geological society of hong kong

NEWSLETTER

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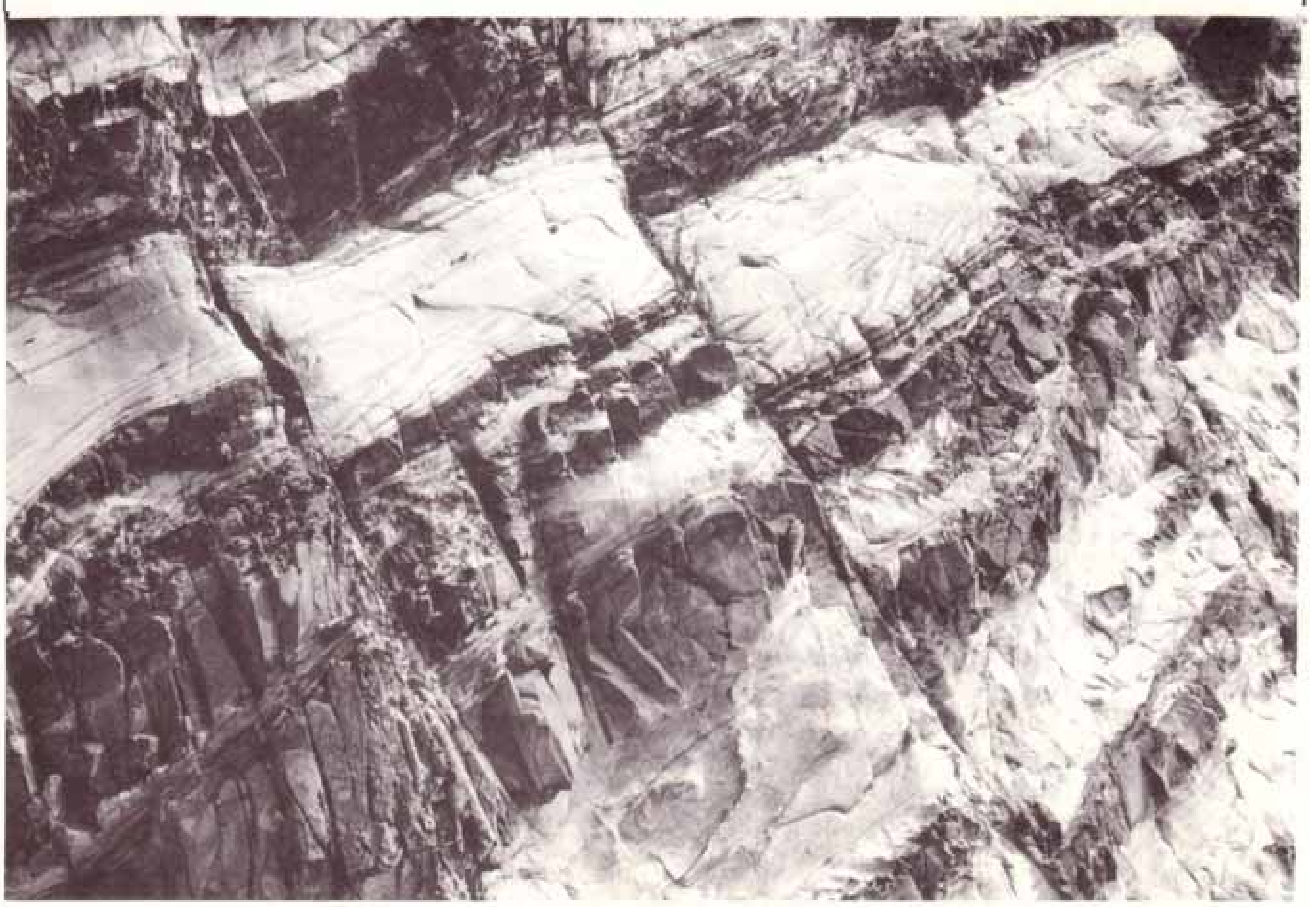

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Typescripts must be accurate and in their final form. Two complete copies should be sent to the Secretary. Typescripts should be double-spaced, including references, on one side of the paper only with a 2.5 cm margin on each side. A4 paper is preferred. 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).

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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)

DISCUSSION ON THE AGE OF THE ROCK SEQUENCE ON THE COAST NORTH OF LAI CHI CHONG, NEW TERRITORIES, HONG KONG.

Nau Pak Sun, University of Hong Kong.

INTRODUCTION

The most widespread rock sequence in Hong Kong is the volcanic succession with sedimentary intercalations which comprises the Repulse Bay Volcanic Group (Addison, 1986, in press). These rocks have been ascribed a Middle to Upper Jurassic age by Allen and Stephens based on radiometric age measurements on granites and age determinations of fossils found in the formations beneath it (Allen and Stephens, 1971).

Plant fossils were found in sedimentary rocks within the group (such as plant remains found in shale at Lai Chi Chong), but they were claimed not to give a conclusive indication of the age (Allen and Stephens, 1971).

Recently, well preserved plant fossils were collected by the writer from mudstone within the volcanic succession on the foreshore west of Lai Chi Chong ferry pier (Figures 1 and 2).

GENERAL GEOLOGY

The geology of the study area is shown in Figure 2. The rock exposed along the shoreline west of Lai Chi Chong ferry pier can be divided into three units: an upper volcanic unit $-J_{1p}(U)$, a sedimentary unit $-J_{1s}$ and a lower volcanic unit $-J_{1p(l)}$. The sedimentary unit is an intercalated unit in the volcanic succession. The rocks strike roughly NE and dip SE at angles ranging from 11° to 72°.

The upper volcanic unit, lying conformably on the sedimentary unit, consists mainly of yellowish green to grey lapilli tuff. Cobble-like chert fragments can be found in the rocks locally. Near the base of this unit, fossil tree stumps with cross sections measuring from 35 to 45 cm have been found by the writer.

The sedimentary unit is composed of black or grey shale and mudstone, grey siltstone and sandstone, and black or grey chert or cherty layers; layers of intercalated tuff and agglomerate are also present. All the sedimentary layers are thinly-bedded, and many are tuffaceous. Cross-bedding, convolute bedding, load, flame, and cut-and-fill structures are common. Plant remains can be found in the black shales and grey mudstones.

The lower volcanic unit occurs at the west end of the study area. It consists of lapilli tuff, coarse ash tuff and, as seen immediately west of the study area, water-laid pyroclastic rocks.

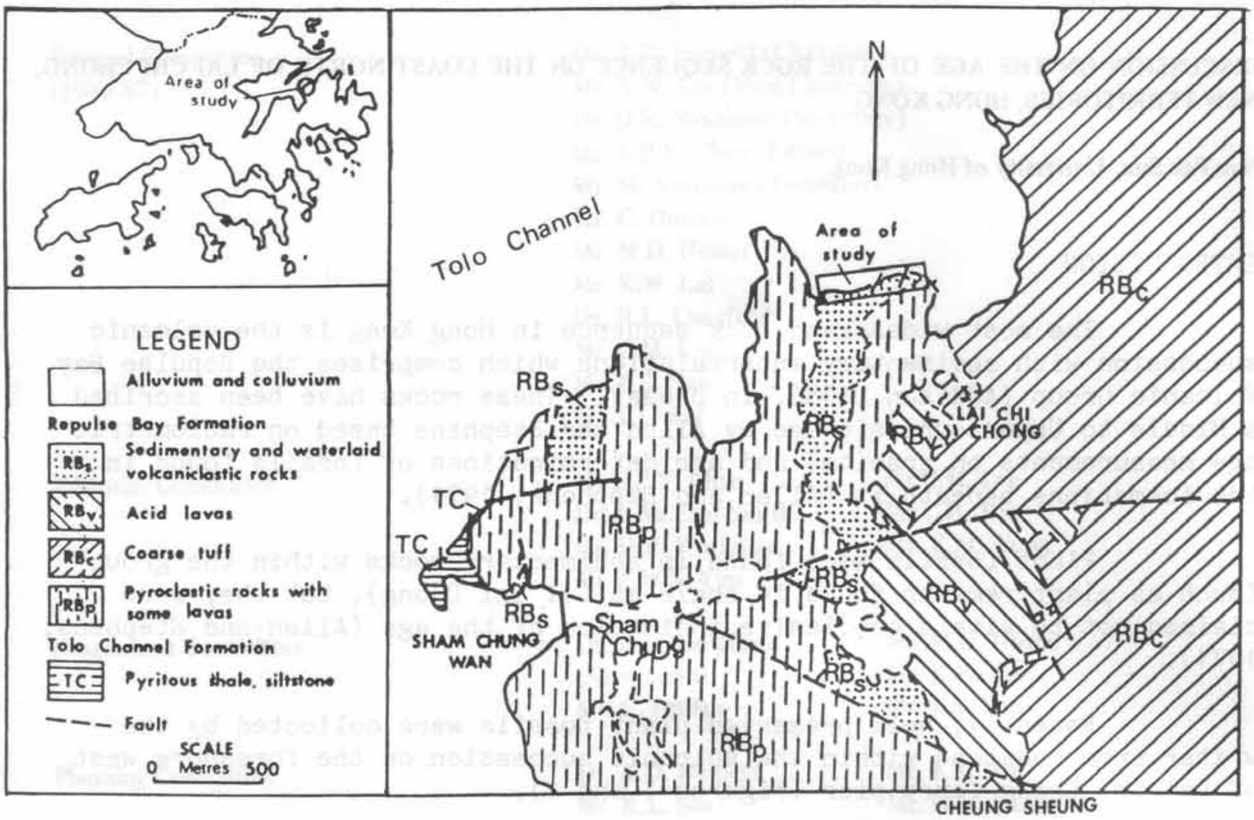
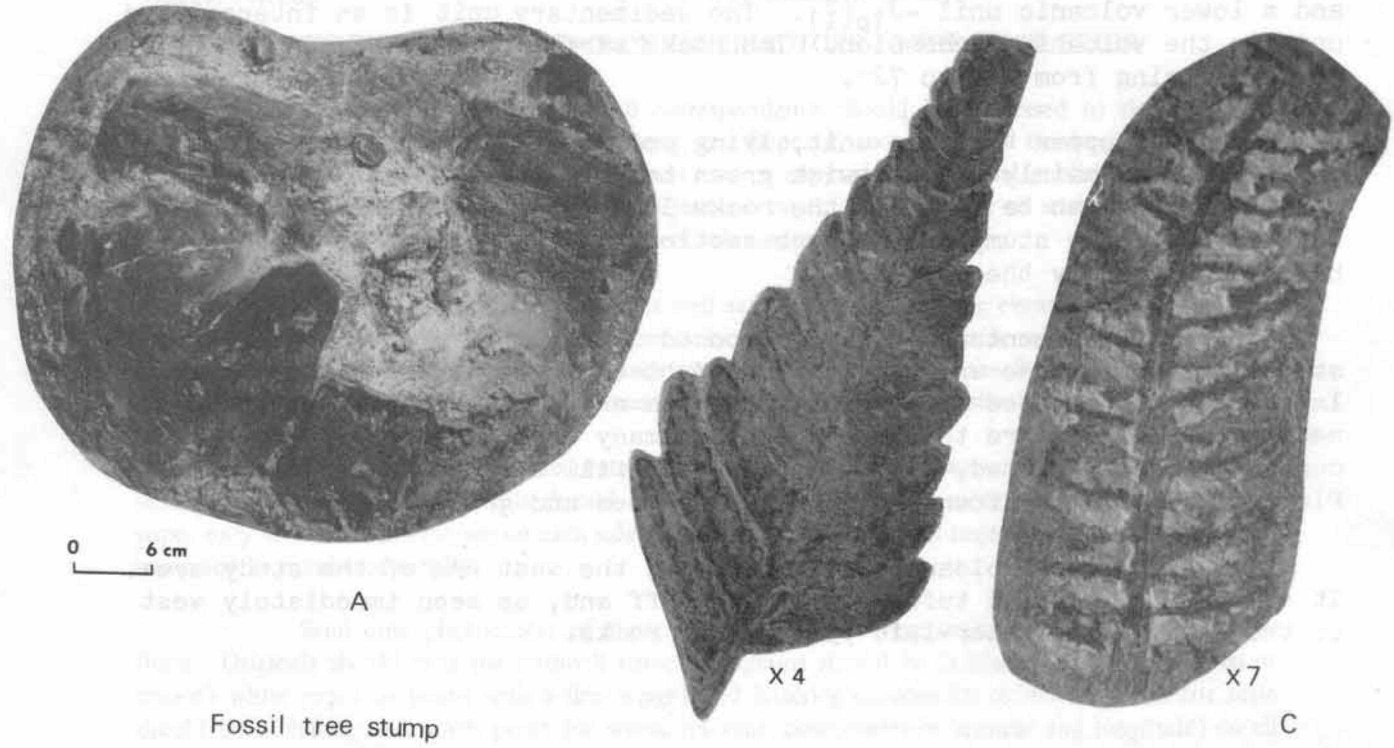


Fig.1 Location map. (Geology after Allen and Stephens with modification)



A

Fossil tree stump

B

C

Cladophlebis sp.

Cladophlebis todiodes Yang

Plate 1

PLANT FOSSIL RECORDS AND AGE

Reports on the discovery of plant fossils in black shale at Lai Chi Chong date back to 1943. According to Williams (1943), plant fossils collected by himself and Dr. Brock include ?Equisetites, ?Nilssonia, Cladophlebis, ?Phoenicopsis and ?Brachyphyllum or ?Thuites, while among the plant fossils collected by Dr. Heanley, one was reported to be identical with Pterophyllum Kingianum Feistm. of Liassic age.

A fossil tree stump was also reported (Ruxton, 1956) as having been found by Heim many years previously in volcanic rocks on the foreshore at Lai Chi Chong. Dale and Nash (1984) reported the discovery of a large piece of fossilized wood in the volcanogenic sediments some 30 metres west of Lai Chi Chong ferry pier. Later, the writer also observed a fossil tree stump in deeply weathered tuff about 80 metres west of the pier (Fig. 2, A and Plate 1, A).

In March, 1984, plant fossils were collected by the writer from grey mudstone and black shale in the upper and the lower parts of the sedimentary unit respectively (Fig. 2, B and C). Most of the plant remains came from mudstone and many of them belong to same genus. Although most of them are poorly preserved, one well-preserved specimen from the mudstone is identified as Cladophlebis todiodes Yang (Plate 1, B) by Professor Q.J. Wu of the Department of Geology, Zhongshan University. Professor Wu gives its age as Lower Jurassic. The plant remains from the black shale were also identified as Cladophlebis sp. (Plate 1, C).

DISCUSSION

Among the plant remains collected previously and recently, two can be identified as Pterophyllum Kingianum Feistm. and Cladophlebis todioides Yang, both Lower Jurassic in age according to Professor Wu. This suggests that the rock sequence concerned is Lower Jurassic in age.

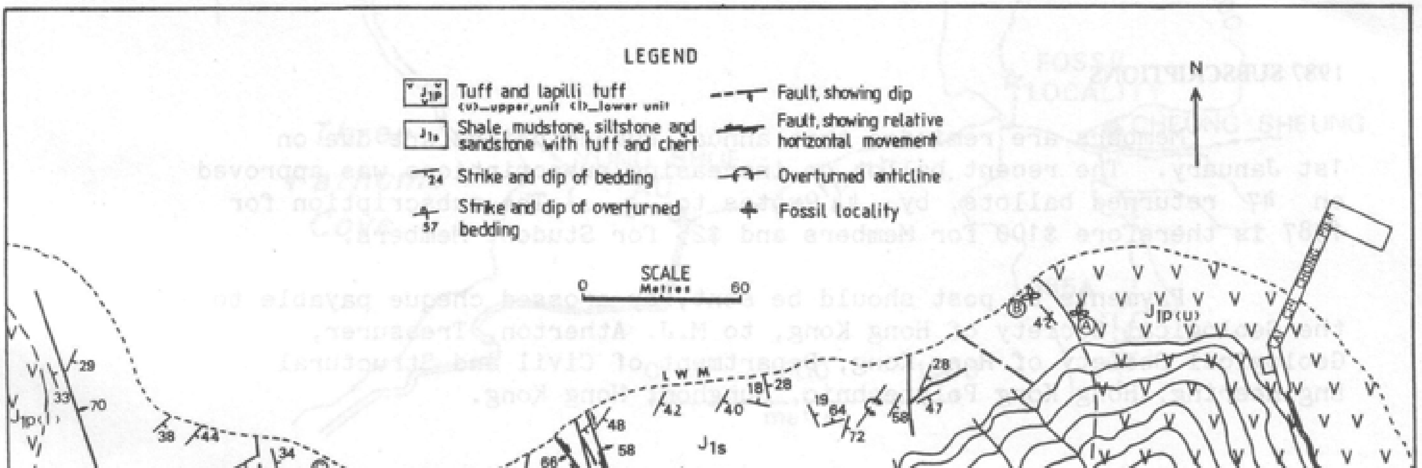


Fig. 2 Geological map

The volcanic rocks of the Repulse Bay Volcanic Group at the region west of Sham Chung (Fig. 1) were considered to lie unconformably on ammonite-bearing sediments of the Tolo Channel Formation of Liassic age by Nau (1984). Therefore, it is possible that the age of the above mentioned volcanic and sedimentary units with contained plant remains is Late Lower Jurassic.

ACKNOWLEDGEMENTS

Grateful thanks are due to Professor Q.J. Wu in the Department of Geology, Zhongshan University, for his help in identification of plant fossils.

REFERENCES

Addison, R. (1986) Hong Kong Geological Survey Memoir No. 1 - Geology of Sha Tin (in press).

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

Dale, M.J. and Nash, J.M. (1984) An occurrence of silicified wood in the Repulse Bay Formation sediments at Lai Chi Chong, New Territories, Hong Kong. Newsletter, Geol. Soc. Hong Kong Vol. 2, No. 3, pp. 1-4.

Nau, P.S. (1984) Note on Lower Jurassic marine strata along shoreline north of Sham Chung Wan, Tolo Channel, H.K. Annals, Geog. Geol. Archaeo. Soc. No. 12, pp. 74-83.

Ruxton, B.P. (1960) The geology of Hong Kong. Quart. Jul. Geol. Soc. Lond. Vol. 115, pp. 233-260.

William, M.Y. (1943) The stratigraphy and palaeontology of Hong Kong and the New Territories. Trans. Roy. Soc. Canada. Vol. 37, pp. 93-117.

1987 SUBSCRIPTIONS

Members are reminded that annual subscriptions are due on 1st January. The recent ballot on increasing subscriptions was approved on 47 returned ballots, by 44 votes to 3 . The subscription for 1987 is therefore $100 for Members and $25 for Student Members.

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A NOTE ON THE DISCOVERY OF FOSSIL WOOD FOUND IN THE REPULSE BAY FORMATION SEDIMENTS AT CHEUNG SHEUNG, SAI KUNG, NEW TERRITORIES, HONG KONG.

C.C. Wai, Chinese University of Hong Kong.

Small pieces of fossil wood can be found scattered on the ground over a large outcrop of sediments of the Repulse Bay Volcanic Group near Cheung Sheung, east of Three Fathoms Cove. The site is located at 300 metres above sea level on the southern slope of Shek Uk Shan (Fig. 1). It is at the side of the path leading to the summit of Shek Uk Shan and is about 100 metres from the top of the path known as the 'Sky Ladder's or Jocob's Ladder' which runs up from Yung Shue Au.

At the site, highly weathered silty shale is interbedded with conglomerate which contains cherty pebbles. During field work in April this year, a small log of fossil wood was found lying almost horizontally in the silty shale (Location 1 - see Plate). The log measured some 16.5 cm in length (Plate, c) and 6 to 7 cm in diameter. Transverse sections of the log shows distinct annular rings in concentric arrangement (Plate, d). Finely preserved cellular structure can be observed in thin sections. (Plate . The log was lying parallel to the east-west strike of the beds, which dip toward the north at angles of 35° to 50°.

In the same beds, up a gentle slope and about 11 metres from the first location, two more large fossilized logs were found (Location 2 - see Plate). They were about 80 cm apart, lying in the same east-west direction as the first log. Here the beds dip at an angle of 40° to the

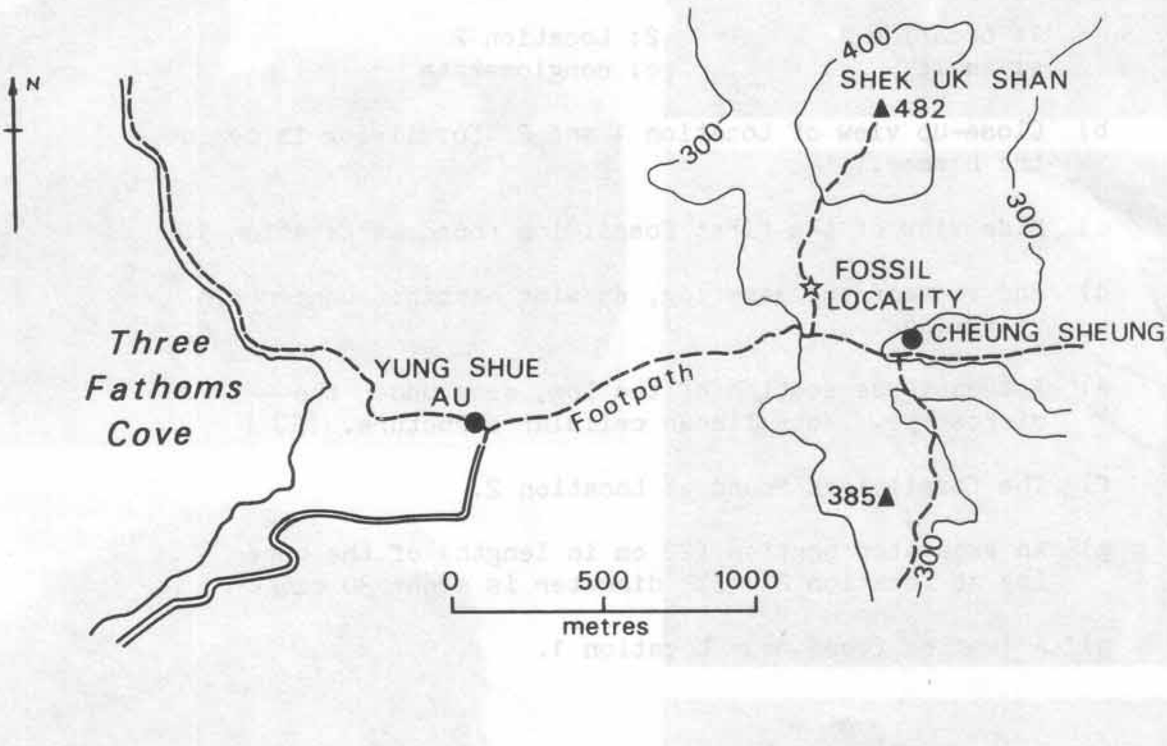


Fig. 1 Location Map

south. As the two logs at Location 2 are almost equal in diameter (about 30 cm), lying close together and almost in a straight line, they very probably belong to the same log with the middle part eroded away. The exposed part of the upper log is about 60 cm in length (Plate, g) and of the lower log, about 55 cm. Year rings are not distinct in these logs.

Fossil leaves were found in abundance in the site. Most of them are Cladophebis sp. One unidentified leaflet (Plate, h) was found in the same bed as the log at Location 1.

The writer would be willing to lend the specimens to anyone who might be in a position to provide a detailed description and, perhaps, identify them.

REFERENCE

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

PLATE 1 (See opposite page; left, top to bottom; right, top to bottom)

a) Site at Cheung Sheung where fossil logs were found.

1: Location 1 2: Location 2
s: shale c: conglomerate

b) Close-up view of Location 1 and 2, fossil log is beside the hammer.

c) Side view of the first fossil log found at Location 1.

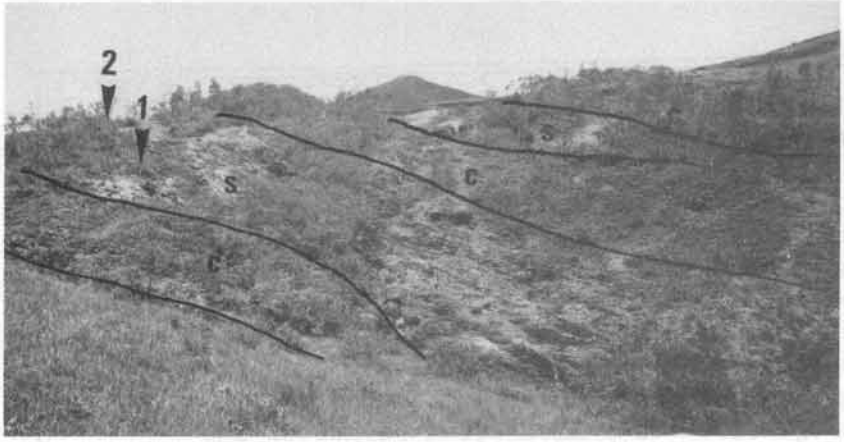
d) End view of the same log, showing distinct concentric year rings.

e) A transverse section of the log, seen under the microscope. Note linear cellular structure.

f) The fossil logs found at Location 2.

g) An excavated portion (22 cm in length) of the upper log at Location 2. Its diameter is about 30 cm.

h) A leaflet found near Location 1.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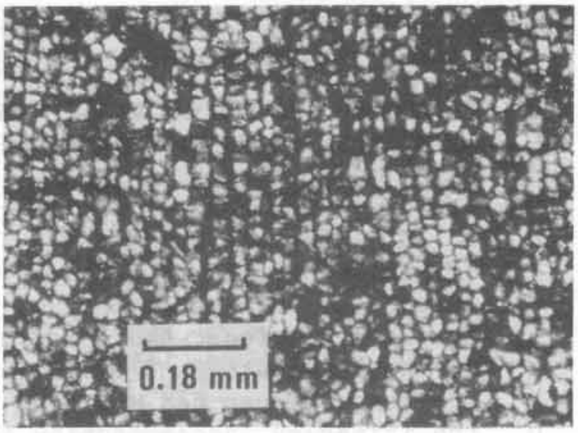
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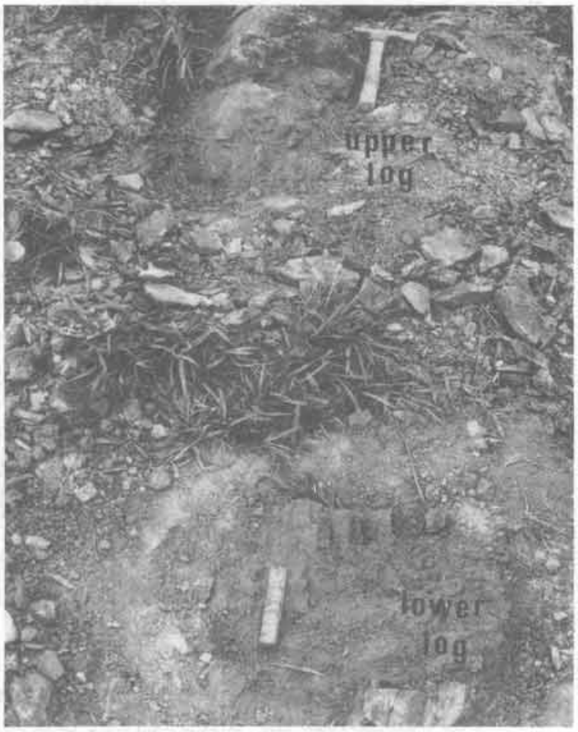
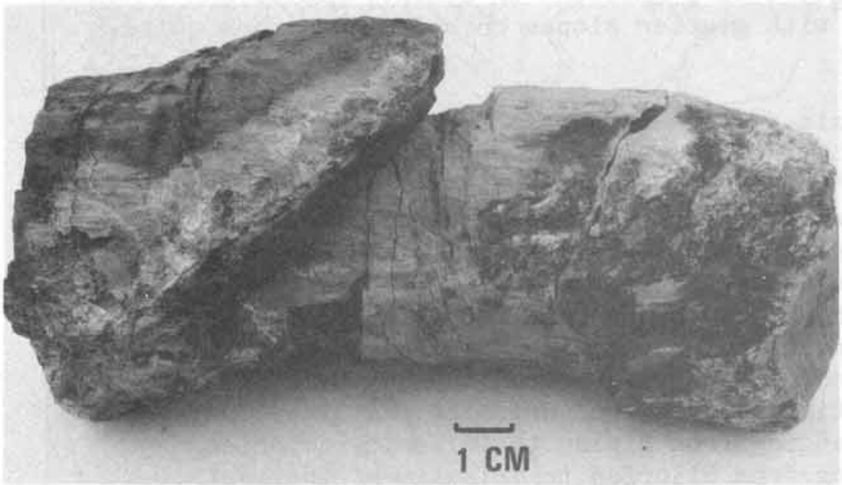

upper log
lower log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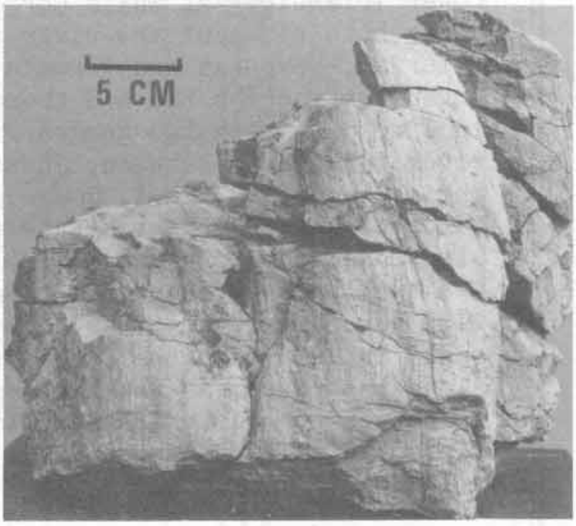
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REPORT ON THE TRIP TO YANGZI GORGES (THREE GORGES) OF CHANGJIANG AND ZHANGJIAJIE (QINGYANSHAN) DISTRICT, DAYONG, HUNAN PROVINCE.

The trip to the Yangzi Gorges and Zhangjiajie District from July 17 to 20, 1986, was organized by the Teacher's Group of the Geological Society of Hong Kong, and assisted by the Yichang Institute of Geology and Mineral Resources, Chinese Acadamy of Geological Science, Yichang City, Hubei Province. Mr. Wang Xiaofeng, the chief of the Section of Palaeontology and Stratigraphy of the Institute, and several geologists (Mr. Xu Guanghong, Ms. Zhou Tianmei, Mr. Feng Shaonan and Mr. Meng Fansong) of that Section kindly helped to arrange the itinerary, accommodation and transit. They also acted as guides and interpreters, and complied a guidebook "Geological guide for Yangzi Gorges and Zhangjiajie district" for the party.

Before describing the trip, a brief introduction about the Yangzi Gorges and the Zhangjiajie District is given below.

THE YANGZI GORGES OR THE THREE GORGES (MAP 1):

The Changjiang (Yangzi) River, running between Baidicheng in Fengjie, Sichuan Province and Nanjinguan in Yichang, Hubei Province for a distance of about 200 Km, incises deeply into three mountainous areas formed by limestone and dolomite, forming lofty precipitous cliffs on both sides of the river with narrow channels (the narrowest width of the channels is about 100 m). These marvellous sections (from west to east) are known as Qutongxia George (just east of Baidicheng), Wuxia Gorge and Xilingxia Gorge (just west of Yichang). Between these Gorges, the river cuts through mountainous areas formed by less resistant sandstone, shale, mudstone or schist, gneiss and granite, and the river channels, with gentler slopes on both sides, are quite broad (300 to 500 m in width).

Geologically, at Qutongxia and Wuxia Gorges, the limestone layers, folded into an anticline, belong to the Daye and Jialingjiang Formations of Lower Triassic. At Wuxia Gorge, the core strata of the anticline exposed along both sides of the river consist of shale, sandstone and limestone of Silurian, Devonian and Permain ages respectively. At Xilingxia Gorge, the river cuts across the N-S trending Huangling anticline. The Xilingxia Gorge includes actually two gorges with narrow channels at both limbs and a broader river channel in between. Less resistant strata (Pre-Sinian) of schist, gneiss (about 2000 M.Y. in age) and intrusive granite (806-819 M.Y. in age) comprise the core part of the anticline. Beds of dolomite and limestone, with some sandstone and shale, ranging from Sinian to Triassic, comprise the two limbs. The strata ranging from Silurian to Triassic of the east limb have been overlain by conglomerate layers of Cretaceous age. Large scale landslides often occur on the west limb of the Huangling anticline along the river, as weak layers of shale (Silurian in age) are sandwiched in between the dolomite and limestone. The latest landslide, that destroyed Xintan Town (on the north side of the river), occurred there on June 12, 1985.

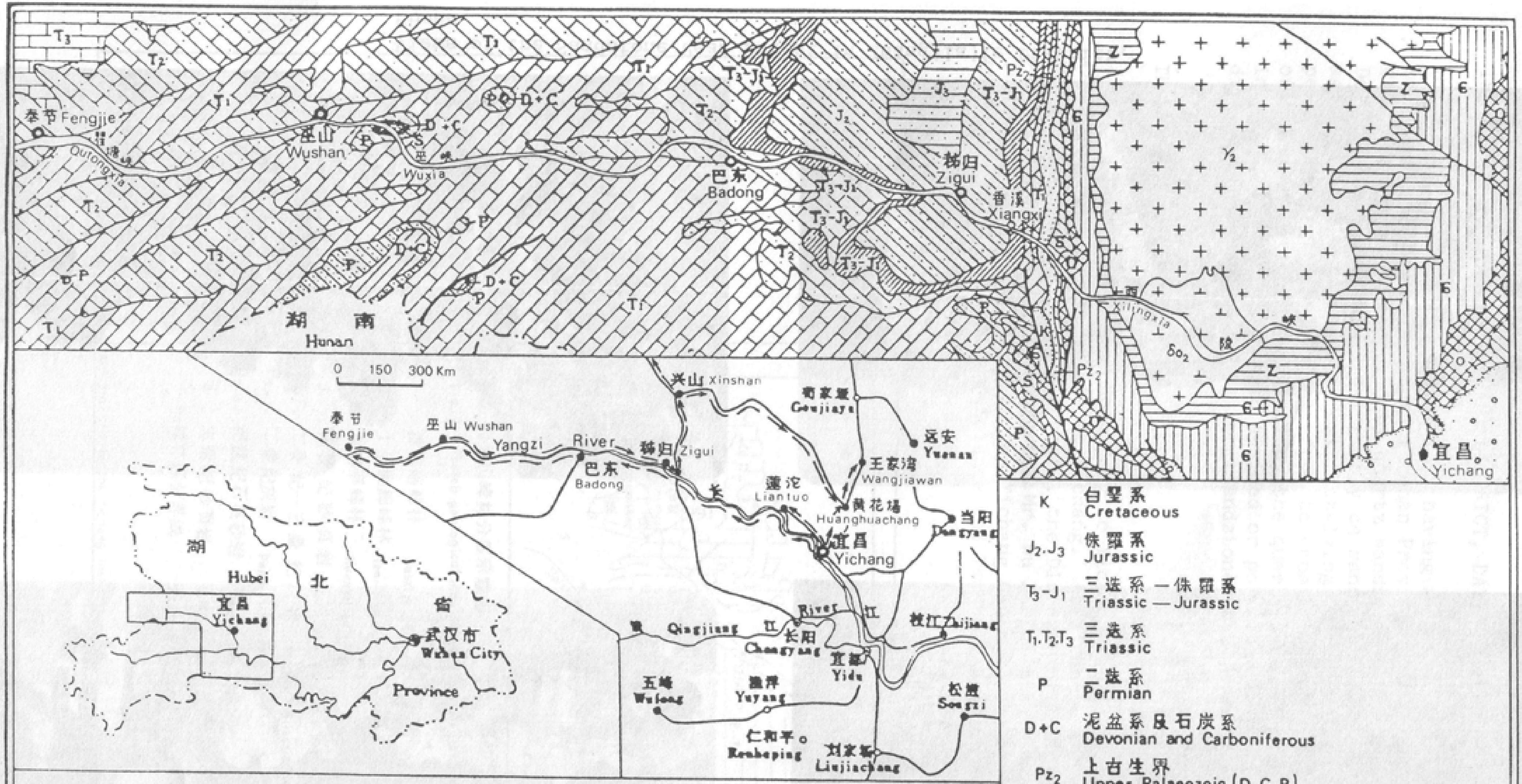


Fig. 1 长江三峡地区地质略图

GENERAL GEOLOGICAL MAP OF THE YANGZI GORGES

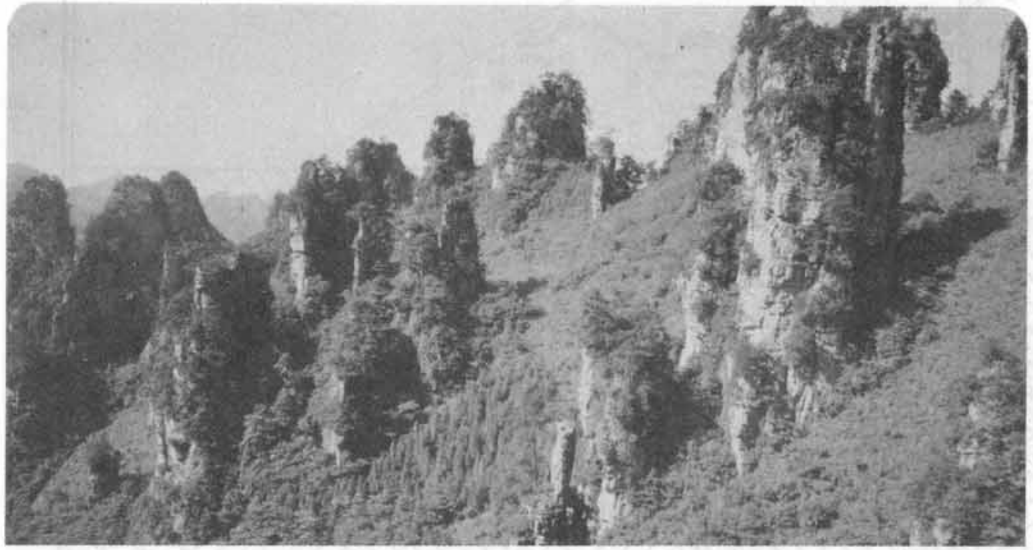
(INSERT : ROUTE OF TOUR)

0 100 200 300 Km

Map provided by the Yichang Institute of Geology and Mineral Resources

The group with hosts at the gate of the Yichang Institute of Geology and Mineral Resources

A section of one of the Three Gorges on the Yangxi River



Views of the Sandstone Peak Forest in Zhangjiajie District, Hunan.

THE ZHANGJIAJIE (QINGYANSHAN) DISTRICT, DAYONG, HUNAN PROVINCE (MAP 2):

The Zhangjiajie District, having an area of about 280 Km^2, is located in the northwest part of Hunan Province, about 30 Km north of Dayong City. The area is occupied by quartz sandstone of the Middle to Upper Devonian, which lies disconformably on sandstone and shale of Middle Silurian age. All the strata are almost flat-lying. There are several joint sets perpendicular to the bedding. Due to erosion along joints and slumping of rock blocks under gravitation, the quartz sandstone has been separated into many marvellous towered 4-sided or polygonal pillars or columns of different size and shape to form sandstone peak forest landform.

THE ITINERARY:

The journey from Hong Kong to Yichang was first by over-night ship to Guangzhou and then by air to Yichang. At Yichang, the party was met and warmly welcomed by Mr. Tan Zhongfu, the Director of the Yichang Institute of Geology and Mineral Resources, Mr. Wu Baolu, the Deputy Director of the Institute and the Chairman of the Yichang Geological Society, Mr. Yau Jiaguang, the Chief of the Section of Science and Technology of the Institute, and

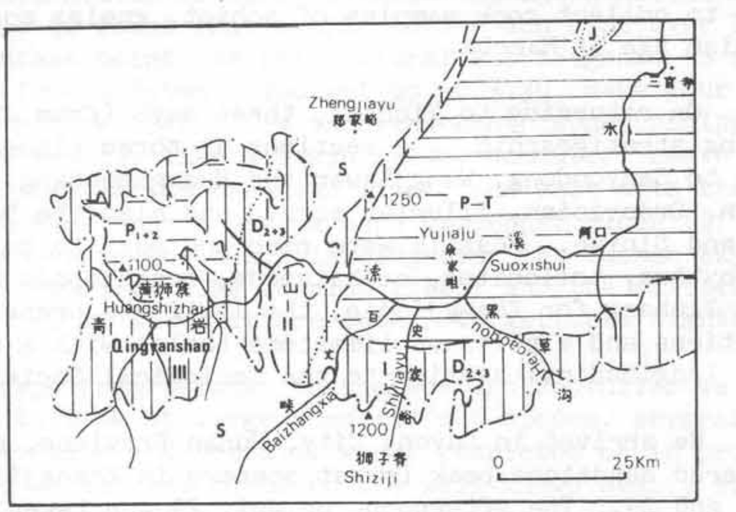


图 2 青岩山峰林分区示意图

Fig. 2 Sketch geological map of Zhangjiajie (Qingyanshan) District

I .	索溪峪峰林	Suoxiyu peak forest area
II .	十里画廊峰林	Ten-mile gallery peak forest area
III .	黄狮寨峰林	Huangshizhai peak forest area
J .	侏罗纪砂页岩	Jurassic sandstone and shale
P—T.	二叠纪—三叠纪灰岩	Permian-Triassic limestone
P_{1+2}.	二叠纪灰岩	Permian limestone
D_{2+3}.	泥盆纪石英砂岩	Devonian sandstone
S .	志留纪砂页岩	Silurian sandstone and shale
……	峰林区分界线	Boundary of Peak forest area

Map provided by the Yichang Institute of Geology and Mineral Resources

Mr. Zhang Faming, the Deputy Director of the Yichang Association of Science and Technology. The party then visited the Exhibition Room of the Institute. That afternoon, there followed a tour to the Gezhouba water control project on the Yangzi. The project consists of a main dam (2595 m in length), power plants (total generating capacity 2715 MW), 3 navigation locks, spillway and silt discharge.

The same night (1:30 a.m.) we set off by ship from Yichang, upstream to Fengjie, arriving at 5 p.m. We passed the main part of the Xilingxia Gorge during the night, but were able to see the site of the Xintan landslide at the west end of the Xilingxia Gorge at dawn. During the day, we traversed the Wuxia and Qutongxia Gorges.

On July 22, we went to Xinshan, (Fig. 1), first by ship to Xiangxi Town and then by coach provided by the Institute. That afternoon we visited the Houzibao hydro-electric power station about 20 Km north of Xinshan.

On the way back to Yichang from Xinshan, on July 23, as the route cut roughly across the Huangling anticline, several stops were made to inspect Orthoceras-bearing limestone of the Baota Formation (Middle Ordovician) at Huanglianping; to visit scenic spots formed by limestone of the Lower to Middle Cambrian at Gaolan; to search for algal fossils (Vendotaenia sp.) in limestone of the Dengying Formation (Upper Sinian) at Shuanghekou (where we were forced to stop due to a landslide nearby) and finally to collect rock samples of schist, gneiss and igneous rocks of Pre-Sinian age at Maerba.

On returning to Yichang, three days (from July 24 to 26) were spent observing stratigraphic type sections at three places (along the road from Liantuo to Sanyoudong, Wangjiawan and Huanghuachang) that include Sinian, Cambrian, Ordovician, Silurian strata and also the boundary between Pre-Sinian and Sinian. Fossils were rich and easy to collect, including algae, archaeocythus, trilobites, cephalopods, brachiopods and corals. Before we left Yichang for Zhangjiajie, the Institute presented a selection of its publications and a polished limestone tablet with a nice Orthoceras fossil showing longitudinal section to the Geological Society of Hong Kong.

We arrived in Dayong City, Hunan Province, on July 27, and toured the towered sandstone peak forest scenery in Zhangjiajie District on July 28 and 29. The afternoon on July 29 was taken up by a tour of Huanglongdong limestone cave scenery in Cili county. The cavern, with a height of about 160 m, is a 4-layered cavern and composed of 13 caves of different size (only 2 are opened at present).

We returned to Zhangsha City, Hunan on July 30, and thence to Hong Kong.

APPRECIATION:

Thanks are due to the Yichang Institute of Geology and Mineral Resources and to Mr. Wang Xiaofeng, Mr. Xu Guanghong, Ms. Zhou Tianmei, Mr. Meng Fansong and other staff who devoted much time and effort to making arrangements and organising this enjoyable trip. Thanks are especially due to Dr. Yang of the Institute who accompanied the party to Zhangjiajie. We also thank Mr. C.M. Lee for his help in liaising with the Institute.

FIELD EXCURSION TO TAIWAN

Sixteen members of the Society visited Taiwan from 7 to 16 June. This brief report outlines what the group did and saw, and puts on record our gratitude to the many persons who provided assistance and hospitality.

The route map (Fig. 1) shows that the group's tour of the island was comprehensive. All the main elements of the geology of Taiwan referred to in the report which follows were studied in excellent sections, mostly at the road side.

The first full day in the field was spent visiting the Tatun geothermal area north of Taiwan and the coast around Chilung, one of the stops being at the strange natural sculptures at Yehliu, produced by erosion of sandstone containing large iron oxide-rich concretions (see Plate). A half-day trip to the Fetsui Dam near Taipei followed, and the next day we started on our journey south. The first night out of Taipei was spent at Lishan, in the heart of the Central Range, midway along the East-West Cross-Island Highway. The precipitous descent from there to the east coast took us through the famous Tailuko (Taroko) Gorge, to Hualien. We then followed the Longitudinal Valley to Taitung and crossed the southern end of the Central Range to reach Kenting, almost at the southern tip of the island.

The northward return took us first to Alishan, again in the heart of the Central Range, where we found that a trip to see sun rise over Yushan was 'de rigueur'. The vantage point for this natural extravaganza is reached by a narrow-gauge railway from Alishan. You get up at 3.30, make your way to the station in the pitch dark with a few thousand other sun-worshippers, squeeze on board the train exactly like a Tokyo subway commuter, reach the top of the ridge above Alishan in the pre-dawn light, and wait amid the jostling crowd. As the sunrise approaches, a hush descends. Then (if you are lucky, and we were), there is the sun, flashing over the Yushan skyline, beyond a vast mist-shrouded valley The sunrise itself and the multitude assembled on the mountain top to watch it are both unforgettable sights.

Retracing our steps from Alishan to the Western Foothills we took our time, with many stops to look at large roadside cut slopes, several recent landslides and preventive and remedial works completed or in progress. Once back in the lowlands, we circled round to the well-known beauty spot, Sun Moon Lake. This was our last night stop. On the final morning the group enjoyed a cruise on the lake in a launch provided by the Minghu Project staff of the Taiwan Power Company, followed by a tour of the main project facilities located nearby, and lunched at the project headquarters before heading for the airport.

Among the highlights of the trip were the comprehensive tours of inspection of two projects of the Taiwan Power Company, the Fetsui project near Taipei and the Minghu Pumped Storage project in Central Taiwan, with briefings by senior project personnel. These two projects will be the subject of a follow-up article in the next issue of the Newsletter. Suffice it to mention here that the main feature of the Fetsui project is a 122.5 m high concrete arch dam the prime purpose of which is to provide increased storage capacity for Taipei's water supply system, while the Minghu project is a 1,000 MW hydroelectric scheme utilizing the famous Sun Moon Lake for storage to convert power output available off-peak into peaking energy for the national grid

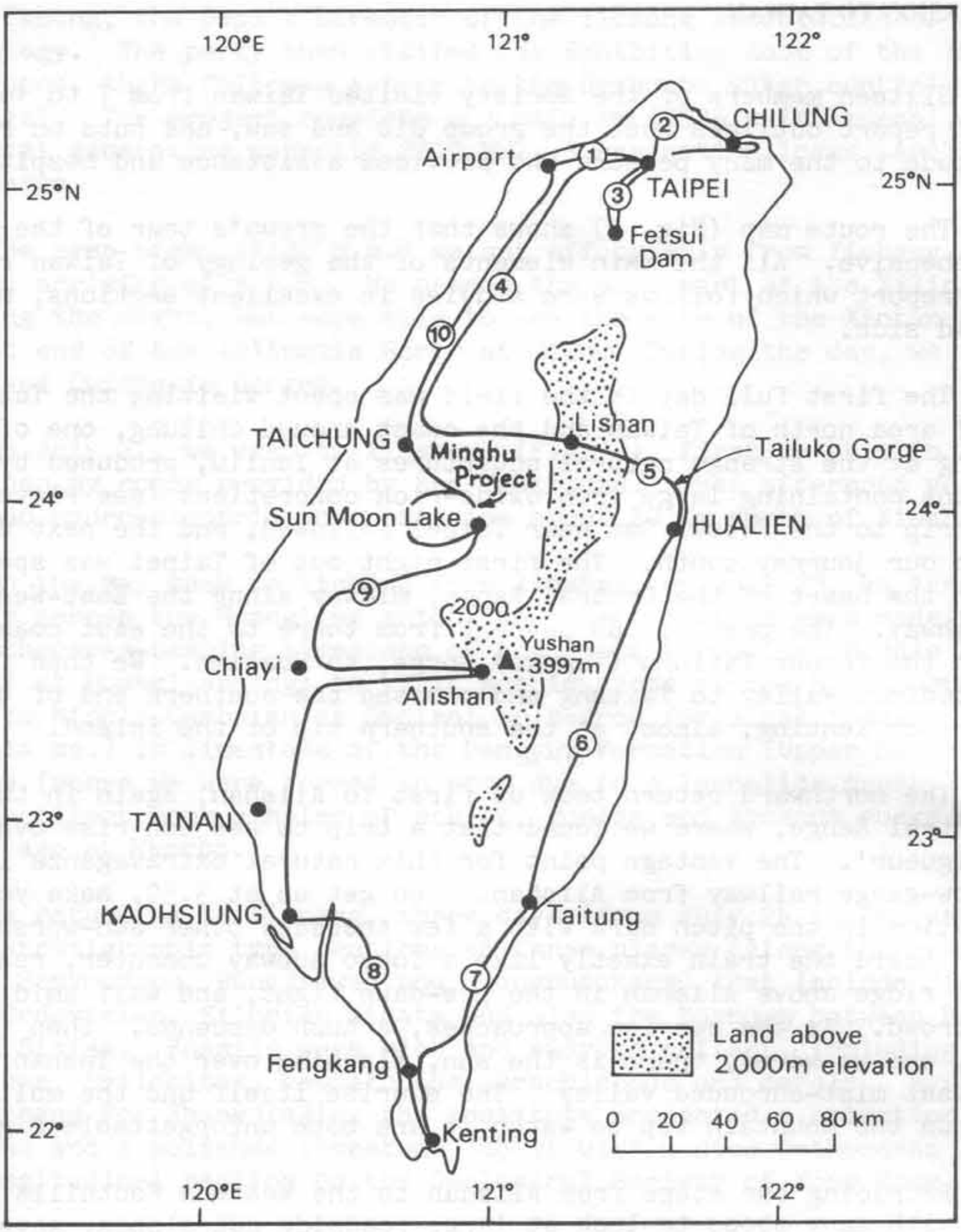
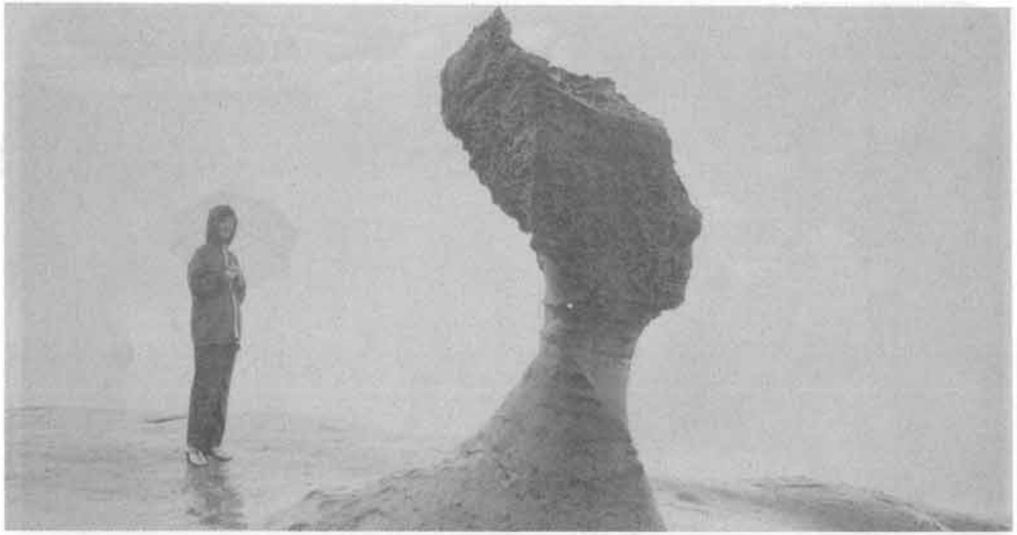


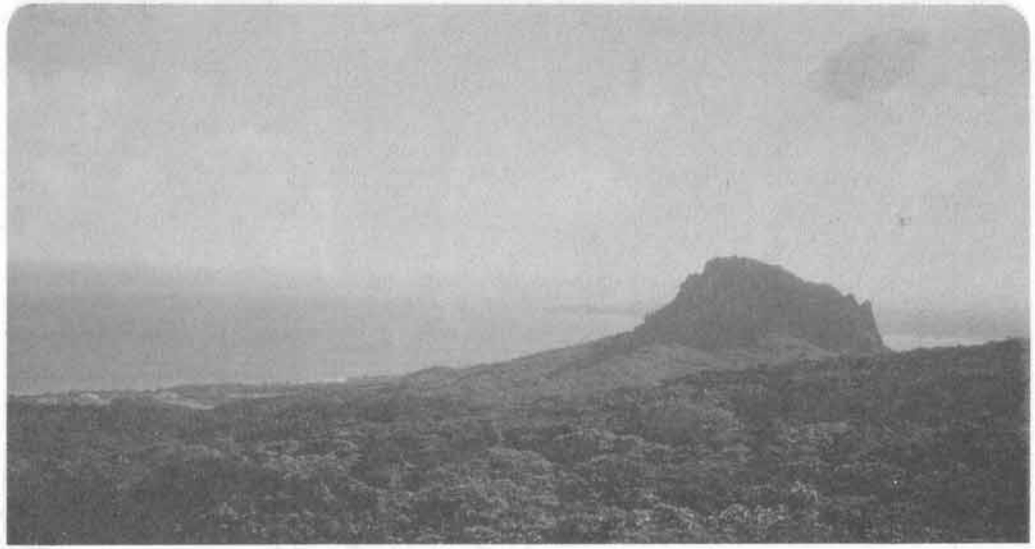
Figure 1. The route followed, days 1-10.

Another highly instructive aspect of the trip was the opportunity of seeing something of the huge slope stability problems which face highway engineers in Taiwan, especially in the central mountains. We were able to examine at close hand a number of high natural and cut slopes in a variety of sedimentary and metamorphic rocks with extensive protective and remedial works in progress, and several recent, large rock slope failures.

Half a day at the beginning of the trip was devoted to a seminar at the Department of Geology, National Taiwan Unviersity. Four N.T.U. staff members gave accounts of aspects of the geology of Taiwan, Dr. S.Y. Teng, Dr. C.Y. Huang, Dr. S.Y.T. Yeh (seismology) and Dr. J.J. Hung (engineering geology). In return, A. Hansen and D. Workman spoke on aspects of the geology of and geological activities in Hong Kong. The group was also received and briefed by the Director of the Central Geological Survey (C.G.S.), Mr. S.F. Tsan.



<u>Top left</u> Erosion of concretionary sandstone at Yehliu, north of Taipei.
<u>Top right</u> Tailuko Gorge.
<u>Bottom left</u> Traversing a recent landslip on the way to Alishan.
<u>Bottom right</u> Slope protection works in progress on the Alishan road.

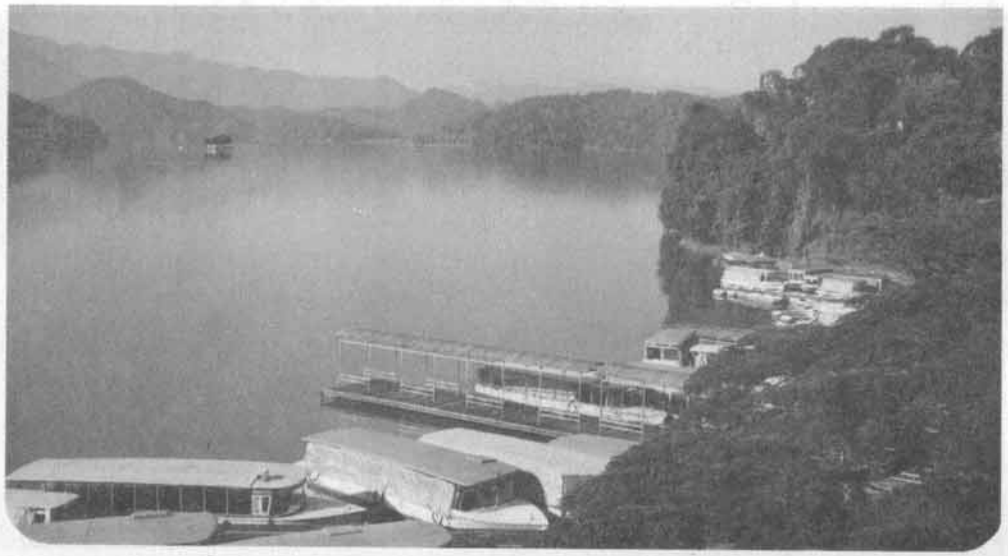


Top left — Mudstone of the Lichi Formation thrust over Quaternary gravels, Juisui, Longitudinal Valley.

Top right — A large hill comprising an exotic block of conglomerate in the melange of the Kenting Formation near Kenting.

Bottom left — The tranquil Sun Moon Lake.

Bottom right — The party at the Minghu Pumped Storage Project on June 16. Mr. Lin Feng Lin, Taiwan Power Co., centre, standing. (R.P. Martin behind the camera).



APPRECIATION

The group is indebted to the Director and staff of the Central Geological Survey, the Chairman of the Department of Geology of National Taiwan Unviersity and the Directors of the Fetsui and Minghu projects, Taiwan Power Company, for their courteous receptions and briefings and for their considerable material assistance. We thank the staff of N.T.U. referred to by name earlier in this report for their contributions to the introductory seminar organized by the University. We are also deeply grateful to the following who accompanied us on different parts of our field trip: C.K. Fong, C.C. Chan, H.C. Chang, Dr. C.H. Chen, C.N. Hu and C.C. Lin, all of G.G.S. and Dr. C.Y. Lu (N.T.U.). To all of these, who devoted so much time and effort making our trip a rewarding and enjoyable experience, we express our heartfelt thanks. The group as a whole is also indebted to one of its members, Mr. Siu Kong Lam, as well as to Mr. Chang Chung Hung and Mr. Cheung Chi Tak, for all their hard work in planning the trip from the Hong Kong end.

OUTLINE OF THE GEOLOGY OF TAIWAN

The principal sources for this article are C.S. Ho (1982) "Tectonic Evolution of Taiwan" published by the Ministry of Economic Affairs, Taiwan, and information supplied in the field by C.K. Fong and others (see preceding item).

The main island of Taiwan is spindle-shaped, with the longitudinal axis extending north-south for 385 km and a maximum width of 143 km. The backbone of Taiwan is the Central Range with a length of 350 km. More than 200 summits along this range exceed 3000 metres above sea level. Yushan is the highest peak, reaching an elevation of 3997 m.

The Central Range slopes westward into strips of foothills and then into broad, elevated tablelands and uplifted terraces. East of the Central Range is the Coastal Range, 140 km long and 10 km wide, with maximum elevations ranging from 1000 to 1700 m above sea level. The Coastal Range is separated from the Central Range by a rift valley known as the Longitudinal Valley. This valley, 150 km long and 3 to 6 km wide, is generally regarded as marking the line of an arc-oontinent collision suture between the Asian continent on the west and an island arc on the Philippine Sea plate to the east, the island arc being represented by the rocks of the Coastal Range, accreted onto the Asian continental margin as a result of the collision.

Taiwan is geologically a Cenozoic orogenic belt containing marine sediments more than 10,000 m thick. The island yields a remarkable history of Neogene to Recent orogenic activities. A large part of the Tertiary sediments in Taiwan has been subjected to differing grades of induration or metamorphism. Large igneous intrusions are rare, but volcanic formations are present in northern Taiwan, eastern Taiwan, and the Taiwan Strait. Frequent and sometimes severe earthquakes in Taiwan indicate that the area is still in a stage of tectonic adjustment.

Figure 1. Outline geological map of Taiwan.

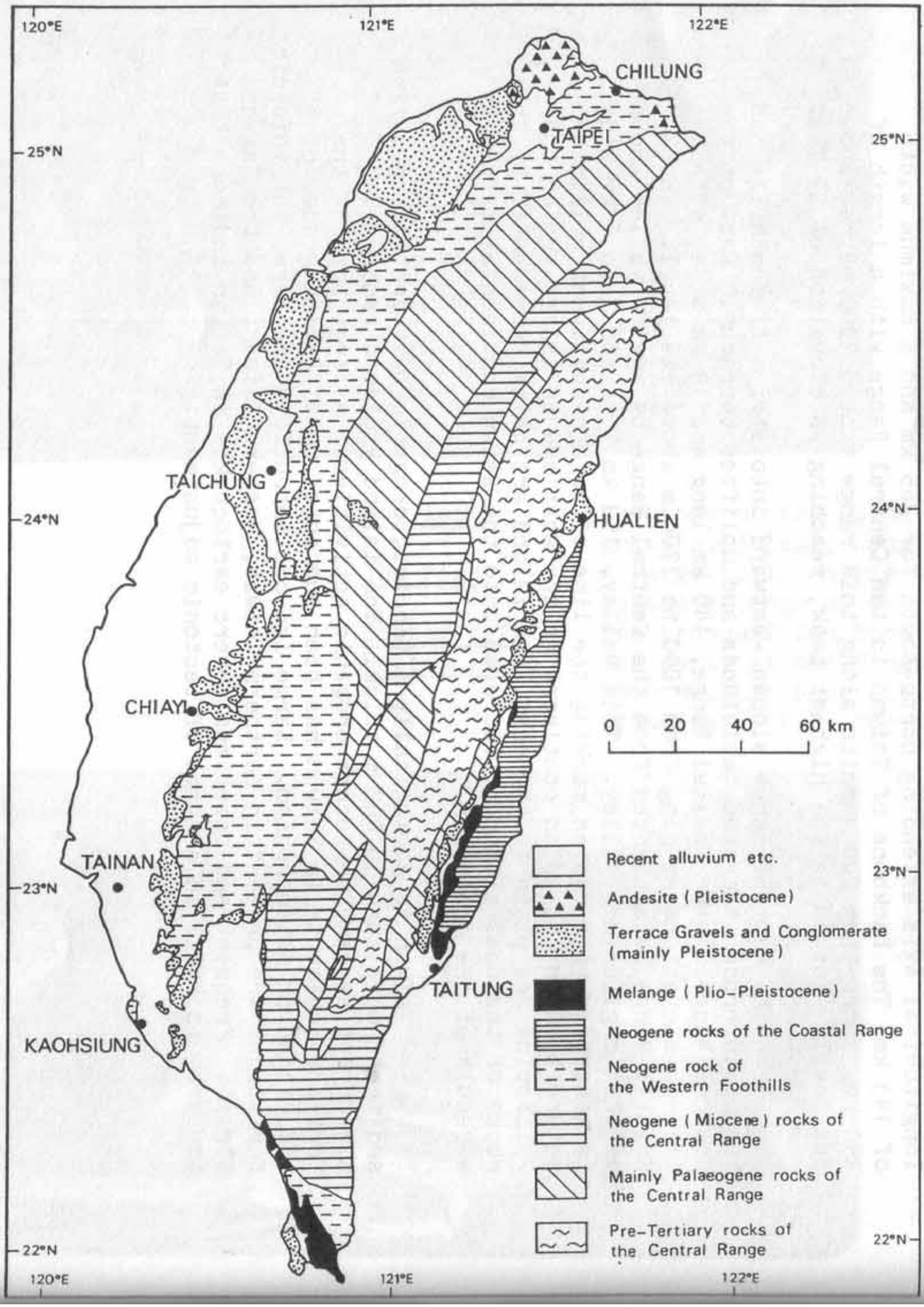
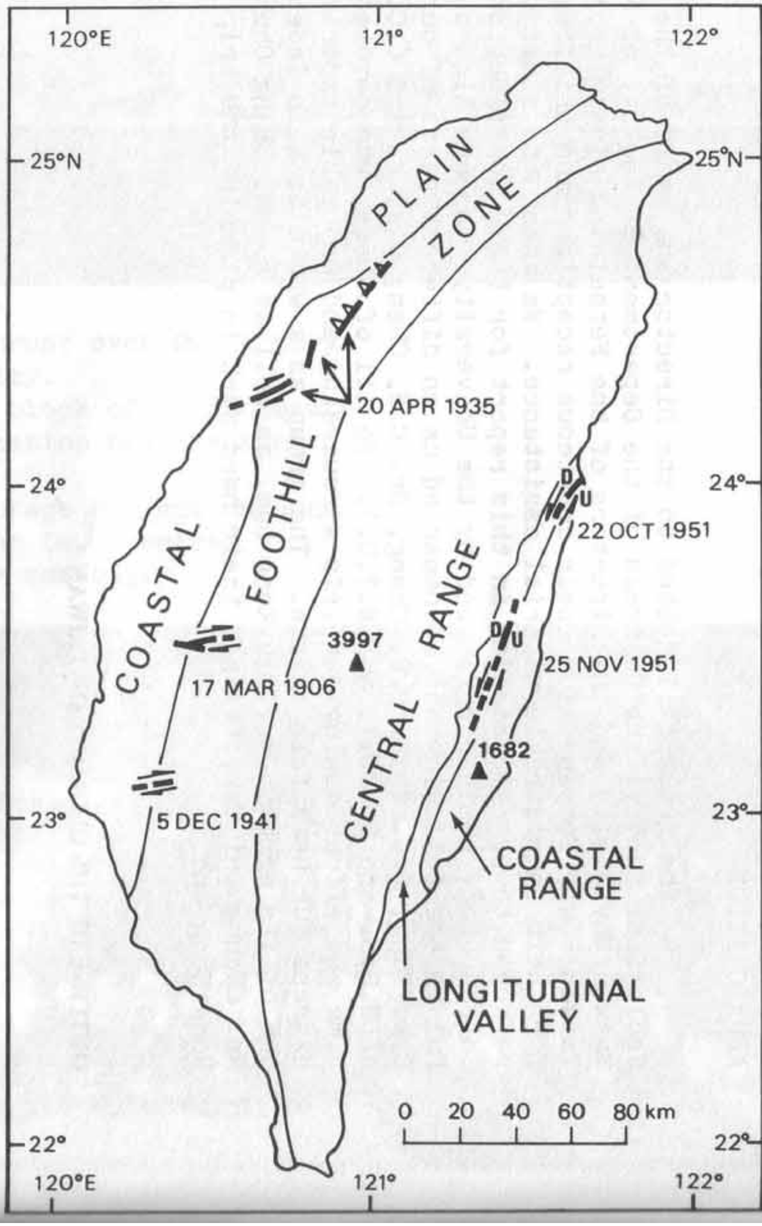


Figure 2. Geological provinces of Taiwan (source: Biq Chingchang). Also shown are known cases of historic surface displacements. Elevations of highest peaks in Central and Coastal Ranges in metres.



The eastern flank of the Central Range is composed of a pre-Tertiary metamorphic basement which is made up largely of schist, metamorphosed limestone, gneiss and amphibolite. Mafic to ultramafic igneous bodies are widely scattered in the eastern part of this metamorphic belt.

The western flank and the high ridges of the Central Range are underlain by a thick sequence of Early to Middle Tertiary marine argillaceous sediments that are unconformable on the metamorphic basement. These sediments have been generally metamorphosed or indurated, the metamorphic grade increasing from west to east. Argillites on the west of this belt grade eastward into slates and then into phyllites. Thick sandstone formations predominate toward the western part.

The western foothills of the Central Range are underlain by late Oligocene or Miocene to early Pleistocene shallow marine clastic sediments. The Neogene rocks are mainly alternations of sandstone, siltstone, and shale with locally intercalated limestone and tuff lenses. These strata exhibit the characteristics of long-continued, shallow-water sedimentation. The total thickness of the clastic rocks in the western basin decreases rapidly from 8000 m in the east to as little as 500 m beneath the western coastal plain.

The Neogene sediments in western Taiwan were deformed into mountains in an early Pleistocene orogeny. Volcanism took place during and after the Pleistocene orogeny. Andesitic volcanoes formed in northernmost Taiwan and erupted through the deformed Miocene rocks.

An interesting feature of the geology of southwestern Taiwan is the so-called Kenting melange (Kenting Formation) of probable Pliocene age - see Fig. . This extends north-northwest for a length of approximately 50 km with a maximum width of 6 km. The melange lies upon normal unmetamorphosed Miocene rocks of the eastern half of the Hengchun Peninsula, which forms the narrowed southernmost segment of the Central Range. It may have originated as an olistostrome - a chaotic mass accumulated by submarine gravity sliding or slumping of unconsolidated sea-floor material, but probably modified by subsequent tectonic movements. In any event, the Kenting melange is a thick sequence of chaotic and poorly stratified dark gray muddy to shaly sediments, including pebbly mudstones, with abundant exotic blocks of conglomerate, turbiditic sandstone and basalt breccia. Some of the blocks are as much as 1 sq. km in areal extent. Fossils show that the rocks in the exotic blocks are mainly Eocene to Miocene in age. The clasts in the spectacular conglomerate blocks consist essentially of mafic rocks, no doubt oceanic crust (ophiolitic) materials, as do the blocks of basalt breccia which include amygdaloidal or glassy basalt and spilitic basalt fragments.

The tectonic significance of the Kenting melange is still poorly-known. It may be related to the subduction-trench setting of the Manila Trench further south, where the South China Sea Basin is underthrust beneath the Luzon Island Arc. The conglomerate of the Kenting melange may be derived from scraped-off terrigenous sediments and oceanic crust fragments, accumulated in a northern extension of the Manila Trench during subduction and subsequently uplifted. The mafic clasts in the conglomerate could come from the fragmented spreading ocean floor of the South China Sea Basin. Materials from a colliding island arc also may be incorporated in the melange.

The eastern Coastal Range differs geologically from the main part of Taiwan. As noted earlier, the rocks of this range belonged to an island arc which was accreted onto the continental margin in a Late Cenozoic arc-continent collision. The lower part of the range is formed of Miocene andestic lavas and pyroclastics with many small intrusive bodies. This complex is followed by andesitic agglomerate and tuffaceous sediments reaching nearly 1500 metres in thickness. A succession of sandy and shaly turbidite rocks and conglomerate several thousand metres thick overlies the agglomerate formation. The age of these rocks is mainly Pliocene. The upper part of the stratigraphic column is another chaotic melange (the Lichi Formation) characterized by blocks of turbidite sandstone and many ophiolitic fragments embedded in a clay matrix. The age of the melange is probably middle to late Pliocene. Toward the west the melange is in contact with a Pleistocene fluvial piedmont conglomerate, the clasts of which are dominantly metamorphic rocks from the Central Range. The conglomerate, despite its youthfulness, is strongly folded and locally overturned, indicating synorogenic emplacement. The materials of the Lichi Formation are also intricately sheared, folded, and slickensided. Andesitic blocks derived from the eastern magmatic arc may have been squeezed upward and slid into the melange complex. These tectonic effects were superposed on the Lichi melange during the collision. Some geologists are of the opinion that although the Lichi melange was originally deposited as an olistostromal melange in the forearc basin of eastern Taiwan, it was later remolded into a tectonic melange during the arc-continent collision referred to above, which probably began in the late Pliocene and reached its climax in the middle Pleistocene.

Collision-related deformation and uplift affected the whole of Taiwan. The pre-Tertiary metamorphic complex now exposed in the uplifted Central Ranges was remobilized, this being reflected by the retrograde (greenschist facies) metamorphism of its constituent rocks. The thick Tertiary sediments in the western basin also were raised, deformed, and partly metamorphosed. The chief motive force for the structural deformation was lateral compression from the east or southeast. In addition, local gravitational sliding of water-saturated sediments from an uplifted core on the east may have caused further deformation.

Volcanism occurred during and after the Pleistocene orogeny. Andesitic volcanoes erupted in northernmost Taiwan, forming the Tatun and Chilung volcano groups.

Products of the erosion of the recently-uplifted central mountains of Taiwan cover large areas, especially in the west. Late Quaternary terrace gravel, partly lateritic, cover much of western Taiwan. Probably as a result of extensional relaxation of compressional forces after a major orogeny, block faulting, broad warping, and regional tilting characterize the late Pleistocene tectonic history along with volcanism in northern Taiwan.

The most significant tectonic event of recent time is the strong vertical movement which has taken place from late Pleistocene to the present. The tectonic uplift rate of Taiwan is one of the highest in the world. The average uplift rate in southern Taiwan and the coastal Range over the last 9000 years is said to be in the range 5 ± 0.7 mm/yr.

The southwest coast (along the Kaohsiung - Kenting road) has spectacular examples of uplifted fossiliferous marine Holocene strata standing high above present sea level.

The rates of uplift in the northern coastal area are smaller, ranging from 2 mm/year (1500 BP to 5500 BP) to 5.3 mm/year (5500 BP to 8500 BP). The average erosion rate of the Central Range is reported to be about 5.5 mm/year and uplift and erosion may be roughly balanced.

The most recent tectonic event in eastern Taiwan is the sinistral strike-slip movement along the Longitudinal Valley fault which is still active at present. This movement is a component vector of plate convergence. Surface faulting has been observed in many other places in Taiwan. Some of the Quaternary faults in the hilly and mountainous areas of western Taiwan could be detachment faulting from gravity tectonics, but a deep-seated regional stress system still predominates in the coastal plain area.

WOOLLY SCIENCE?

The following is taken from an article by Dr. B. Halstead, a palaeontologist, entitled "The physicists and the palaeontologists in the battle of the giants" which appeared in "The Guardian" newspaper on 5th September this year. Everything except the words in brackets is in the original. Dots indicate parts omitted.

As an illustration of the difference between the hard and woolly sciences, let me give an example of instances where such contrasting disciplines have been in direct conflict ....

The Nobel Laureate Luis Alvarez was responsible to a great extent for getting across the notion that the dinosaurs were wiped out as the consequence of an asteroid splatting the planet ("splatting" is in the original -Ed.) That was an eye-catching idea that took hold so firmly that many people .... speak of this event now as an established fact.

It all began with the discovery of a layer of clay with an ..... iridium concentration 30 times that usually found in terrestrial rocks, the recognition that similar levels occur in meteorites, the postulation of a 15 km diameter asteroid to produce such a global iridium concentration, the calculated effects of such an impact, the nature of the dust cloud and the effect this would have on planet and animal life.

Well, there was certainly a lot of computer power in there, all pretty impressive stuff ...... And it was an elegant solution to a lot of problems - a SINGLE DRAMATIC EVENT. A clear-cut solution.

To the astonishment of Alvarex and his colleagues, the palaeontologists were not at all impressed. Alvarez became quite exasperated "I simply do not understand why some palaeontologists deny that there was ever a catastrophic extinction." Palaeontologists did not seem able to handle quantitative data as he remarked: "The field of data analysis is one in which I have a lot of experience ... so far as I know, such great computing power has never before been brought to bear on problems of interest to palaeontologists. I'm really quite puzzled that knowledgeble palaeontologists would show such a lack of appreciation for the scientific method .... I'm really sorry to have spent so much time on something the physicists in the audience will say is obvious".

As Robert Jastrow, former director of NASA's Goddard Institute of Space Studies, has it "Perhaps the experts on ancient plant and animal life didn't know much maths, but they knew theri fossils, and the fossils told them Alvarez was wrong." ...... (As one of numerous examples) the dinosaurs went into a gradual decline during the last seven million years of the age of dinosaurs and this process speeded up during the last 300,000 years.

There was a rapid reduction in both diversity and population density. Furthermore some seven species of dinosaur seem to have survived into the succeeding geological period, later than the iridium enrichment layer.

Meanwhile, ... there were futher searches for iridium and lo and behold it was all over the place. The geological evidence now points to the iridium coming from Earth's volvanoes during a well documented period of increased volcanic activity. There is no need any longer to postulate a single unique event of asteroid impact. The iridium seems to have been deposited not instantaneously as claimed by Alvarez but over a period between 10 and 100,000 years.

So what can one conclude from this little episode? .... What it does highlight is a fundamentally different way of tackling a problem. A mathematician, physicist or chemist seeks to eliminate as many extraneous areas as they can ending up with a simple clear elegant solution, backed up by some sophisticated number crunching.

The aim is to arrive at a single problem that can be subjected to the appropriate analysis which will provide clear answers. The Alvarez scenario was a classic case of this.

There was only one little problem. Although animals and plants on land, sea and in the air dutifully died out, they did it all at different times, some long before the supposed impact and others long after. Many forms that by all accounts should have died out just carried on as if nothing had happened. So palaeontologists .... are asked: why did the dinosaurs die out? The answer is we do not know and actually are not particularly bothered ....

We do not spend our times looking for the answers, instead we go around trying to find as many chunks of information that need to be taken into account, that need to be taken on board before any theory can get off the launching pad. ....

Dream up a theory that explains the extinctions, but you need to think about the birds, mammals, cuttle fish, bony-fish, lizards, snakes, crocodiles, turtles, all of which did not seem to realise that there was some great crisis going on around them ....

...... when someone comes up with claims to having solved the riddle, we turn and say, " .. how can you deal with this fact, and all these others?" One day someone will do it but we won't half make it difficult.

Postscript This question was also exmained in the "Planet Earth" documentary series shown on TV In Hong Kong recently. Dr. Alvarez and his colleagues and supporters, including some geologists, presented their case at some length, but no dissenting voices were heard.

NOTICE OF GEOLOGICAL SOCIETY OF HONG KONG PUBLICATIONS

BULLETIN No. 1 (1984), 177 p., Ed. W.W.-S. Yim. Geology of Surficial Deposits in Hong Kong - a collection of 17 papers presented at a symposium at the University of Hong Kong in September 1983, dealing with general geology of the deposits (colluvial, alluvial and marine), investigation and sampling methods, weathering and erosion, landslides and prehistoric coastal development.

BULLTIN No. 2 (1985), 236 p., Ed. I. McFeat-Smith. Geological Aspects of Site Investigation - proceedings of a conference at the University of Hong Kong in December 1984, 17 papers dealing with geological site investigations for new towns, reclamations and tunnels, rock strength testing, drilling, problems of soil erosion, debris flows, joint and fault systems, seismological measurements in Hong Kong, current offshore practice in Hong Kong.

MARINE GEOLOGY OF HONG KONG AND THE PEARL RIVER MOUTH (1985), 96 p., Eds. P.G.D. Whiteside and R.S. Arthurton. A Collection of 12 papers presented at a Marine Studies Group seminar at the Unversity of Hong Kong in September 1985. - OUT OF PRINT

ABSTRACTS NO. 1, 79 p. Abstracts of papers presented at the meeting on Geology of Surficial Deposits in Hong Kong, September 1983.

ABSTRACTS No. 2, 50 p. Abstracts of papers presented at the conference on Geological Aspects of Site Investigations, December 1984.

ABSTRACTS No. 3, 51 p. Extended Abstracts of papers presented at a meeting on Sea-level Changes in Hong Kong During the Last 40 000 Years, held at the University of Hong Kong in May 1986.

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Vol. 3 (6 issues), 1985; Vol. 4 (4 issues), 1986.

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DISCUSSION OF "RESULTS OF A PALAEONTOLOGICAL INVESTIGATION OF CHEK LAP KOK BOREHOLE (B13/B13A) NORTH LANTAU" BY SHAW, ZHOU, GERVAIS & ALLEN.

(NEWSLETTER OF THE GEOLOGICAL SOCIETY OF HONG KONG, VOL. 4, NO. 2, PP. 1-12)

M.D. Howat

The authors postulate that the soils below the marine deposits are sediments which have been exposed to oxidising conditions by emergence during a sea level regression. This theory was first suggested by Howat (1985a) and could explain the presence of shell debris within apparently terrestrial soils, such as found in drillhole M41, some 500m west of borehole B13/B13A (Anon, 1981). The presence of rootlets within such soils could be explained by the growth of vegetation during periods of emergence.

However, it is not possible to explain the presence of leaves, twigs, bark or pollen within marine deposits by this scenario. Such terrestrial floral debris float and cannot have been sedimented through sea-water.

It is much more likely that the majority of soils at the Chek Lap Kok site are the result of slumps and cold mud flows (Howat, 1985b), which would explain the presence of both marine and terrestrial debris and microfossils in the same soil, and the poor to extremely poor sorting of most of the deposits, as shown on figure 1.

Observations of exposures of similar deposits in Western District, Hong Kong Island, confirmed the colluvial structure of the soils (Howat, 1985b). The lower "marine" deposits only sporadically contained marine debris, which can easily be missed in boreholes such as B13/B13A.

In fact, the writer is convinced that no definite conclusion could ever have been reached on the origin of the Western District deposits from the study of borehole samples alone.

REFERENCES

Anon (1981). Replacement Airport at Chek Lap Kok, Site Investigation Report, Vol. 2. Gammon (H.K.) Ltd., Geotechnical Information Unit, Hong Kong Government, Reference 3427.

Howat, M.D. (1985a). Marine or terrestrial? The soils of Tai Lam Bay. Proceedings of the Conference on Geological Aspects of Site Investigation, Bulletin No. 2 Geological Society of Hong Kong, pp. 151-165.

Howat, M.D. (1985b). A nearshore colluvial deposit in Western district, Hong Kong Island, Newsletter of the Geological Society of Hong Kong, Vol. 3, No. 6, pp. 6-12.

Yim, W.S.-S. and Li, Q. Y. (1983). Sea level changes and sea-floor surficial deposits off Chek Lap Kok. Geology of Surficial Deposits in Hong Kong, Abstracts No. 1, University of Hong Kong, pp. 48-59.

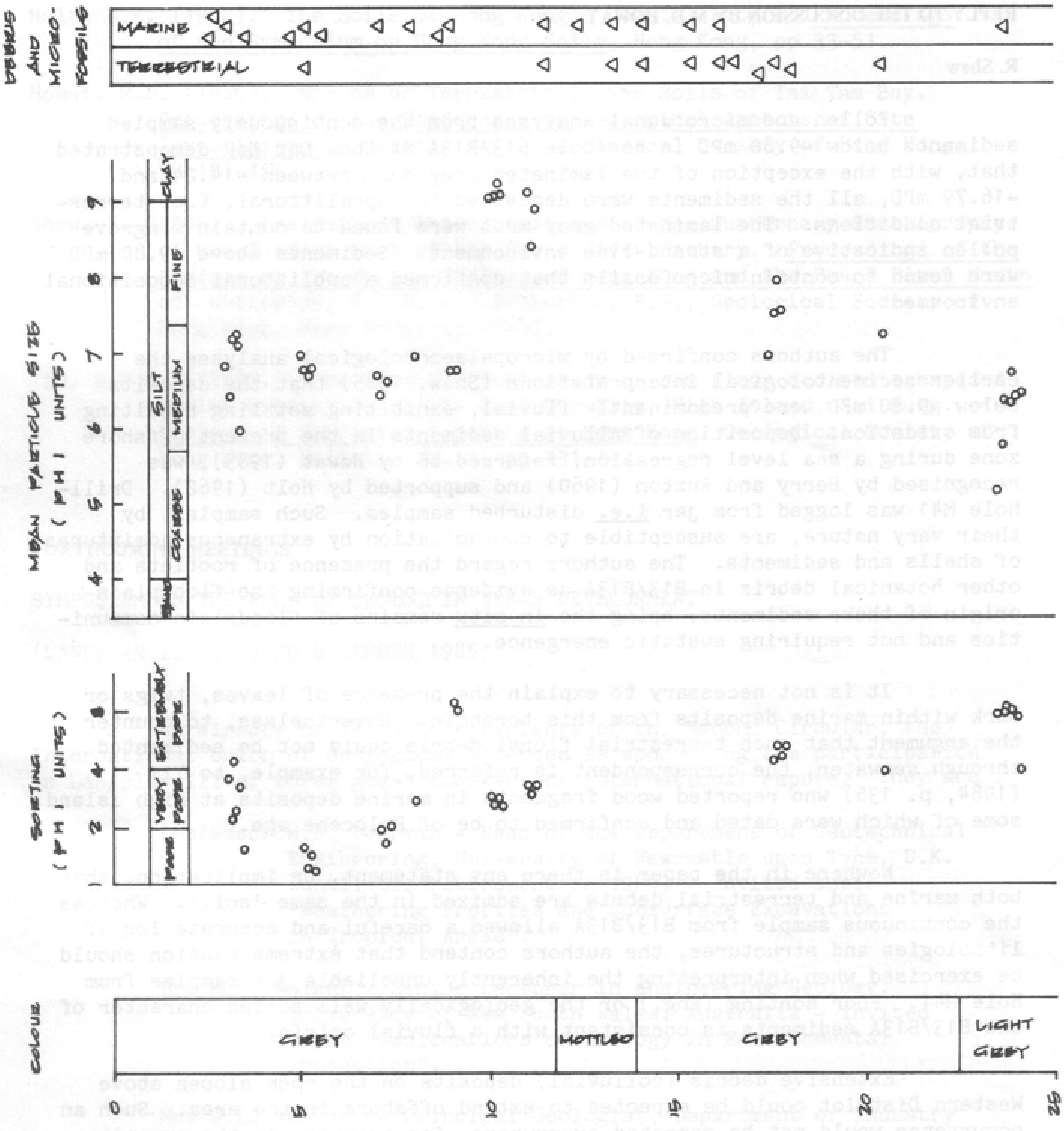

Figure 1 Borehole M41 Chek Lap Kok - Data from Yim & Li (1983) and Gammon (H.K.) Ltd. (Anon, 1981)

REPLY TO THE DISCUSSION BY M.D. HOWAT

R. Shaw

Pollen and microfaunal analyses from the continuously sampled sediments below -9.80 mPD in borehole B13/B13A at Chek Lap Kok demonstrated that, with the exception of the laminated grey muds between -14.24 and -16.79 mPD, all the sediments were deposited in supralittoral, i.e. terrestrial conditions. The laminated grey muds were found to contain mangrove pollen indicative of a strand-line environment. Sediments above -9.80 mPD were found to contain microfossils that confirmed a sublittoral depositional environment.

The authors confirmed by micropalaeontological analyses the earlier sedimentological interpretations (Shaw, 1985) that the deposits below -9.80 mPD were predominantly fluvial, exhibiting mottling resulting from oxidation. Deposition of alluvial sediments in the present offshore zone during a sea level regression, referred to by Howat (1985), was recognised by Berry and Ruxton (1960) and supported by Holt (1962). Drillhole M41 was logged from jar i.e. disturbed samples. Such samples, by their very nature, are susceptible to contamination by extraneous admixtures of shells and sediments. The authors regard the presence of rootlets and other botanical debris in B13/B13A as evidence confirming the floodplain origin of these sediments, being the in-situ remains of floodplain communities and not requiring eustatic emergence.

It is not necessary to explain the presence of leaves, twigs or bark within marine deposits from this borehole. Nevertheless, to counter the argument that such terrestrial floral debris could not be sedimented through seawater, the correspondent is referred, for example, to Yim (1984, p. 136) who reported wood fragments in marine deposits at High Island, some of which were dated and confirmed to be of Holocene age.

Nowhere in the paper is there any statement, or implication, that both marine and terrestrial debris are admixed in the same 'soil'. Whereas the continuous sample from B13/B13A allowed a careful and accurate log of lithologies and structures, the authors contend that extreme caution should be exercised when interpreting the inherently unreliable jar samples from Hole M41. Poor sorting (Eng.) or the geologically well sorted character of the B13/B13A sediments is consistent with a fluvial origin.

Extensive debris (colluvial) deposits on the open slopes above Western District could be expected to extend offshore in the area. Such an occurrence would not be expected everywhere, for example, on the opposite side of the Harbour off the low-lying Kowloon peninsula. The close similarity in all sedimentological aspects between B13/B13A and eleven other continuously sampled boreholes logged by the first-named author, and the close accordance of the micro-palaeontological results from two of these boreholes strongly support the argument that they were all formed under similar conditions.

REFERENCES

Berry, L. and Ruxton, B.P. (1960). The Evolution of Hong Kong Harbour Basin. Zeitschrift Fur Geomorphologie, Band 4, Heft 2, pp 97-115.

Holt, J.K. (1962). The Soils of Hong Kong's Coastal Waters. Proceedings of the Symposium on Hong Kong Soils, Hong Kong, pp 33-51.

Howat, M.D. (1985). Marine or Terrestrial? The Soils of Tai Tam Bay. Proceedings of the Conference on Geological Aspects of Site Investigation, Bulletin No. 2, Geological Society of Hong Kong, pp 151-165.

Shaw, R. (1985). Preliminary Interpretations of the Quaternary Stratigraphy of the Eastern Part of the Pearl River Estuary. Proceedings of the Seminar on the Marine Geology of Hong Kong and the Pearl River Mouth, ed. Whiteside, P.G.D. and Arthurton, R.S., Geological Society of Hong Kong, Hong Kong, pp 61-67.

Yim, W.W.S. (1984). A sedimentological study of sea floor sediments exposed during excavation of the East Dam Site, High Island, Sai Kung. in Geology of Surficial Deposits in Hong Kong, Geological Society of Hong Kong, Bulletin No. 1, pp 131-142.

FORTHCOMING MEETINGS

SYMPOSIUM ON THE ROLE OF GEOLOGY IN URBAN DEVELOPMENT

(LANDPLAN III), 15-20 DECEMBER 1986

As already notified to recipients of the Second Circular, the International Union of Geological Sciences is sponsoring the participation in Landplan III of three guest speakers of international repute. They are :

Professor W.R. Dearman - Head of the Department of Geotechnical Engineering, University of Newcastle upon Tyne, U.K. (until his retirement in 1986) - invited topic "Weathering Profiles and Subsurface Excavations in Tropical Areas".

Dr. M.J. Knight - Senior Lecturer in Engineering Geology, University of New South Wales, Australia - invited topic "Applications of Geology in Environmental Protection".

Mr. J.L. Neilson - Principal Geologist, Department of Industry Technology and Resources, State of Victoria, Australia - invited topic "Geological Mapping in the Urban Environment".

Other leading figures in engineering geology who are attending Landplan III include two regional Vice-Presidents of the International Association of Engineering Geology, D.H. Bell of the University of Canterbury, New Zealand (IAEG Vice-President, Austrasia) and Professor Wang Sijing, of the Academia Sinica, Beijing (IAEG Vice-President, People's Republic of China). Among the speakers will be representatives of many universities and technical institutes in Asia, including the Asian Institute of Technology, the Indian Institute of Technology, the National universities of Malaysia and Singapore, the University of the Philippines, and universities in China, Indonesia and Thailand.

Registrations have been received from Australia, Bangladesh, China, Fiji, France, India, Indonesia, Korea, Lebanon, Malaysia, New Zealand, The Netherlands, Pakistan, Philippines, Singapore, Thailand, U.K. and U.S.A. About 15 delegates are expected from China.

The symposium proper will be formally opened at 9:30 a.m. on Wednesday, December 17 by the Vice-Chancellor of Hong Kong University, Dr. Wang Gungwu. It will be preceded on Monday and Tuesday, 15-16 December, by eight half-day workshops and seminars. The programme of the symposium itself will probably be as follows (all technical sessions in the Rayson Huang Theatre, University of Hong Kong).

17th, Wednesday	- morning and afternoon	: Technical sessions
	evening	: Reception
18th, Thursday	- morning	: Technical sessions
	afternoon	: Field trips
19th, Friday	- morning and afternoon	: Technical sessions
	evening	: Dinner
20th, Saturday	- morning	: Technical session and closing ceremony
	afternoon	: Field trips

Further details will be given in the Final Circular, in early November. This will be sent to all who have registered by then and those others who request it. Copies of the Second Circular, with details of registration fee, and of the registration form, can also be obtained on request. Members of the society can also register in person at the Rayson Huang Theatre on Wednesday December 17, from 8:30 a.m. until 11 a.m. In the latter case, however, a full set of conference documentation cannot be guaranteed.

EXCURSION TO PING CHAU (MIRS BAY)
Sunday, January 11, 1987
(Second & Final Announcement)

By popular request, the third Society outing to Ping Chau (previously January 1984 & July 1985). We have hired a 100-seat double-deck ferry which will be more comfortable than our usual Ma Liu Shui boats. We hope to encourage families to attend by using this better boat.

Ferry departs Ma Liu Shui 9:30 a.m.
Returns by about 5:20 p.m.

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COST Adults $40 Children $30

MEMBERSHIP NEWS

The Society welcomes the following new members who have joined since the last issue of the Newsletter :

Chan Liu Yung	Chan Man Chung
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Chung Kwok Fai	Mrs. I. Curzon
Dr. Khoo Teng Tiong	Kong Paul Kong Ming
Kwong Tse Hin	Luk Kwok Man
Ng Chun Kao	Mrs. Ng Tang Sau Yung,
A.G. Piper	Dr. J. Premchitt
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Miss Yam How Ling	

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Payment should be sent with booking slips, by crossed cheque made out to the Geological Society of Hong Kong.

Children under 16: Age should be given against name. Children aged 3 or under are free.

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PING CHAU
JANUARY 11, 1987

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I/We wish to attend the boat trip to Ping Chau on Sunday, January 11, 1987.

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回程中，我們經過小梅沙海濱稍事休息，小梅沙爲高達 5 米白古沙堤，現已開始爲旅遊勝地。

我們衷心感謝深圳市地質學會爲我內容豐富的地質旅行，尤斯感周德雨先生等人的熱情接待。祝願今後香港和深圳兩地地質學術交流活動不斷加強。

請本文讀者同時參看本會通訊一九八六年三月之第四卷第一號內英文記述之圖片——編者

照片六：團友在深圳市小梅沙合照留念。

照片四：大亞灣核電廠平整廠地情況，照片最前面即爲反應堆位置。

四、觀察，下沙紅層

下午離開核電廠工地直達大鵬灣東岸的下沙，觀察了海濱出露的紅層。由於海蝕作用使紅層。由於海蝕作用使紅層形成十多米高的海蝕崖、海蝕壁龕和高約1米多的海蝕岩石灘。紅層由深褐色的礫岩夾合礫砂岩所組成、厚層、層理不很清楚。礫石有各種成份，包括沉積岩及火山岩礫石，但未見花崗岩礫石，礫石大小不等，次稜角狀，疏密不一，由沙泥質及鐵質所膠結，部分具鋁質。可能代表山麓及河流上游的堆積或斷陷盆地的堆積(照片五)。

據周德雨先生介紹，紅層中曾發現植物化石葉片，經鑑定爲Laricopsis angustifolia Fontaine，爲早白堊世。因此下沙紅層下白堊統。

照片五：下沙紅層礫岩內礫石特點

照片三：大亞灣核電廠選址地區區域地質圖。

三、參觀大亞灣核電廠

次日，我們沿深圳河東行徑，沙頭角、大小梅沙直達，大鵬半島中段大坑的大亞灣核電廠廠址，參觀了核電廠的工程地質，平整地盤等基本建設情況。

核電廠的吳工程師介紹了核電廠的工程地質特徵，工程要求和規格以及當前工作進度(照片二)。他指出自一九七九年到一九八二年，先後選擇了三個廠址候選點，然後經過幾年的詳細構造地質、地震地質及物探測量，最後選擇了離深圳四十五公里，離香港五十二公里的現址。

核電廠廠址位于大鵬半島中段，在此東東向和北北西向兩組斷裂交義所形成的斷塊中，泥盆石炭系地層組成排牙山傾伏皆斜，背斜南翼爲黑雲母花崗岩與泥盆系的接觸地帶。而廠址則建立於花崗岩岩基上面，經過人工地震法等物探測量，該廠址的深部構造較穩定，附近沒有活動的深大斷裂，地基是比較穩固的。(圖片三)(詳見另文廣東大亞灣核電廠地質簡介)。

吳工程師還介紹，廠址五十公里範圍內沒有發生過六級地震，二十公里內沒有小地震記錄，八公里範圍內從無微地震記錄。同時又作了深部測井，跨井(Cross Well) 探求地應力特點，做地應力解除法。據測定，地應力方向與外圍地應力一致。再加模擬實驗檢驗。

核電廠內反應堆裝置，俗稱核島則在花崗岩內的大型捕虜體——泥貧牙的角頁岩中。核電廠反應堆是法國產品，係壓水式反應堆，根據法國規範，核島地基彈性模量應爲20－30公斤/厘米^2 ，而花崗岩則高達50－65公斤/厘米^2 。若核島建于花崗岩上，勢必增加彈性材料，增加成本，而角頁岩的彈性模量則恰好適合上述要求。地震設計參數，地面水平加速度爲0.2g (1g＝9.81米/秒^2)。

核電廠裝置兩個法國的壓水式反應堆。發電量爲是九十萬千瓦，預計一九九三年建成正式運行。

我們參觀了廠址平整地盤的施工情況，斜坡的預切排鑽爆破、塡海等，大亞灣核電廠自一九八四年開始施工，目前基本完成場地平整(照片四)，並已建好了新公路、供水、供電設備及施工住宅等。

照片一：深圳市沙灣斷裂糜稜岩及其傾向。

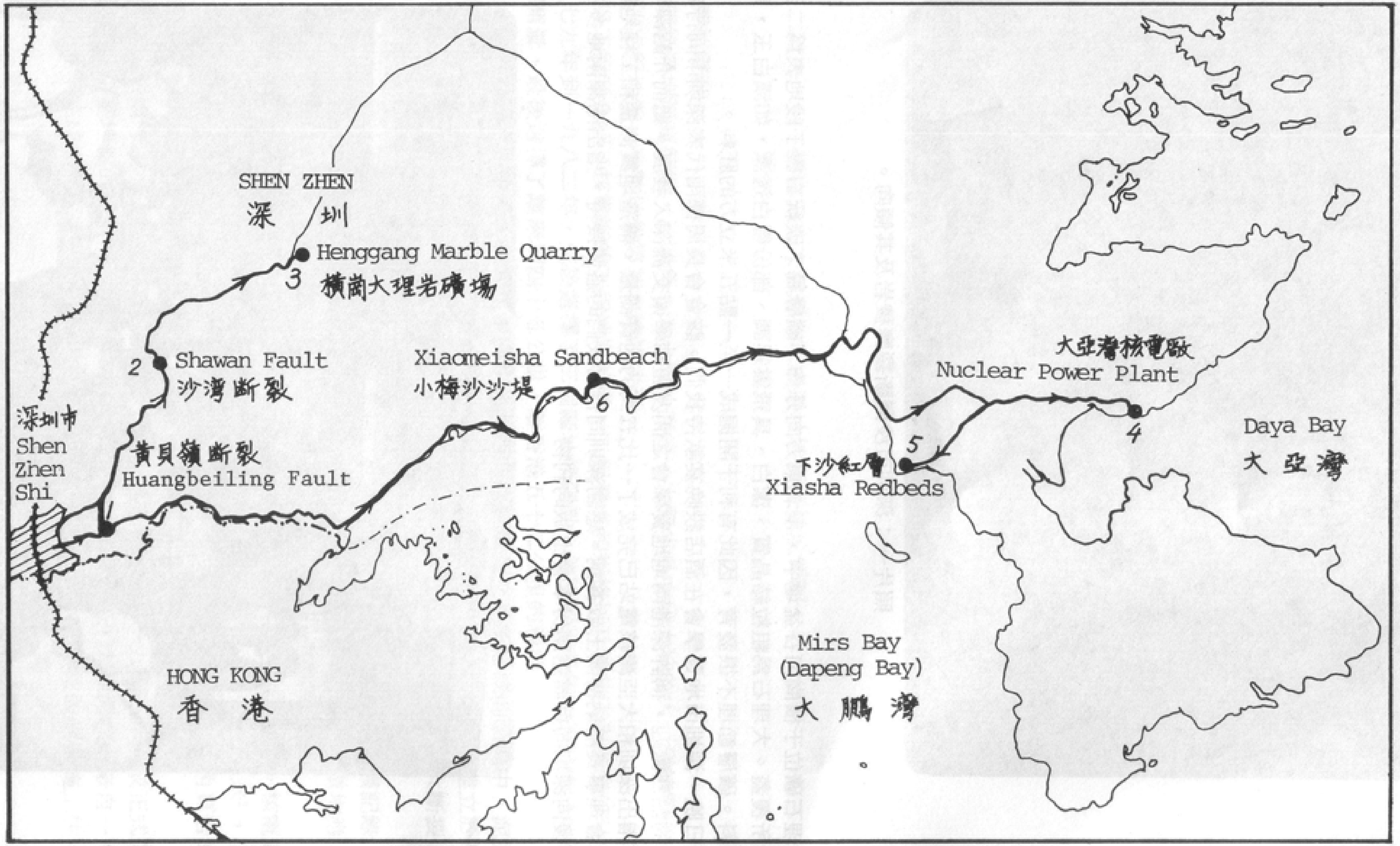
大理石礦位于橫崗河谷盆地中，呈北東方向分佈，礦層屬下碳統石磴子段地表為二至三米的河流冲積層所覆蓋。大理石為粗粒結晶質、潔白、具飛雲彩調、部份瑩白透潔，如漢白玉，為大理石板的上好材料。礦層節理不很發育，因此有利于開掘成一至一點五米立方的胚料。

是日晚，深圳市地質學會在酒店設晚宴款待我們。該會會長周德雨代表深圳市同行致詞表示對我們一行的熱烈歡迎，稱許深港兩地地質學會之間友誼和學術交流深入發展。繼而介紹深圳市地質工作概況，指出深圳和大亞灣核電站已完成了一比五萬的地質測量，構造地震測量和工程地質圖。

我會理事長潘納特博士致答詞，感謝深圳同行對我們的盛情接待，指出港深兩地多次交流甚有成效。然後向深圳同行贈送兩份本會出版的刊物。

照片二：深圳市大亞灣核電廠工地辦公室內，在介紹核電站建設情況

圖一：深圳及大亞灣核電廠址地質旅行路線圖（箭頭表示路線）



遇到滑坡(該地上震旦統陡山沱組的白雲岩中夾頁岩及泥岩，易受雨水影響而產生山泥傾瀉)，被迫作短暫停留，並於岩屑扇中的燈影組灰岩(上震旦統，陡山沱組之上)碎塊中尋找到文德藻化石；最後於馬兒壩近旁的頁陽河岸邊採集前震旦系的變質岩及火成岩標本。

返回宜昌後的三天(自24至26日)用於觀察三個地點的不同時期的典型地層剖面。24日是考察西陵峽東翼是長江北岸自蓮沱鎮至三遊洞之間的震旦系(包括震旦系與前震旦紀黃陵花崗岩的接觸關係)及寒武系剖面；25日觀察宜昌北面王家灣的志留系剖面及其與奧陶系的界線；26日上午往宜昌與王家灣之間的黃花場看奧陶系剖面。最令各人有興趣的是大多數地層含有豐富的化石而且易於採集（有的俯拾即是）。採集到的化石包括有文德藻、古杯類、頭足類、腕足類、三葉蟲及珊瑚等。在離開宜昌前往張家界前，於26日下午我們與研究所副所長及各有關工程師舉行座談。研究所並贈送了一批書籍及一塊打磨光滑的含有直角石縱切面的灰岩標本給香港地質學會。隨後我們又參觀了該所各實驗室。

27日前往湖南省大庸市，跟着的兩天(28及29日)是考察張家界(青岩山)地區的砂岩峯林地形及往遊黃龍洞(29日下午)。黃龍洞爲位於湖南省慈利縣境內的灰岩洞穴(灰岩年代爲二疊紀～二疊紀)，洞高約 160 米，分四層，由大小共13個洞穴組成(現時只有兩個洞開放)。於洞內小山般的坍塌堆積物上發育有衆多的大小不一，高度不同，形態各異的石筍，洞頂亦有各種形狀的石鐘孔。

我們於30日抵達湖南省長沙市，然後返回香港。

我們衷心地感謝宜昌地質礦產研究所及該所古生物地層組的汪主任，徐光洪、周天梅、馮少南、孟繁松等工程師以及該所的其他有關職工，他們在安排和組織此次考察中付出了許多寶貴的時間和精力，我們更感謝該所的楊醫生，她隨我們往張家界地區，沿途爲我團的生病者看病，對於宜昌科技協會及興山縣對外事務辦公室在我們的考察過程中給予的支持一併在此感謝，最後，我們多謝李作明先生幫助安排此次愉快的旅程。

深圳市及大亞灣核電廠地質旅行紀實

李作明　　廖國雄

本會于三月十五日至十六日組織了第四次前往深圳及大亞灣核電站爲時兩天的地質旅行，共有七十七人參加，爲歷年來人數最多的一次地質旅行。行程如(圖１)所示，見聞頗多，會員普遍反應良好。

一、參觀黃貝嶺斷裂觀測站(１)和沙灣斷裂(２)

我們一行於十五日晨乘直通車抵羅湖，深圳市地質學會會長、深圳市地質局副局長兼總工程師周德雨先生等人早在車站外迎接我們。分乘五部車先到深圳市東北近郊參觀了黃貝嶺斷裂觀測站。

周先生介紹了在黃貝嶺山坡上安裝的橫切及斜切黃貝嶺斷裂的八個觀測標石。標石混凝土內安裝了精度爲0.1mm的精密三相短水準測定儀，能測定三相裂位移的大小和速率，該儀器於四月份正式開始操作。

黃貝嶺斷裂被認爲是深圳市主要斷裂之一，斷裂走向東北，傾向北西，下盤爲早碳世測水段千枚岩，上盤出露混合岩，岩石風化強烈，觀測站可以對斷裂的活動進行定量測定。

接着，到深圳東北的沙灣採石場參觀銜接上述斷裂的沙灣斷裂。斷裂發育於內紅道中特黑雲田劣花崗岩，主斷裂帶寬達５米，爲糜稜岩，壓性構造清楚，走向北來，傾向北西，糜稜岩綠泥石化，兩側爲花崗糜稜岩及碎裂花崗岩。(照片一)

二、參觀橫崗大理石礦場和加工廠

下午二時，參觀了深圳的大理石工廠。該廠引進了意大利設備，可將大理石鋸成不同規格的大理石板和磨光。主人還贈給我們每人一份禮物——壓紙用的大理石。

接着我們到深圳東北的橫崗大理石礦場。該礦場四年前爲深圳市地質局所發現，經過普查勘探確定大理石礦的規模大小及儲量，而後去年正式開採。我們參觀了大理石礦開採及胚料加工的全過程。

長江三峽及湖南省張家界(青岩山)地區考察紀行

香港地質學會教師組自1986年 7 月17日至30日在長江三峽及湖南張家界(青岩山)地區進行考察。參加者共25人。是次考察得到中國科學院宜昌地質礦產研究所的大力協助，由該所古生物地層組的汪嘯風主任及徐光洪、周天梅、馮少南、孟繁松多位工程師負責安排各項行程、食宿及交通，且擔任嚮導與講解，更爲此行編寫了"長江三峽及張家界地質指南"。

在此且先對長江三峽及張家界作一簡短介紹。

長江三峽(圖 1)：

自四川省奉節縣的白帝城起至湖北省宜昌市的南津關止，在長約 200 公里的山地中，長江切割了三段由石灰岩、白雲岩組成的山地。這三個地段江面狹窄(最窄處約 100 米寬)，兩岸懸崖峭壁，高聳入雲，形成深峻且雄偉的峽谷。自西而東分別稱爲瞿塘峽、巫峽及西陵峽，是爲長江三峽。峽與峽之間河道較開濶且兩岸地形較平緩。河道可寬達300至500米。這是由於這些地段，水流切割較軟弱的砂岩、泥岩、頁岩或變質岩與花崗岩。地質上，瞿塘峽及巫峽兩側的灰岩、白雲岩屬早三疊世大冶組及嘉陵江組。這兩個地段的岩石均褶曲成背斜。在巫峽於河道兩側可見到背斜核部地層爲志留系的頁岩，泥盆系的石英岩及二疊系的石灰岩。在西陵峽地段，長江穿越南北走向的黃陵背斜，背斜核部地層爲較易風化的前震旦系崆嶺群片岩及片麻岩(約20億年)，及侵入於這些變質岩的黃陵花崗岩（約8－9億年)。兩翼地層則由震旦系至三疊系的灰岩、白雲岩夾砂岩、頁岩組成（東翼自志留系至三疊系地層爲白堊系礫岩覆蓋)。長江在穿越兩翼的灰岩及白雲岩時形成峽谷，而在核部則形成較爲開濶的河道。黃陵背斜的西翼，由於灰岩及白雲岩中夾有頁岩(志留系)，故時有大規模的崩塌及滑落。最近一次摧毀性的滑坡發生於1985年 6 月12日，地點是在西陵的西端，黃陵背斜西翼，長江北岸的新灘鎮。在大地構造上，長江三峽及其鄰近地區位處地質上穩定的楊子地台，故地層發育完整，地層間多爲整合或假合接觸，而且地質構造簡單。

張家界(背岩山)地區(圖 2)：

張家界位於湖南西部大庸、慈利和桑植之間(或大庸市以北30公里)，面積約 280 平方公里。該區出露的地層爲中、上泥盆統的石英砂岩，其下爲中志留統紗帽組的砂岩及頁岩。兩者爲假整合接觸。岩層傾斜角度不大，頗爲平緩。垂直於層面有多組節理發育。這些節理受到水流侵蝕，加上岩塊在動作用下崩塌，導致泥盆系的石英砂岩分割成大小不等的，高聳入雲的四邊形或多邊形的砂岩柱體，從而形成了具有奇峯異境的峯林地形。

以下是此次考察行程：

7 月17日乘搭開往廣州的夜船開始了我們的旅程。18日於廣州轉乘飛機往湖北宜昌。19日上午，宜昌地質礦產研究所所長譚忠福，副所長及宜昌地質學會理事吳保祿，該所科技處處長饒家光，汪嘯風主任及其他工程師以及宜昌科技協會副主任張發明在研究所熱情地接待我們。我們隨後參觀該所的陳列館(陳列三峽地區從震旦系到第三系的岩石及化石標本)。當天下午冒雨參觀葛洲壩水利樞紐工程。該工程包括大壩(長2592米)，三座船閘，泄水閘及冲沙閘，發電機21台(總發電量爲271萬54千瓦)。大壩曾經受了歷史上最大的一次洪水(110,000立方米/秒)。當晚研究所並科技協會設宴招待我們。

20日的行程是自宜昌乘船往四川省奉節，沿途觀察長江三峽兩岸的地質，地貌及自然景觀。船在晨早一時半開航，於當天下午五時抵奉節。是以此次行程未曾目睹西陵峽之全貌，僅在晨曦下，略見西陵峽西端的新灘滑坡。汪嘯風主任、徐光洪及周天梅工程師沿途爲我們講解有關的地質、地層、地貌以及風景點。跟着的一天(21日)是往遊奉節附近的白帝城勝景(位於瞿塘峽西端入口處)。

22日離開奉節乘船往湖北香溪鎮然後轉乘研究所提供的汽車往興山縣(湖北省)。於當天下午參觀該縣以北約20公里的猴子抱水電站(該地出露岩層爲寒武系灰岩)。返回興山的途中遊覽了昭君故里。

23日自興山返宜昌，因行車路線大致橫越南北走向的黃陵背斜，途中曾作多次短暫停留。先是在黃糧坪(該地區爲高約1000米的古夷平面)察看含有頭足類(直角石)化石的中奧陶統寶塔灰岩；再在高嵐風景區作短距離步行觀看由中、下寒武統灰岩形成的峯林地形，稍後在雙河口一處岩屑崩積扇附近

香港地質學會

1985－86年度常務委員會

投稿本會通訊簡則

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我們歡迎一些專門性的稿件，有趣事項的報導，書評或專題討論等。來稿以簡爲主。雖然有些時候本會可作出例外，但普通稿件請以一千二百字爲限。請盡量減少插圖及附表等，而所有圖表請另外分頁。

所有來稿必須清晰——英文稿用打字機打出，中文則以正楷謄寫。來稿需寄兩份。英文稿（包括援引）必須隔行，不可一紙兩面用；請用A4號紙張。中文稿則請用原稿紙。中英文稿每頁均必須有頁編號及作者姓名。

所有插圖請只寄影印本，待本會通知時始可將原版寄來，而必須註有來稿者姓名。圖表必須用黑色繪在描圖紙或滑面白紙或紙板上；所有綫條或字體之粗幼必須能縮影後仍可保持清晰，所有地圖必須附有公制比例，正北指向及如適用的話附有經緯綫座標。

援　引： 來稿者須負責確定所有援引的準確性，而公報之簡寫須以現藏於倫敦地質學會圖書館內倫敦地質學會1978年出版之定期出版物目錄爲準。

單行本： 經本通訊刋出之稿件，本會不負責供免費單行本給作者，但可代向承印商洽商，使作者可向承印商購買單行本。

封面圖片：赤門海峽荔枝庄淺水灣組中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

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