geological society of hong kong

NEWSLETTER

CONTENTS

Vol. 2 No. 4 July, 1984

GEOLOGICAL SOCIETY OF HONG KONG

GENERAL COMMITTEE
(1984 - 85)

NOTES FOR THE GUIDANCE OF CONTRIBUTORS TO THE NEWSLETTER

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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 Photograph : Courtesy - Dr. D.R. Workman
Fold in Tolo Harbour Formation
Ma Shi Chau

ZHUJIANG DELTA - EXTRACTS FROM A RESEARCH PUBLICATION BY THE GUANGZHOU INSTITUTE OF GEOGRAPHY

W.W.-S. Yim & P.S. Nau, Department of Geography & Geology, University of Hong Kong

Introduction

In December 1982, a research report in the form of a book entitled Zhujiang (Pearl River) Delta was published in Chinese by Huang Zhen-Guo et. al. of the Guangzhou Institute of Geography, Academia Sinica. This is a major work which collates current knowledge on the formation, development and evolution of the Zhujiang Delta.

In this article, we have attempted to translate certain parts of the book which may be of general interest to members of our society. We are solely responsible for any inaccuracies in the translation.

Authors Summary

This work is based on the analysis of over 1,200 boreholes and about 620 samples of Quaternary sediments. Much attention is devoted to the recognition of sedimentary facies and the interpretation of radiocarbon dates in order to study the landscape evolution associated with the development of the Zhujiang Delta. Major topics covered include the following:-

(1) Topography of the basement rocks

(2) Age of formation

(3) Cyclic sedimentation

(4) Climatic change

(5) Land subsidence and uplift

(6) Quaternary stratigraphy

(7) Sedimentation rates

(8) Stages in development.

Workers in geomorphology, Quaternary geology, petroleum geology, hydrology and engineering geology, water management, and navigation, may find this book useful as a source of reference.

Reference

Z.Huang, P. Li, Z. Zhang, K. Li & P. Qiao (1982). Zhujiang Delta - Formation, Development and Evolution. Guangzhou Institute of Geography Research Results, Universal Science Publishing House, Guangzhou, 274. (in Chinese).

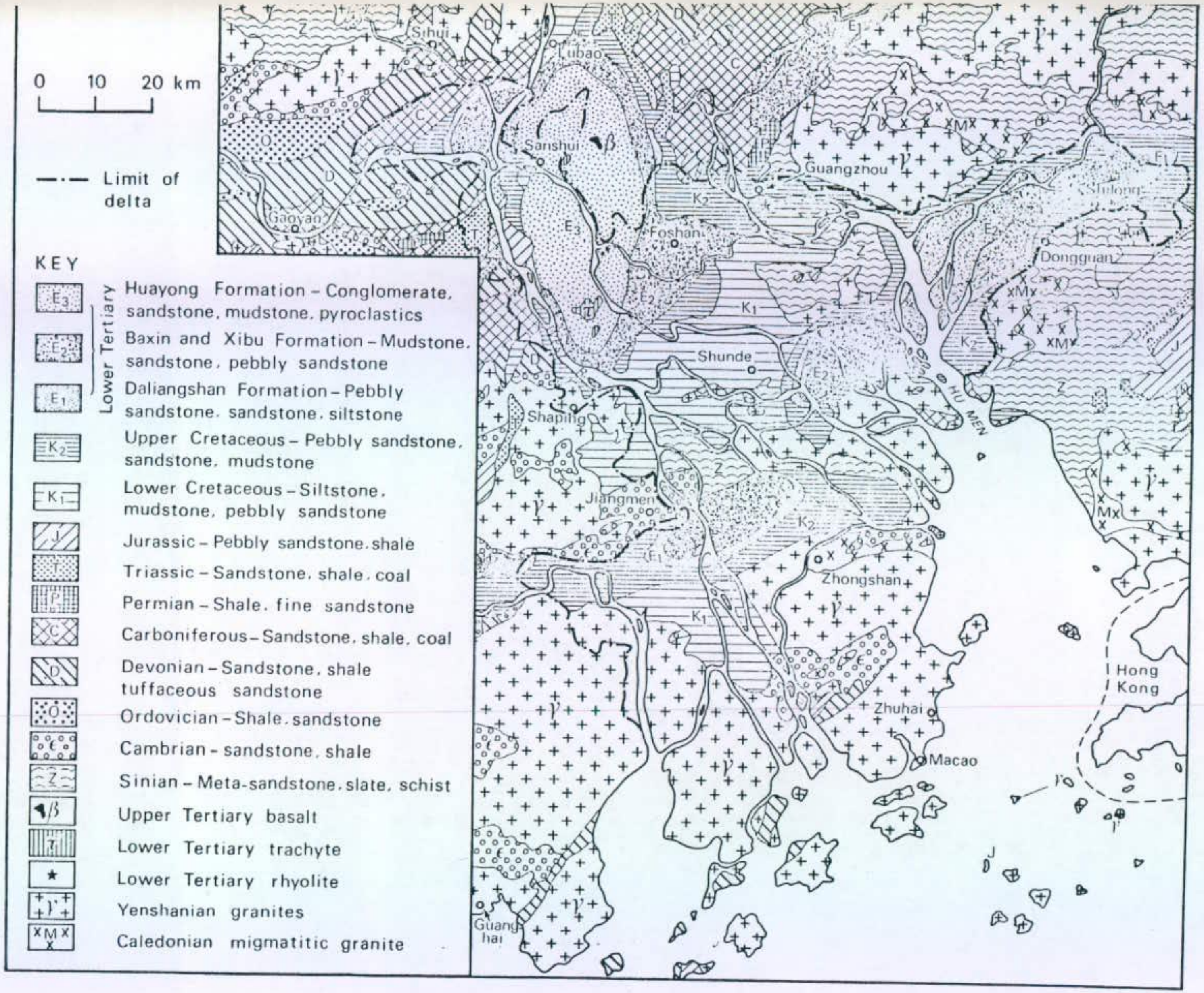

Fig. 1 Pre-Quaternary geology of the Zhujiang Delta

Table 1 Summary of tectonic events and landscape evolutionary stages of the Zhujiang Delta.

Period	Age / Years	Tectonic activity	Evidence	Evolutionary stage	Cycle	Stage
Holocene	Q_4^3 0 – 2,500	Differential uplift and subsidence; rate of uplift of marginal plains 1.03 mm/year; rate of subsidence of plains 0.59 mm/year; rate of subsidence of coastal regions 3.44 mm/year	Marine transgression 1,260-2,350 radiocarbon years	Sub-Atlantic stage transgression	Third sedimentary cycle	Delta development stage
Holocene	Q_4^2 5,000		Slightly weathered clay, sand and gravel	Sub-Boreal stage regression		
Holocene	7,500		Marine transgression 4,445-8,050 radiocarbon years	Atlantic stage transgression	Second sedimentary cycle	
Holocene	Q_4^1 10,000	Differential uplift and subsidence	Mottled clay, sand and gravel	Late Würm to Boreal stage low sea level		
Pleistocene	Q_3^3 22,000		Marine transgression 23,170-30,440 radiocarbon years	Pre-Würm interglacial stage	First sedimentary cycle	
Pleistocene	Q_3^2 40,000		Oldest sediment in delta 33,000-37,000 radiocarbon years	Accumulation of a lower gravel horizon along the main rivers		
Pleistocene	Q_3^1 0.1 my	Downfaulting	Buried residual soil; buried limestone caverns at -20 m below S.L.	Formation of six main basins; development of parallel ridges and valleys and a grid-like basement, controlling the main river courses		Formation of basement topography
Pleistocene	Q_2 0.7 my; Q_1 2.0 my	Following the Himalayan Movement, large scale periodic uplift and subsidence	Animal remains from late Q_2 to early Q_3 buried in limestone caves at -20 m below S.L. at Sanyuanli, Guangzhou	Residual soil on the basement was formed not later than Q2; periodic uplift led to the formation of the 300-350 m erosional surface, fourth order platforms and second order terraces		
Tertiary (Late)	N 38.0 my	Himalayan Movement - strong uplift, northeast trending faults active	Upper Tertiary missing	No sedimentation; stage of weathering and denudation, parallel ridges and valleys and the grid-like basement formed by three sets of faults		
Tertiary (Early)	E 65.0 my	Inherent faulting activity; volcanic eruptions	Radiometric dates of volcanics - 47, 52 and 64 my	Further development of the three basins and the deposition of red beds		Formation of topographical outline
Cretaceous	K 130.0 my	Yanshanian Movement - granitic intrusions and faulting, northeast and easterly trending faults well-developed	Radiometric dates of granites - 100, 135, 140-150 and 170-190 my	Formation of the Sanshiu, Xinhui and Dongyuang basins; deposition of the Lower Cretaceous red beds		
Jurassic	J 190.0 my					

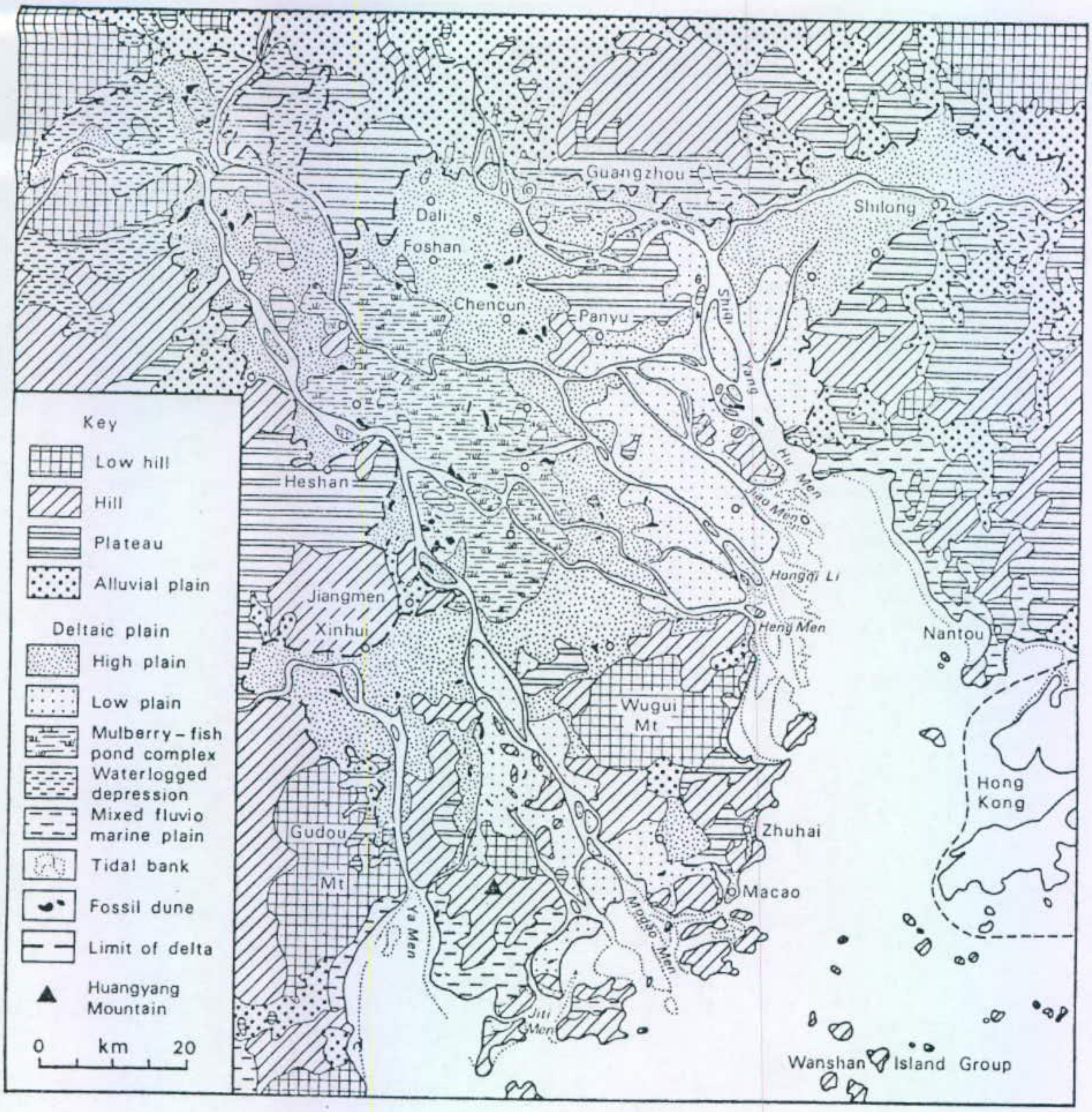

Fig. 2 Landform Classification of the Zhujiang Delta

LECTURE MEETING - OCTOBER 11 1984

SKARN DEPOSITS AND POLYMETALLIC ORES

OF SOUTH CHINA TYPE

Prof. GUNTER MOH

University of Heidelberg

See elsewhere in this issue under Forthcoming Programme for details of time and venue.

LECTURE BY PROF. LIU ZHAOSHU, 26th June 1983

About forty members attended an excellent lecture by Professor Liu Zhaoshu, Head of the Department of Marine Tectonics at the South China Sea Institute of Oceanology, Academia Sinica, on the work of the Institute and the geological structure of the South China Sea.

The following is a record of part of Professor Liu's lecture, which was given in Chinese with English interpretation by Mr Lee Kwan Wing and background paper translated by Mr Tan Chow Hu (see references).

A brief introduction to the South China Sea Institute of Oceanology

The Institute was established in 1959, in Guangzhou. It is a research organization with activities in a number of aspects of Oceanology with, of course, special reference to the South China Sea.

Research topics include: Environmental characteristics of the South China Sea; Ecologic systems, Evolution of geology; Coastline and River mouths, Zoology, Environmental protection, and so on.

The Institute has nine departments: i) Offshore structural geology; ii) offshore sedimentation; iii) geology of coastline and river mouths; iv) ecology; v) biology; vi) oceanic physics; vii) atmospheric physics and hydrology; viii) oceanographic instrumentation and survey; ix) computer division. There are also a laboratory centre, information centre and editorial unit. There are field stations at Zhanjiang, Shantou and Lokhutou (Hainan).

The Institute has two periodical publications: "Nanhai Studia Marin Sinica" and "Tropical Oceanology".

A department of oceanic geology was established in early 1961. In 1979, this was divided into three parts: Offshore geological structure; Oceanic deposits and Coastline-river mouth geology. Research work in oceanic geology since 1961 falls into two stages:

First stage (1961-1974), focussed mainly on continental shelf of northern portion of South China Sea:

a. Quaternary geological investigation and Neo-tectonic research in coastal ranges of mainland.

b. Topographic study of sea-floor and sea-bed investigation in shelf area of northern portion of South China Sea, including Qiongzhou strait.

c. Morphologic study, geological study and gravity survey in Xisha islands.

d. Combined study with 2nd Oceanic-Geological Investigation Team of the Bureau of Geology, to carry out 'Main characteristics of structural geology and its bearing on oil and gas exploration' in Beibu Wan (bay between Vietnam and Hainan island).

e. Special research on topography of sea-floor and sea bed in connexion with engineering problems in several coastal regions and bays.

Second stage (from 1975 to present). Work has been concentrated on the continental slopes and central sea basin area in this period. It includes:

a. Coverage of large area by geophysical surveys (depth-sounders, gravity survey, magnetic etc.)

b. Geological and geophysical surveys in Xisha islands and Zhongsha islands.

c. Under Professor W.Y. Chang, assistance in compilation of the map "Tectonic map of China and its surrounding areas".

d. Special research on the basement structure of the Pearl River Mouth Basin.

(Note : A background paper by Professor Liu giving details of results of some of this research is being translated by Mr Tan Chow Hu and will be summarized in a forthcoming newsletter).

Outline of the geological structure of the South China Sea

Professor Liu pointed out that the South China Sea differs from other West Pacific marginal seas in the following aspects: 1) the Taiwan Arc and the northern Luzon Arc face the marginal sea; 2) the Manila Trench lies in the marginal sea with an opposite subduction zone; 3) the major lineaments of the central basin are perpendicular to the island arc.

It is believed that South China Sea is a continental margin garden system forming when a compressive regional stress field was relaxed and the continental margin dismembered by faulting. Sea-floor spreading took place in a many-period and multi-axis way. Continental blocks (islands) dispersed towards the ocean in the Late Mesozoic to Cenozoic from what had been, in the Mesozoic, an active continental margin of Andes type.

Along the northern margin of the South China Sea there is a series of step-like normal faults with basement grabens and horsts bounded by the faults. In the grabens Cenozoic basins filled with sediments of huge thickness.

Along the southern margin of the South China Sea Basin, the Palawan Trough is the residual sea of the Tethys, which has been consuming successively towards the South China Sea since Yenshan Period, and in the north of Kalimantan formed a series of imbricate overthrusts. The pre-Quaternary strata have undergone deformation and metamorphism to different degrees. Therefore, the southern margin of the South China Sea Basin differs from the northern margin; it is of compressive (convergent) type.

The western margin of the South China Sea Basin is the narrow East Vietnam Continental Shelf which runs in a N-S direction, roughly parallel to the coastline. On the Shelf there is a series of step-like regular and normal faults.

The N-S trending Taiwan-North Luzon Arcs and Manila Trench lie at the eastern margin of the South China Sea Basin and bulge to the sea. Seismic data indicate that the Benioff Zone at the Manila Trench declines eastward.

The above-mentioned basic features of the margins of the South China Sea Basin roughly reflect the principal movement characteristics of marginal spreading out from NW to SE, tension in the rear and compression in the front, shear on either side.

The faults within South China Sea are mainly zigzag tensional faults, dominated by two groups lying respectively in NE-SW and approximately E-W directions.

The NE-trending tensional faults are crust and lithosphere faults of large scale, they control the configuration and extending direction of the entire South China Sea.

The nearly E-W trending tensional faults involve ENE-WSW and E-W trending groups. The former occur mostly in the continental shelf and slope of the northern South China Sea; they have moved time and again since Yenshan Period and are characterized by heritability and polycyclicity. The latter occur largely in the central basin, they are newly formed faults to Xishan Period. Both are smaller in scale than the NE-trending faults.

In the central basin of South China Sea the thickness of the crust is 5 - 9 km; it possesses the characteristics of oceanic crust. The calculated crustal thickness based on gravity anomalies coincides with the measurements of sonobuoys.

The oceanic crust of the central basin is in direct contact with the peripheral continental crust along deep lithospheric faults, showing a striking contrast of geomorphology, high gradient of gravity and magnetic anomalies, a high or low heat flow zone and abrupt change of crustal thickness.

Evolution of the South China Sea

The evolution of marginal sea basins may be divided into six developmental stages, namely, embryonic, young, mature, ageing, old, and extinct. The present South China Sea corresponds to the ageing stage. The development of the South China Sea so far has undergone four stages.

1. The Embryonic stage (Late Cretaceous to Early Tertiary (Paleocene)). The Kula-Pacific block subducted under the eastern Asian continent from southeast, a regional compressive stress field in NW-SE direction was formed. At the uplifted continental margin (overthrust mass) a secondary compressive local stress field in NE-SW direction was formed, giving rise to X-shaped shear faults in NNE and ENE directions. With intensifying of the regional compression, the NE-trending tensional zigzag faults were formed and further developed into a series of graben-like fault-subsided basins.

2. The young stage (Eocene - Early Oligocene). Evolution of the active continental margin of Andes Type came to an end, the regional compressive stress field relaxed and became tensional. The mantle rose and rose and crust thinned, faults hereditary from the embryonic stage cut deep down. The mantle material rose along the lithosphere faults, grabens became deeper and wider, the continental margin spread seawards, the subduction zone retreated. The Calamian microcontinent separated from the South China continent and became a residual continental block in the Philippine Xishan eugeosyncline. The new oceanic basic linked with the Palawan residual sea which lay to the SW of it and made up a NE-trending basin similar to the narrow basin of the present day Okinawa Trough. The primitive South China Sea took shape.

3. The mature stage (Mid-Oligocene to Early Miocene). The regional stress field was still tensional, the continental margin went on spreading towards the ocean. At the fore-continental margin approximately E-W oriented compressive stress resulted in the forming of the Philippine Island Arc. In the relatively depressed South China Sea graben area NNW- and ENE-trending shear faults of X-shape were formed. An E-W trending seafloor spreading axis was formed and N-S trending shear-tension was produced.

4. The ageing stage (Mid-Miocene-Quaternary). After the Early Miocene, density of the mantle increased with its cooling. Horizontal movement was replaced by vertical movement and regional subsidence occurred in the South China Sea. At the same time the Philippine Sea fault block went on compressing WNW-ward. As a result, the Luzon Arc overthrust westward onto the South China Sea oceanic crust, so that an island arc showing its back to the marginal sea was formed and a trench appeared in the sea, resulting in an opposite subduction zone, towards the ocean. The vertical subsiding movement of the seafloor and the lateral drag of the opposite subduction zone made the NE-trending faults active once more and various types of island blocks were formed. The Nansha Islands deviated and rotated clockwise toward SE and drifted away from Zhongsha Islands. A wedge-like basin in SW part of the central basin was formed. In the East Xisha Trough, which lies between the Zhongsha and Xisha island blocks, new oceanic crust has appeared locally since the Pliocene. The basin offshore the mouth of the Zhujiang turned from a fault basin into a subsided one, and terrigenous clastic marine strata of huge thickness were deposited. Thus, the structural setting of the modern South China Sea was basically formed.

If in the South China Sea area the E-W oriented compression keeps up, the oceanic crust in the central basin continues consuming eastward, and the Philippine Island Arc keeps overthrusting westward, then, the Philippine Island Arc will not stop accreting westward, and Manila trench will not stop retreating. Finally, the island arc will collide with the continent, and the South China Sea will be closed. Thus, the evolutionary cycle of the marginal sea will be at an end.

References

1. A brief introduction to the South China Sea Institute of Academia Sinica, by Professor Liu Zhaoshu, June 1984 (in Chinese, English translation by Tan Chow Hu)

2.2 Second stage (from 1975 to present). Work was concentrated on the continental slopes and central sea basin area in this period. It include

a. A large area of geophysics survey (depth-sounders, gravity survey, magnetic etc)

b. Geological and geophysical surveys in Xisha islands and Zhongsha islands.

c. Under Professor W.Y. Chang, assist compilation of the map "Tectonic map of China and its surrounding areas".

d. Special research in "Basement structure study of Pearl River Mouth Basin".

3. Some research results from the past twenty years.

3.1 Quaternary geology of coast region of South China. We believe that this area, South China sea and its northern surrounding area suffered a large marine transgression in Late Tertiary Period (Neogene). The marginal region of continent (Early Tertiary Period) subsided to become a continental shelf. The latest transgression occurred in the early Pliocene. The land totally subsided about 80 to 100 metres, and the highest sea level rose to +3m to +10 m. We estimated that an early Tertiary basin, which might contain oil and gas bearing Mesozoic and P 1 ogene Formations, was buried under the Neogene of the continental shelf and slope. We also pointed out the old(now offshore)delta of Pearl River Mouth was the principle promising area for oil and gas investigation and exploration. In 1974, we reported these ideas in an Oil operation conference of Guangdong Province and other similar conferences held in China. The investigation works carried out by Chinese and foreign groups have confirmed these ideas in recent years.

3.2 We also studied the volcanic activities in Qiong area. The age of Volcanic activities in this area is from Tertiary Period to early Quaternary, with strongest activity in the Pleistocene. The volcanic eruptions were mainly basaltic and they are due to several intermittent explosive events. Most of the Quaternary basalts are nearly horizontal volcanic sheets overlying sedimentary formations. Their thickness varies from a few centimeters to tens of centimeters and their contact metamorphism zone is very thin. Most of volcanics are locally distributed in the marginal area of the Qiong - Beibu Wan Depression. The volcanic activity ~~activity~~ is younger than the oil bearing formations in this area. Between 1977 and 1979, 8 investigation drillholes were completed in Beibu Wan and 4 holes drilled in Yinkuhai Basin. The results also proved our ideas were correct. These research results were published in the book "Quaternary geology of South China Coast area", in 1978.

3.3 Qiongzhou Street

This strait is between Qiongzhou Peninsula and Hainan Island. It is an E-W trending channel about 80 km long and 20 to 30 km wide.

A deep water basin is located in the central portion of the strait. Its depth is about 50 metres and the sea-bed is regular and flat, but some places are very deep, as much as 113 m.

The strait and the peninsula are located on a Cenozoic depression. Lower Tertiary Formations are continental deposits, locally distributed in many smaller rifted basins within the depression. The average density of rocks are 2.37 g/cm^3. Upper Tertiary Formations are broadly distributed in the depression. They are marine deposits, their average density value is 1.97 g/cm^3. So, interface between Lower and Upper Tertiary Formations is a sharp contact. Gravity anomalies reveal clearly variations in the thickness of Upper Tertiary Formation.

Quaternary formations are marine deposits with several layers of volcanics.

3.4 Beibu Wan (Bay)

It is a crescent-shaped and semi-closed bay between Hainan Island and Vietnam coast. Area about 120,000 km^2.

The sea-bed is generally flat, only a little complex in southern part. From north to south, there are five stepped sub-water terraces ((a)-15 20 m (b) -30 - 45 m (c) -60-75 m (d) -85 - 95 m and (e) -100 - 120 m), step by step downward. The age of the lowest terrace (-100 - 120 m), may be the end of Pleistocene. Since which time the wave-cut terrace may have subsided about 120 m below main sea level.

The characteristic of gravity anomalies of the bay are: high value in Northern side and Southern side, but low value in centre. We estimated the main geological factors affecting the results of gravity anomalies are the different surface levels of Palaeozoic basement. The difference of rock density between Palaeozoic basement and overlying formations is 0.4 g/cm^3.

The magnetic intensity of the bay is higher in eastern portion and lower in the west apparently because basalts occur in the east but not in the west part of the bay.

Beibu Wan (Bay) is a large Mesozoic to Cenozoic Depression. It has a complex basement. From Cretaceous to Early Tertiary, deposition was under interior (inland) basin conditions. After this, marine conditions were imposed at a Late Tertiary date. Our report "Structural features of Beibu Wan and its oil-gas bearing appraisal" (1973) discussed these problems.

From 1977 to 1979, China drilled 8 holes and 6 holes found oil. In April 1984, first high productive drillhold carried out by China-France cooperation was completed at 2945 m depth. It penetrated 6 oil bearing beds. After testing, two beds are relatively rich. No. 2 bed daily production: 320 ton of oil and 59,000 m^3 of gas. No. 3 bed daily production: 320 ton of oil and 70,000 m^3 of gas. They are in the depth of 2,457 m, and are Tertiary sandstone.

3.5 Continental shelf of Northern South China Sea

Topography of the sea bed is very flat. Rifted valleys and uplift ridges occur along the margin of the shelf. We found 4 steps of submarine terraces: (a) -25 - 30 m (b) -35 - 40 m (c) -80 - 90 m and (d) -110 - 120 m. The third one - 80 - 90 m is the most prominent.

The Bouguer gravity anomalies of the continental shelf is -10 - +40 mgal. Most of the free air gravity anomalies are low values plus and minus. Depth of Moho is about 30 km.

There are three development stages in the shelf: Cretaceous to Lower Tertiary; Miocene to Middle Pleistocene and Late Pleistocene to recent. Lower Tertiary Formations were deposited on different formations of Palaeozoic and Mesozoic, also Yanshan Granites, with angular unconformities.

Pearl River Mouth Basin is the largest depositional basin in the continental shelf area. Its area is about 150,000 km^2. Lower and Upper Tertiary Formations' thickness is several thousand metres in general, but in the centre of the basic is up to 11,000 m.

Translated by C.H. TAN on 22-6-1984
(P & T Civil Engineering Ltd)

N.B. Remaining parts of the original article, dealing with the Continental Slope, Xisha (Paracel) Islands area, Macclesfield Bank and Central Basin of South China Sea will be translated in summary and distributed to registrants later.

A brief introduction to the South China Sea Institute of Oceanology of Academia Sinica

Professor Liu Zhaoshu
June, 1984

N.B. This is a provisional unchecked translation from the original Chinese and may contains errors; it is subject to later review and alteration.

1. About the Institute

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1.1 Our research topics include: Environmental characteristics of the South China Sea; Ecologic system; Evolution of geology; Coastline and River mouths, Zoology, Environmental protection, and so on.

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1.3 There are also a laboratory centre, information centre and editorial unit. There are field stations at Zhanjiang, Shantou and Lokhutou (Hainan).

1.4 The Institute has two periodical publications: "Oceanology of South China Sea" and "Tropical Sea and Ocean"

2. Geological and geophysical work in the South China Sea

In early 1961, we established a department of oceanic geology. In 1979, this was divided into three parts: offshore geological structure; Oceanic deposits and coastline-river mouth geology.

Our research work since 1961 falls into two stages.

2.1 First stage (1961-1974), focussed mainly on continental shelf of northern portion of South China Sea.

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c. Morphologic study, geological study and gravity survey in Xisha islands.

d. Combined study with 2nd oceanic-geological investigation team of the Bureau of Geology, to carry out 'Main characteristics of structural geology and its bearing on oil and gas exploration" in Beibu Wan (bay between Vietnam and Hainan island)

e. Special research on topography of sea-floor and sea bed in connexion with engineering problems in several coast regions and bays:

2. *Liu Zhaoshu, Yang Shukang, He Shanmou, Huang Ciliu and Chen Senqiang. Geologic structure of South China Sea and the continental margin spreading (unpubl. manuscript with 2 tables and 1 figure).*

Copies of these papers have been added to the Society's reference collection.

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Professor Liu has presented the Society with a set of geographical/bathymetric maps of the South China Sea on scales ranging from 5 to 10 million and copies of two maps recently published in China in both English and Chinese:

> The Marine and Continental Tectonic Map of China and its Environ, 1:5 million, Chief compiler Zhang Wenyou (Science Press, 1983).
>
> Tectonic Map of Asia, 1:8 million (Chinese Academy of Geological Sciences, 1982).

The Society warmly thanks Professor Liu for these and for a very stimulating and enjoyable lecture. Thanks are also due to Mr Lee Kwan Wing and Mr Tan Chow Hu for their efforts in providing invaluable interpretation/translation services for non-Chinese speaking members of the audience.

MEMBERSHIP NEWS

The Society welcomes the following new members: P. Blacker, Cheung Wai Keung, Fung Wing Kun, A. Hee, Hong Wong Shui Ling (Mrs), Hui Chu Yan, Leung Yim Ngan (Miss), Lo Po Kwong, Lui Yu Kwong, A. Ng, Tam Chung Chiu, Tam Po Che

The following members have recently transferred to overseas membership: J.D. Bennett, G.W. Borrie, M. Dale, Mrs A. Pearson.

The Society acknowledges receipt of the 1984 subscription from the following members since the last issue of the Newsletter:-

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Fung W K		Man F T		Yuen S C
				Suen Y C R

THE USE OF THE POINT LOAD TEST FOR THE DETERMINATION OF STRENGTH OF WEATHERED ROCKS IN HONG KONG

T.I. Gamon, Freeman Fox (F.E.) Ltd

1. Introduction

The portable point load test apparatus has proved to be an invaluable tool for logging and assessment of weathered rock material (Fookes et.al. 1971, Dearman 1974, Dearman and Irfan 1978, Franklin et.al. 1970, Broch and Franklin 1972) but its full potential has not yet been realised in Hong Kong. The results of the point load test can be directly related to the uniaxial compressive strength of the rock material, which forms the basis of the objective rock strength classification system suggested by the Geological Society of London (Anon 1972), the International Association of Engineering Geology (Anon 1981a) and the British Standards Institution (Anon 1981b). The test provides a cost effective and reliable method of assessing weathered rock strength in both the field and laboratory. One of its major advantages is that the specimens to be tested do not require any preparation and can be in the form of core or irregular lumps.

By comparison, the preparation of specimens for the laboratory determination of the uniaxial compressive strength is both time consuming and tedious. In Hong Kong, most commercial laboratories have overcome the necessary elaborate specimen preparation by adopting inappropriate test standards. This commonly leads to an under-estimation of the material strength, with subsequent repercussions on parameters for geotechnical design and therefore project costs.

This paper explains the point load test procedure and compares the results of point load tests with uniaxial compressive strength tests carried out on the Hong Kong Granite to demonstrate the advantages of the point load test over the uniaxial compressive strength test for the determination of the strength of weathered rock.

2. The Point Load Test Procedure

The standard procedure for the point load test is described in detail in Broch and Franklin (1972).

The test apparatus comprises a small hydraulic pump and ram, with a loading frame of maximum rigidity which should be easily adjustable to test core or rock lumps of different sizes. The specimen is placed between two conical platens of standard dimensions and loaded until the specimen fails by splitting between the platen contact points. The pressure in the hydraulic system, that operates the ram and platens, is measured by a pressure gauge connected to the end of the pump. The apparatus is diagrammatically illustrated in the Geotechnical Manual for Slope (GCO 1981 p32).

The point load strength index (Is) is calculated by multiplying the gauge pressure by the ram area, to give the force at failure (P), and dividing this force (P) by the square of the core diameter (D),

$$Is = P/D^2$$

The ram area is usually stamped on the loading frame, but to simplify the conversion, the manufacturers of the test apparatus generally supply graphs, relating to their particular apparatus, for reading the point load strength index (Is) directly from the gauge pressure and specimen diameter. Alternatively, this conversion can be carried out using the nomogram presented in Broch and Franklin (1972) to compute the point load strength (Is) from the failure load and platen separation.

The standard pressure gauge supplied with the apparatus has a large pressure range, up to say 35 MN/m^2, which is suitable for general use with most slightly weathered to fresh rock material. For weaker material, such as moderately weathered rock, where the anticipated failure load is low, this standard gauge can be replaced by one with a smaller range, up to say 5 MN/m^2. The pressure gauge should be fitted with a follower to record the maximum pressure as the specimen fails.

The specimen diameter should be determined by accurate measurement prior to testing or be derived from the scale, attached to the side of the loading frame, that measures platen separation. The length of the specimen should not be less than 1.4 times the diameter. For irregular lump samples the ratio of the distance between the loaded points to the smallest specimen dimension in a perpendicular direction should be between 1.0 (for a well-rounded specimen) and 1.4 (for a prismatic specimen), and the specimen thickness should be close to 50 mm.

The point load strength index (Is) has been found to decrease with increasing specimen diameter, so, to enable comparisons to be made with tests on specimens of different diameter, the point load index (Is) should always be normalised to a reference diameter of 50 mm using the size correction chart from Broch and Franklin (1972). The normalised point load strength index is commonly designated Is(50) to avoid confusion with the "uncorrected" point load strength (Is).

The median value of point load strength index (Is(50)) is derived by systematically deleting the highest and lowest values recorded from individual normalised determinations and taking the average of the last two remaining values.

The number of determinations to be made depends on the purpose of the test programme. For routine tests on weathered rock core of up to 80 mm diameter, a minimum of 4 individual determinations per core run would give a representative index, provided that the determinations are within 20% of the median value. To determine representative strength indices for cores of a particular material type, and/or weathering grade, a minimum of 10 individual determinations for each median value would be more appropriate. A sufficiently large number of median values will be required to establish the range. A larger number of individual determinations, say 15 to 25 for each median value, would be recommended for irregular lump specimens.

3. The Results Of Point Load Tests On The Hong Kong Granite

The point load strength index (Is(50)) for specimens of the Hong Kong Granite has been determined by testing lengths of core obtained during a routine site investigation programme.

A median value was derived from the determination of Is(50) for a minimum of 4, but usually 6, individual specimens from selected 1500 mm to 2000 mm lengths of rock core. Each specimen was approximately 150 mm to 200 mm in length. A further 150 mm to 200 mm specimen was extracted from the selected length of core for the laboratory determination of uniaxial compressive strength.

The results of 319 individual point load strength determinations for moderately weathered and slightly weathered to fresh granite are summarised as a histogram in Fig. 1.

The point load strength index (IS(50)) for moderately weathered granite lies between 0.78 MN/m^2 and 3.6 MN/m^2, and the slightly weathered to fresh granite lies between 3.8 MN/m^2 and 14.30 MN/m^2 with the majority of the results between 4 MN/m^2 and 8 MN/m^2. Higher indices were generally recorded for the finer grained granite, although a separation of the test results based on grain size could not be justified.

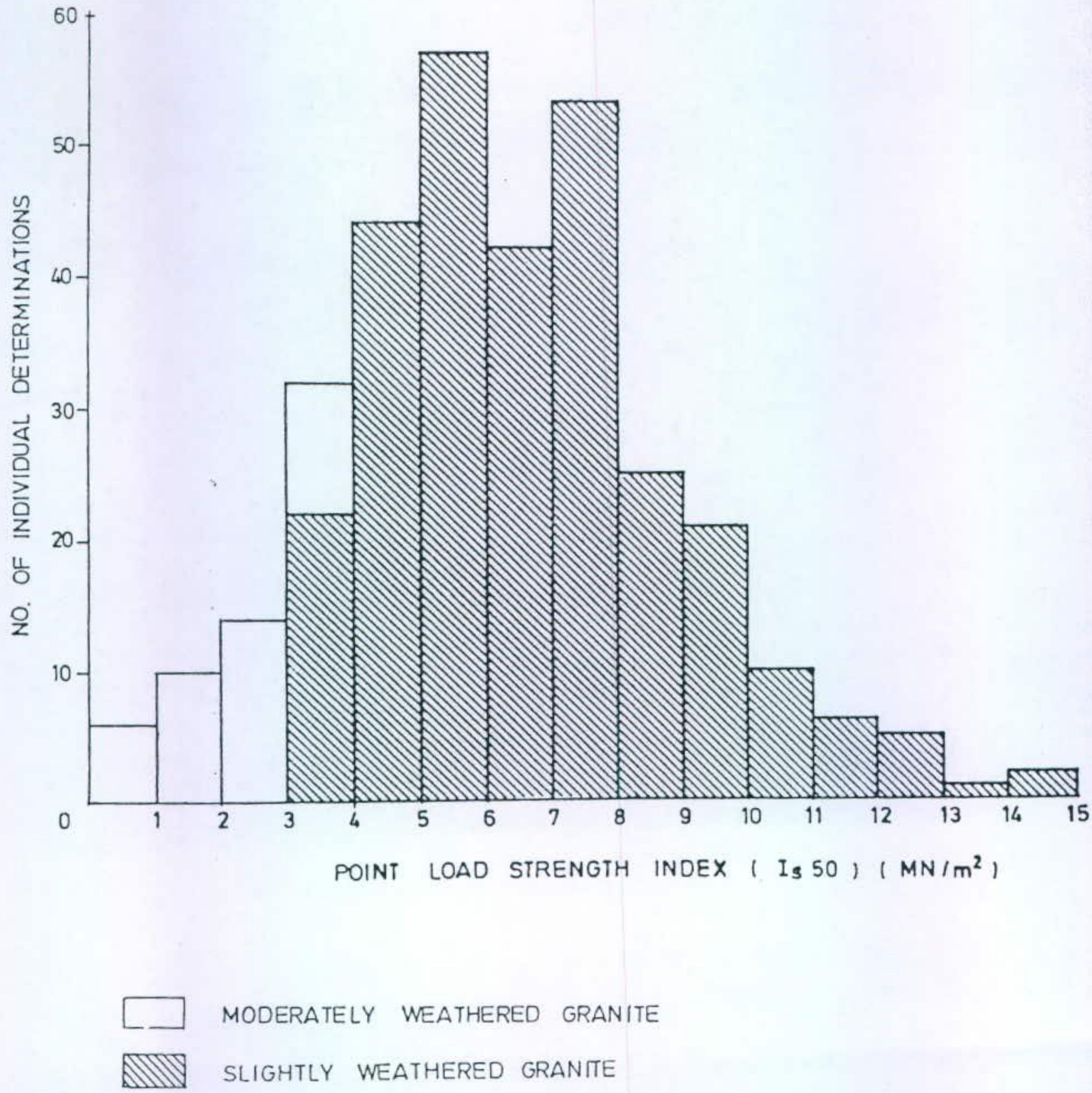
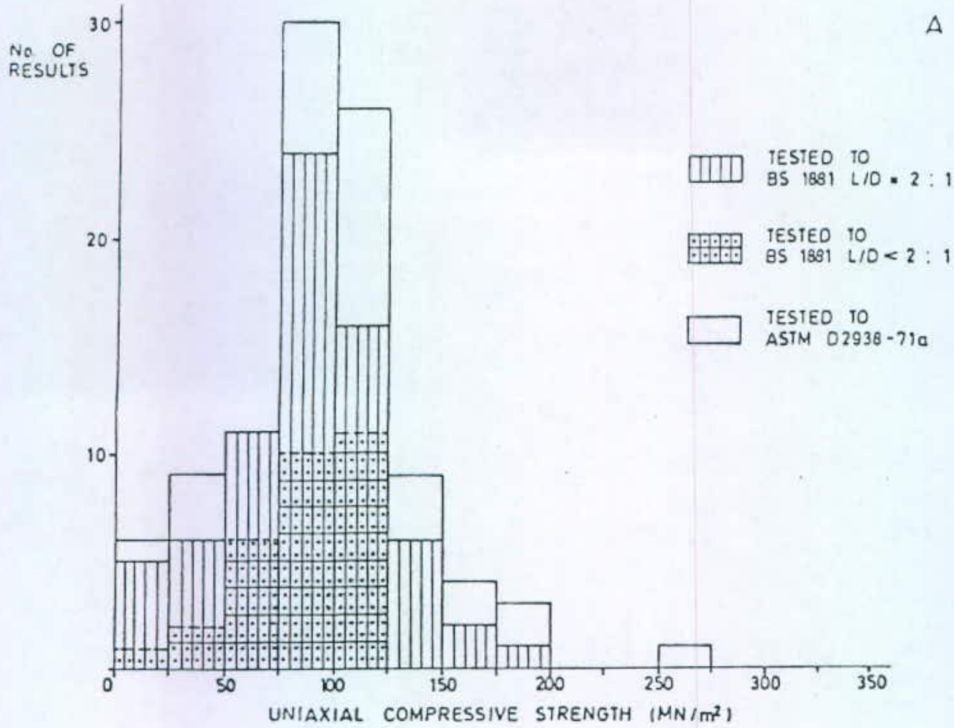


Fig. 1 Histogram of Point Load Strength Index (Is 50) for the Hong Kong Granite



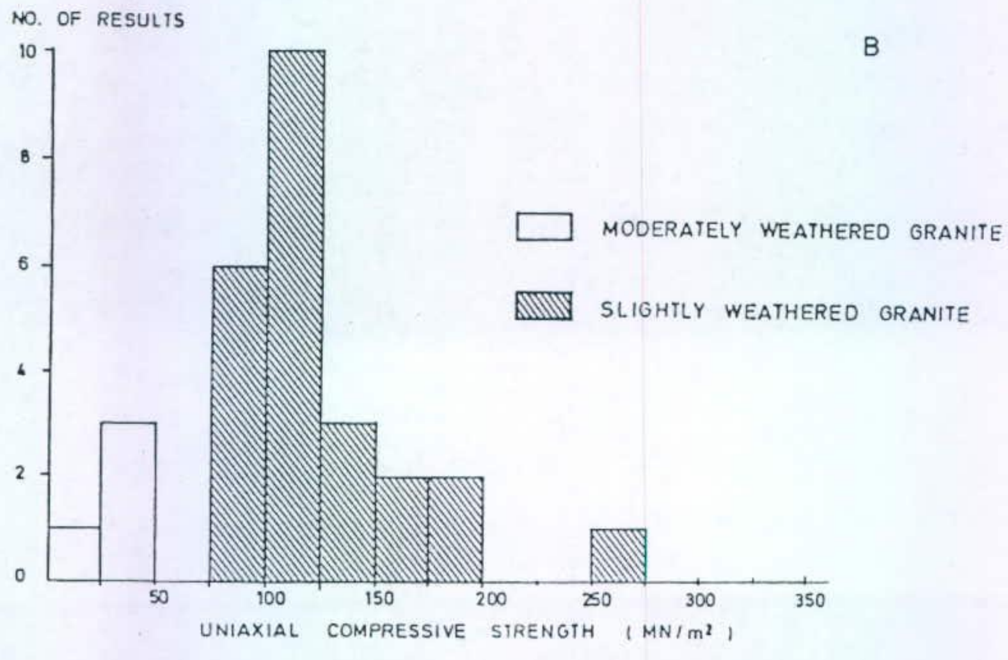


Fig. 2 Uniaxial Compressive Strength of the Hong Kong Granite

A: Histogram of uniaxial compressive strength for the Hong Kong Granite tested in accordance with BS1881 (1970) and ASTM (1974).

B: Histogram of uniaxial compressive strength for the Hong Kong Granite tested in accordance with ASTM (1974).

4. The Results Of Uniaxial Compressive Strength Tests On The Hong Kong Granite

A total of 100 specimens of the Hong Kong Granite were distributed to various commercial laboratories for the laboratory determination of uniaxial compressive strength.

The recommended procedure for the preparation of rock core specimens for uniaxial compressive strength testing (ASTM) (1974) (Test Designation D2938-71a), Brown (1981)(ISRM Suggested Methods) is to lap or grind the end of the specimen to ensure that it is flat and perpendicular to the axis of the specimen. The use of capping materials or end surface treatment other than machining is not permitted.

The tolerance for the flatness and perpendicularity is relatively strict and in practice, most laboratories adopt the standard methods of specimen preparation recommended for testing concrete (Anon 1970 (BS 1881)). Preparation of the specimen to this latter standard comprises rough diamond-sawing the core and then capping each end of the specimen with a 2 mm to 3 mm thick sulphur/sand compound.

The length to diameter ratio of the specimen should be between 2:1 and 3:1, but, where specimens are tested in accordance with the concrete standard, a smaller length is sometimes used and the measured compressive strength corrected using the standard correction factor from BS 1881 (Anon 1970).

The results of the uniaxial compressive strength determinations on capped and uncapped specimens of the Hong Kong Granite are summarised in Fig. 2a.

The uniaxial compressive strength recorded for the uncapped specimens, tested in accordance with ASTM (1974), represents the true material strength and is generally found to be 30% higher than the strength recorded for specimens capped and tested in accordance with BS 1881 (1970).

The strength of the moderately weathered granite ranges from 20 MN/m^2 to 49 MN/m^2, with the majority of the results between 25 MN/m^2 and 49 MN/m^2, and the slightly weathered or fresh granite ranges from 78 MN/m^2 to 264 MN/m^2 with the majority of the results between 78 MN/m^2 and 125 MN/m^2 (Fig. 2b).

5. A Comparison Between The Point Load Strength Index (Is(50)) And The Uniaxial Compressive Strength

A reasonably reliable relationship between point load strength index (Is(50)) and uniaxial compressive strength has been established by repeated experimental work. This relationship can be expressed as:

UCS = 25 (Is(50))

Where UCS = Uniaxial compressive strength for uncapped specimens.

Is(50) = Point load strength index normalised to a 50 mm reference diameter.

This relationship is recommended by the International Association of Engineering Geologists (Anon 1981a) for the comparison of point load strength indices (Is(50)) with uniaxial compressive strength for the objective classification of material strength.

Other published relationships between these parameters should be carefully examined, as they are often quoted for a particular core size, e.g. NX core (GCO 1981), or they may be for failure load or "point load tensile strength"(Dearman 1974).

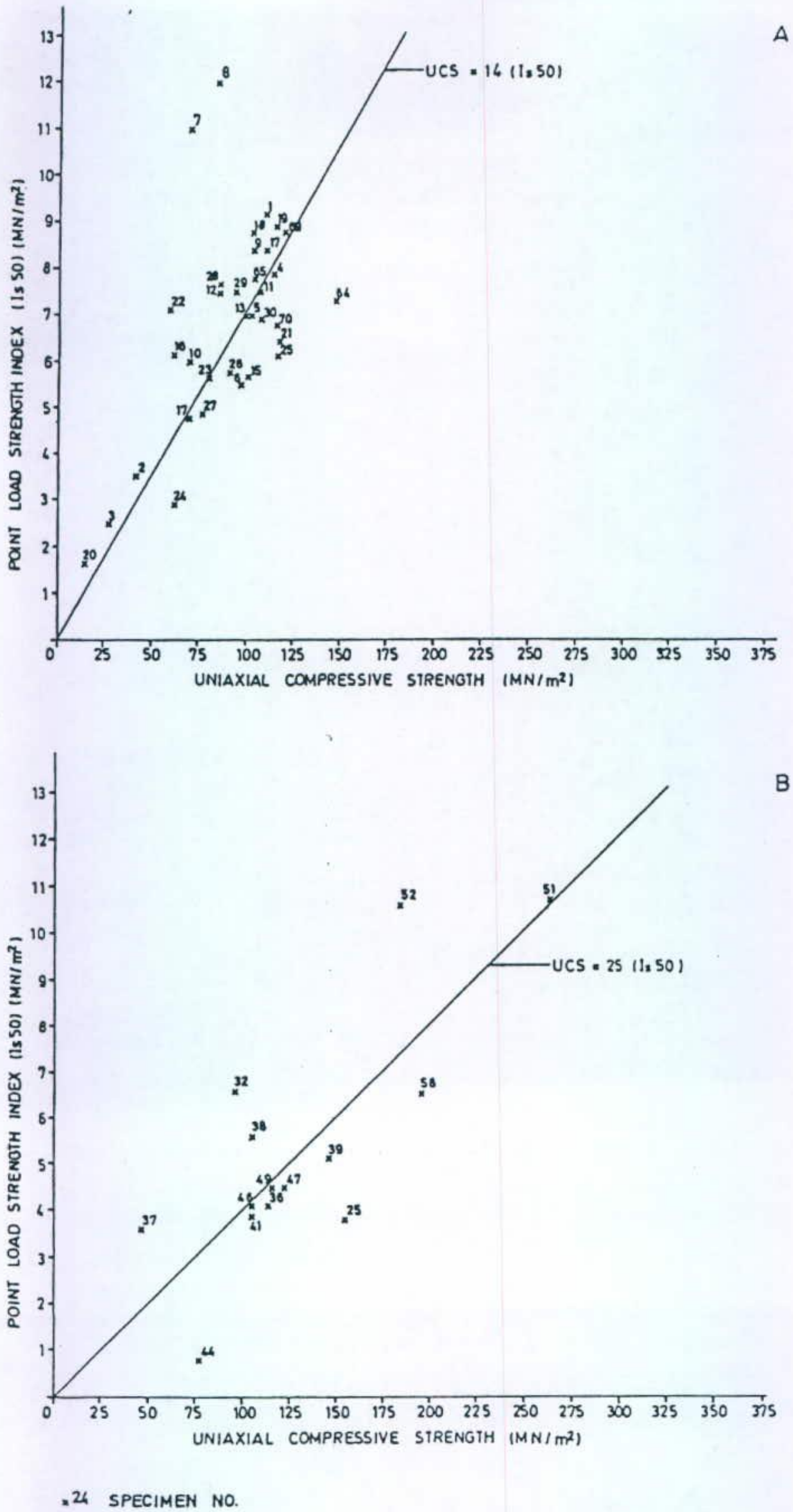


Fig. 3 The relationship between Is (50) and UCS for the Hong Kong Granite.

A: Relationship for samples tested to BS1881 (1980).

B. Relationship for samples tested to ASTM (1974).

The point load strength indices (Is(50)) and corresponding uniaxial compressive strengths for the Hong Kong Granite together with the linear relationship recommended by the IAEG (Anon 1981a) are presented in Fig. 3a.

The data shows a reasonable correlation, but where the fit is poor, the point load strength indices are considered to be more reliable than the uniaxial compressive strength because the sample size is more representative.

The point load strength index (Is(50)) and the uniaxial compressive strength for the specimens prepared and tested in accordance with BS 1881 (Anon 1970) can be related by the equation:

$$UCS = 14\,(Is(50))$$

The data show a good correlation with this relationship but the uniaxial compressive strength recorded does not represent the true material strength (Fig. 3b).

6. Conclusions And Recommendations

The point load test provides a viable alternative to the uniaxial compressive strength test for the determination of material strength of weathered rocks in Hong Kong. The uniaxial compressive strength of the material can be as accurately derived from point load tests, using the linear relationship between these parameters recommended by the International Association of Engineering Geologists (Anon 1981a), as it can by laboratory determination of specially prepared specimens. The use of the point load test as a routine geological logging tool is recommended, as it introduces greater objectivity into the classification of material strength.

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MARINE STUDIES GROUP

The Marine Studies Group is meeting monthly in the Societies Room, Hong Kong Museum of History, Kowloon Park. All members of the society are welcome to attend. Further information on the activities of the group is available from Mr Phillip Blacker, Honorary Secretary (Tel. No. 5-779023). The programme to November is as follows:

Date	Seminar Topic
13 August	Surficial deposits in Shatin (P. Whiteside)
17 September	Mapping of marine deposits from tunnel faces (N. Shirlaw & M. Howat)
8 October	Superficial deposits in Tolo Harbour (R. Purser)
12 November	Marine site investigation for Junk Bay New Town (C. Matson)

All meetings commence at 6 p.m.

PROPOSED TEACHERS GROUP

In response to suggestions from members, it is proposed to set up a Teachers Group to cater for the needs and interests of members who are teachers.

The group could do a number of things, for instance it could provide a lending service of geological specimens and visual aids for school teachers and organize field excursions and other activities.

To establish in what way to go ahead, all who are interested are invited to come to a meeting at the Societies Room, Museum of History, Kowloon Park, on Monday September 3 at 5:30 p.m.

Bring along any friends and colleagues who may be interested in participating.

If you are interested but unable to attend this meeting, please inform Mr P.S. Nau at H.K.U. (H 859 2832) beforehand so that we will have an idea of numbers.

GCO GEOLOGICAL SURVEY PROJECT - TECHNICAL NOTES

It might be of interest to engineers and geologists alike to know that the procedures and technical guidelines being followed as part of the Geological Survey Project are set down and documented in a series of GCO Geological Survey Section Technical Notes.

These notes, which have been writeen largely by the British Geological Survey consultant staff as a first (draft) edition with a view to updating as necessary in the light of project experience, fall into the broad categories of administration/requirements, logistics/procedures, and technical guidelines/discussion.

The notes are compiled as a bound set and kept updated with new or revised editions and are available for reference in the GCO Geotechnical Information Unit (GIU) - 6th Floor Empire Centre. The list of current Technical Notes is as follows:

GCO Planning Division
Geological Survey Section - Technical Note Series

Technical Note	Title
1.	Geological Laboratory Requirements
2.	Geological Laboratory : Equipment Requirements
3.	Field Data Recording (Draft)
4.	Geological Laboratory Requirements (II)
5.	Sample Submission and preparation procedures
6.	Field and Office Equipment Requirements
7.	Classification and Nomenclature of Rocks and Superficial Deposits
7A (No. 7 revised)	Classification and Nomenclature of Rocks and Superficial Deposits
8.	Geological Research, Specialist Investigations and the Acquisition of Post-Graduate Research Students
9.	Provisional Work Programme, Field Area Allocations and Reporting Requirements
10.	Rock and Drillcore Storage Requirements

PROCEEDINGS OF THE MEETING ON 'GEOLOGY OF SURFICIAL DEPOSITS OF HONG KONG', GEOLOGICAL SOCIETY OF HONG KONG BULLETIN NUMBER 1, AVAILABLE NOW

A collection of 17 papers presented at a meeting held at the University of Hong Kong in September 1983. The papers include:

- A proposed framework for the classification and description of superficial deposits (A.D. Burnett)
- A review of investigation and sampling methods in the recent sediments of Hong Kong (C.J. Beggs)
- Computer-stored databases and analysis of superficial deposits (A.J. Brimicombe)
- Geology and engineering properties of surficial deposits at Tai Long Wan, Chi Ma Wan peninsula, Lantau Island - a case study (P. Blacker)
- Weathering of shoreline rock masses - an introduction (J.R.A. Gammon)
- Quaternary geology, weathering and geomorphology of Hong Kong (K.H. Liu & J.R.A. Gammon)
- Geology and hydrogeology of natural tunnel erosion in superficial deposits in Hong Kong (J.M. Nash & M.J. Dale)
- The classification of colluvium in Hong Kong (K.W. Lai & B.W. Taylor)
- Geological recognition of a colluvial deposit at Woodland Heights, Happy Valley, Hong Kong (S.S.F. Hui)
- Landslide system and hazard perception (R. Harris)
- Delineation of colluvial deposits in Hong Kong using the technique of terrain classification (K.A. Styles)
- Preliminary assessment of sedimentation in Victoria Harbour, Hong Kong (M.L. Chalmers)
- A sedimentological study of sea-floor sediments exposed during excavation of the East Dam site, High Island, Sai Kung (W.W.-S.Yim)
- Deep alluvial deposits beneath Victoria Park, Causeway Bay (A.J. Willis & J.N. Shirlaw)
- Pattern of Quaternary sediments revealed during piling works at Sha Tin, Hong Kong (P.G.D. Whiteside)
- The use of engineering data for mapping alluvial features (M.D. Howat & R.W. Cater)
- Prehistroic occupation and coastal development in Hong Kong (W. Meacham)

177 pages, available July 1984. Cost inclusive of postage and packing in Hong Kong - $ 50 (members of the Society and meeting participants); $ 70 (others).

To purchase the Proceedings, please complete the tear-off slip below and return it with the appropriate fee to - The Publications Secretary, Geological Society of Hong Kong, c/o Department of Geography & Geology, University of Hong Kong, Pokfulam Road, Hong Kong.

(Please tick)

Please send me one copy of the Proceedings
I am a member of GSHK
I was a participant at the meeting

I enclose a cheque for $ .... payable to the Geological Society of Hong Kong.

Signature . . . . Date . . . .

Name . . . .

Address . . . .

. . . .

FORTHCOMING PROGRAMME (AUGUST - OCTOBER)

AUGUST 13 (MONDAY)	:	Marine Studies Group meeting - see separate news item
SEPTEMBER 17 (MONDAY)	:	Marine Studies Group meeting - see separate news item
SEPTEMBER 23 (SUNDAY)	:	Field excursion to Sham Chung (Tolo Channel) - see below
OCTOBER 8 (MONDAY)	:	Marine Studies Group meeting - see separate news item
OCTOBER 11 (THURSDAY)	:	Lecture "Skarn Deposits and Polymetallic ores of South China type" by Prof. Gunter Moh, University of Heidelberg. Lecture Room LG-1, Hui Oi Chow Science Building, Hong Kong University, at 6 p.m. Tea/coffee available in Room 2-22, same building, from 5.30. PLEASE NOTE THIS MEETING IN YOUR DIARY. Unless there is another newsletter issued before the meeting this will be your only notification.

Please note : The junk trip to Fan Lau provisionally set for September 2nd as announced in the last Newsletter has been **CANCELLED**. The General Committee feels that the junks currently available are too slow to allow adequate time for field work at such a far-flung destination.

SHAM CHUNG FIELD EXCURSION - SEPTEMBER 23rd

The Sham Chung field trip provisionally scheduled for October has been brought forward to a day with low tide in the early afternoon, to give larger shoreline exposures.

Ammonites and other fossils have recently been discovered in pre-Repulse Bay formation beds at this locality and it is hoped that the collective efforts of members will result in more finds.

We shall also be seeing some excellent exposures of sedimentary rocks of various kinds belonging to the Repulse Bay Formation. This is a trip of exceptional geological and scenic interest and an easy coastal walk suitable for all but very small children.

Transport will be hired junk from Ma Liu Shui and it may be necessary to limit numbers to size of available junk so please book early.

The junk will leave Ma Liu Shui ferry pier near Chinese University at 9.30 a.m. and return there about 5.30 p.m. Journey time is only about 30-40 minutes each way. Please contact Mr P. S. Nau for further information (H859-2832). To make a booking, send the reply slip in this newsletter to Mr Nau.

節目預告

八月十三日（星期一）——海洋研究組集會。
九月十七日（星期一）——海洋研究組集會。
九月廿三日（星期日）——吐露港深涌野外考察，見下段。
十月八日　（星期一）——海洋研究組集會。
十月十一日（星期四）——西德海德堡大學Gunter Moh教授主講「華南類之矽卡岩礦床及多金屬礦」下午六時在香港大學許愛周科學舘LG-1演講室舉行；在（2.22室）茶敍於下午五時卅分開始。

注意：前此預告之芬流野外考察，現因交通問題，宣佈取消。

原定十月舉行之深涌考察，現因九月時低潮更便於觀察，特改於九月廿三日舉行。

在考察地區內會員可以見到極佳的淺水灣組沉積岩露頭，菊石及其他化石。

渡船將於上午九時卅分開出及於下午五時卅分回抵中文大學馬料水碼頭。航程約30－40分鐘。詳情可向鈕柏燊先生（電話5-8592832）查詢。有興趣參加者請塡妥本期內附之回條儘早寄回鈕柏燊先生。

REPLY SLIP (Field Excursion to Sham Chung) Sunday, 23rd September

Send this slip to Mr P. S. Nau, Department of Geography and Geology, University of Hong Kong.

I wish to attend and will be accompanied by (　　) adults and (　　) children. I enclose payment in full of $ ____________.

NAME ______________________

TEL. NO. ______________(Office) ______________(HOME)

Cost : Adults $20　　　　Members and
Children (2-15) $12　　　　Guests alike

建議成立一個教師組

響應會員的提議，我們建議在地質學會內建立一個教師組。

該組能做大量的事情。例如它可提供地質標本的借閱服務，給學校教員使用的直觀教具以及組織野外旅行等等其他活動。

如何做好？請有興趣的人來一個聚會：九龍公園的歷史博物館，學會室。時間是九月三日（週一）下午五時三十分。

請帶有興趣的朋友和同事們來。

如果您有意參加該組而該日又無時間來開會的，請於會前通知香港大學的鈕柏燊先生(H8592832)

應用負荷載試驗於確定香港風化岩石之强度

在本期的英文版裏有 T.I. Gamon 論及應用負荷載試驗來確定香港風化岩石之强度，陳兆湖先生將會把原文翻譯於下期的通訊裏刊出。

預　告

由陳兆湖先生以中文報導的劉昭蜀教授於六月廿三日的演講，將會在本通訊的九月版刊出，請各位留意。

「珠江三角洲形成發育演變」

在本期的英文版裏香港大學的嚴維樞先生及鈕柏桑先生介紹了這篇由廣州地理研究所黃鎮國等的著作，并以圖表簡介了內容。

下面是這部由科學普及出版社廣州分社出版的「珠江三角洲形成發育演變」的內容簡介：

本書據1200多個鑽孔剖面約 620 個第四系樣品的實驗分析結果，以沉積相及 C^{14} 年代爲中心，對珠江三角洲的形成、發育、演變規律進行了較深入的研究，在基底地貌、形成年代、沉積旋回、氣候變遷、陸地升降、第四紀地層、沉積速率、發育階段等方面提出了不少新的觀點。可供地貌、第四紀地質、石油地質、水文工程地質、水利、航運等工作者參考。

土力工程處地質調查組——重製地質圖註釋

土力工程處爲重編本港地質圖而製訂了的程序和方針現時已編成一輯註釋。

該等註釋大部份爲英國地質調查局的顧問專家們所編寫，現藏於九龍帝國中心六樓的土力資料組以便市民參閱。

現存的目錄有：一地質實驗室及其設備的必要條件；實地資料紀錄；樣本呈交及準備程序；野外及辦公室設備之必要條件；岩石及地表沉積物之分類及命名法；搜集地質研究，專家勘察及研究生的資料；暫定的工作程序，分區及報告之必要條件；貯存岩石及鑽蕊之必要條件；地質圖之形式及顏色；製備地圖之必要條件及程序；輔助職工之責任；地質圖用之符號；製圖程序之報導形式；地質圖表集系統等。

海洋研究組

該小組每月均有一次集會在九龍公園內博物館的會議室舉行。詳情可向義務秘書P. Black（電話5-779023）查詢。該小組至十一月內的活動如下（所有集會於下午六時開始）：—

日期	討論題目
八月十三日	沙田之地表沉積（P. Whiteside）
九月十七日	從隧道採掘面繪制海洋沉積物圖（N. Shirlaw及M. Howat）
十月八日	吐露港的表面沉積（R. Purser）
十一月十二日	將軍澳新市鎮的海上勘探（C. Matson）

會員消息

在本期的英文版內刊有自上期截稿後交了1984年度會費的會友芳名。

該項報導並有錄出最近參加的會友芳名及因離港而轉爲海外會員的會友消息。

香港地質學會

1984－85年度常務委員會

投稿本會通訊簡則

概　則：請將所有稿件，查詢及通訊寄香港地質學會秘書收（煩香港大學地理地質系轉）。本會並不負責刊登在本通訊內文章之版權。如寄來的文章或資料有在過去曾引用過，或現時及將來可能會引用到的話，作者請於來稿時特別註明。

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：經本通訊刊出之稿件，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。

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香港地質學會

通　訊

目錄

第二卷第四號一九八四年七月