbered serially.

Send only photocopies of illustrations, retaining the originals until the Society asks for them. Originals should bear the author's name. Diagrams should be in black on tracing material or smooth white paper or board with a line weight and lettering suitable for reduction. A metric scale should be included, and north point (or where relevant, coordinates of latitude and longitude) on all maps.

References : The author is responsible for ensuring that the references are correct and that Journal abbreviations comply with those in the List of Serial Publications held in the Library of the Geological Society of London (Geological Society, 1978).

Offprints : The society does not provide authors with free offprints of items published in the Newsletter, but will obtain quotations on behalf of authors of technical articles who may which to purchase offprints from the printer.

Cover Photo : Faulted sequence of cross-bedded tuffaceous sands and chert-like fine ash tuffs in the Repulse Bay Formation at Lai Chi Chong, Tolo Channel. (Scale x 0.15)

POLYGONAL JOINTING NEAR THE MARGIN OF THE HONG KONG GRANITE

P.G.D. Whiteside, Scott Wilson Kirkpatrick & Partners

INTRODUCTION

In the various rocks throughout Hong Kong one can find examples of most types of joints. Particularly prevalent are tectonic joints related to the regional structure and, in the granitic rocks, joints parallel to and normal to the local igneous contact. These joints in the granite are usually taken to reflect stress changes related to the cooling of the pluton (Gamon and Finn, 1984).

Hills (1972) discusses joints parallel to the plutonic contact and notes that they can be related to flow direction of the magma and also be formed as a secondary feature due to stress relief resulting from erosion of overburden. When of the latter, secondary type they are called sheeting joints.

In two localities in Hong Kong, both near the granite contact, a development of polygonal jointing with the axis of the polygons at right angles to the contact, have been observed.

These joints which are akin to columnar jointing are probably related to the stress changes associated with the cooling of the granite.

LOCALITY A

Figure 1 shows the position of Locality A near Tsuen Wan, HK Grid Ref. 830215E 824645N. The rock outcropping is equigranular medium grained granite with localised areas of fine grained granite; in addition there are thin basalt and feldsparphyric rhyolite dykes. This locality lies on the 1:20,000 Hong Kong Geological Survey Sheet 7 (Shatin) on which this pattern of outcrops can be seen in the broader context of the area. (Dr. R. Addison, written communication, April 1986).

It can be inferred from the published 1:50,000 geological map (Allen and Stephens, 1971) that the general granite contact in this area probably dips gently to the south-west or west and, before erosion, was perhaps only a few hundred metres above Locality A.

The pattern of jointing in the granite is quite consistent. This pattern is illustrated in Figure 2 which shows an equal area density plot of the results of a joint survey. The joint measurements were made in the general area of Locality A on all varieties of granite but particular attention was paid to the outcrops of fine grained granite at Locality A (Plates 1 and 2). The contours indicate the centres of concentrations. They do not show relative frequency of occurrence. The intensity of some concentrations reflects the fact that the joints of some orientations were more obvious in the field and so more readings were taken.

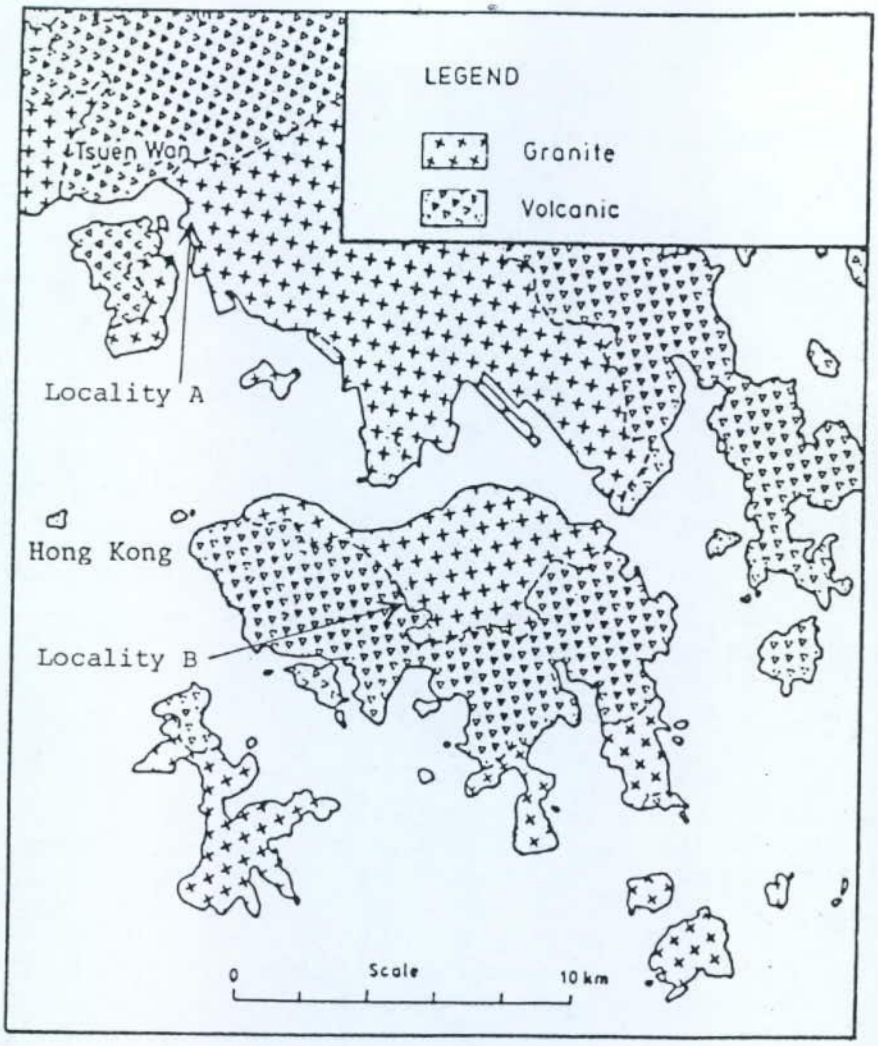


Fig. 1 Plan showing Localities A and B.
(After Allen & Stephens, 1971)

There are three main types of joint present :

Polygonal Tension Joints

Poles to these near vertical joints lie on a great circle as shown in Figure 2. Joint poles are not evenly distributed around this circle but are apparently grouped at intervals of about 30 degrees. Within the medium grained granite there are usually two main directions developed while in the fine grained granite there are three or more. Those in the fine grained granite form near vertical polygonal columns (Plates 1 and 2).

These joints are generally smooth, planar, persistent parallel to the polygon axis and, on a scale visible with a hand lens, they show no signs of having suffered shear movement. For this reason and because in the fine grained granite especially, simultaneous formation of three directions of shear joint is unlikely, these joints are taken to have formed as a result of tensile stresses. Joint spacing is typically 200 to 400 mm.

Joints Subparallel To Granite Contact

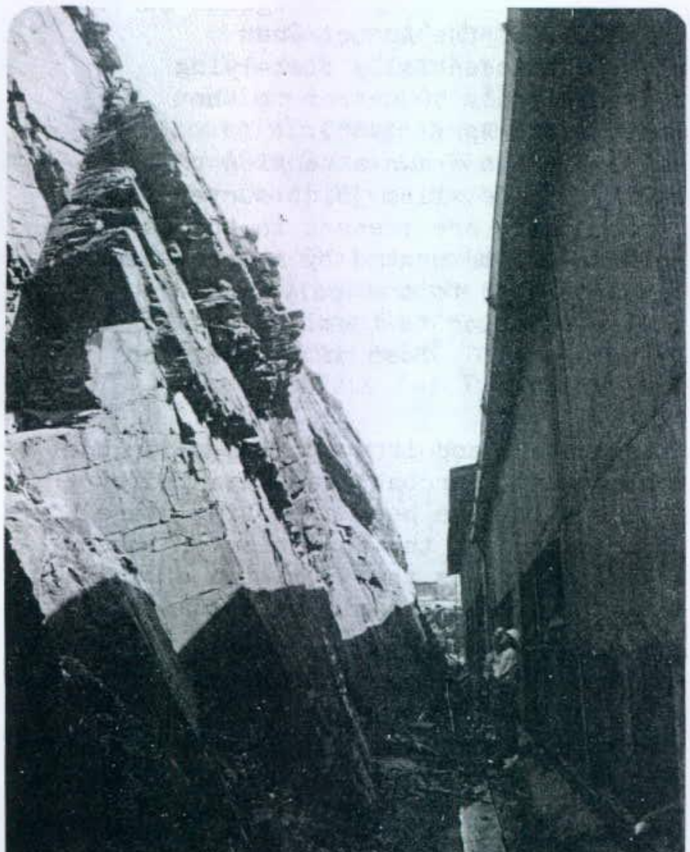
These gently dipping, smooth, planar but not very persistent joints can be seen to be consistently but not strongly developed. The surfaces of these joints also indicate that they are probably tension joints. They are commonly spaced between 50 and 500 mm and in Hong Kong might tend to be called sheeting joints even although in this locality they are apparently primary joints. Of particular interest is the fact that, as shown on Figure 2, they are essentially normal to the axes of the polygonal columns.

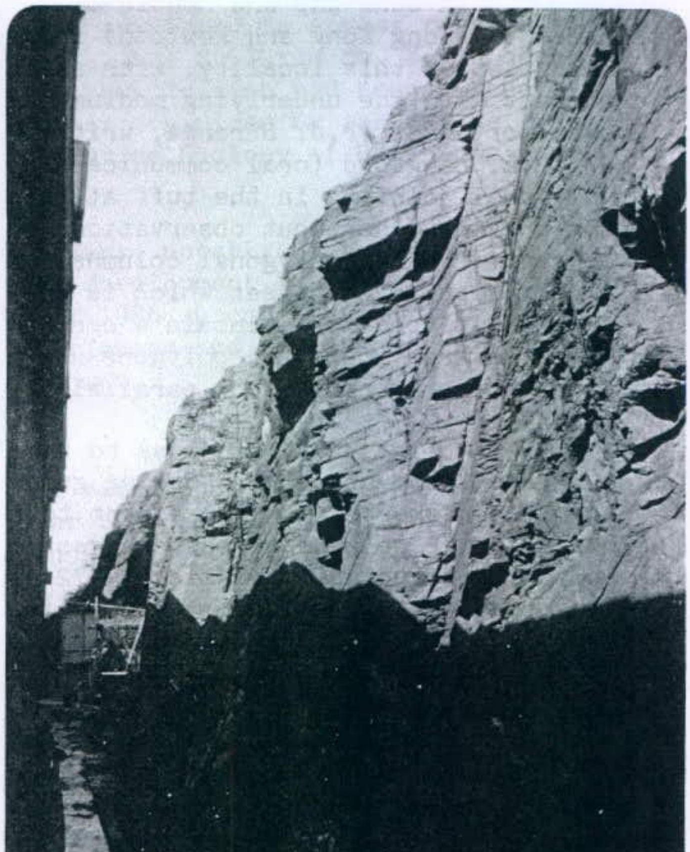
Later Shear Joints

These joints are thought to be a later development because they are different in character to those already described and because locally they appear to displace the other tension joints. These joints usually consist of a concentration of many closely spaced shear planes giving an overall "joint thickness" of 50-100 mm. They are developed on a 2 to 5 metre spacing, are very persistent - commonly for 10-20 metres - and usually have thin coatings of clay grade material. They are best seen in the rock face at HK Grid 830260E 824700N.

Other Joints And Faults

There exist throughout the area minor faults and local, usually impersistent developments of joints whose orientation lies outside the major groupings already discussed.





Plates 1 & 2 Polygonal jointing in fine grained granite, Locality A.

Discussion

From the nature of the joint surfaces and from their consistently maintained mutual orientation it seems likely that the polygonal tension joints and the joints subparallel to the granite contact represent a single period of joint development possibly associated with the cooling phase of the granite.

The similarity between this development and that of the well known columnar, cooling related, jointing found typically in basaltic sills is clearly to be remarked on. As Hills points out (1972 p. 374) the presence of such cooling joints in plutonic rock is however uncertain. Nevertheless the polygonal as opposed to rectangular nature does argue in favour of them being primary, cooling related columnar jointing. The more obviously polygonal development in the fine grained granite is perhaps not unexpected since it is commonly observed that joints in a particular lithology are often more intensely developed in fine grained units than in adjacent coarser units of the same lithology. (The fine grained granite was probably emplaced slightly later than the medium grained at a time when the cooling process had already started - hence its smaller grain size. This is also a possible contributory factor.)

LOCALITY B

Figure 1 shows the position of Locality B, approximate HK Grid Ref. 8363E 8139N, (the rock exposures near the highest point of 'Black's Link' between Wan Chai Gap and Middle Gap). The 1:20,000 Hong Kong Geological Survey Sheet 11 (Hong Kong and Kowloon) shows vitric tuff of the Ap Lei Chau Formation at this locality, with an irregular, but essentially flat-lying contact with the underlying medium grained granite only 50 metres to the east-northeast (P.J. Strange, written communication, April 1986). Dr. R.L. Langford (oral communication, April 1986) has drawn attention to the polygonal jointing in the tuff at this Locality. A detailed joint survey is not presented here but observations show that joints are present in the form of near-vertical polygonal columns. The columns are truncated by a persistent gently dipping joint set which is apparently unrelated to the polygons in that it does not maintain a constant angular relation to them. Plate 3 shows an area where the polygons are nearly hexagonal. Most of the polygon faces are only persistent parallel to the column axes.

This tuff is close to the granite contact and it must have undergone a marked temperature rise during granite emplacement - probably accompanied by thermal metamorphism. Subsequent to this there will have been a cooling stage during which related stress changes possibly resulted in the formation of these polygonal structures. Hills (1972 pp.111-112) discusses the formation of this type of jointing (which he terms prismatic) and shows an example of rectangular columns produced in sandstone near the contact with a basalt sill (Plate 4).

CONCLUSIONS

As Price points out (1966 pp.159-160) in his discussion on the release of strain energy by the formation of tensile fractures it is only under conditions of complete isotropy that one would expect the ideal hexagonal development of joints to appear. In Localities A and B lithological and structural variations seem to have resulted in the development of irregular polygonal columns. Nevertheless these columns which are orientated with their axes normal to the local cooling surface appear to be related to the stress changes accompanying cooling.

DRAFT

MINUTES OF THE ANNUAL GENERAL MEETING OF THE GEOLOGICAL SOCIETY OF HONG KONG, 1986

1. The Geological Society of Hong Kong held its Fourth Annual General Meeting at Hong Kong University on Thursday 8 May 1986. Twenty one members attended. Apologies were received from C. Dutton and P. Whiteside.

2. The Chairman of the society, Dr A.D. Burnett, chaired the meeting. The meeting was called to order at 5.45 p.m.

3. The minutes of the Annual Meeting of 20 May 1985 were adopted.

4. Chairman's report

   The Chairman reported on progress during the year since the A.G.M. held on 20 May 1985, including the programme of 15 general technical sessions and field meetings of the Society (not counting those mentioned below) and those of the Marine Studies Group and Teacher's Group. Among highlights, the Third Joint Annual Meeting with the Geotechnical Group of the Hong Kong Engineers, in April 1986, and the continuing strength of links with the Geotechnical Group were noted. Also of note were the growing ties with geologists in Guangzhou and Shenzhen, with reciprocal visits taking place during the year, and the excursion to Guilin in October 1985.

   It was noted that the Newsletter had continued to appear regularly at 2-month intervals throughout the year, that Bulletin No. 2 had been published in mid-1985 and that a special publication had been issued containing papers presented at the seminar organized by the Marine Studies Group in September 1985 on the Marine Geology of Hong Kong and the Pearl River Mouth.

   The Chairman also outlined future plans, notably progress on the regional conference on geology in urban development in East and Southeast Asia in Hong Kong to be held in December 1986 in cooperation with Unesco, the International Union of Geological Sciences and the Association of Geoscientists for International Development.

5. Treasurer's report

   The Treasurer reported on the financial situation at 31.12.85, noting a net decline in the society's assets over the calendar year of $3,094.70, to $113,160.30. Adequate funds were in hand to cover expenditures in the current calendar year.

   R. Langford asked whether there was any reason why none of the Stephen Hui donation has been spent. The Chairman replied that so far the Committee had not identified any justifiable reason to use any of this capital sum, bearing in mind it was income-generating (admittedly now at very low rates of interest) and provided a fund which the society could draw on when advance funding was needed, e.g. in planning conferences or issuing publications against subsequent reimbursement by means of fees or sales.

6. Membership

The Secretary reported the following:-

	Honorary	Resident	Overseas	Student	Total
Membership at 20.5.85	9	234	10	16	269
Membership at 31.12.85	9	268	15	19	311
Membership at 8.5.86	9	219	16	6	250

No active recruitment of student members had been undertaken in 1985. All members had been reminded, up to three times, via the newsletter and circulars, to renew their subscriptions for 1986, but rather a large number had not done so. The number of formal resignations was 1. The fall in membership since 31.12.85 reflects mainly the large number of resident members (64) who had not renewed their subscriptions (61 the year before) and a smaller number of newly-elected members than in the equivalent period last year. The number would gradually increase again through the year.

7. General Committee for 1986-87

The Secretary reported that no nominations had been received other than those of the nominations committee. This meant that a ballot was not required. The General Committee of the Society for 1986-87, to take office upon adjournment of the Annual General Meeting, was declared to be as followed:-

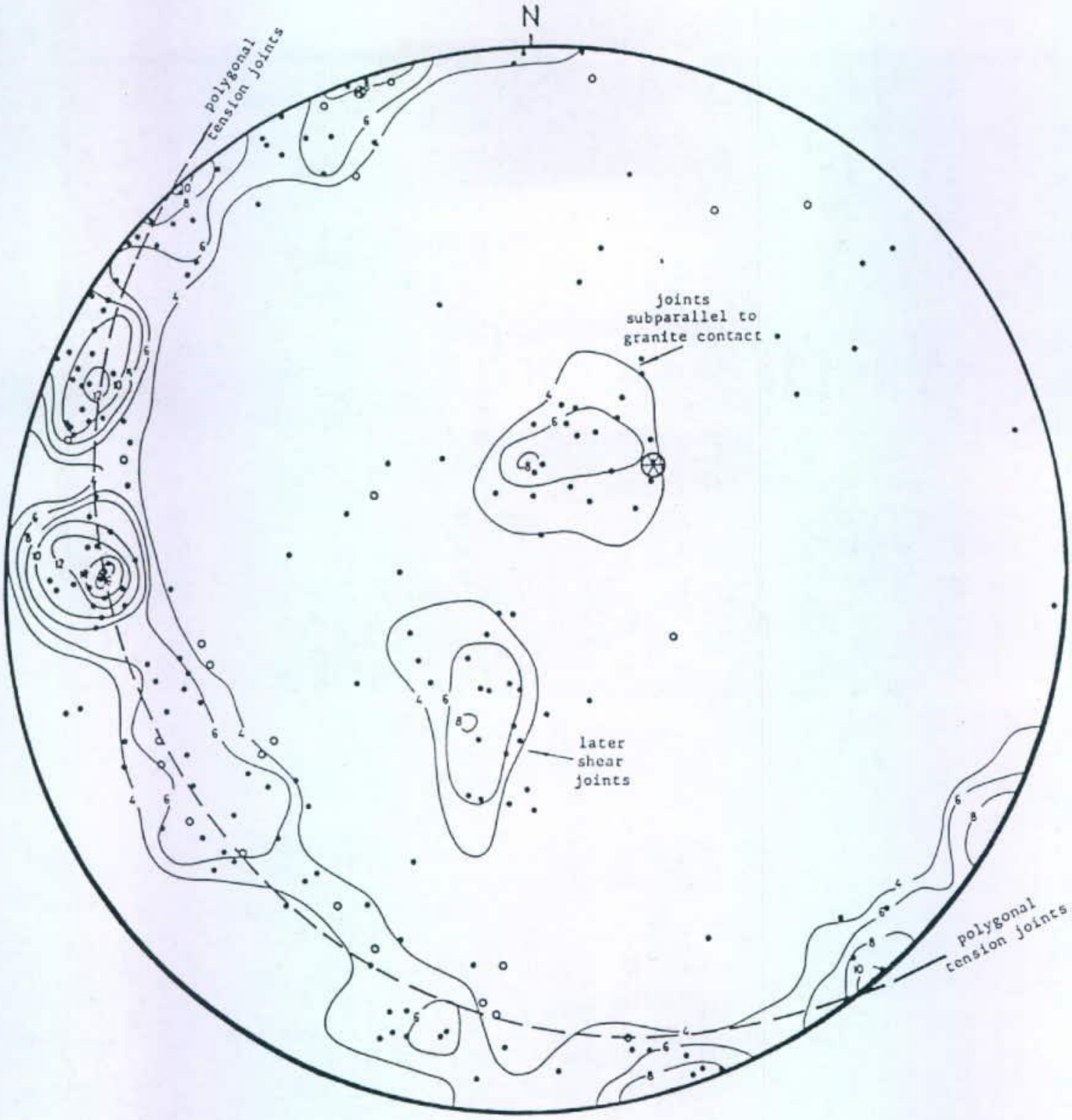
Chairman	Dr A.D. Burnett
Vice-Chairman	Mr K.W. Lee
Secretary	Dr D.R. Workman
Editor	Mr E.P.Y. Chau
Treasurer	Mr M.J. Atherton
Members	Mr C. Dutton
	Mr M.D. Howat
	Mr K.W. Lai
	Dr R.L. Langford
	Mr C.M. Lee
	Mr P.S. Nau
	Mr K.L. Siu

On behalf of the society the Chairman expressed thanks to W. Yim, retiring Committee member and Vice-Chairman 1982 to 1985, for his services on the committee.

8. Appreciation

A vote of thanks to the University for allowing the meeting to be held on its premises was proposed and carried unanimously.

There being no further business, the Chairman declared the meeting closed at 6.30 p.m.



KEY

Great circle of poles to major joints.

⊗ 64/050 : pole to great circle formed by major joint poles.

• Joint

o Minor fault

⊕ Dyke

NOTES

Equal area projection.

Total 213 poles.

Contoured using Kalsbeek counting net.

Contours in poles / 1% area.

Contours less than 4 poles / 1% area are omitted.

Fig. 2 Equal area density plot of joint poles at Locality A.

ADDENDUM

Engineering Significance Of Polygonal Jointing

To the rock engineer interested in designing stable slopes the recognitiion of the presence of polygonal jointing is important since it can significantly reduce the number of possible failures which have to be analysed. That is, the intersecting faces of polygons, such as are shown on Figure 2, can clearly give rise to a large number of potential wedge failures. However, because the poles of all these faces lie on a great circle the axes of all possible wedges lie in exactly the same direction namely that represented by the pole of the great circle.

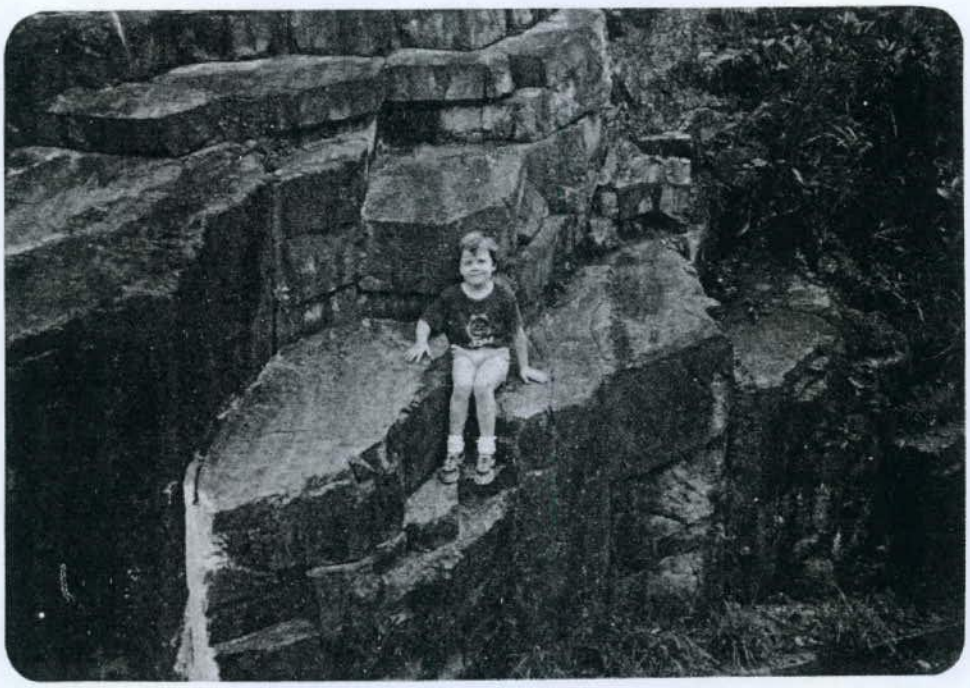


Plate 3 Polygonal jointing in volcanic tuff, Locality B.

Plate 4
Polygonal (prismatic) jointing in sandstone at the contact with a basalt sill.
Taken from Hills, 1972, Fig. v-6

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UPPER TRIASSIC STRATA ALONG THE SHORELINE AT NAI CHUNG FERRY PIER, NAI CHUNG, NEW TERRITORIES, HONG KONG.

Nau Pak Sun, University of Hong Kong.

INTRODUCTION

Sedimentary rocks exposed along the shoreline at Nai Chung ferry pier (Figure 1) were previously ascribed to the Repulse Bay Formation of Middle to Upper Jurassic age as a sedimentary intercalation within pyroclastic rocks (Allen and Stephens, 1971). However, the lithological characteristics are somewhat similar to those of the Tolo Channel Formation (Uglow, 1926) or the Tolo Harbour Formation (Ruxton, 1960). There are no published records of fossils from the rocks at Nai Chung.

The discovery of an ammonite (Sinoceltites sp.) and other macrofauna by the writer in January 1986, indicates that the age of the rock sequence at Nai Chung is Upper Triassic.

GEOLOGICAL SETTING

A faulted sequence of sedimentary rocks occurs along the shoreline at Nai Chung ferry pier (Figure 1). It includes sandstone, siltstone, mudstone and shale as well as conglomerate. The grain size of the sediments appears to be coarser in the lower part of the sequence and finer in the upper part. The fine-grained rocks in the upper part contain floral and faunal remains. Neither the top nor the base of the sequence are seen. The lower part of the sequence has been intruded by granite and the upper part is covered by recent alluvial and marine deposits. The aggregate thickness of the exposed sedimentary sequence is estimated to be greater than 52 metres.

The rocks strike roughly ENE (050° - 070°) and dip SSE at angles ranging from 44° to 68°. The rocks have been displaced by several high-angle strike faults. Because of the granite intrusion the rocks are slightly metamorphosed. Pink to grey, medium-grained granite is exposed along the coast to the west of the pier. The granite intrudes the arenaceous sediments, causing alteration of the minor argillaceous cementing materials to form yellowish green talc and sericite. The contact is partly faulted.

Almost all the faults affecting the sedimentary sequence are strike faults, with strikes roughly parallel to that of bedding planes. Many of the faults dip SSE at angles ranging from 76° to 87°, but one of them dips NNW at 61°. The existence of mylonite, cleavage and small-scale folding along most of the faults indicates that they are mainly compressional in nature. However, a NE-trending fault just next to the pier has a fracture zone about 2 to 2.5 m in width and seems to be tensional in nature. A conglomerate layer has been affected by this fracture zone, so the zone contains not only angular fragments but also well-rounded pebbles from the conglomerate. This fracture zone has been subjected to silicification forming quartzitic rocks and also to pyrite mineralization.

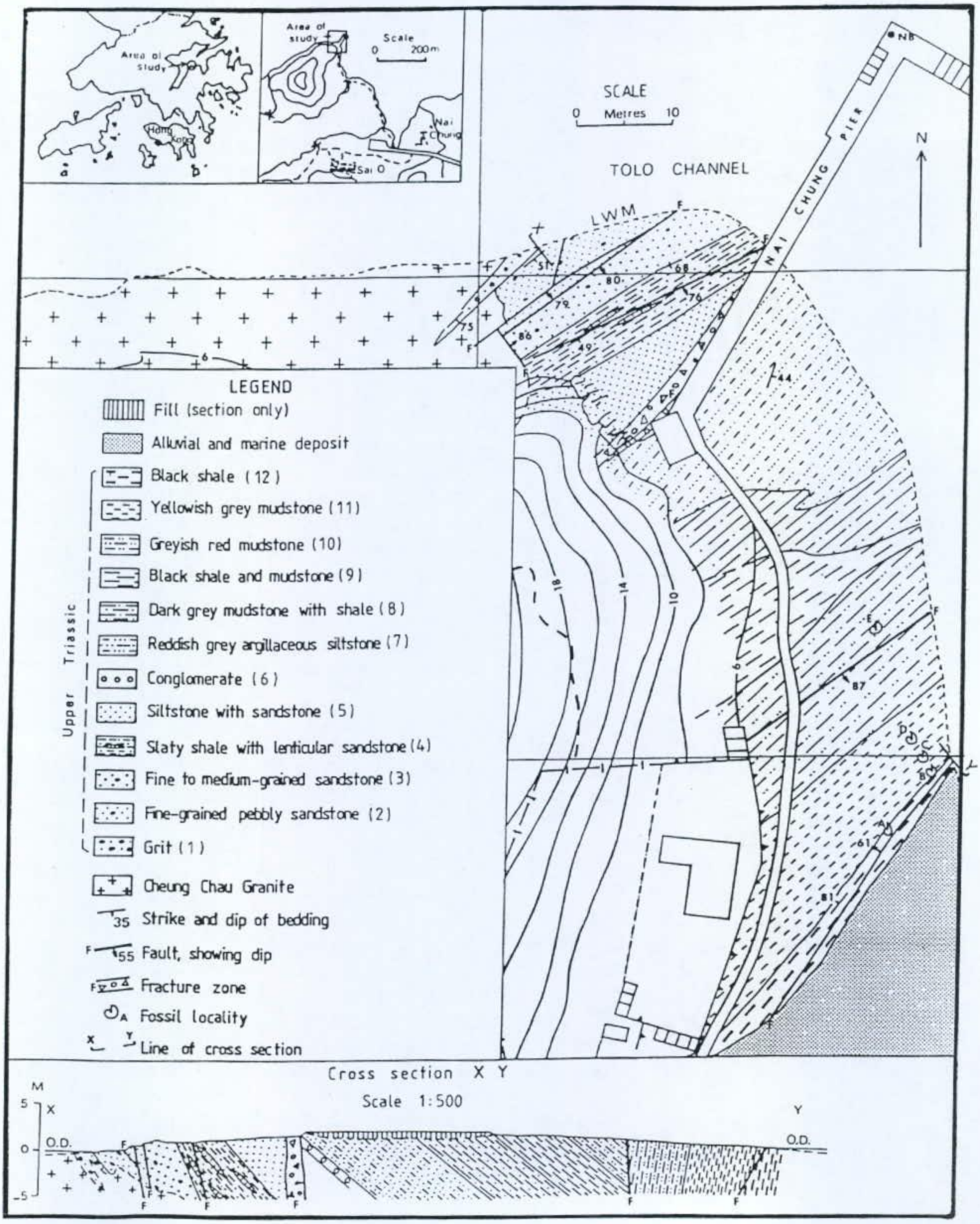
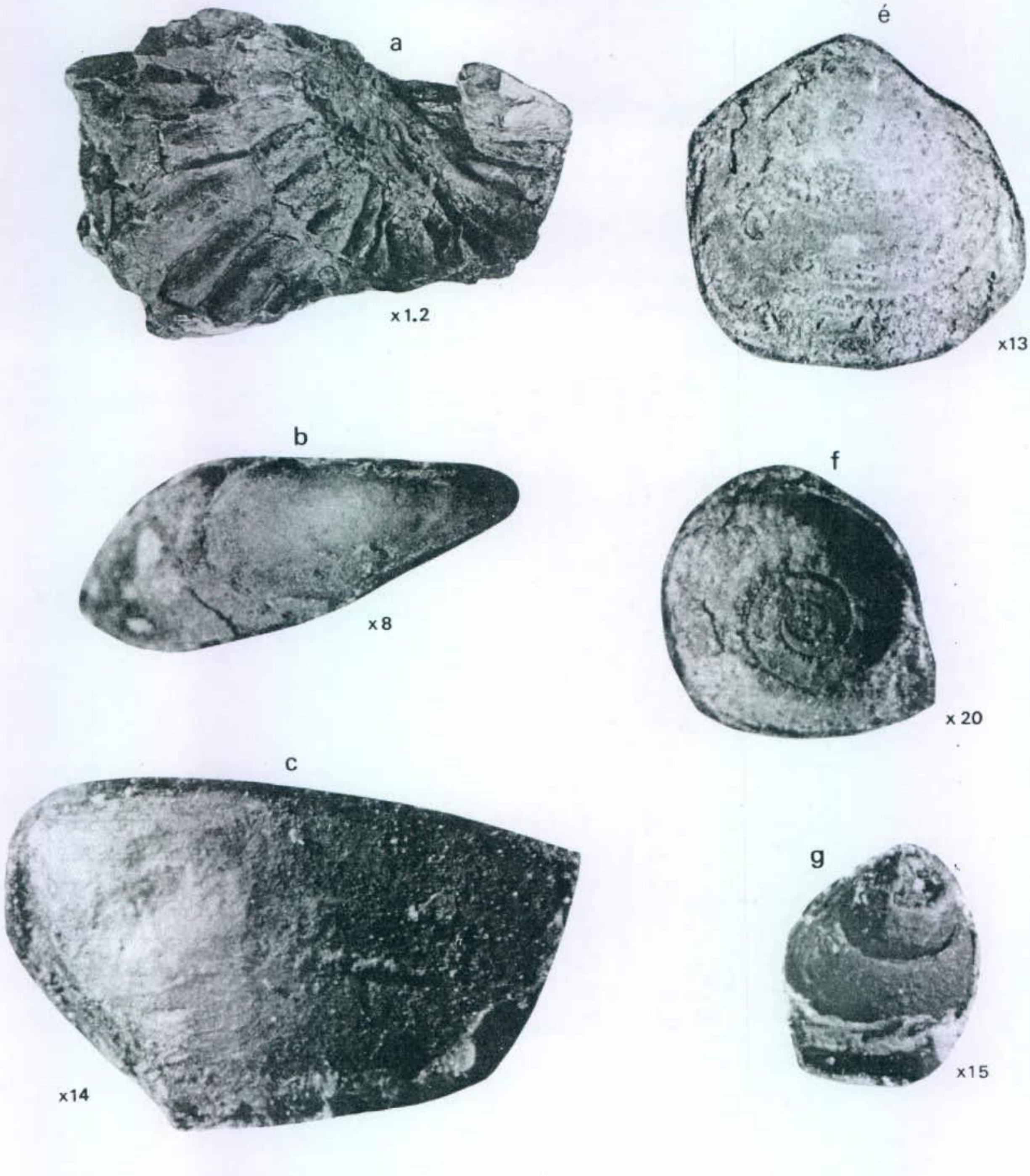
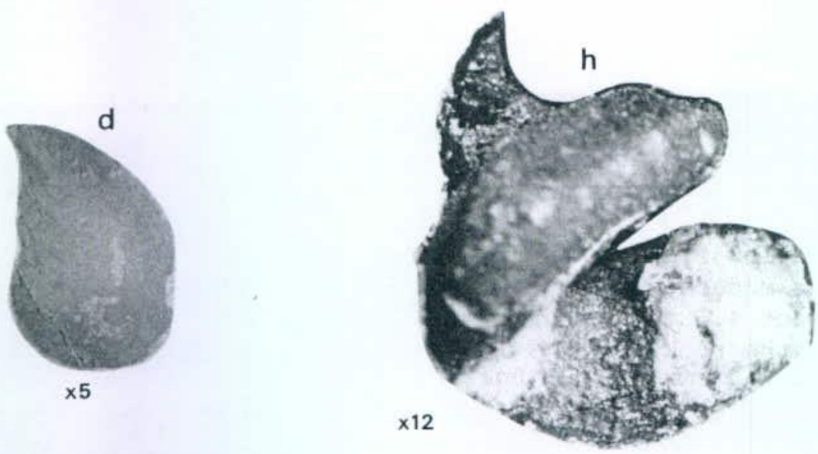


Fig. 1 Geological map of Nai Chung ferry pier and insert location maps.

Plate 1





a <u>Sinoceltites</u> sp.

b <u>Modiolus</u> sp.

c <u>Bakevelloides</u> sp.

d <u>Falcimytilus</u> so.

e <u>?Astarte</u> sp.

f <u>Naticopsis</u> sp. (top view)

g <u>Worthenia</u> sp. (top view)

h <u>Euomphalus</u> sp. (dorsal view)

ROCK SEQUENCE

The exposed rock sequence from young to old is given below :

Unit	Description	Thickness
12	Black carbonaceous shale, cleaved with cleavage dipping N55°E at 82°. It yields indeterminate plant remains, lamellibranchs: Modiolus sp., Bakevelloides sp., ?Halobia sp. and the gastropod: Euomphalus sp.	>2m
11	Yellowish grey micacious mudstone locally with black carbonaceous mudstone. The boundaries between unit 12 and 10 are not sharp. The unit yields plant remains, the ammonite: Sinoceltites sp., Lamellibranchs: Modiolus sp., Bakevelloides sp., ?Falcimytilus sp. and the gastropod: Naticopsis sp.	Around 7m
10	Greyish red micaceous mudstone. It yields the gastropod: Worthenia sp.	>10m
9	Black carbonaceous shale and mudstone. It is locally slate-like.	About 4.5m
8	Dark grey to black mudstone with shale.	About 5m
7	Reddish grey argillaceous siltstone with discontinuous thin layers of siltstone.	About 7.5m
6	Grey conglomerate. It is quartzitic and hard. Pebbles composed of sandstone, siltstone and quartzite are about 2 to 3cm in size with the largest about 10cm.	>0.5m
	<u>Fault</u>	
5	Grey laminated siltstone with fine-grained sandstone.	About 5m
4	Black to dark grey slaty shale with lenticular fine-grained sandstone. The lenses are about 0.3 to 1m in width and around 2 to 3m in length. At the base of this unit, laminated siltstone with cross-bedding (about 30cm thick) and mudstone (about 60cm thick) can be seen locally.	About 5m
3	Brownish yellow fine to medium-grained sandstone. The rock is moderately sorted containing small pebbles about 1.5 to 2mm in size. Muscovite can be seen in the rock.	>3m

Fault

2 Grey quartzitic fine-grained pebbly sandstone with muscovite about 1%. >4m

1 Grey quartzitic grit (or fine-grained conglomerate) with unequal grain size ranging from 1.5 to 5mm. Argillaceous materials in the rock have been altered to yellowish green talc and sericite. >2m

FOSSIL ASSEMBLAGES

Fossil collection was made during the period from late 1985 to early 1986. The fossils collected include fauna and indeterminate flora. The fossils were collected from 5 localities, labelled from A to E as shown in Figure 1, distributed in the Units 10, 11 and 12. Unit 11 has yielded most of the fossils found. The faunal association shows that bivalves constitute the bulk of the fauna, though many specimens are of the same genera.

The fossils were identified by Professor Q.H. Wu in the Department of Geology, Zhongshan University, partly based on the fossils themselves and partly on photographs. Some of the fossils from Unit 12 are too small (about 2mm) to be identified.

Fossil assemblages and ages identified are as follows :

	Locality	Age
Ammonite:		
Sinoceltities sp. (Plate 1, a)	D	Upper Triassic
Lamellibranchs :		
Modiolus sp. (Plate 1, b)	A,B	Upper Triassic
Bakevelloides sp. (Plate 1, c)	A,B	Upper Triassic
?Halobia sp.	B	Middle to Upper Triassic
?Falcimytilus sp.* (Plate 1,d)	B	Upper Triassic
?Astarte sp. (Plate 1,e)	C	Triassic to Jurassic
Gastropods:		
Naticopsis sp. (Plate 1,g)	C	Middle Devonian to Triassic
Worthenia sp. (Plate 1,g)	E	Devonian to Triassic
Euomphalus sp. (Plate 1, h)	A	Ordovician to Jurassic

(*Identified by the writer)

DISCUSSION

The age of the ammonite and the bivalves is given by Professor Wu as Upper Triassic. The gastropods, however, are not diagnostic and have a long time range from Early Palaeozoic to Early Mesozoic.

It is worth notice that, although the ammonite Sinoceltites sp. was found in Hong Kong, its occurrence has not yet been reported in South China. It has, however, been found in Provinces in West China such as Sichuan and Xicang (Tibet) (Professor Q.J. Wu, pers. comm.).

According to Nan (1979), the lithofacies of the Lower Triassic in Guangdong Province is neritic carbonates (limestone, argillaceous limestone and oolitic limestone) with clastic rocks (sandstone and shale), and that of the Middle Triassic is neritic and littoral clastics (sandstone, siltstone and shale) while that of the Upper Triassic in Central Guangdong (Xiaoping Formation) is littoral (or neritic) clastics (sandstone, siltstone, carbonaceous mudstone with conglomerate and coal seams). The bivalves Modiolus and Bakevelloides found in Hong Kong are also found in rocks of the Xiaoping Formation.

SUMMARY

The biota shows that the sequence has been deposited in littoral conditions. The ammonite and the bivalves found indicate that the sequence is Upper Triassic.

ACKNOWLEDGEMENTS

Thanks are due to Professor Q.J. Wu in the Department of Geology, Zhongshan University, for the identification of the fossil specimens. The writer would also like to thank Dr. D.R. Workman in the Department of Geography and Geology, University of Hong Kong, and Mr. R.S. Arthurton, Geotechnical Control Office, for their helpful comments on the first draft.

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ARTICLES WANTED

The Editor seeks contributions for future issues of the Newsletter. We are looking for short technical articles on any geoscience topics (see guidelines on the inside front cover of this issue), as well as news items, commentary, book reviews and interesting photographs.

Also welcome are comments on the Newsletter content and format, and ideas for improvement.

DISTRIBUTION OF METALS IN SOME BLACKISH SHALES OF HONG KONG

W.W.S. Yim, Dept. of Geography & Geology, University of Hong Kong
C.Y. Ng, Magna Industrial Company of Australia, Hong Kong.

INTRODUCTION

The term 'black shale' usually implies that the sediment was deposited in a marine or brackish water environment in contrast to carbonaceous shale and coal which are usually formed in a non-marine environment (Vine & Tourtelot 1970). Some beds of black shale are known to contain metallic elements in concentrations more than a hundred times their average crustal abundance (Krauskopf 1955). Cody (1971) found that the absorption on clay minerals greatly affected the reliability of trace elements as environmental indicators for ancient shales. This may have been responsible for the lack of success in attempts to relate trace elements to depositional environments (Potter et al. 1980). Nevertheless, the study of the distribution of metals in shales from known depositional environments may provide clues for assisting stratigraphic correlation.

In Hong Kong 'black' or at least 'blackish' shales occur in the Tolo Harbour Formation and in sedimentary intercalations of the Repulse Bay Formation (Allen & Stephens 1971). 'Blackish' is used in the present study to include the paler or greyish varieties of shales which occur. On the basis of fossils occurring within the shales which have been identified, the depositional environments are variable from marine to terrestrial. However, the darker 'black' shales which may for example be found in the Tolo Channel near Lai Chi Chong, are thought to be enriched in carbonaceous materials. This is indicated by the low specific gravity of the shales.

In this study, blackish shales from four localities in the north-eastern part of the New Territories have been collected for the geochemical determination of twenty-two metallic elements. The four localities are Ping Chau, Lai Chi Chong, Nai Chung and Ma Shi Chau (Figure 1). There are two main objectives. Firstly, to determine whether the blackish shales are enriched in heavy metals including copper, zinc, cadmium and lead, and, if so, whether these shales could be a major contributor of these metals to recent marine sediments in Tolo Harbour. Secondly, to determine whether geochemical differences exist in shales from different depositional environments in order to facilitate stratigraphic correlation.

METHODS

A summary of information on the sampling localities is given in Table 1. At each locality, over 500 g of shales was collected for chemical analysis. Two samples were collected from Lai Chi Chong, one from above the High Water Mark (HWM) and the other from below the HWM. This was to permit investigation of the possible effects of sea water in the intertidal zone.

The chemical composition of the shales were determined by Inductively Coupled Plasma System (ICP) using methods of the Applied Geochemistry Research Group, Imperial College. A direct reading ARL 34000 ICP Quantometer was used to measure the content of twenty-two metallic elements after sample digestion using a mixture of hydrofluoric, nitric and perchloric acids. The metals studied were lithium, beryllium, sodium, magnesium, aluminium, phosphorus, potassium,

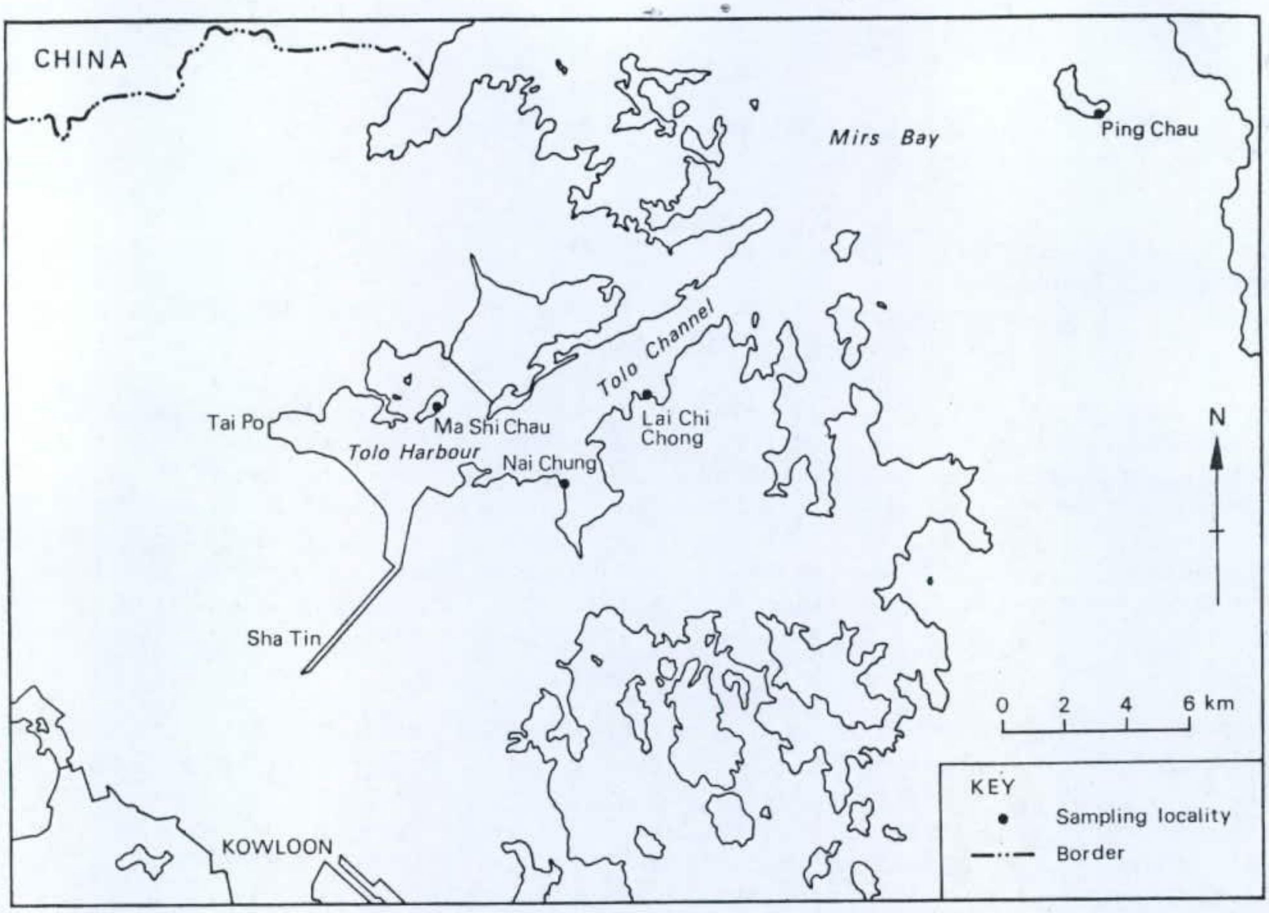

Fig. 1 Location map of the sampling localities.

Locality	Formation (after Allen & Stephens 1971)	Colour	Environment of Deposition	Remarks
Lai Chi Chong (above HWM)	Repulse Bay	Black	Terrestrial	Carbonaceous; plant fossils present
Lai Chi Chong (below HWM)	Repulse Bay	Black	Terrestrial	Carbonaceous; plant fossils present
Ma Shi Chau	Tolo Harbour	Greyish	Marine	Marine fossils present
Nai Chung	Repulse Bay	Greyish-black	Marine ?	Severely fractured and cleaved
Ping Chau	Repulse Bay	Brownish-black	Lacustrine	Plant fossils present

Table 1 Summary of information on the sampling localities.

calcium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, strontium, cadmium, barium, lanthanum and lead. The overall precision of the method is better than ±15 per cent at the 95 per cent confidence level. Further information and discussions on the method can be obtained from course notes on environmental sampling, analysis and analytical quality control available from Imperial College (1983).

RESULTS AND DISCUSSION

The metal distribution in Hong Kong shales and average shale are summarized in Table 2.

The colour of the two blackest samples, both from Lai Chi Chong, have not been found to be related to the enrichment of any of the metals investigated. This is in agreement with the suggestion of Potter et al. (1980) that the amount of organic carbon present is an important and partly independent controlling factor of colour. Both samples are indicated by their low specific gravities to have a high organic carbon content. At Nai Chung, the greyish-black shale of probable marine origin is found to show the highest concentrations in P, K, Ti, Fe, Co, Ni, Cu, Ba and Pb. Because this sample is located in a zone of extensive fracturing and shearing with vertical or near-vertical beds, post-depositional cementation by mineralizing fluids enriched in these metals is likely to be the cause.

The two Lai Chi Chong samples are found to contain similar amounts of Li, Ti, V, Cr, Co, Ni, Cd and Ba, while other metals show differences. Be, P, Sr, La and Pb are enriched in the sample above HWM, and Na, Mg, Al, K, Ca, Mn, Fe, Cu and Zn are enriched in the sample below HWM. The enrichment of metals in the former suggest leaching of these metals by sea water when the shales occur below the HWM. In the latter, the increase in metals found enriched in sea water including Na, Mg, K and Ca is consistent with the immersion of the shales at high water and the deposition of salt on the surface of the rock as sea water evaporated.

There is good agreement between metal distribution and the environment of deposition of the blackish shales. Terrestrial shales represented by the two Lai Chi Chong samples are found to show the highest concentrations of Be and K, and the lowest concentrations of Li, Na, Mg, Al, P, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Sr, La and Pb. Marine shales, best represented by the Ma Shi Chau sample, contain the highest concentrations of Al, V and Cr, and the lowest concentration of Be. On the other hand, the lacustrine shales of Ping Chau which contain acmite and zeolite minerals (Peng 1971a and 1971b), show the highest concenttrations of Li, Na, Mg, Ca, Mn, Zn, Sr and La. This is in agreement with the highly saline and alkaline environment necessary for the formation of zeolite minerals.

The mean metal content of the analysed shales is comparable to the average shale value given by Levinson (1964) and Pettijohn (1975) in the case of only four metals, Na, Al, K and Cd. Li, Be, Ti, La and Pb exceed the average shale content by more than 25 per cent while Mg, P, Ca, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Sr and Ba contents are more than 25 per cent less than those of the average shale. For Ti, the Nai Chung sample with 51,000 ppm is largely responsible for the high Hong Kong mean. Hong Kong shales are below average in the enrichment of heavy metals, with the possible exception of lead. They are therefore unlikely to be a major source of Cu, Zn and Cd in the recent marine sediments of Tolo Harbour.

Locality	Li	Be	Na	Mg	Al	P	K	Ca	Ti	V	Cr
Lai Chi Chong (above HWM)	5	11	320	1,300	54,000	58	21,000	6	1,020	20	4
Lai Chi Chong (below HWM)	6	7	900	1,960	70,000	41	27,500	150	1,050	21	5
Ma Shi Chau	95	2	5,900	8,000	80,000	650	17,500	1,190	4,700	220	104
Nai Chung	121	3	2,700	11,200	74,000	745	27,500	240	51,000	163	84
Ping Chau	166	3	32,000	20,300	67,000	320	26,500	50,000	2,500	82	35
Hong Kong mean	79	5	8,364	8,552	69,000	363	24,000	10,317	12,054	101	46
Average shale a-Levinson (1964); b-Pettijohn (1975)	60[a]	3[a]	9,640[b]	14,720[b]	81,500[b]	742[b]	26,900[b]	22,230[b]	4,600[a]	130[a]	100[a]
Locality	Mn	Fe	Co	Ni	Cu	Zn	Sr	Cd	Ba	La	Pb
Lai Chi Chong (above HWM)	88	5,100	2	3	2	3	15	<0.5	300	36	51
Lai Chi Chong (below HWM)	99	8,800	2	3	5	7	10	0.5	300	31	37
Ma Shi Chau	180	36,500	10	28	9	52	124	<0.5	240	34	48
Nai Chung	730	48,000	17	52	27	79	55	<0.5	550	41	82
Ping Chau	1,030	33,500	16	26	23	89	230	<0.5	320	54	76
Hong Kong mean	425	26,380	9	22	13	46	87	<0.5	342	39	59
Average shale a-Levinson (1974); b-Pettijohn (1975)	850[a]	41,290[b]	20[a]	70[a]	50[a]	100[a]	300[a]	0.2[a]	700[a]	20[a]	20[a]

Table 2 Metal distribution in Hong Kong shales and average shale. Value of Hong Kong shales based on the mean of two readings. In parts per million (ppm).

Several workers (e.g. Vinogrador & Ronor 1956, Van Moort 1972) have reported significantly higher potassium content in Palaeozoic shales than in younger shales. However, the Ma Shi Chau sample in the present study, which is of Permian age, is found to contain the lowest potassium content, 17,500 ppm. The three samples from the Jurassic Repulse Bay Formation all contain 21,000 ppm or more. The present findings are therefore not in support of these workers.

CONCLUSIONS

Although the adsorption and fixation of metals to clay minerals in shales are dependent on many factors which are poorly understood at present, the metal distribution in shales may assist the understanding of their origin. In the present study, a knowledge of the environment of deposition determined from fossil and mineralogic evidence as well as the post-depositional history is found to be useful in accounting for the distribution of metals in blackish shales of Hong Kong. As a source of heavy metals, based on the low concentrations found, the shales are unlikely to be a major contributor to recent marine sediments in Tolo Habour. However, only a small number of samples have been investigated. The geochemical characteristics of blackish shales is suggested to be a useful tool in stratigraphic correlation on a local scale. Further studies are warranted.

ACKNOWLEDGEMENTS

The analytical work was carried out at the Applied Geochemistry Research Group, Imperial College, London. We are particularly grateful to the head of Group, Dr. Iain Thornton, for providing laboratory facilities. Mr. P.S. Nau assisted in the collection of the rock samples.

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TEACHERS GROUP

The Teacher's Group, established in November 1984, held five field meetings in 1985, including boat trips to islands of Mirs Bay and Rocky Harbour and to the West Brother Island and Chek Lap Kok, and two indoor meetings. Four field meetings and a lecture meeting have been scheduled for the first half of 1986 and an excursion to central China is being organized for July (see 'Forthcoming Events').

The Group currently has more than 60 members. A 5-person steering committee has been set up, consisting of KEUNG Hon-ming, LAM Lai-fong, LAM Wing-po, LIU Kwok-hung and POON Yuen-han.

Details of the group's acitivities are mailed directly to its members and not normally announced in the Newsletter. There is no additional subscription for membership of the group. Enquiries should be addressed to :-

Mr. KEUNG Hon-ming,
5/F, 6D, Babington Path,
Hong Kong.

Tel.: 3-405916 (school)
5-492720 (home)

Teaching Aids

The society possesses a collection of 200 35mm colour slides of Hong Kong geology in 5 sets of 40, donated by Dr. Workman of the University of Hong Kong. The sets, intended for general educational use, cover the following topics or themes :

- Igneous rocks
- Sedimentary rocks
- Weathering
- Geology and scenery
- Geology and development

The sets are available for inspection and short-period loan (collection and return by hand only). The slides may be copied for personal use.

VISIT TO GUILIN, OCTOBER 1985.

Ten members of the society visited Guilin from 18 to 23 October, 1985.

The first leg of the journey, from Hong Kong to Guangzhou, was by ship (overnight) and the remaining stages by air. On arrival in Guangzhou, the party was met by representatives of the Guangdong Seismological Bureau, which kindly took care of the transit arrangements and provided transporation. The first stop was at the Bureau, for refreshments and a meeting with the Director, Prof. Ding Yuang Zhang (Hon. Member). This was followed by a tour of some of the scenic parts of the city, and then lunch at the airport before our early afternoon departure for Guilin.

At Guilin, we were accommodated in the very comfortable guest house of the College of Geology, courtesy of the President of the College, Prof. Yuan Kuirong. On the first morning in Guilin the group was introduced to the staff and work of the Institute before being shown round the geological museum. This was followed by a visit to the Institute of Karst Geology, located in another part of town, where Prof. Yuan Daoxian, Director of the Institute, gave an illustrated talk about the geology of the Guilin area and the work of the Institute. We were shown round the Insitute's impressive Exhibition Hall, a must for any geologically-minded visitor to Guilin, and apparently not on the regular tourist itinerary at present. That afternoon and subsequently we visited several of the limestone hills and caves in and near the city, as well as an interesting archaeological museum at Zhenpiyan and an adjacent excavated Neolithic cave-dwellers' site not at present open to the public.

One day was spent amidst the breathtaking tower karst scenery on the famous Li River cruise from Yangti (the water was too low at the usual starting point, Daxu) to Yangshuo. On another day, as a change from geology, a visit was paid to the Guangxi Institute of Botany at Yanshan, about 20 km south of Guilin.

All in all the itinerary was full and varied, provided a comprehensive insight into the geology and natural history of the area.

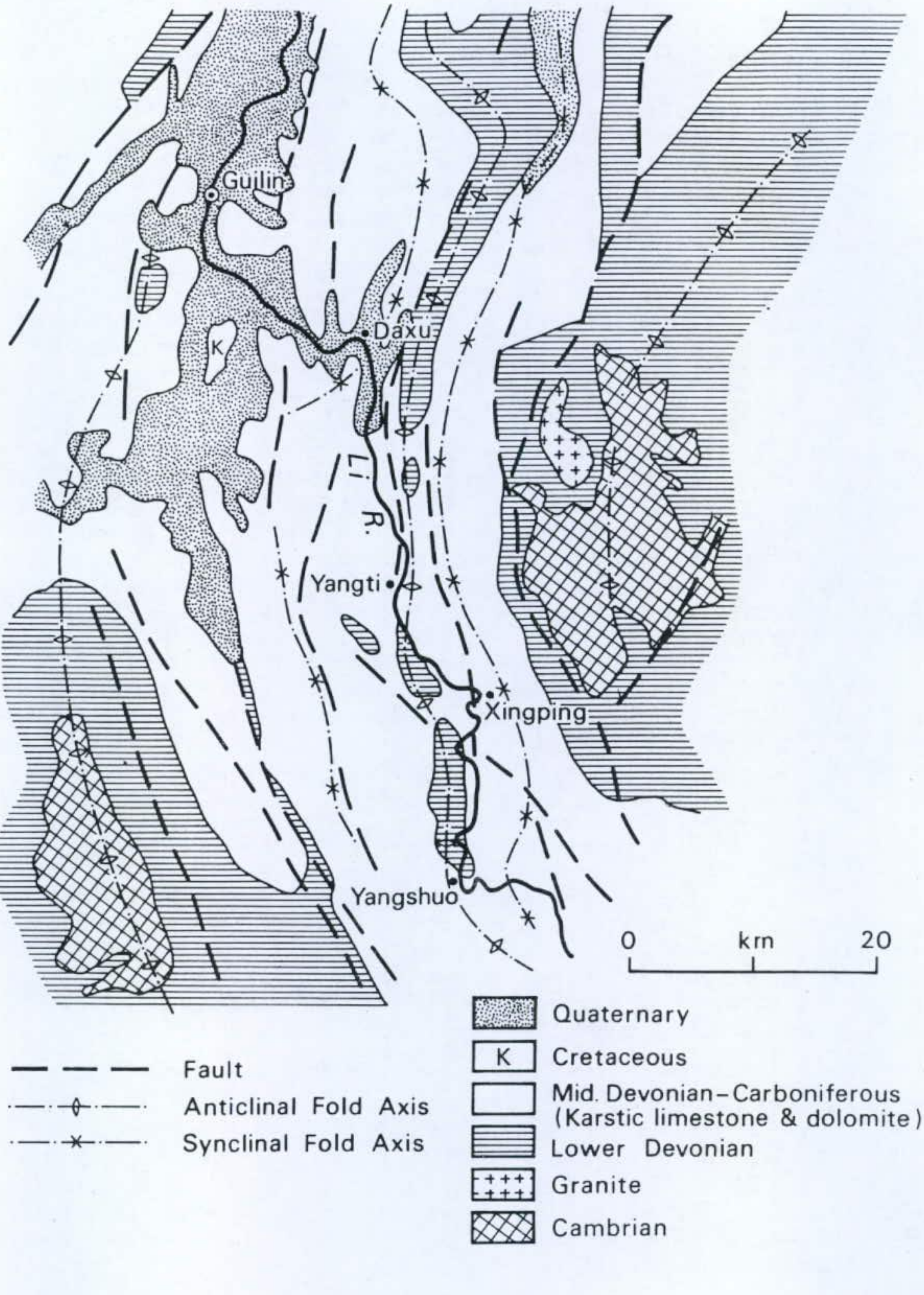
The morning and evening of one day was taken up by a series of lectures by members of the group to a large audience of staff and students of the College of Geology and the Karst Institute. Topics ranged from tunnelling methods (R. Treble) and geological work in Hong Kong (A.D. Burnett, M.D. Howat, R. Shaw, D.R. Workman), to drainage basin studies and karst in Britain (J.L. Ternan and K. Gardner), all valiantly translated, verbatim, into Putonghua by staff of the College and the Institute.

OUTLINE OF THE PRE-QUATERNARY GEOLOGY OF THE GUILIN - YANGSHUO AREA

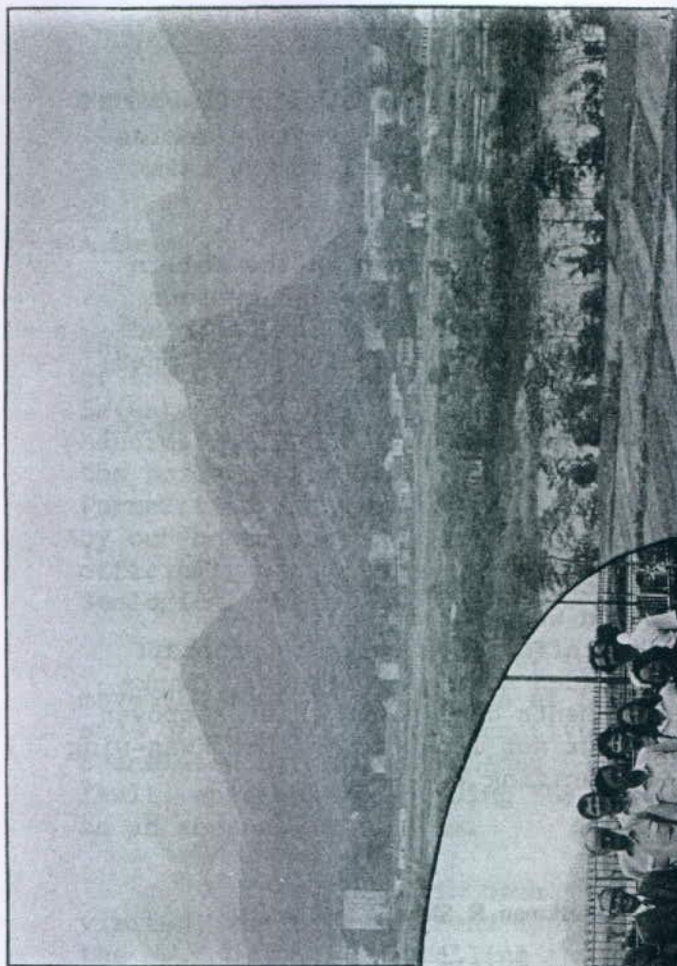
The karstic limestone and dolomite of the Guilin area comprise the upper and major part of a series that ranges without any significant stratigraphic break from Lower Devonian to Lower Carboniferous. This series occupies almost the whole area between Guilin and Yangshuo.

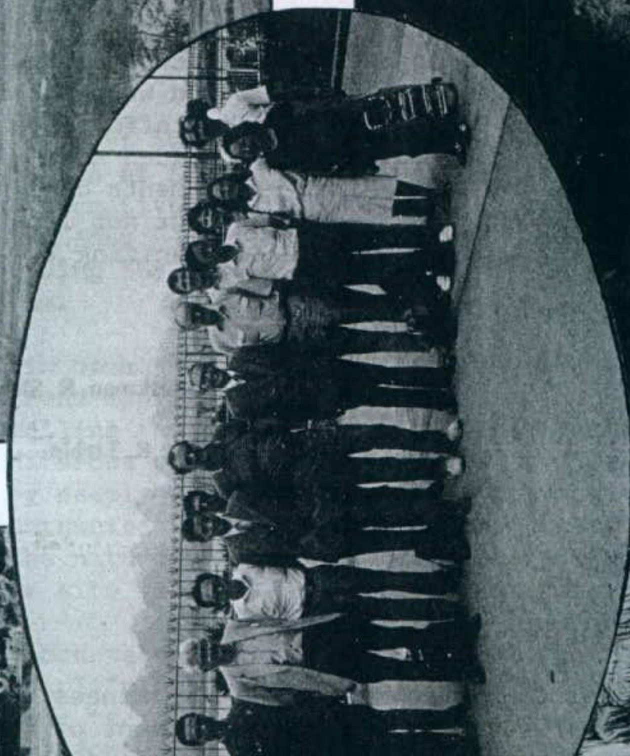
Cambrian strata (sandstones and shales) are exposed in inliers along major anticlinal folds east and west of the Li River south of Guilin (see map). An angular unconformity separates the Cambrian and Devonian rocks. "Caledonian" (pre-Devonian) granite is exposed in one area east of the Li River.

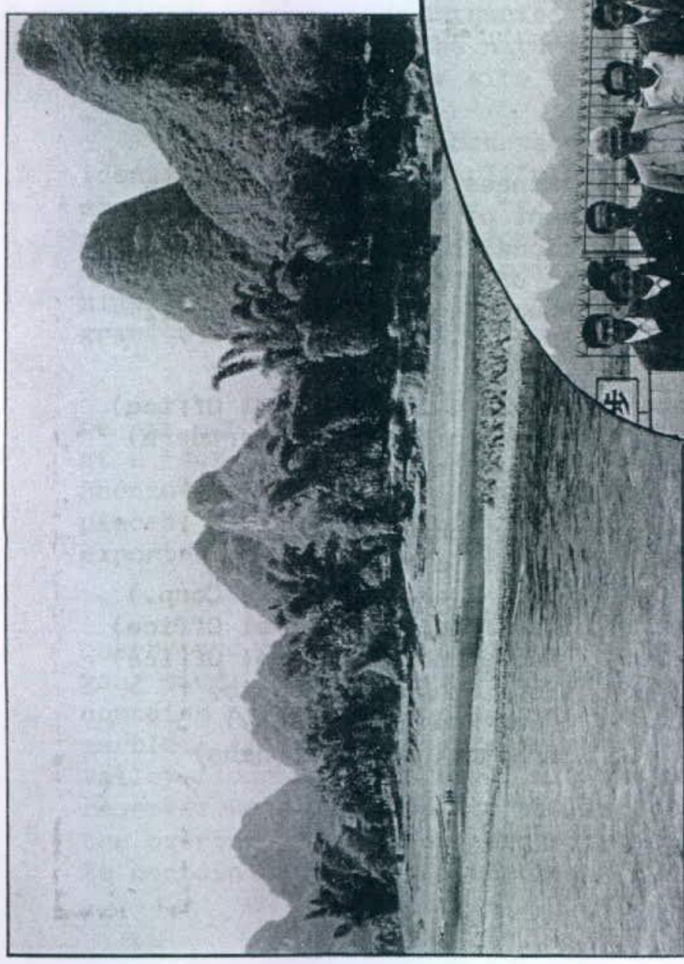
Fig. 1 Outline geological map of Guilin - Yangshuo area, Guangxi Province, China. (Source : Geological Map of Guilin 1:100,000)



The Devonian begins with a basal conglomerate followed by mudstones and sandstones. This succession is exposed along the axes of anticlines trending generally N-S (see map). One small inlier of these Lower Devonian rocks along the Li River just north of Yangshuo gives rise to 'normal' scenery in striking contrast to the tower karst all along the river further upstream. The remainder of the succession, beginning in the Middle Devonian, is virtually all thick-bedded limestone and dolomite.







The Devonian-Carboniferous succession is only gently folded. Over large areas, dips are in the range 10-25^{o}, locally steeper. There is a series of prominent faults, both normal and reverse, generally parallel to the main fold axes.

The only post-Carboniferous, pre-Quaternary rocks seen in the Guilin area are Lowest Cretaceous red beds, which locally include a basal limestone conglomerate. These occur only as a few small outliers, notably in the broad valley south of Guilin. There is one interesting case of a karst tower capped by the Cretaceous conglomerate. The erosion surface marked by present-day summit levels of the karstic mountains is believed to be pre-Cretacous feature.

APPRECIATION

Throughout our stay we enjoyed lavish hospitality, including two banquets, and painstaking organization, for which we thank equally Prof. Yuan Kuirong and Yuan Daoxian and their staffs, especially those staff who devoted much time and effort to acting as guides and interpreters. Thanks are also due to Prof. Ding for this kind arrangements during our brief stopover in Guangzhou en route from Hong Kong, and last but not least to Mr. Lee Kwan-wing for much hard work in Hong Kong planning and organizing the trip.

D.R. Workman, R. Shaw, A.D. Burnett

Photos : R. Treble

1986-1987 GENERAL COMMITTEE

The General Committee's list of 12 nominees was circulated with the November 1985 Newsletter, with the announcement of the approved increase in size of the Committee from 9 to 12. No additional nominations have been received in the allotted period. The composition of the 1986-87 Committee, to take office immediately following the 1986 Annual General Meeting, will therefore be as follows :-

Chairman	A.D. Burnett*	(Geotechnical Control Office)
Vice-Chairman	K.W. Lee*	(Charles Haswell & Partners)
Secretary	D.R. Workman*	(Hong Kong University)
Editor	E.P.Y. Chau*	(Binnie & Partners)
Treasurer	M.J. Atherton*	(Hong Kong Polytechnic)
Committee Members	C. Dutton*	(Binnie & Partners)
	M.D. Howat	(Mass Transit Railway Corp.)
	K.W. Lai*	(Geotechnical Control Office)
	R.L. Langford	(Geotechnical Control Office)
	C.M. Lee*	(Hong Kong Polytechnic)
	P.S. Nau	(Hong Kong University)
	K.L. Siu	(Freeman Fox & Partners)

* Present Committee Member/Position Holder

REPORT ON THE FIELD EXCURSION TO SHENZHEN & DAYA BAY, 15TH - 16TH MARCH, 1986

陳兆湖

A. Hansen

At the almost reasonable hour of 8:30 a.m., the largest party from the Geological Society of Hong Kong yet to visit China, under the invitation of the Geological Society of Shenzhen, gathered at Kowloon Station. Seventy-seven geologists and accompanying family members proved quite a handful for Mr. C.M. Lee as he shepherded us onto the KCR on the journey to the border. By 10:45 a.m., even the stragglers had cleared immigration formalities and were safety ensconced aboard the fleet of minibuses provided by our hosts outside Shenzhen Railway Station - the party having been officially met and welcomed by Mr. ZHOU De-yu, Chairman of the Shenzhen Geological Bureau.

The party was first taken to inspect a newly installed fault-movement monitoring station at the Huangbeiling Fault on the north-eastern side of the city. The narrative was given by Mr. ZHOU De-yu, and was ably translated by Mr. Paul Cheung. Eight monuments have been erected across the fault, apparently providing the capability to detect movements in 3 dimensions to an accuracy of 0.1 mm.

This fault, in common with the Shawan fault at the second location visited, was said to trend approximately SW-NE and dip at some 45 degrees to the NW. On the Huangbeiling fault, migmatite was reported to form the hanging wall, overlying Carboniferous phyllites possibly of the Ceshui Member. The bedrock is however very deeply weathered; this was particularly noticable as the monuments were constructed in long deep trenches excavated into the hillside (Plate 1). The nature of the rock types was not apparent from field inspection at the site visited in the time available.

Although no observatory has been erected at the Shawan fault, the identification of the fault plane was considerably clearer than at the first stop because we were able to inspect the sides of a small quarry excavated in relatively fresh granite containing the fault plane. Bounded by breccias and mylonites, the central mylonite zone has been extensively chloritized, highlighting the fault zone by a striking blue-green swarth across the pink granite rock (Plate 2).

Following lunch at the offices of the Shenzhen Geological Bureau, we set off to visit the Henggang marble quarry. On the way, a stop was made at a recently equipped and commissioned trimming and polishing factory in Shenzhen where we were able to see the marble slabs being turned into finished pieces. The manager informed us that over 70 per cent of this marble is exported.

A half-hour drive northeast of Shenzhen took us to the marble quarry and primary cutting shed which housed the large diameter rotary and gang saws. The quarry, which is located in the floor of a long narrow valley, contains a steeply dipping band of Lower Carboniferous (Shidengzi Member) marble. Although there is only a 5 metre overburden to the marble, its valley-floor location may limit the workable depth of the outcrop although reserves were purported to be large. In the areas of the quarry floor where the overburden had been removed, the surface of the marble could be seen to contain many karstic features (Plate 3).

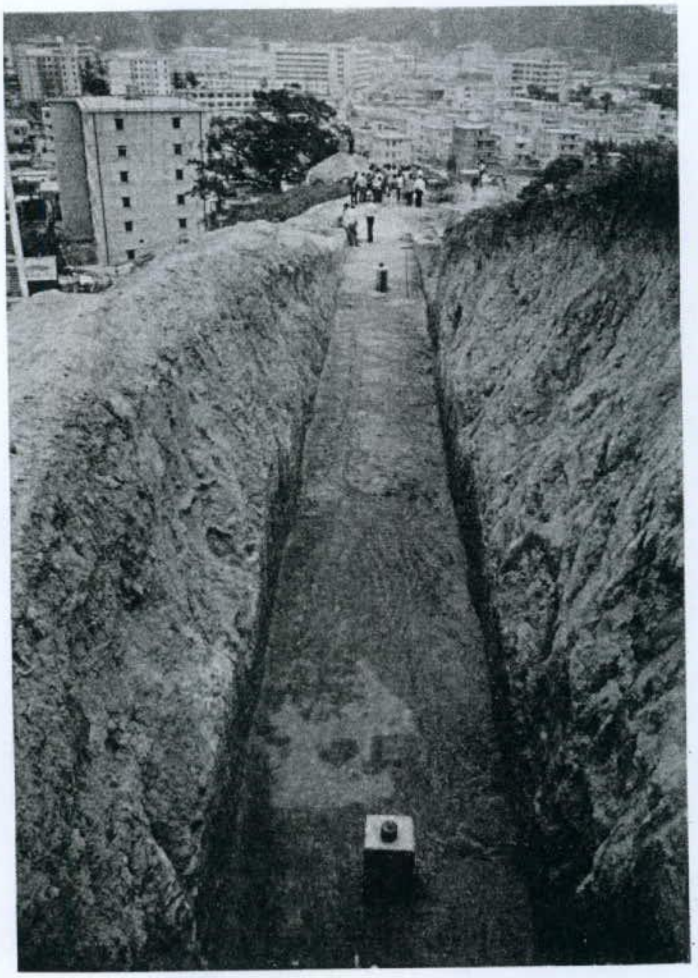


Plate 1
Survey monuments at the Huangbeiling Fault Monitoring Station in Shenzhen

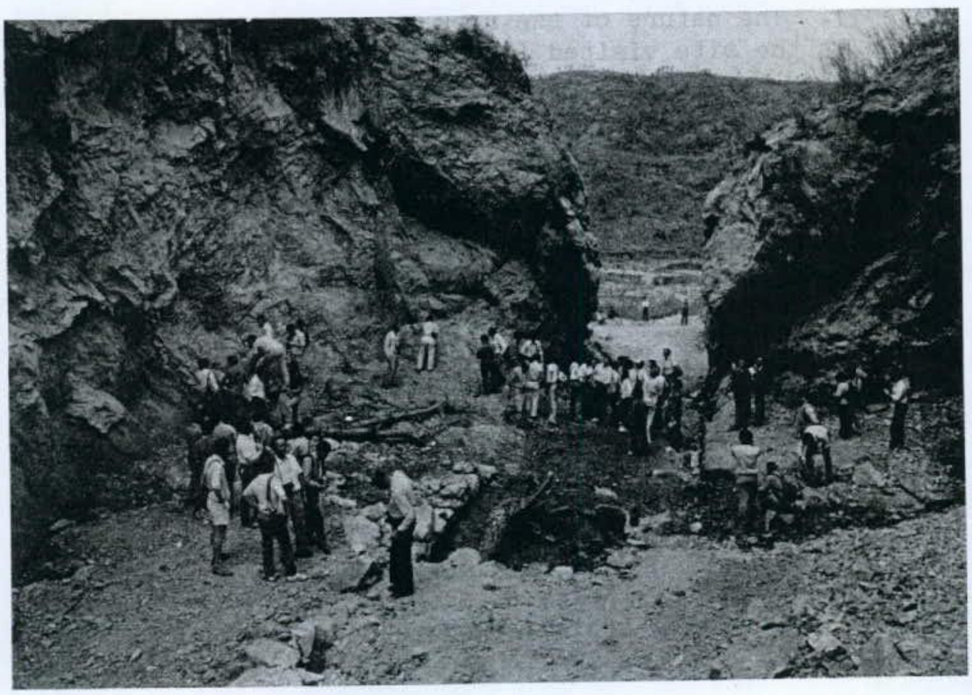


Plate 2 Geologists inspect and discuss the features of the Shawan Fault.

A thrust fault limits the length of both the outcrop and the valley. The marble is believed to be the result of contact metamorphism with the underlying granite - a situation probably mirrored in Hong Kong where an identical marble underlies the alluvial plains of Yuen Long.

At the evening dinner at our hotel in Shenzhen, Mr. Zhou formally welcomed the group to Shenzhen and observed that friendly exchanges such as the present one were mutually helpful. He then proceeded to describe the types of work and responsibilities of the Shenzhen Geological Bureau, which has grown over the past few years to include engineering geology and water supply in addition to the 1:100,000 and 1:50,000 scale geological mapping.

Dr. Alister Burnett, in his response on behalf of the Society, gave praise to our Shenzhen colleagues for the progress they have achieved and agreed that these meetings were very useful. As a small token of appreciation to the hosts, Dr. Burnett presented Mr. Zhon with copies of the GSHK Bulletin No. 2 on Site Investigation Practice and the Proceedings of the Seminar on the Marine Geology of Hong Kong.

Sunday morning saw the party rising early, ready for a long drive eastwards to Daya Bay. Upon Arrival at the construction site of the nuclear power station, Mr. Wu, the Chief Resident Engineer on site described the details of the site geology, history and engineering specifications of the project. Translation was ably provided by Mr. CHAN Yun-cheung, member of our group.

The site had been selected after an extensive comparison of alternatives. The first phase, extending from 1979 to 1982, considered many alternative locations over a wise area and included extensive geological mapping, an assessment of geological structures and in situ stresses. Three possible locations were considered in the general area of the present site. The site at Dakeng was finally selected after more detailed investigations during the period 1983 to 1985. It is 45 km from Shenzhen and 52 km from Hong Kong.

The Dakeng site lies astride a contact between Devonian sedimentary rocks and a Mesozoic granite intrusion. The party was not able to see any geological maps of the site or obtain a more detailed picture of the geological structure in the time available. The reactor complex is to be constructed near the contact between the granite and the partly metamorphosed (hornfelsed) Devonian rocks. The two French-designed 900 Megawatt reactors are to be founded on hornfelsed sedimentary bedrock rather than granite because of its more favourable dynamic modulus. The reactors are to be of the pressure-water type and are expected to be completed by 1993.

The talk was followed by a two hour walking tour around the site. A large part of the site formation works have been completed but some reclamation is continuing. We were fortunate to witness production and finishing blasting using black powder (gunpowder - not normally used in Hong Kong), distinctive as the 'Guy Fawkes Night' odour wafted across to us.

Following a packed lunch at the site office, the party toured the nearby dam retaining the reservoir which will service the construction requirements of the project and will later serve as an emergency cooling-water reserve.

Plate 3 The Henggang Marble Quarry. An outcrop of marble visible in the left foreground has been stripped of overburden and shows karstic microtopography on its surface.

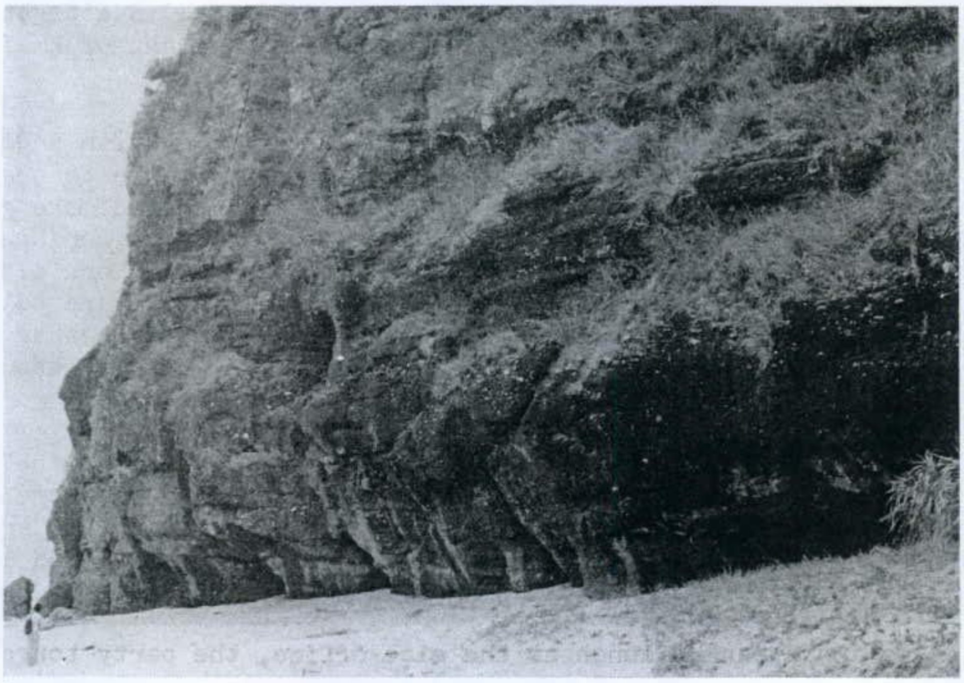


Plate 4 Sea cliffs of the Xiasha red beds.

The drive back to Shenzhen was broken at two points. At the first intermediate halt we were able to observe the 15 to 20 m high coastal cliffs (Plate 4) and wave-cut platform (Plate 5) formed in the Xiasha red beds. These consisted of dark red and grey, coarsely stratified conglomerates containing lenses of finer sandstone. Purportedly of similar age to the deposits at Ap Chau and Ledge Point, the Xiasha red beds contain boulders and cobbles that are less rounded than at Ap Chau and include clasts of slate and quartzite. These appeared to be from an alluvial fan environment.

A final brief stop was made at the beach resort of Xiaomeisha before the group returned to Shenzhen, where coherence of the group crumbled amidst the jostling crowds returning across the border to Hong Kong.

Thanks are due to Mr. C.M. Lee for organising this very enjoyable visit and to Mr. ZHOU De-yu and his colleagues at the Geological Society of Shenzhen for their splendid hospitality.

Plate 5 A wide wave-cut platform in the Xiasha red beds on the eastern side of Mirs Bay.

MEMBERSHIP NEWS

The Society welcomes the following new members who joined in the period 1st January - 31st March 1986 :-

CHAN Lung-sang (Dr.), CHAN Tat-sang, CHEUNG Ping-yip (st.), CHU Wai-fu, P.J. Clews, R. Ganeshanantham, HO Yui-man, B. Hudee (Miss), IP Kim-wai, KO Koon-hong (Miss), LAI Ching-shan (Miss), LAI Wing-kin, LEUNG Wing-yuen (st.), W. Meacham, NG Sai-kwong, TSE Siu-hung, Esther Wong (Ms.), WONG Hang-sing, YEUNG Kwok-ming.

REPORT ON THE IMM CONFERENCE "ROCK ENGINEERING AND EXCAVATION IN AN URBAN ENVIRONMENT"

In February Hong Kong was host to the first international conference "Rock engineering and excavation in an urban environment" which was held at the Sheraton Hotel.

The theme of the conference was planned by the Hong Kong Section of the Institution of Mining and Metallurgy and the conference was run by the IMM with the cooperation of the Hong Kong Institution of Engineers.

The IMM which was founded in 1892 was one of the founder members of the Council of Engineering Institutions. The main concern of the IMM has been advancing the science and practice of the minerals industry and most IMM members throughout the world are involved in finding, extracting and refining minerals. However in recent years the IMM membership has increasingly included people working in the field of civil engineering with interests ranging from site investigation, rock and soil slope engineering, deep excavations and tunnelling. In fact at present the IMM membership in Hong Kong is almost entirely in this field of engineering although many of those here also have expertise and experience in mineral exploration and mining.

Two of the most widely used and quoted texts in rock engineering are Hoek and Bray's Rock Slope Engineering and Hoek and Brown's Underground Excavations in Rock, both published by the IMM. As with all fields, there is a constant need to refine and improve techniques and it was as part of this process that the IMM decided to hold the conference. The theme is very much a timely one since, for various reasons, the constraint of an urban environment is increasingly producing rock engineering problems which require special consideration that are peculiar not to the nature of the work so much as the area in which it is located. Hong Kong was an obvious venue for such a conference both from a tèchnical and a tourist point of view.

Nearly 150 delegates attended, 50 of whom came from overseas from Europe, U.S.A., China, Malaysia, Australia and South Africa. The Conference was opened by Bill Yuill, the President of the IMM and himself an exploration geologist. The delegates were then addressed by Evert Hoek who had specially rearranged his hectic programme of worldwide commitments so as to be able to attend the opening session. Dr. Hoek delivered a fascinating keynote speech on the development of rock engineering over the past 25 years and with his unrivalled experience was able to set the scene for the following days of technical discussion.

Over 40 technical papers were presented in a series of theme sessions devoted to topics of site investigation, design and excavation of rock slopes, groundwater, deep excavations, drilling and blasting and underground excavations.

The sessions were arranged for the Rapporteur system in which a group of papers were first summarized and then the authors and contributors from the floor addressed specific key aspects. The system was very successful in that not only was there a great deal of interesting spontaneous discussion but also the attendance at the various sessions was maintained at a high level throughout the conference - a fact remarked on by seasoned conference goers. The sessions on drilling and blasting and tunnelling were almost standing room only.

All of the papers were included in a bound volume of preprints issued before the conference. At present the various discussion items and authors' replies are being collated and in June will be available as the full volume of the Proceedings of the Conference. Judging from the opinions expressed at the conference by the delegates it seems that the Proceedings will become an essential part of rock engineering literature for civil engineering work.

On the day after the technical sessions the morning was devoted to a visit to a rock excavation site on Tsing Yi Island where delegates saw a variety of activities underway. All enjoyed the lunch generously provided by Aoki Corporation and also the boat trip - even if it was over an hour late in returning !

The afternoon of the same day was devoted to a whole range of individual site visits with delegates being despatched to various parts of Hong Kong, Kowloon and New Territories in small groups to see all sorts of open and udnerground excavations. The list of the organisations and people who made these visits possible is too extensive to give here but all those who went on the trips expressed their thanks. In fact since then the IMM here has received letters of appreciation from Switzerland and the UK referring particularly to the site visits.

The last tehcnical visit was an all day visit on Saturday, March 1st to Daya Bay and Shenzhen. A coach load of delegates attended this very successful visit in which not only was the nuclear power station site visited, for which thanks to Blasting Consultants Asia, but also various other areas of interest including both portals of the Chinese constructed Sha Tau Kok road tunnel, Shenzhen old quarry, stonecutters' works,etc. The tour ended with a meal in the Shenzhen Hotel and a KCR trip back home.

Many of the conference activities were conceived as part social/ tourist value and this went down well with the overseas visitors particularly. However there were a number of specific social events arranged starting with the conference Reception held in the Sheraton. The IMM decided to subsidise the daily conference lunches and this provided a well patronised occasion for delegates to continue the technical discussions or just to talk about the best place to buy computer software.

The Conference Dinner, in Chinese Banquet style, was well attended and gave those new to Hong Kong something out of the ordinary as far as food goes. As with all conferences many made new contacts and in some cases renewed old friendships.

Those in Hong Kong who originally conceived the idea of the conference theme have been rewarded with the knowledge that the event was a great success - even the weather was about as good as could have been expected for this time of year.

The true success of any conference is however to be judged by the use which is made of the volume of Conference Proceedings. With the large number of excellent well documentated case histories presented and the very pertinent discussions to be included, it seems that this volume, like Hoek and Bray and Hoek and Brown, is set to be regularly used by those involved in urban rock engineering.

Peter Whiteside
Secretary, Hong Kong Section of IMM

SYMPOSIUM ON THE ROLE OF GEOLOGY IN URBAN DEVELOPMENT IN SOUTHEAST ASIA (LANDPLAN III)

Progress Report (see Newsletter, v.3, no.6, November 1985, for full description of the conference).

There has been a very good response to the call for papers. The total number of papers indicated stood at 112 on April 10th, with about 66 Abstracts received and being reviewed. Responses have come from all the five ASEAN countries, also China, India, Bangladesh, Pakistan, Sri Lanka and Fiji, among others.

The International Union of Geological Sciences has confirmed that it will sponsor three guest speakers of international standing. Among other overseas organizations, the French Bureau de Recherches Geologiques et Minieres has offered several papers and consulting firms in Australia, the Netherlands and the United Kingdom have expressed their intention or interest in contributing.

Organizing Committee

A large number of persons have been approached and have agreed to assist in various capacities in organizing the symposium. Overall liaison is being handled by Dr. A.D. Burnett (Chairman and technical programme), Dr. D.R. Workman (Secretary and conference facilities), Mr. K.W. Lee (liaison with China), Prof. C.J. Grant (liaison with Unesco), Mr. C. Dutton (Treasurer and hotel accommodation), Mr. P.G.D. Whiteside (Abstracts and editorial) and Mr. M.D. Howat (field trips and exhibitions). Sub-committees are being organized to handle these matters as the need arises.

Anyone or any organization wishing to assist in or contribute to any aspect of the symposium or its organization, especially in respect of training course inputs (see below), site visits, exhibitions and demonstrations is requested to contact the Chairman of the organizing committee, the Secretary or any of the memebrs of the Committee named above. The address of the Organizing Committee and the Secretary is : Geological Society of Hong Kong, c/o Department of Geography and Geology, University of Hong Kong (Tel. 5-8592831 or 2836). The Chairman, Dr. Burnett, may be contacted directly at the Geotechnical Control Office, 6/F., Empire Centre, 68 Mody Road, Tsim Sha Tsui East, Kowloon (Tel. 3-7211873) or at the Society's address, above.

Workshops/Training Courses

It is planned to hold short parallel sessions on some or all of the following topics, to be presented mainly by Hong Kong speakers and invited guest speakers, over a 2-day period (15-16 December) preceding the conference sessions proper.

A Geological mapping in the urban environment

B Geotechnical area studies and terrain evaluation for urban development

C Weathering profiles and subsurface excavations in tropical areas

D Geological aspects of slope stability

E Site investigation and laboratory testing

F Marine studies for harbours, reclamations and foundations

G Applications of geology in environmental protection

H Education of geologist for employment in civil engineering

In returns from the First Circular, interest has been expressed in all of these topics by a total of more than 50 persons. All eight topics have received at least 15 indications of interest in attending from outside Hong Kong, and A, B, D and G more than 25 (the average response of the 53 shows interest in about 3-4 topics per person responding).

It is not intended to hold to any rigid deadline for local contribution, as the symposium is recognized as an opportunity to give wide exposure to the range of engineering geological work going on currently in Hong Kong. So far there have been about 15 Abstract submissions by Hong Kong authors. Anyone wishing to submit Abstracts (200-500 words) should do so as soon as possible.

1985 IN RETROSPELT

The year was another busy one. A total of 20 events were organized by the society. The Marine Studies Group and Teacher's Group, both established in 1984, also continued to hold regular meetings. Two groups of geoscientists from China, one from the Guangdong Seismological Bureau and one from the South China Sea Institute of Oceanology, accepted invitations to visit Hong Kong, and each participated in a special seminar. Field excursions to Hainan, Guilin and the environs of Guangzhou and a one-day excursion to Shenzhen were organized.

The Proceedings of the Conference held in December 1984 on "Geological Aspects of Site Investigation" were published in the summer of 1985 as Bulletin No. 2 of the Society, containing 17 papers. The collected papers presented at the seminar on Marine Geology of Hong Kong and the Pearl River Mouth (see below) were also issued as a special publication.

The Society undertook to organize a conference in Hong Kong in December 1986 on 'The Role of Geology in Urban Development in Southeast Asia', sponsored by the Association of Geoscientists for International Development with the support of the International Union of Geological Sciences and the Unesco Regional Network for Geosciences (see Newsletter v. 3 no. 6, November 1985).

SUMMARY OF PROGRAMME

SPECIAL SEMINARS	Aspects of the seismology of Guangdong - lectures by member of the Guangdong Seismological Bureau (July).
	Marine Geology of Hong Kong and the Pearl River Mouth (Whole-Day Meeting organized by the Marine Studies Group) - lectures by members of the society and staff of the South China Sea Institute of Oceanology, Guangzhou (September).
	(Both seminars were reported on in the Newsletter, v. 3, no. 5, September 1985).

JOINT MEETING WITH HKIE GEOTECHNICAL GROUP (2nd Annual Meeting)	Quarrying and Aggregate Production in Hong Kong. Speaker : M.J. Atherton and C. Maunder (February).
LECTURE	Classification of the Hong Kong Granites P.J. Strange (March) Geology of Sheet 7 (Taipo-Shatin area) R. Addison (April) Recent Advances in Hong Kong Stratigraphy C.M. Lee, with contributions by M. Howat, K.W. Lai and P.S. Nau (May) Some Geological Features of Hainan R. Shaw and R.L. Langford (June) Palynology and its Applications and Clastic Sedimentology - its Applications in the Oil and Gas Industry C.P. Sladen and J. Ince (December)
VISIT TO GCO	Visit to the Geological Survey Section of the Geotechnical Control Office, with presentations and exhibitions by members of the GSS staff led by R.S. Arthurton (September)

FIELD MEETINGS AND EXCURSIONS	Shenzhen	(January)
	Castle Peak	(February)
	Ma Wan	(March)
	Hainan	(April - 8 days)
	High Island	(May)
	Ping Chau	(July)
	Ledge Point	(October, repeated in November)
	Guilin	(October - 6 days)
	Lamma Island	(November)
	Guangdong	(December - 6 days)

ANNUAL GENERAL MEETING (May)

FUTURE INTERNATIONAL MEETINGS

(See also Newsletter v.4, no. 4)
Language English unless otherwise stated. Chinese and English for meetings in China.

August 8-17, 1986.
ENGERGY RESOURCES IN ASIA, Hong Kong.
(The Co-ordinator, AEMP, Asian Research Service, GPO Box 2232, Hong Kong.)

August 17-22, 1986
CIRCUM-PACIFIC ENERGY AND MINERAL RESOURCES (4th Conference), Singapore.
(Circum-pacific Conference IV, c/o AAPG, P.O. Box 979, Tulsa, OK 74101, U.S.A.)

September 1-5, 1986
INTERNATIONAL CONFERENCE ON DEEP FOUNDATIONS, Beijing.
(Comprehensive Institute of Geotechnical Investigation and Surveying, c/o Prof. WANG Zhong-qi, 7 Shan Lao Hutong, East City District, Beijing, China.)

October 7-14, 1986
SEA-LEVEL CHANGES AND APPLICATIONS (Symposium), Qingdao.
IGCP Project 200. (Prof. ZHAO Song-ling, Institute of Oceanology, Academia Sinica, 8 Nan-hai Road, Qingdao, China.)

November 3-7, 1986
ENGINEERING IN COMPLEX ROCK FORMATIONS (International Symposium), Beijing.
(Prof. TAN Tjong-kie, Institute of Geophysics, Academia Sinica, Beijing, China.)

December 15-20, 1986
THE ROLE OF GEOLOGY IN URBAN DEVELOPMENT IN SOURTHEST ASIA
(Geological Society of Hong Kong, c/o Department of Geography and Geology, University of Hong Kong.)

April 7-10 1987
DRILLEX '87, international conference and exhibition on drilling for the minerals industry and geotechnical engineering, Stoneleigh, Warwick, England.
(Conference Office, Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, England.)

May 4-8, 1987
INTERNATIONAL SYMPOSIUM ON ENGINEERING GEOLOGICAL ENVIRONMENT IN MOUNTAINOUS AREAS, Beijing.
(Prof. WANG Sijing, Organizing Committee, International Symposium on Engineering Geology, Institute of Geology, Academia Sinica, Beijing, P.O. Box 634, China.)

July 20-24, 1987
EIGHTH ASIAN REGIONAL CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING, Kyoto
(T. Adachi, Secretary of the 8th ARCSMFE, Kyoto International Conference Hall, Takara-ike, Sakyo-ku, Kyoto 606, Japan.)

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

August 20-23, 1987
PACIFIC SCIENCE ASSOCIATION (16th Congress), Seoul. Section B: Solid Earth Sciences
(Prof. Bong Kyun Kim, Department of Geological Sciences, College of Natural Sciences, Seoul National University, Seoul, South Korea.)

August 26-29, 1987
PACIFIC RIM CONGRESS: Geology, structure, mineralisation and economics of the Pacific Rim
(Australian Institute of Mining and Metallurgy, P.O. Box 731, Toowong, Qld 4006, Australia.) Some reply cards available from GSHK Secretary.

August 30-September 4, 1987
INTERNATIONAL SOCIETY FOR ROCK MECHANICS (6th International Congress). Montreal

(Prof. B. Ladanyi, Department of Civil Engineering, Ecole Polytechnique, Box 6079, Stn. A. Montreal, Canada H3C 3A7.)

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

JOURNAL OF SOUTHEAST ASIAN EARTH SCIENCES

From the publisher (Pergamon Press) :-

Geoscientific literature in English for most parts of Southeast Asia is limited and the Journal of Southeast Asian Earth Sciences is launched to fulfill this long-felt need amongst earth scientists for a geoscientific journal to serve and to assist in the promotion of the geoscientific development in Southeast Asia.

The Journal of Southeast Asian Earth Sciences is an international interdisciplinary journal devoted to all aspects of research related to the earth sciences in Southeast Asia. Papers featured will include the results of research on regional geology, economic geology, geochemistry, petroleum geology, petrology, palaeontology, geophysics (seismology, magnetics, electrical and gravity), structure, tectonics, geomorphology, engineering geology, Quaternary geology and analysis of sedimentary basins.

The geographical area covered by the journal is taken to include Burma, Thailand, Malaysia, Vietnam, Kampuchea, Laos, Southern China, Hong Kong, Singapore, Indonesia, Papua New Guinea and the Philippines.

The journal will be primarily devoted to research papers but short communications relating to new developments of broad interest, book reviews and technical reports of meetings will also be included. In addition, the journal will welcome reviews and bibliographies/abstracts of important communications written originally in local Southeast Asian languages.

Submission of papers for publication will be welcomed. Contributors should send three copies of completed manuscripts to the Editor-in-Chief.

Editor-in-Chief : B.K. Tan,
Department of Geology,
University of Malaya,
59100 Kuala Lumpur, Malaysia.

Subscription Information

The first issue of the Journal of Southeast Asian Earth Sciences is due in 1986.

Published quarterly

Annual subscription (1986)	US$ 90.00
Two-year rate (1986/87)	US$171.00

Send orders or enquiries to :-

Pergamon Press, Headington Hill Hall, Oxford OX3 OBW, England.

FORTHCOMING MEETINGS

31 May Saturday	SEA LEVEL CHANGES IN HONG KONG DURING THE LAST 40,000 YEARS.
2:00 p.m. - 5:30 p.m.	The provisional list of speakers and topics includes : T.S. Cheng (Royal Observatory) Sea-level changes during the last 80 years. R. Cheung (Engineering Development Department) Evidence for sea-level changes from the North Lantao Airport Replacement Study. W. Meacham (Hong Kong Archaeological Society) Archaeological evidence for sea-level changes. C.D.R. Evans (British Geological Survey) Holocene marine sedimentation and erosion in Hong Kong waters - evidence from seismic profiles. M.D. Howat (Mass Transit Railway Corporation) Geotechnical evidence for sea-level changes in Hong Kong. B.S. Morton (University of Hong Kong) Biological evidence for sea-level changes. W.S.-S. Yim (University of Hong Kong) A sea-level curve for Hong Kong during the last 40,000 years. Members of the Society wishing to attend are asked to register as soon as possible, using the reply slip enclosed, if they have not already done so.
7-14 June	EXCURSION TO TAIWAN Booking now closed. Enquiries about possible last-minute places to Paul Cheung, K-7216062.
29 June Sunday	Field excursion to CHEK CHAU (PORT ISLAND). A rare chance to visit this beautiful and uninhabited island, type locality of the Port Island Formation.
Dep. Ma Liu Shui (Chinese University) ferry pier at 9:30 a.m. Arrive back about 5:30 p.m.	Cost : Members $35 accompanying persons $45. Return reply slip in this issue, with payment, to P.S. Nau, Dept. of Geography & Geology, University of Hong Kong. (Tel. 5-8592832).

TEACHER'S GROUP FIELD-TRIP TO CENTRAL CHINA IN LATE JULY

Tentative Itinerary (Estimated cost : HK$2500)

July 17 (Thursday) to July 31 (Thursday) (14 days inclusive)

Day 1 (17)	:	leave H.K. by night ferry to Guangzhou
Day 2 (18)	:	reach Guangzhou by early morning, fly to Yichang (宜昌)at 12:50 p.m.
Day 3 (19)	:	visit Gezhouba (葛洲壩)
Day 4 (20)	:	visit Sandouping (三斗坪) and stay at Shennongjia (神農架)
Day 5 (21)	:	visit Shennongjia
Day 6 (22)	:	visit along Changjiang (長江) by boat up to Zigui
Day 7 (23)	:	along Changjiang up to Wushan (巫山)
Day 8 (24)	:	along Changjiang up to Fengjie (奉節)
Day 9 (25)	:	from Fengjie across mountains to Enshi (恩施)
Day 10 (26)	:	to Dajong (大庸)
Day 11 (27)	:	visit Zhangjiajie (張家界)
Day 12 (28)	:	visit the largest limestone cave in China
Day 13 (29)	:	go to Changsha (長沙)
Day 14 (30)	:	reach Guangzhou by train
Day 15 (31)	:	return Hong Kong by through-train

** Transport without specification is by coach.

The main interest include folding, faulting, mass wasting, limestone features, fossils, stratigraphy, temperate forest, and water conservancy projects; plus the beautiful scenery.

Hong Kong leader : Mr. Nau P.S.

Local leader : Yichang Geological Research Bureau (translation)

There may still be a limited number of places available, when this issue of the Newsletter appears, and if so applications from members of the society who are not members of the Teacher's Group will be considered. The reply slip contained in this issue should be sent without delay to :-

Miss POON Yuen-han,
18 Tong Shui Road, 4/F, Flat 510,
North Point,
Hong Kong.

REPLY SLIP

MEETING ON SEA LEVEL CHANGES IN HONG KONG DURING THE LAST 40,000 YEARS

Name & Title ______________________________ Tel. No. __________

Affiliation ____

Address ____

I wish to attend the meeting and enclose a crossed cheque for \$20* to cover the cost of attendance, refreshments and handouts.

Signature ____________________

* Payable to - 'Geological Society of Hong Kong'
Please return this slip to the Geological Soceity,
c/o Department of Geography & Geology, University of Hong Kong,
Pokfulam Road, Hong Kong.

REPLY SLIP CHEK CHAU (PORT ISLAND)

I/We wish to attend the Chek Chau field meeting on June 19th.

NAME(S):

NAME(S) OF ACCOMPANYING PERSON(S):

I/We enclose payment of \$
(Cheque payable to Geological Society of Hong Kong - see under Forthcoming Meetings for cost)

Contact Telephone No. __________

If any proposed accompanying persons are under age 16,
please give age in brackets.

Please return this slip to the Geological Society,
c/o Department of Geography & Geology, University of Hong Kong,
Pokfulam Road, Hong Kong.

REPLY SLIP - FIELD-TRIP TO CENTRAL CHINA ORGANIZED BY THE TEACHERS GROUP

I/We are members of the Society and am/are interested in joining the trip to China. I/We understand that personal particulars and payment shall reach the responsible person about one week after notification of acceptance.

Name(s): Tel. No. __________

Address: ____

Occupation : ______________________________

Send completed slip to :

Miss POON Yuen-han,
18 Tong Shui Road, 4/F, Flat 510,
North Point,
Hong Kong.

3. 褐黃色細粒至中粒砂岩。含大小約爲1.5至2毫米的細粒礫石及少量白雲母片。岩石分選性中等。厚 3 米。

斷層

2. 灰色石英岩狀細粒含礫砂岩。含約 1 %的白雲母片。厚度大於 4 米。

1. 灰色石英岩岩(或細粒礫岩)。碎屑物粒度不均勻，從1.5至5毫米變化。岩石中泥質膠結物受蝕變作用而爲黃綠色滑石及絹雲母。厚度大於 2 米。

化石組合

化石是在一九八五年底至一九八六年初採集，有植物及動物化石，但前者多爲碎片不易辨認。化石採自如圖 1 所示的從 A 至 E 的五個地點。這些地點分佈於10，11及12三個層位中。大部分的化石來自層位11。動物化石中以瓣鰓類爲主，且多爲同一屬種。化石由中山大學地質系吳起俊教授鑑定，部分依據實物標本，部分依據作者所提供的照片(因部分實物標本未能及時送往中山大學)。由於採自層位12的部分化石只有 2 毫米大小，故頗難鑑定。已鑑定的化石組合及化石年代如下：

	化　石	採集地點	年　代
菊　石：	Sinoceltites sp.(圖版1, a)	D	
瓣鰓類：	Modiolus sp.(圖版1, b)	A,B	上三疊世
	Bakevelloides sp.(圖版1, c)	A,B	
	?Holobia sp.	B	中至上三疊世
	?Fadcimytilus sp*(圖版1, d)　d	B	上三疊世
	?Astarte sp.(圖版1, e)	C	三疊紀至侏羅紀
腹足類：	Naticopsis sp.(圖版1, f)	C	中泥盆世至三疊紀
	Worthenia sp(圖版1, g)	E	泥盆紀至三疊紀
	Euomphalus sp.(圖版1, h)	A	奧陶紀至侏羅紀

(*由作者鑑定　圖版 1 請參閱英文版)

討論

如上列，菊石及瓣鰓類化石的年代屬上三疊世，但腹足類的年代則可自早古生代延續至早中生代，因此，岩層的年代應以菊石及瓣鰓類化石的年代爲依歸。

據吳起俊教授指出，在此之前，菊石Sinoceltites sp.只見於四川及西藏，在華南地區未找到過。這一菊石在香港出現顯示在上三疊世時，中國西部及南部的海盆地是有聯系的。

根據南頤所著廣東地層概述一書，廣東省下三疊世爲淺海相炭酸鹽岩及碎屑岩，中三疊世則爲淺海及濱海相碎屑岩，而上三疊世在廣東省中部爲濱海相(或淺海相)碎屑岩(小坪組)。本區所找到的瓣鰓類如Modiolus及Bakevelloides 均見於小坪組碎屑岩中，可見本區地層與廣東中部的小坪組地層是可以對比的。

結論

根據本區碎屑岩中所產的菊石及瓣鰓類化石，本區地層年代爲上三疊世。岩中所含的古生物群顯示當時的沉積環境爲濱海沉積。本區地層建議命名爲泥涌組。

參考文獻

南頤，1979，廣東地層概述，廣東地質學校翻印。

Allen, P.M. and Stephens, E.A. (1971). Report on the Geological Survey of Hong Kong. Hon Hong Kong Government Press.

香港新界泥涌村輪渡碼頭沿岸的上三疊統地層

鈕柏燊
香港大學地理地質系

簡介

依據Alien及Stephens 1971年的香港地質報告，泥涌輪渡碼頭(泥涌村在此碼頭東南500米) 沿岸的沉積岩屬中一上侏羅統淺水灣組火山岩系中的沉積夾層(RBs)。其岩性則與吐露海峽組或吐露港組有相似之處。

作者最近(一九八六年一月)在該碼頭附近發現了第一個菊石化石(Sinoceltites sp.) 。這有助於確定該處沉積岩層的時代。根據所採集到的菊石及其他化石，該地沉積岩層的年代屬上三疊世；建議命名爲泥涌組。

地質背景

泥涌碼頭沿岸的沉積岩爲砂岩、粉沙岩、泥岩、頁岩及礫岩。岩層大致呈北東偏東延伸，傾向南東偏南(140°－160°)，傾角自44°至68° 。岩層中無強烈褶曲現象但爲多條高角度走向斷層切割。岩層雖受斷層破壞，仍可注意到岩層下部沉積物的粒度較上部的爲粗粒。岩層底部和頂部均未見出露，因爲其下部受到花崗岩侵入而上部則爲現代河流及海洋沉積物所覆蓋。岩層厚度估計大於52米。由於受到花崗岩侵入及斷層作用的影響，岩石多具輕微變質，岩層層序將於下節討論。

出露於碼頭西側沿岸的花崗岩爲肉紅至灰色，中粒，侵入於砂質岩層中並使砂質岩石中的泥質膠結物產生蝕變形成黃綠色的滑石及絹雲母。

岩層中的多條斷裂均屬走向斷層，其走向大致與岩層走向平行。多數斷層向南東偏南方向傾斜，傾角76°至87°。其中一條傾向北西偏北，傾角61°。沿各斷層可見糜稜岩，劈理，小型褶曲及石英脉，這顯示斷層壓性斷層。其中緊靠碼頭出現的一條斷層爲一寬約2至2.5米的破碎帶，呈北東走向，傾角陡，傾向不明，屬張性斷層。由於斷裂側的一層角礫岩受到影響，故破碎帶中除見有稜角狀的斷層角礫外，亦見有來自礫岩的滾圓礫石，破碎帶受硅化作用的影響形成石英岩石。此外亦有黃鐵礦化。

本區地質參閱圖 1 (見英文版部分)。

岩層層序

本區岩層層序不完整。自新至老列述於下：

12. 黑色炭質頁岩。岩石中含植物碎片，瓣鰓類：Modiolus sp., Bakevelloides sp., Halobia sp. 及腹足類：Euomphalu sp.等化石。岩石具劈理，傾向N55°E ，傾角82°，厚度大於 2 米。
11. 黃灰色雲母質泥岩，局部夾黑色炭質泥岩。岩石中含植物碎片，菊石：Sinoceltites sp.,瓣鰓類：Modiolus sp., Bakevelloides sp., ?Astarte sp., Faclcimytilus sp.,及腹足類：Naticopsis sp等化石。本層與上、下層位之間的界線不明顯。厚約 7 米。
10. 灰紅色雲母質泥岩，含腹足類：Worthenia sp.化石。厚度大於10米。
9. 黑色炭質頁岩及泥岩，局部具板岩狀。厚約4.5米。
8. 暗灰至黑色泥岩夾頁岩。厚約 5 米。
7. 帶紅的灰色泥質粉砂岩夾不連續的簿層粉砂岩。厚約7.5米。
6. 灰色堅硬的石英岩狀礫岩。礫石由砂岩，粉砂岩及石英岩組成。礫石滾圓，大小爲2至3厘米，大者可達10厘米。厚度大於0.5米。

斷層

5. 灰色紋層狀粉砂岩夾細粒砂岩。厚約 5 米。
4. 黑色暗灰色板狀頁岩夾細粒砂岩透鏡體，透鏡體約爲0.3至1米寬，2至 3米長。本層底部具部可見具交錯層的紋層狀粉砂岩(厚約30厘米)及泥岩(厚約60厘米)。厚度大於 4 米。

桂　林　遊

李 坤 榮

一九八五年十月18－23日我會應桂林地質學院及桂林岩溶地質研究所邀請組團訪問。此行由於主方的適當安排使我團在這短短五日行程中：有時間作了六個專題的學術演講和參觀了桂林地區的著名岩溶和風景區。現按行程順序報導如下：

18日晨我團抵達廣州市州頭咀碼頭，得到廣東省地震局高承范副局長、何啓義主任的熱誠接待，隨即到地震局會見了丁源章局長和該局的工程師。賓主進行了座談。當天上午該局安排我團到越秀山五層樓遊覽。由於部份團員是首次到廣州，因此對羊城風貌極感興趣。中午時高副局長在機場餐廳設宴招待，並親自到閘口送行。

下午三時許抵桂林機場，地質學院袁奎榮院長，岩溶所長袁道先博士等列隊歡迎我團。當晚全體出席了主方的晚宴。袁院長致歡迎詞，表示熱烈歡迎我會組團到訪。我團由會長A. D. Burnett 致答詞。當晚賓主盡歡。

19日上午分別參觀了桂林地質學院和岩溶所。前者由袁院長介紹該院狀況和設施，並參觀了該院的地質陳列館。岩溶所由袁道先博士介紹中國各地不同的岩溶特徵，同時放映了幻燈片。俟後參觀了新建的岩溶地質陳列館。桂林岩溶所是全國唯一的岩溶研究中心，擔負了三百萬平方公里面積的碳酸鹽岩層的岩溶研究任務。該所成立多年，研究成果不斷地受到國內外同行的重視。這次巧遇牛津大學地理系主任M. Sweeting 教授的第五次到訪。

下午參觀了蘆笛岩和叠彩山。

20日乘當地遊覽船沿漓江航行至陽朔。適逢天高氣爽，沿途層岩叠翠、奇峰異景，使人有點目不暇給。主方特別安排幾位熟識兩岸地質及岩溶情況的專家作導遊。牛津大學M. Sweeting 教授亦同船遊覽。

21日在岩溶所我團作了三個專題演講，其中涉及城建工作如何規劃、城市環境中的隧道挖掘，珠江口與香港近代海平面的變化。同時放映了介紹南斯拉夫、愛爾蘭岩溶的幻燈片。

下午先參觀廣西植物園，該單位保存數以萬計的華南地區植物標本，其中一部份是罕見的標本。俟後參觀了新石器時代古人類洞穴，該處已進行過現地挖掘，我們不但見到出土的古人類骨骼和用具，同時亦見到已挖掘的現場。實在大開眼界。上述兩單位均為我們作了詳細講解。

晚上在桂林地質學院作了三個專題演講，其中包括有香港地質介紹、英國花崗岩及其水文地質特徵，香港風化花崗岩的分類。

22日上午參觀了穿山、七星岩、象鼻山。當晚由岩溶所在榕城飯店設宴送別。宴會中袁道先博士致詞，我團D. Workman代表我會向主方致謝。

23日上午，兵分兩路，六位團員到遠離桂林40餘公里的六屯參觀第四紀冰川的冰磧層，其餘團員到市內購物。

午膳後即奔赴機場，袁院長及袁道先博士等均有到機場。入閘前雙方握手道別時，A. Burnett及D. Workman等表示歡迎桂林同行早日到港回訪。下午五時許乘搭的 737 航機降落啓德機場。這便結束了這次桂林遊。

學者訪問

長春地質學院院長張貽俠教授、副院長李獻中先生、後勤設備科科長王先生共三人，應香港教科文協作顧問有限公司邀請，於一九八六年一月十七日至二十三日間訪問香港。

他們專程來港目的，是來考察大中學校的教育，尤其側重於地理、地質學的教育。來港期間，他們訪問了香港大學地理地質系、香港中文大學地理系、香港地質學會、工務局土力工程處以及它的香港地質調查組。他們也訪問了一些中學，例如培僑中學以及一些職業專科學校。

他們向被訪問單位及人員贈送了1985年長春地質學院學報；1976－1985論文摘要選；1985年10月在長春地院召開的國際早前寒武紀成礦作用討論會的論文摘要。他們還向各有關單位贈送了中國東北區的岩石及礦物之袖珍標本。香港地質學會秘書 D. Workman 博士也回贈了他們一些禮物，包括香港地質學會的兩本論文專輯及一套通訊；土力工程處 A. D. Burnett 博士也贈送了邊坡設計規範等出版物。

張貽俠教授是國內著名的變質岩及變質岩礦床專家之一。由於行程匆匆，來不及去野外參觀香港的多條變質岩剖面，和跟本地的同行們作進一步的學術交流，此乃雙方的一件憾事。

一九八五年春節　陳兆湖記述

8.白雲山登高

十二月三十一日，最後一日，參觀了廣州市北部風景名勝的白雲山，全區三十多座山峰，面積達二十八平方公里，主峯摩星嶺，亦爲廣州市最高處，海拔 372 米，山峰頂常爲白雲繚繞故名。它是羊城八景之一，從山頂可遠眺廣州全景歷歷在目，近則層巒叠翠。

由山頂順路而下，觀察了白雲山地質，該山爲一大致向西傾斜之南北走向單斜構造，白雲山主體，是一套中深度變質混合岩化之岩石，夾兩層石英岩。

9.虎門炮台

中午時分，驅車出廣州，經黃埔，東莞到達面對伶仃洋，地勢險要的虎門炮台，參觀了民族英雄林則徐的紀念碑，鴉片戰爭使用的大炮和清末軍事設施，憑吊了炮台遺址。

下午七時到達深圳海關，省地質局的陳挺光及王文校工程師熱情歡送我們離開。

10.後　語

這次地質旅行承蒙廣東省地質局及地質研究所盛情款待，局長親耳接見安排，研究所領導親自組織節目，參觀內容，事前做好了準備工作。陳挺光和王文校不辭勞苦，自始至終陪伴我們，陳先生在各地介紹地質地貌，深入淺出，使我們得益不淺。王先生積極安排食宿交通，使這次地質旅行得以順利全部完成。我們十分感謝廣東省地質局，研究所和陳王兩位先生。

這次是我會首次與廣東省地質局接觸交往，希望今後能促進相互訪問，進行學術交流。同時我們也期待他們早日回訪香港。

5.鼎湖山

下午，登上華南著名的風景幽雅的鼎湖山，它也是世界自然保護區之一。鼎湖山，群山環抱，古木參天，濃蔭蔽日，山間瀑布，清涼世界，古跡勝景甚多，明代慶雲寺，千人鍋尤出名，唐朝日高僧榮睿曾輾轉經此而終。

由山口到山上，鼎湖山出露三億六千萬年以前泥盆紀下中統桂頭群砂礫岩，石英砂岩夾粉砂岩及頁岩，厚約二千多米，與香港赤門海峽北岸白沙頭洲一帶所發現含魚化石的黃竹角咀岩性相當。

當晚星夜趕回廣州。

6.番禺蓮花山

廿九日晨，由廣州向南跨過珠江，經番禺縣城，到達距廣州二十多公里的蓮花山。蓮花山原名"石獅頭"，面臨珠江口尾的獅子洋，其東麓，自明代以來先民不斷地開採石材，目前遺下懸崖峭壁，奇岩異洞，雄偉挺拔，如蓮花石，獅子石，蓮花岩，八仙岩及南天門等。這些人工地形陡峻如屏，勢如刀劈，點綴着蒼松綠水，非常壯觀，令人嘆爲觀止。

蓮花山的紅岩，是四千多萬年前白堊紀時和廣州三水相連形成的湖相沉積，在炎熱乾燥氣候條件下，所有砂礫堆積都染上紅色的氧化鐵，並經鈣質及泥質所膠結，形成整套鮮紅色的地層—紅層。只是到了二千五百萬年時，地殼上升，湖水消退，隆起成山丘，並被剝蝕，日久形成今日紅層假岩溶景觀——丹霞地貌。

近百萬年以來珠江三角洲一次小海浸，冲蝕到蓮花山東麓，幾經變遷，而今古海蝕崖的獅子石却依然得以保留，佐證海浸的古痕跡。

我們參觀了蓮花山的古城和蓮花塔。

參觀蓮花山完畢折回廣州，晚上還遊覽了廣州的人民公園。

7.流溪河水電站及從化溫泉

卅日，我們驅車到東北七十多公里的從化流溪河水電站，該站建於五十年代，水壩建於花崗岩基上，拱壩高七十八米，屬單拱壩。工程地質條件良好，裂隙少，主壩施工質量佳，壩底幾乎滴水不漏。發電廠則建於下游岩洞內，發電量爲四萬多千瓦，我們參觀了機房的發電運轉，並了解下游水利灌溉受益等綜合利用情況。

接着參觀了附近的療養勝地—從化溫泉，溫泉產於花崗岩裂隙帶中，溫泉衆多，達十二個泉眼，出露面積約零點二平方公里，水溫最高達71°C，晝夜流量約一千四百多噸，溫泉水無色，無味，含鈣、鎂、二氧化矽及氡等，有益於人體健康。溫泉以水好，環境優美著稱，故闢爲療養勝地。

溫泉花崗岩屬侏羅白堊紀，受北北東向及北西向兩組斷裂所割切，溫泉水沿着這兩組斷裂交叉處成沿北東向主斷裂上升流出，形成地下熱水。顯然，從化溫泉的形成主要是受廣州—從化大斷裂控制，而其熱量則來源於地下深處的地熱影響。

此外，我們還遊覽了天湖水庫。回程中，尙參觀了新建的北回歸線紀念塔。

3.三水油田

當日下午北上參觀了三水油田。首先由地質部第十二普查大隊負責人介紹該油田地質概況，旋即觀察了含油地層剖面，不少人採到石膏礦層，接着參觀了一個油井的抽油情況。三水油田位于廣州以西三水縣附近而得名。那裡發育數千米的白堊系及第三系地層，白堊系有豐富的石膏礦層。而含油層則發育於早第三紀始新統地層中。油層在千米以下。我們很幸運看到從深油井抽油噴油的情況。

當晚宿於肇慶鼎湖山風景區的地質療養院內。

三水油田一抽油井

4.肇慶七星岩和端硯

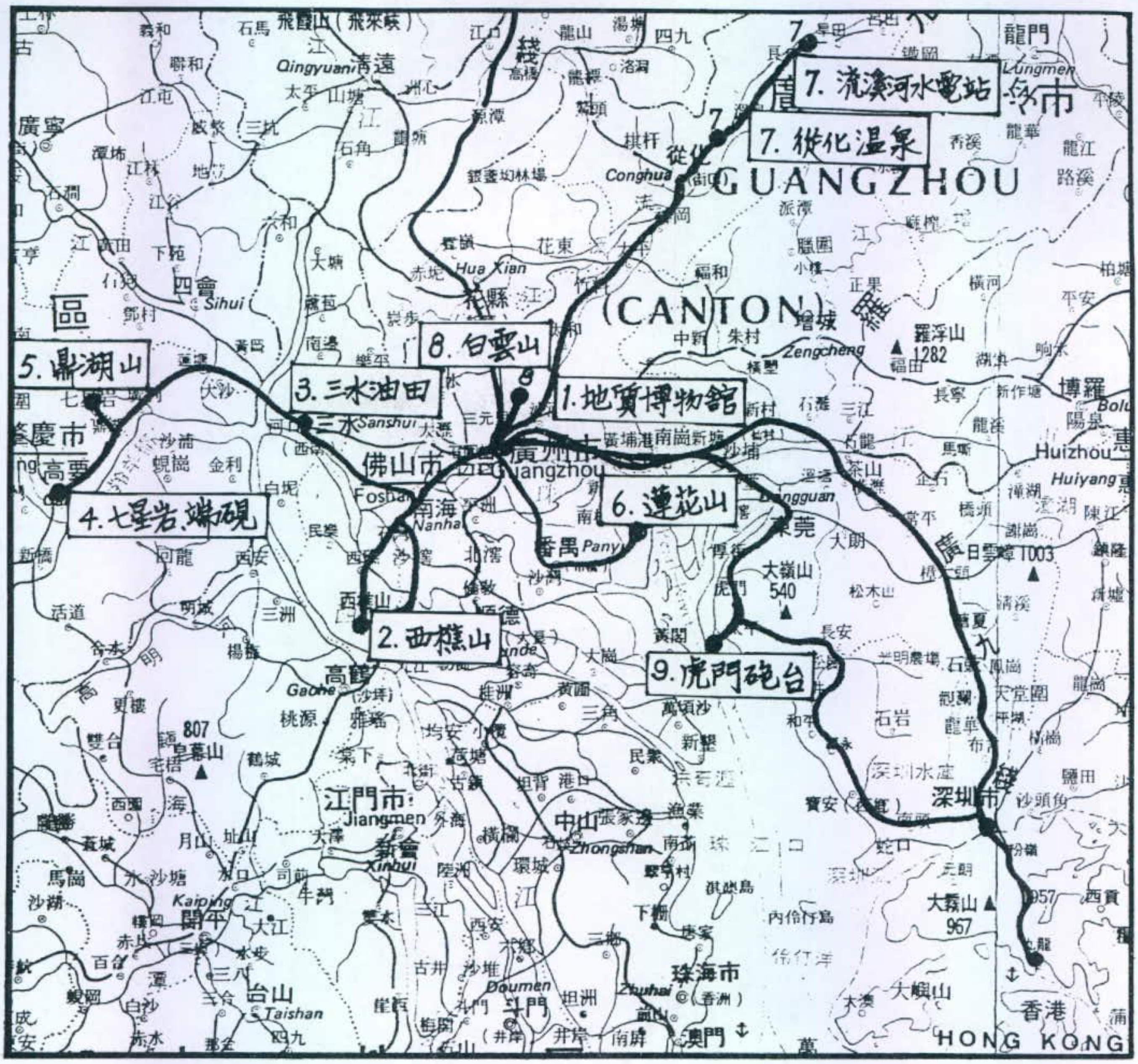
廿八日，早上到廣東著名風景區之一的肇慶七星岩，攀登了主峯之一的天柱峰。從峯頂瞰視一群峰林石山散佈在一片湖水之間。原來七星岩是三億年前中上碳統形成的石灰岩，由於受到印支運動的作用發生了褶皺形成了次一級背斜，七星岩恰好位於傾伏背斜轉折端附近，經長期流水侵蝕和溶蝕，終於形成了當今的七個奇峰，宛如天上北斗七星。

七星岩有三層溶洞，最下層石室岩洞頂高達三十多米，洞下儲水可乘艇遊暗河暗洞，水面深度受西江水影響，洞內可見石鐘乳、石筍及石柱等。三層溶洞代表地殼三次升降活動。洞外及七星岩周圍廣佈的七星湖實際上是西江三次改道遺留下的牛軛湖，在天柱峯頂我們欣賞和領略到西江河流改道自然營力作用及其結果。

在七星岩畔的米洞，大家採集到不少精美和完整的下石炭統腕足類及其他化石，如獲至寶。

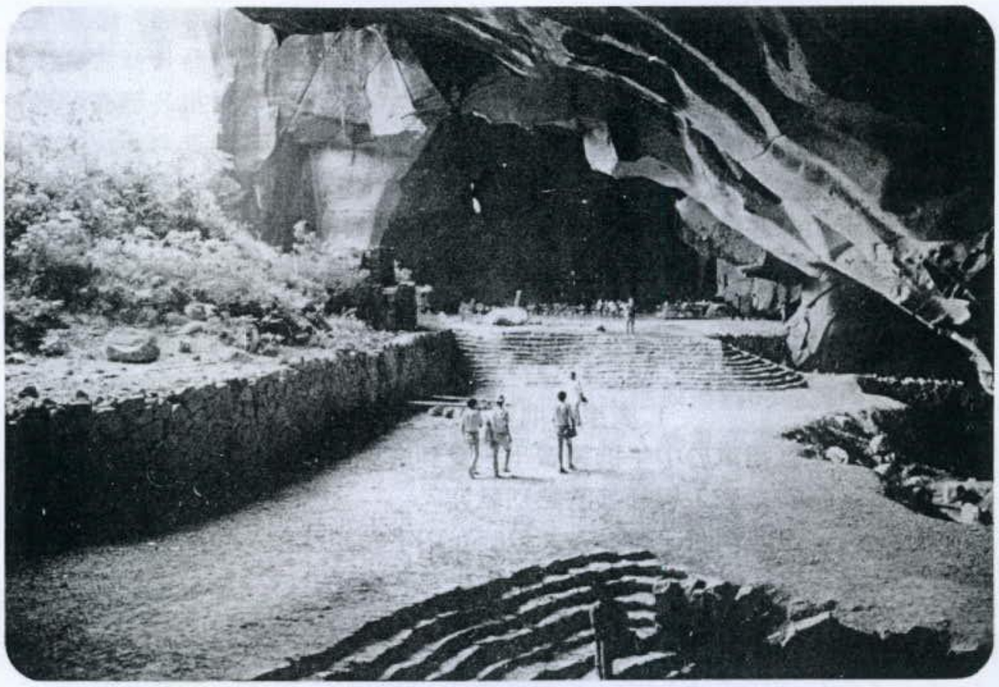
然後驅車前往西江羚羊峽出口的端溪附近，一方面看到西江穿山而出形成奇特的羚羊峽，一方面參觀出產著名端硯所出露的原石板材料。端硯爲中國文房四寶之佳品，製作始於唐朝，產品遠銷海外，在日本尤獲盛名。而原材料乃是下中泥盆統（三億七千萬年前）桂頭群泥質砂質絹雲母板岩，紫色頁岩及泥質硅質絹雲母板岩。端硯石質除具有發墨快，儲水不涸，溜不損毫的優點外，觀賞價值極高

廣州及鄰近地區地質旅行路線略圖



西樵山輪廓近圓形，它是45～51百萬年前由火山噴發所形成，是由火山角礫岩及粗面岩組成的蓮花狀火山錐，山頂依然保留有火山口湖。

由凝火岩及灰山角礫岩構成的石燕岩，是一座規模雄偉巨大的古採石場，明代先民開鑿巨大的石板和石柱。切去了半邊山，形成數十米絕壁。並深入地下開挖，猶如卡斯特洞穴，從開採技術到規模都令人驚嘆，它閃耀着珠江三角洲先民高度的智慧。至今在佛山、順德、廣州以至香港的許多古老建築物和寺廟上都可找到這種石柱和石板。



西樵山燕子岩古採石場及人造洞穴

廣州市白鶴洞白堊紀紅層恐龍蛋

廣州及其鄰近地區地質旅行紀實

李 作 明

應廣東省地質局的邀請，我會一行十八人自一九八五年十二月二十六至三十一日訪問廣東省地質局和地質研究所，並對廣州及其鄰近地區展開六日的地質觀察和旅行。我們受到該局和研究所的熱情款待，跑遍了珠江三角洲，欣賞了自然美景，豐富了對珠江三角洲地理地貌和地質的了解，同時還參觀了三水油田和從化流溪河水電站。(圖 1)

時間雖然緊迫，但安排緊湊，參觀內容十分豐富，大家都感覺收獲很大。

1.廣東省地質礦產博物館

十二月二十六日我們乘直通車於中午抵達廣州，受到廣東省地質科學研究所劉公民所長，周樹強總工程師，王文校副所長和陳挺光工程師等的熱烈歡迎。

下午參觀了該局地質礦產博物館，陳挺光工程師介紹了該館特點，我們參觀了十個陳列室，該館陳列了豐富的各時代地層、火成岩、變質岩、古生物化石、礦物及礦產標本及各種掛圖，標本之多，目不暇給，反映廣東具有十分豐富的礦產資源，世界有 156 種礦產，廣東就有 116 種，全省有1430個礦產地，其中海南島水晶礦，石碌鐵礦，雲浮黃鐵礦規模巨大和豐富的儲量尤爲著名，粵西青玉，肇慶黃金儲量也很可觀，我們還看到成窩的廣州恐龍蛋。

晚上蘇成曼副局長設宴爲我們洗塵，馬倫博士代表我們致謝。之後還夜遊廣州市。

廣東地質局蘇成曼副局長接見並合照留念於地質局大院內

2.西樵山

次日清晨，出發向南經佛山市到距廣州西南六十多公里著名的西樵山，它從珠江三角洲平原騰空而起，海拔高達三百四十餘米，危崖幽谷，流泉飛瀑，加以亭台樓閣點綴，文人墨士留書刻跡，風景特別秀麗。

較遠和強大的斷裂組，經常斜切上述兩組構造。此外，尚見吐露港地區及元朗屯門地區北東東向斷裂復活，往往順走向逆時針發生潮移呈走滑斷裂。

已有資料表明香港各地區升降運動差異不大，表現較微弱。

歷史上香港在一九八三年八月二十九日於大嶼山梅窩西北禾凹首次發生有感微地震(北緯22°17.9′，東徑114°0.7′)，震級1.5，震央 3 公里。接着同年十一月七日同上述地區(北緯22°17.9′,東徑114°0.7′)又發生了1.5級，震央也是 3 公里的微地震。一九八三年十二月六日在香港北部米舖以此后海灣內（實際已在境外）也發生了震央 3 公里，1.5級微地震。此外，在吐露港、大鵬灣、西貢半島以南外海、灣仔、佐敦海灣、西貢及后海灣亦曾發生超微地震。

這些地震均落座於北北東向及北東東向斷裂與北北西向斷裂交截部位及其附近地區，類似廣東境內新豐江地震、海豐地震及陽江地震，顯示這些交截部位是地殼薄弱的地塊亦易地震。總括香港地震記錄，它們均屬微小地震，加以地處多個構造斷裂系統交截，能量亦易於釋放。

從蓮花山大斷裂延伸北東至福建省及浙江省部份，從整體及歷史地震發生的周期性分佈看十七世紀活躍，十八世紀寧靜，十九世紀至上半世紀再活躍，而最近可能進入第二次寧靜周期。結合到香港地質條件及溫泉記錄，蓮花山大斷裂特別是香港地區於近期發生大地震的可能性很小。

然而，也應該指出，中國南海的擴張，華南地塊大陸架與南海海盆擴張碰撞的深大斷裂即位於南澳外海向南西至香港外海，中國擔桿群島以南呈北東東向延伸，歷史上有過中強地震。它的活動勢必影響距該斷裂以此相距近百公里的香港地區，這是值得留意的(圖 3)。

三、

最後，李坤榮先生以地下鐵港島線建造過程中某些工程施工實例論述工程地質重要性。

第一個實例是北角地鐵隧道湧水。407工段東行隧道Ch197-233米發生水浸，當時水深達 1.2 米，施工被迫停頓。經現場調查後，發現水源主要來自淡水，僅少量來自海水。因海水含鹽度達33%，憑味覺試驗隧道中滲水只稍具咸水。90%滲水均流自隧道中幾個超前探孔。問題性質査出來了，便對症下藥，處理辦法是首先堵塞所有探孔，加大抽水設備。措施證實有效，結果迅速排除了水浸。

第二個實例是灣仔軒尼詩道地陷及其主因。一九八三年元旦凌晨，軒尼詩道18－22號前發生了突發性地陷。初時被認爲是由於探土工程不足之故。經現場仔細調査研究，事實上該地段作爲探土用的鑽孔佈置和數量都是恰當的。施工前地質剖面圖也明確地表示不同的土層和岩土分界面位置。塌陷主因是施工挖掘過程中忽視了該處恰位於新鮮而堅硬花崗岩與鬆軟風化層及人工塡土的分界面，同時盲目地採用全巷法掘進。因而當交界面被爆硬後，鬆土自上而不貫注，數以千噸計的泥土向西回塡已掏空的隧道。幸好封閉道路及時，迅速處理，未發生其它傷亡事故，是所幸也。

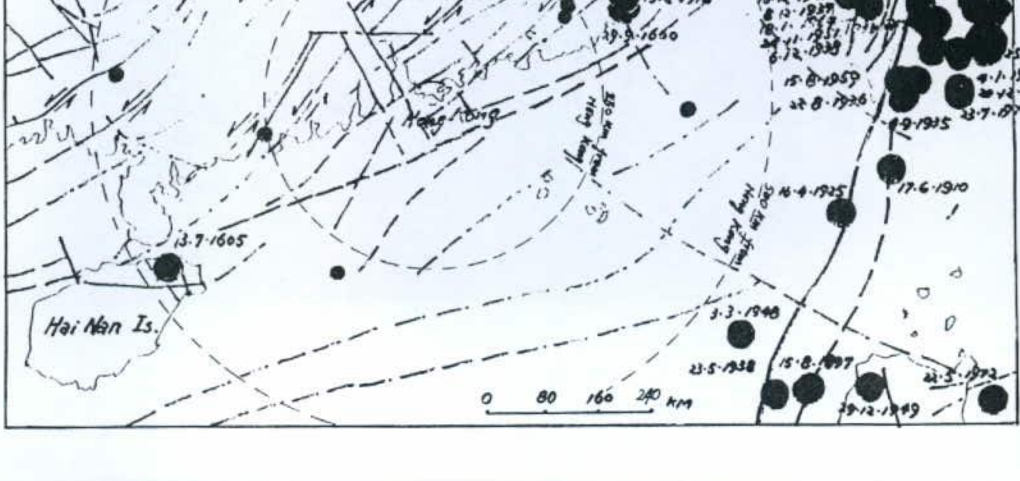


圖 3　公元1600後，香港及鄰區錄有黎克特制六級以上地震之分佈圖

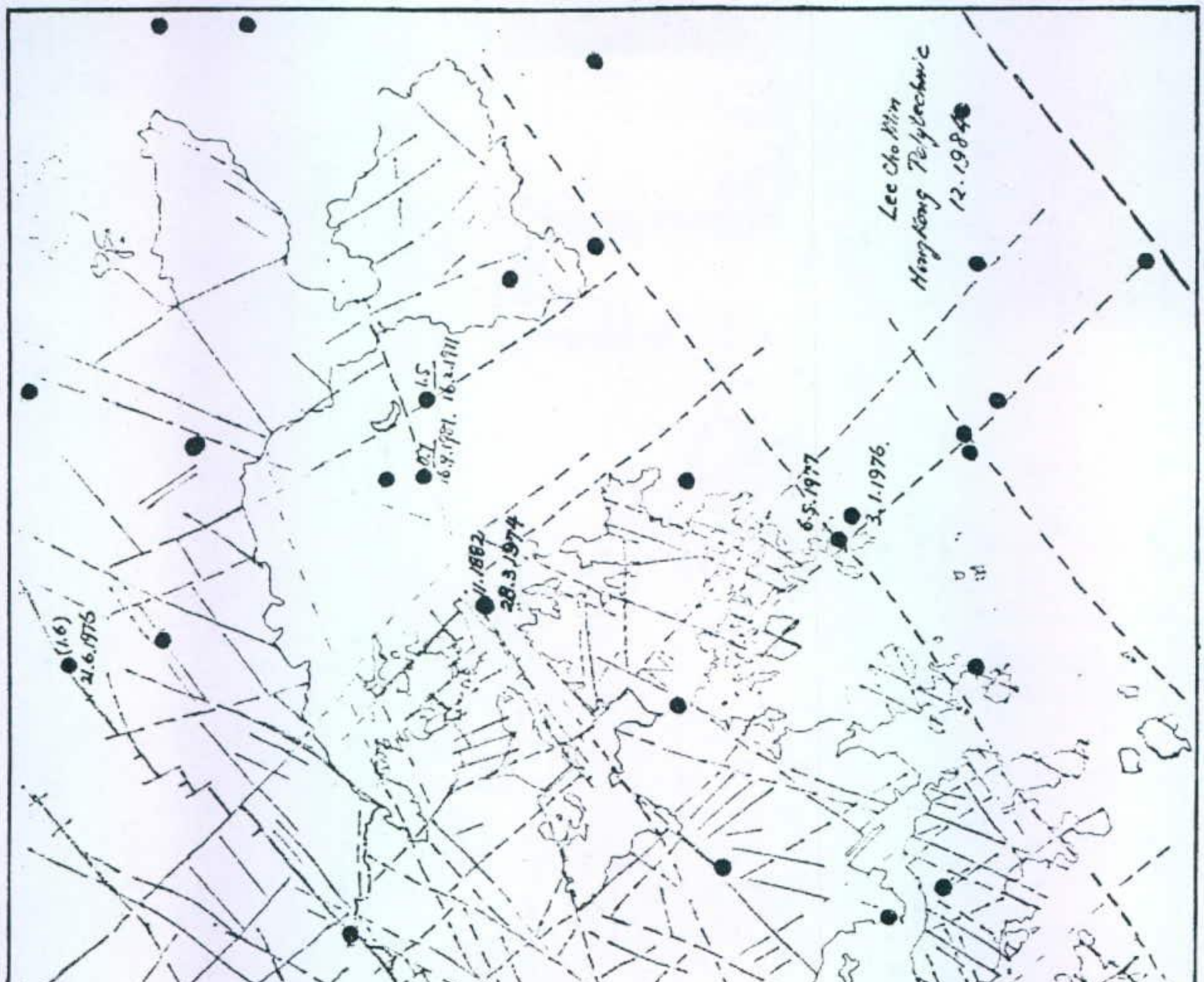


圖 2 香港及其鄰區斷裂構造及地震草圖

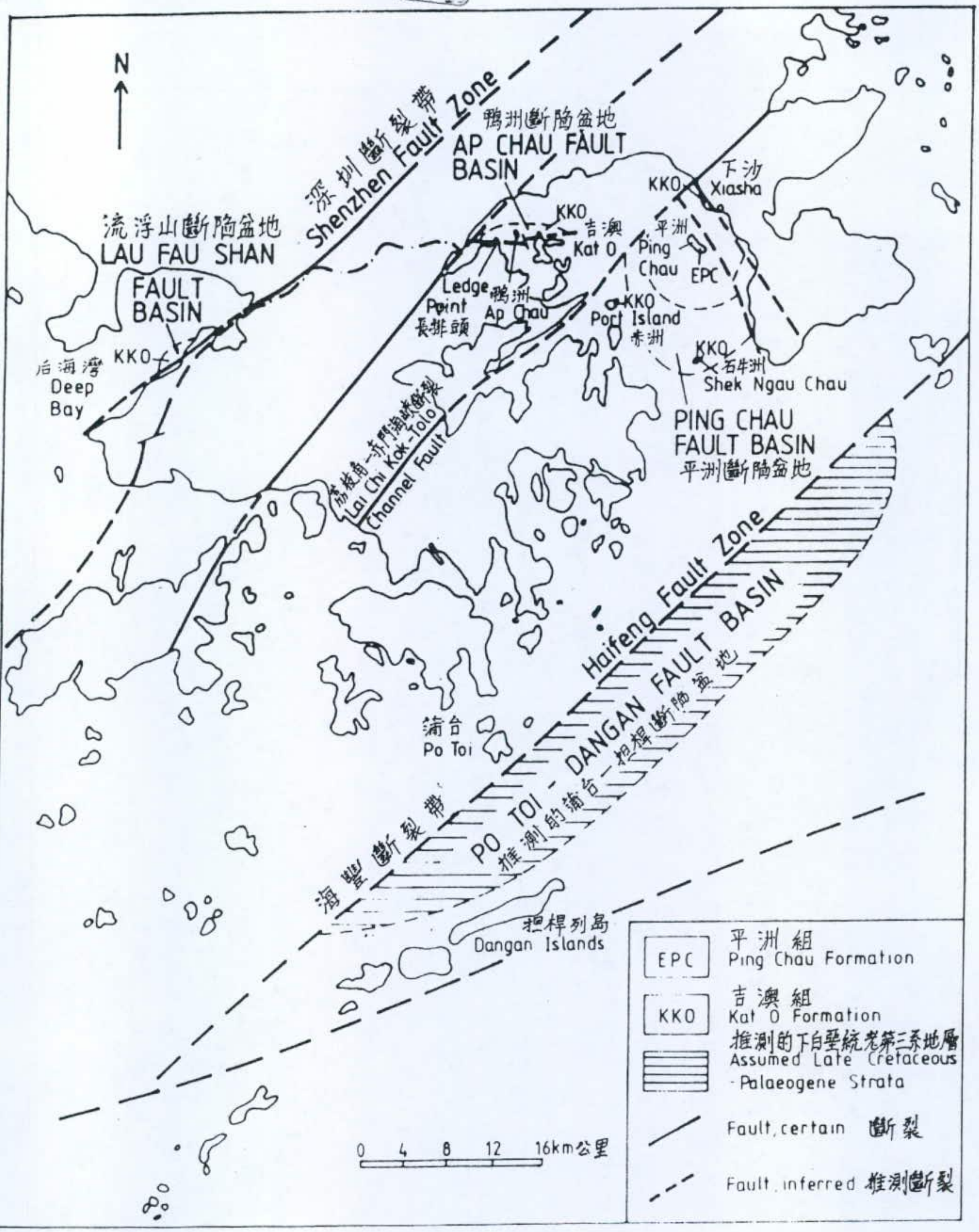


圖 1　香港晚白堊世—老第三紀的斷陷盆地

二月十九日地質專題演講摘錄

李作明輯

一、

二月十九日星期三下午六時至八時我會假九龍公園香港博物館舉辦了第一次專題中文演講。黎權偉先生、李作明先生及李坤榮先生三位會員就香港地質、地震及工程地質分別作了介紹。

首先，黎權偉先生介紹了香港中新生代的斷陷盆地，其中包括多出露在各海灣內小規模的平洲、鴨洲及流浮山斷陷盆地(圖1)。位於大鵬灣內的平洲盆地，主要沉積物有白堊紀吉澳組、早第三紀平洲組和第四紀地表沉積。吉澳組為山麓堆積相紫紅色角礫岩夾薄層粗砂岩，出露於大鵬灣南部的石牛洲和深圳特區大鵬半島西岸的下沙。平洲組為乾旱氣候鹹水湖相灰黑色薄層狀粉砂岩、泥岩夾泥灰岩和燧石粉砂岩，僅出露於平洲島。第四系主要為大鵬灣內海灣內海積物和冲積物。盆地主要受北西向的下沙正斷裂所控制。盆地中心就位於平洲附近。盆地兩側不對稱，東側沉積較深，西側較淺，呈一箕狀盆地。

鴨洲斷陷盆地位於沙角海南岸，自長排頭向東延伸經大、小鴨洲至吉澳島北端，長達四公里，出露吉澳組紫紅色鈣質角礫。盆地受南緣的東西向鴨洲一吉澳斷裂所控制。

呈北東向的流浮山斷裂盆地，僅見於後海灣東岸流浮山，長約一公里，出露吉澳組紫紅色角礫岩。

黎先生還推測蒲台島和擔桿列島之間的海域可能存在一個斷陷盆地，但有待進一步證實。

二、

接着，李作明先生就香港地震的地質背景作了概略性介紹。

他認為香港及廣東地區屢經加里東、印支特別是燕山運動的岩漿侵入與噴發和斷裂活動，使本地區形成較為穩定的華南大陸塊的組成部份，奠定了香港及廣東地質構造基礎，控制了以後喜馬拉雅階段構造發展及現今地震活動。自粵東到西發育的十條強大的北東東向大斷裂帶以及相應的北北西向斷裂帶完全控制着兩地區白堊第三紀斷陷盆地的分佈，紅層沉積和發育及演化，兩組斷裂活動的結果在廣東沿海形成一系列隆起及斷陷。斷隆有香港九龍半島、大鵬半島、碣石半島等，斷陷則形成此北西向的珠江三角洲、大鵬灣、大亞灣、紅海灣及汕頭韓江三角洲等。而近兩百個溫泉以及地震主要均發育上述斷裂交截部位也是明證，說明它們乃是活動斷裂和發展構造。

粵東北東東向蓮花山大斷裂以東的南澳大斷裂，汕頭大斷裂及普寧大斷裂，地震活動較強和較頻繁，以西依次為河源、廣州吳川及雲南大山等大斷裂。蓮花山大斷裂由東西兩帶組成密集的斷裂束，呈斷裂隆起的蓮花山山脈。西岸是五華——深圳斷裂束，東帶則是大埔——海豐斷裂束。歷史上西帶於一九三三年五月二十一日惠來縣發生五級地震，南西延至澳門，於一九〇五年八月十一日也發生五級地震。東帶在二百多年來發生多次地震，如海豐縣於一六九三年四月二十五日、一八七四年、一九一一年、一九八一年四月九日先後發生遇小震群和微震，但這些小震遠不如粵東上述另三條斷裂地震發生那麼頻繁而震級也較強。此外，向西除河源及廣州至陽江大斷裂發生過六級較強地震而稍為加強外，其餘均減弱。蓮花山大斷裂在粵東分佈衆多的溫泉，溫度較高，為上述十條斷裂出露溫泉較突出的一條。相對而言，蓮花山大斷裂較左右相鄰斷裂所發生的地震次數少，震級也小，可能說明地鼓運動能量的釋放已從溫泉形式釋放出來，故地震較弱。

在地形地貌上，香港位於蓮花山脈西南延伸入海傾沒端，而在地質構造上也是屬蓮花山大斷裂南西端伸入南海尾端，北起有深圳大斷裂為界，南有海豐大斷裂在蒲台島以南為界，故香港實屬斷塊構造(圖2)

香港地區發育三組主要斷裂構造，依次為北東東向，北北西向及北北東向，次要的還有東西向及近南北向斷裂構造，上述主要構造相互作用的結果形成香港獨特的斷折型陡峭海岸和地形，在構造上則形成了香港九龍半島的斷隆以及東西兩側的大鵬灣和珠江三角洲斷陷。它也控制區內白堊第三紀紅層構造盆地的分佈和堆積。

北東東向斷裂構造是本區主要的區域性構造，它控制香港各時代地層乃至岩漿岩，火山岩和斷裂的分佈和發育。北北西向斷裂則往往橫截或剪切北東東向構造。而北北東向構造斷裂則又是較新延伸

投稿本會通訊簡則

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具交錯層理的凝灰質沙岩和
燧石狀細火山灰凝灰岩中的
斷裂序列。

香港地質學會

通訊

第四卷　第一號　一九八六年三月

目錄