geological society of hong kong

NEWSLETTER

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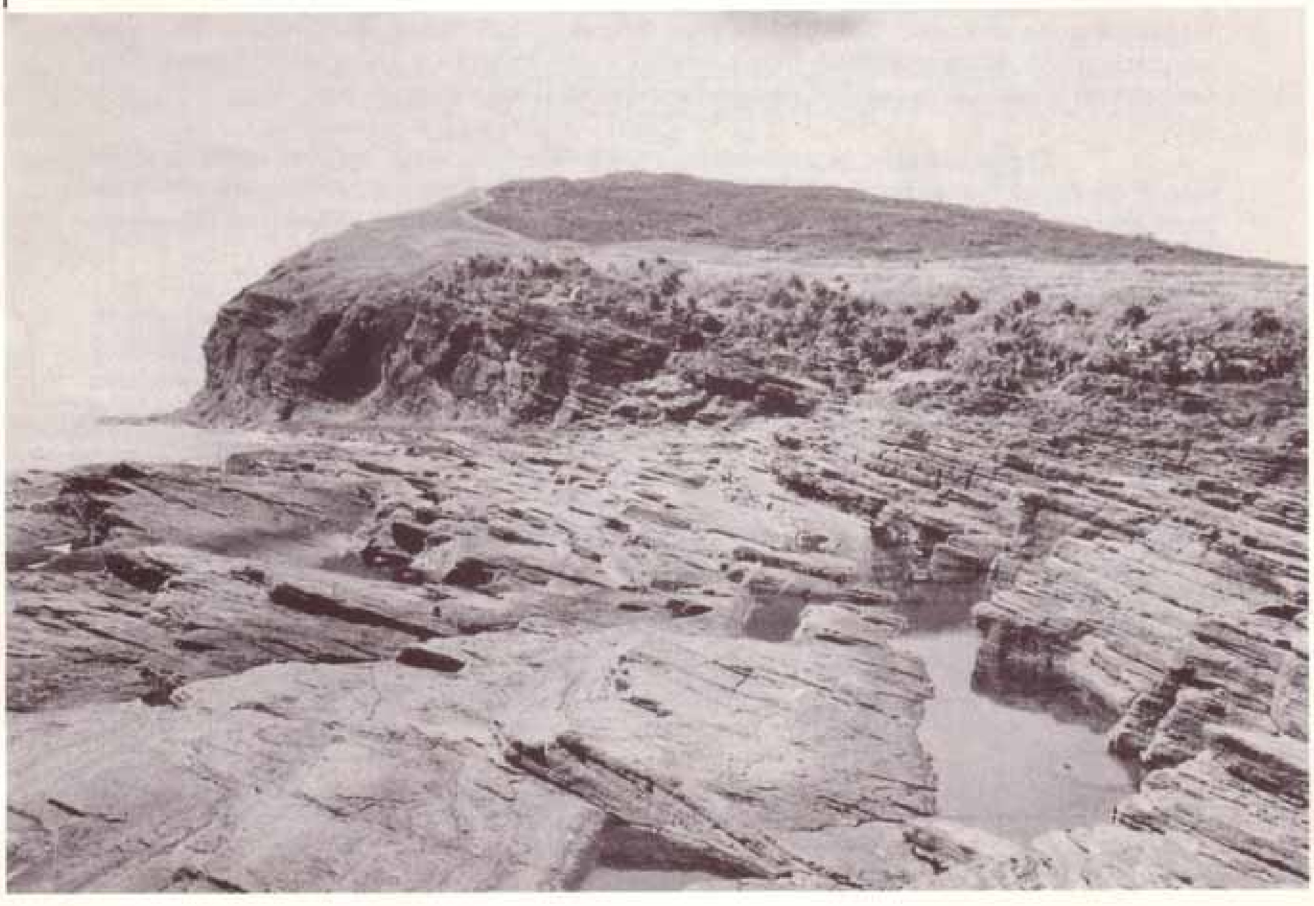

GEOLOGICAL SOCIETY OF HONG KONG

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Cover Photograph : Dipping strata (mudstones and siltstones) on the south coast of Ping Chau, Mirs Bay.

RELATIONS BETWEEN THE FAULTS OF THE PEARL RIVER DELTA AND THE PROCESSES OF FORMATION OF THE DELTA

Huang Yukun, Xia Fa and Chen Guoneng
(Department of Geology, Zhongshan University)

SUMMARY this paper discusses the formation and development of the Pearl River Delta on the basis of analyses of the fault systems, lithofacies, depositional thickness, ancient coastline and C_{14} dating. We consider that the delta is a multi-fault block whose external form, internal structure and configuration of its ancient coastline are all strictly controlled by three sets of faults.

INTRODUCTION

The Pearl River Delta is the general name for the Xijiang - Beijiang delta and Dongjiang delta, which in fact are two independent deltas with no genetic relation. We call them the Pearl River Delta just as we use the Pearl River as the general name for Xijiang, Beijiang and Dongjiang River. The mouth of the Tanjiang River to the southwest may also be regarded as part of the Pearl River Delta (Fig. 1).

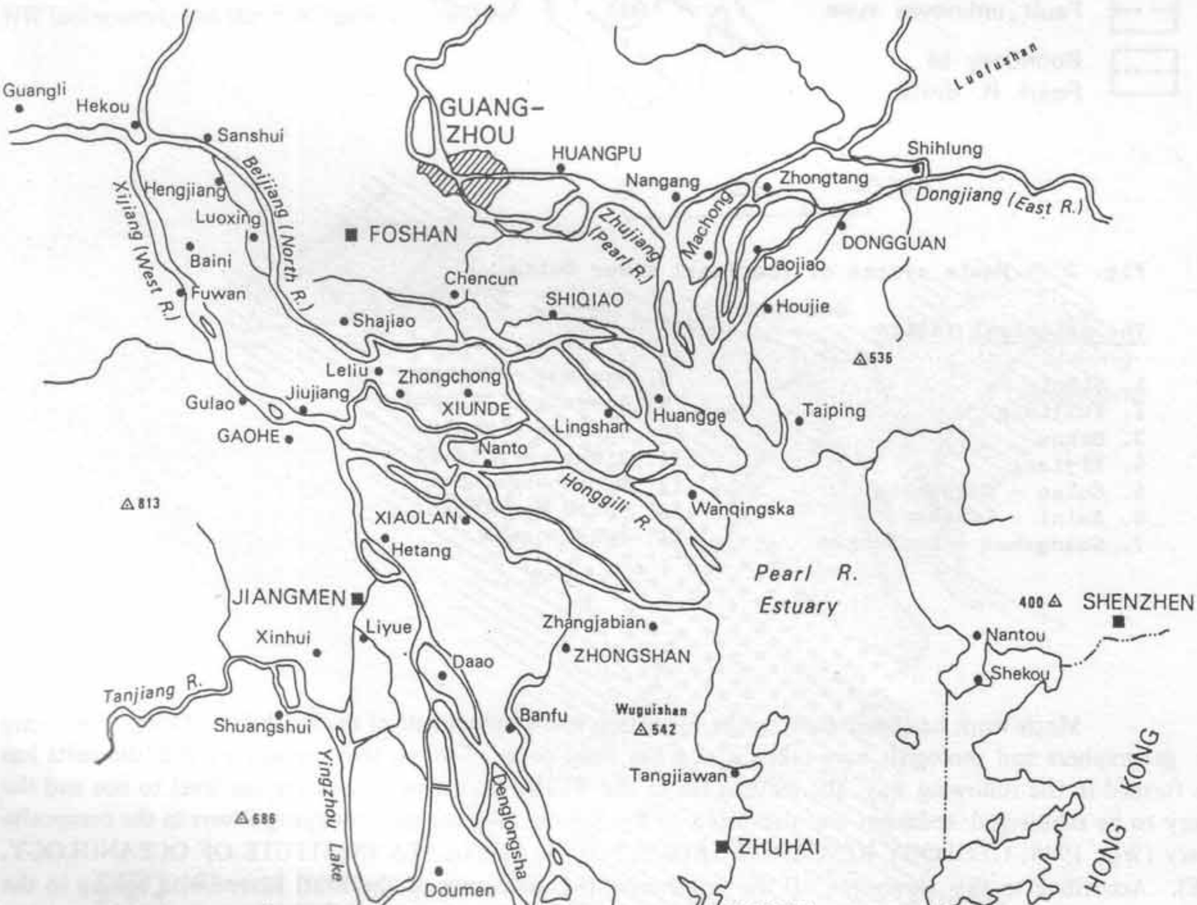

Fig. 1 Location map.

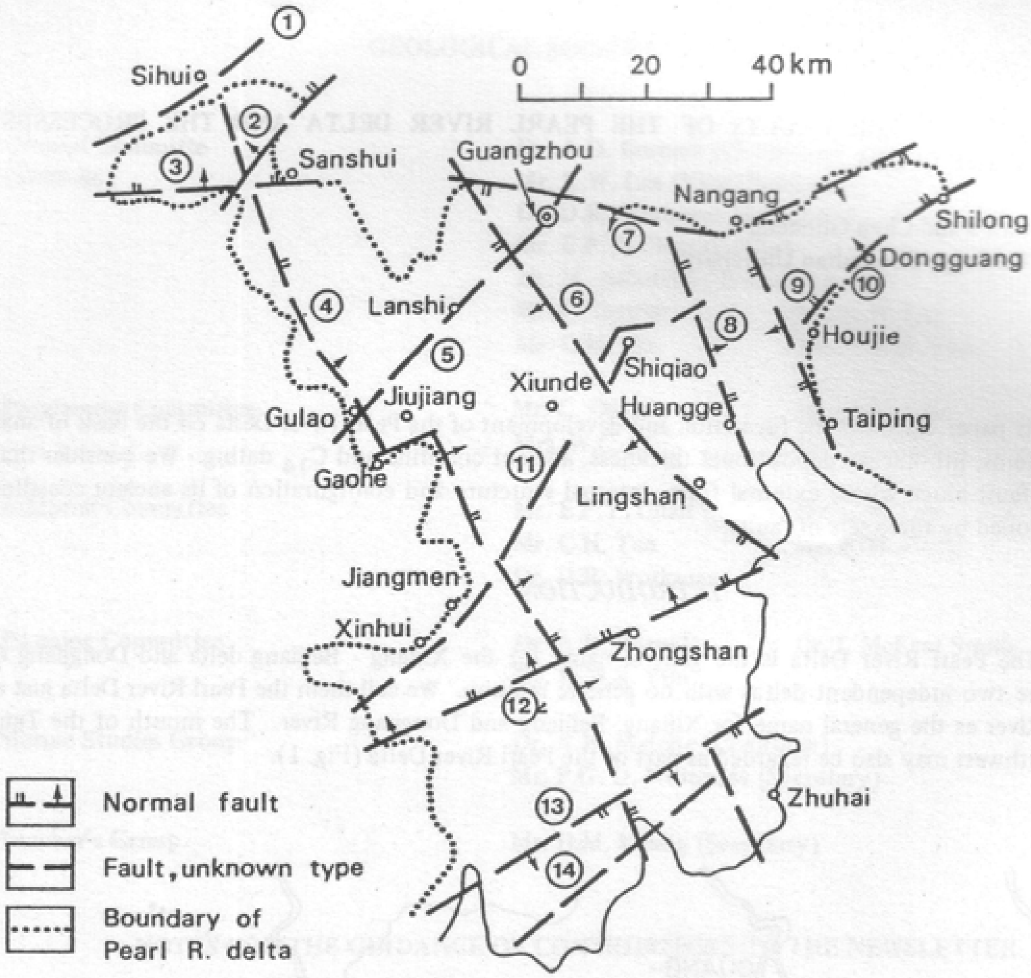

Fig. 2 Fault system of the Pearl River Delta

<u>The principal faults</u>

1. Sihui
2. Suijiang
3. Hekou
4. Xijiang
5. Gulao - Guangzhou
6. Baini - Linshan
7. Guangzhou - Luofushan
8. Hualong - Huangge
9. Nangang - Taiping
10. Shilong - Houjie
11. Xinhui - Shiqiao
12. North Wuguishan
13. South Wuguishan
14. Denglongsha

Much work has been done on the formation and development of the Pearl River Delta. For a long time, geographers and geologists have taken it as a bay head delta. That is, they considered that the delta has been formed in the following way: the melting ice of the WURM glaciation caused the sea level to rise and the estuary to be submerged; sediment was deposited by the Xijiang, Beijiang and Dongjiang Rivers in the composite estuary (WU, 1948; GEOLOGY RESEARCH GROUP, SOUTH CHINA SEA INSTITUTE OF OCEANOLOGY, 1978). According to this viewpoint, all the unconsolidated sediments of the Pearl River Delta belong to the Holocene and are divided into two parts: a lower part, the Liyue formation (early Holocene) and an upper part, the Guizhou formation (late Holocene) (HUANG, 1974). However, radiocarbon dating indicates that deposits of the late Pleistocene are also present in the Pearl River Delta.

This paper discusses relations between the faults and the processes of formation and development of Pearl River Delta, and attempts to show that the simple concept of a bay head delta is untenable.

MAIN FAULT SYSTEMS OF THE PEARL RIVER DELTA

The main fault systems of the Pearl River Delta include three sets of faults trending respectively NW, NE and E (Fig. 2). The NW set includes the Xijiang, Baini-Linshan, Hualong-Huangge and Nangang-Taiping faults, the NE set the Beijiang, Shilong-Houjie, Gulao-Guangzhou and northern and southern Wuguishan faults; and the E-trending set the Guangzhou-Luofushan and Hekou faults. Most of the faults are normal faults; they govern not only the external configuration of the delta, but the courses of the rivers, the distribution of the ancient coastline and arrangement of the Quaternary sediments.

Although the formative times of the three sets of faults mentioned above differ, it is generally estimated that the NE and E-trending faults may have been formed during the Mesozoic Yenshanian orogeny, and that they controlled the distribution of the Cretaceous - Tertiary as well as the Quaternary sediments. The formative time of the NW faults was later; they formed in the late Xishan stage of the Tertiary Himalayan orogeny. The three sets of faults intersect one another and cut the basement of the delta into several fault-blocks differing in movement rate and in size. According to the data available, we can divide the Pearl River Delta into four block fault depressions (northern, western, central and Dongjiang regions), and corresponding block-fault uplifted regions (Fig. 3). The recent deposits are superimposed upon the faulted blocks. Thus the lithofacies and thickness of the sediments are affected by the pre-existing and continuing differential elevation and subsidence of the fault blocks.

Analysis of historical earthquakes, features of geology and geomorphology (including hot springs), LANDSAT imagery and geodetic, geophysical and borehole data indicates that the three sets of faults were active, to varying degrees, during recent geological time. Generally speaking, the NE faults have been the strongest, the NW faults next, and the E-W faults the weakest.

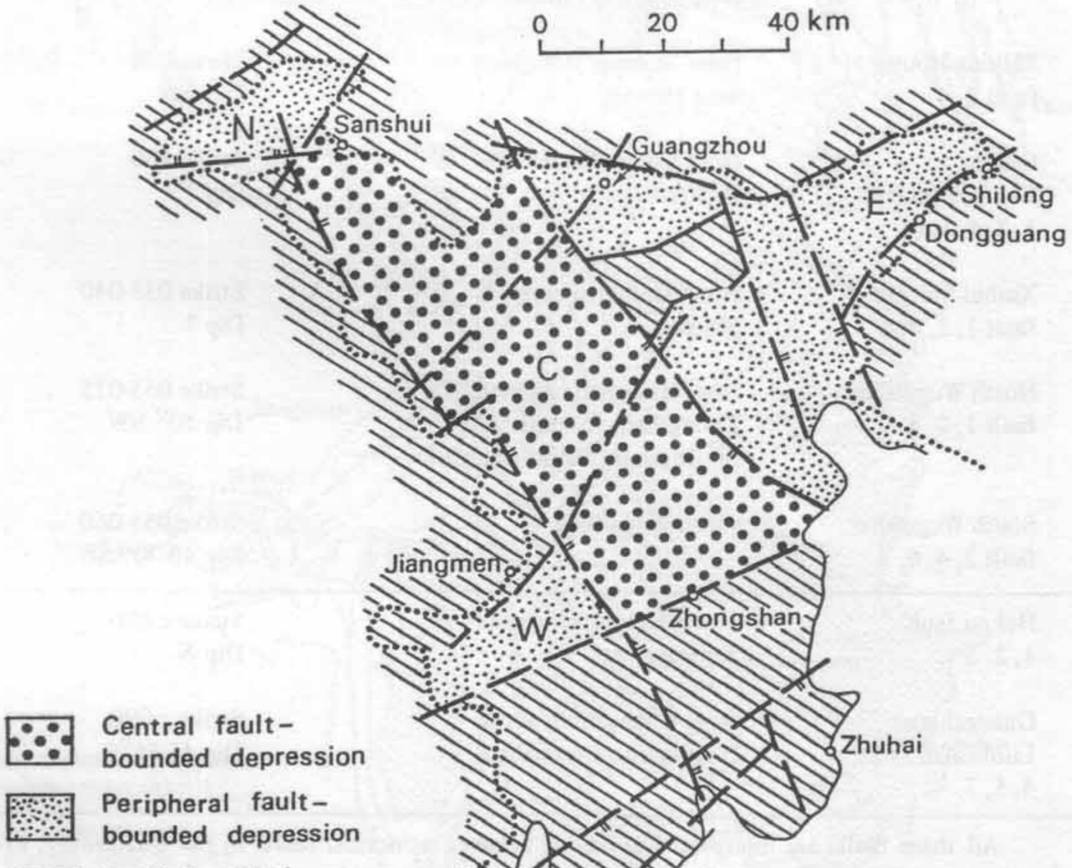

Fig. 3 Fault-bounded blocks of the Pearl River Delta.

The intensity of the active faults differs from place to place. As an example, the activity of the Guangzhou-Luofushan fault has been greater in the east than in the west.

The active modes in the Quaternary, the recent active condition and the extent of the three sets of faults are shown in Table 1.

Table 1 Principal faults of the Pearl River Delta (see also Fig. 2)

	Faults	Location	Orientation
NW trend	Xijiang fault 2, 3, 5, 6	from Muodaomen to north of Hekou, along the Xijiang river	Strike 335-345 Dip >70° NE
	Baini-Linshan fault 1, 2, 4, 7	from Baini (Sanshui county), Shawan and Linshan, along the Hongqili, which flows into the Linding estuary	Strike 340 Dip >50° SW
	Hualong-Huangge fault 2	from Huangpu, Hualong, Fanyu to Huangge	Strike 345 Dip NE
	Nangang-Taiping fault	from Nangang to south Taipin	Strike 335 Dip SW
NE trend	Suijiang fault 2, 4	from south Hekou (Sanshui county), along the Beijiang river to north Lubao	Strike 025 Dip NW
	Shilong-Houjie fault 2, 4	from Shilong, Dongguan, to west Houjie	Strike 050 Dip NW
	Gulao-Guangzhou fault 1, 2, 4, 5, 6	from Gulao, Guohe to Guangzhou	Strike 350 Dip ?
	Xinhui-Shiqiao fault 1, 2, 4, 5	from Xinhui to east Shiqiao	Strike 035-040 Dip ?
	North Wuguishan fault 1, 2, 4	from Hengmen channel, Zhongshan, to south Shuangshui (Xinhui county)	Strike 055-075 Dip 50° NW
	South Wuguishan fault 2, 4, 6, 7	south Wuguishan	Strike 055-060 Dip 40-70° SE
E-W trend	Hekou fault 1, 2, 5	across Hekou, along the Xijiang river	Strike c.090 Dip N
	Guangzhou-Luofushan fault 4, 5, 7	from Guangzhou, across Huangpu to Luofushan	Strike c.090 Dip 45-55°S

All these faults are interpreted as having behaved as normal faults in the Quaternary, except the Gulao-Guangzhou and Xinhui-Shiqiao faults for which there is no evidence. The numbers under each fault name in the table refer to the lines of evidence for recent activity: 1: historical seismic data, 2: general characteristics of geology and geomorphology, 3: geodetic data, 4: satellite imagery, 5: drilling data, 6: hot springs and termal water, 7: geophysical data.

CONTROL OF FAULTS OVER ORIGIN AND DEVELOPMENT OF THE PEARL RIVER DELTA

The control of faults over origin and development of the Pearl River Delta is manifested as follows:

(i) Control of faults over the external configuration of the Pearl River Delta.

The configuration of the Pearl River Delta is controlled by NE and NW faults of different size. The northern margin of the Xijiang and Beijiang delta is the Guangzhou-Luofushan fault, the western one the Xijiang fault, and the eastern one the Hualong-Huangge fault. The northern margin of the Dongjiang delta is the Guangzhou-Luofushan fault, the southern is the Shilong-Houjie fault. The northern margin of the Tanjiang delta is the Xinhui-Shiqiao fault, and the southern one is the north Wuguishan fault. As mentioned above, most of the

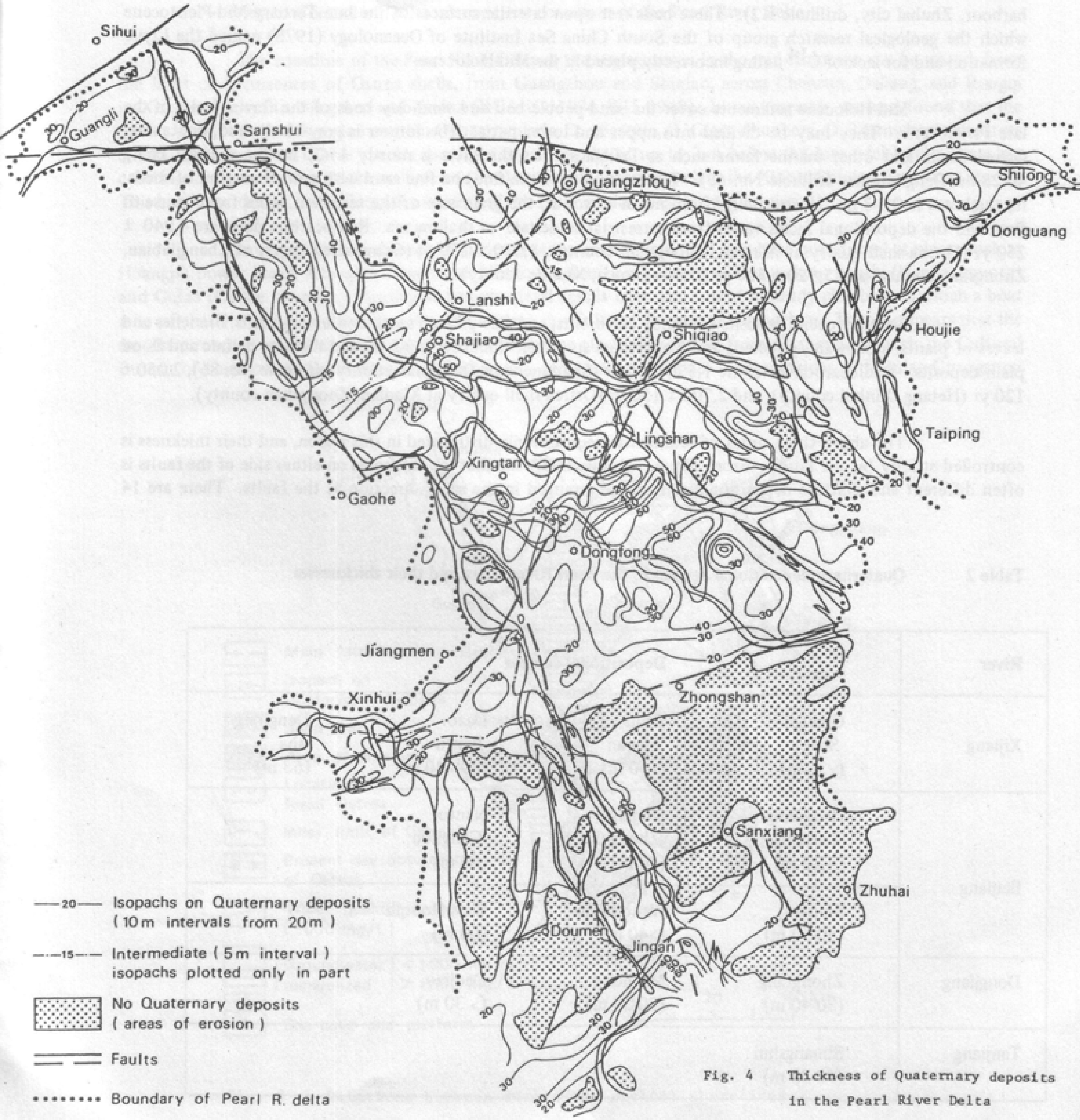

Fig. 4 Thickness of Quaternary deposits in the Pearl River Delta

faults are normal faults, and the main part of the delta is located in the hanging wall of the faults. The activity of these faults reflects the origin of the Pearl River Delta resulting from the differential elevation and subsidence of the block faults. Eustastic movements alone cannot explain the configuration of the delta, the fit of fault lines with the boundaries of geomorphological units, or the coincidence of the main part of the delta with the subsidence regions in geological history.

(ii) Control of Faults Over Thickness of Deposit and Lithofacies

The thickness of Quaternary sediments in the Pearl River Delta is generally about 30-40 m (Fig. 4 and Table 2), the greatest being 63 m (Denglongsha drilling No. 43). The sequence can be divided into three parts, each part varying in thickness. Sand-pebble and sand-clay beds containing decomposed wood and plant remains lie at the bottom, about 3-5 m thick with 16.28 m maximum. These are river deposits of the late Pleistocene. Radiocarbon dates are 20,480 ± 750 yr (Dongfong commune, Zhongshan county, drill hole PK13-4), 24,400 ± 1,950 yr (Shuangshui, Xinhui county, drillhole PK 24), 28,240 ± 2,220 yr (Xinan, Sanshui county, drillhole K5), 37,600 ± 2,700 yr (Guangli, Gaoyao county, drillhole K4), and 30,000 ± 2,800 yr (Jiuzhou harbour, Zhuhai city, drillhole K2). These beds rest upon lateritic surfaces of the late Tertiary-Mid-Pleistocene which the geological research group of the South China Sea Institute of Oceanology (1978) named the Liyue formation and for lack of C^{14} dating incorrectly placed in the Mid-Holocene.

Mid-Holocene sediments cover the sand-pebble bed and sand-clay beds of the fluvial facies of the late Pleistocene. They may be divided into upper and lower parts. The former is grey-black mud, containing Ostrea shells and other marine fauna such as Tellina sp.; its thickness is mostly 15-20 m, the greatest being 40.28 m (Denglongsha, drillhole No. 43). The latter is medium-fine and fine sand with a small amount of shells; its thickness is 0.5-3 m. Horizontally, from north to south, the grain size of the sediment varies from coarse to fine, and the depositional facies varies from terrestrial to deltaic or shallow sea. Radiocarbon dates are 4,940 ± 250 yr (Ostrea-shell quarry at Xiaolan, Zhongshan county), 5,030 ± 250 yr (Ostrea-shell quarry at Zhangjiabian, Zhongshan county) and 5,920 ± 300 yr (Daliang town, Xiunde county).

Late Holocene deposits are sandy clays, silts, and fine-grained sands containing shells, branches and leaves of plants, stoneware, potsherd and Tomistoma sp. Their thickness is 3-5 m, and they are deltaic and flood plain deposits. Radiocarbon dates are 1,520 ± 90 yr (Shatianchang, Dongguan county, drillhole No. 86), 2,050 ± 120 yr (Hetang, Xinhui county), and 2,700 ± 150 yr (Ostrea shell quarry at Xiaolan, Zhongshan county).

The above three series of sediments are not evenly distributed in this region, and their thickness is controlled strictly by the faults. From Fig. 4, we can clearly see that the thickness on either side of the faults is often different and that the depositional centres are arranged in the same direction as the faults. There are 14

Table 2 Quaternary depositional centres in the Pearl River Delta and their thicknesses

River	Depositional centres			
Xijiang	Guangli-Shapu (>36 m)	Baini-Fuwan (>40 m)	Daao-Banfu (30 - 40 m)	Denglong-sha (63 m)
Beijiang	Hengjiang-Luoxing (47.3 m)	Shajiao-Zhongchong (40 m)	Nanto-Gangkou (60 m)	
	Shiqiao (40-50 m)	Wanqingsha (>40 m)	West Honqili (60 m)	
Dongjiang	Zhongtang (30-40 m)	Machong (30-39 m)	Daojiao (> 30 m)	
Tanjiang	Shuangshui (30-38 m)			

paternoster depositional centres in the Pearl River Delta (Table 2). The lines of depositional centres can be divided into three groups, trending NE, NW and nearly E-W. They are arranged regularly along the Xijiang, Beijiang and Tanjiang, indicating that the deposit is under the control of the river courses. But the river courses are themselves controlled by the faults as mentioned above.

It is a feature of the Pearl River delta that its basement relief declines from south to north, with the lowest relief always near faults. This indicates that after the development of ancient erosion surfaces in the area, the faults again became active, causing the topographical surface to decline toward the north and the greatest depositional thickness to appear near the faults.

The vertical change of the sediments in the Pearl River Delta tends be from coarse to fine gradually upward, and from fluvial facies through shallow sea facies or delta facies, to flood plain facies and deltaic facies. In detail, there are regular changes from coarse to fine and again from fine to coarse in many sections. This is especially clear in the case of the Dongjiang delta.

(iii) Control of faults over ancient coastlines of the Pearl River Delta.

The coastline of the Pearl River Delta at the transgression in the mid-Holocene can be traced, from the limit of occurrences of Ostrea shells, from Guangzhou and Shiqiao, across Chencun, Daliang, and Rongqi in Xiunde county, to Jiangmen and Xinhui (HUANG, 1974; WU, 1948). In our research, we have found that the Ostrea shell beds in this region contain Ostrea rivularis, O. plicatula, O. Gigas Thunberg, O. Taienwhanensis Gross and O. Denselamellos. These species generally live at depths of up to 7 m below the low tidel level. There is a coincidence between the northern limit of the Ostrea shell occurrences and the Xinhui-Shiqiao fault line (Fig. 5). This is not accidental, but reflects the control of the fault on the coastline at that time.

In recent years, evidence of ancient marine erosion and sand bars have been found at places such as Huangpu power plant, Miaoqian, Seven Star hills in the Southern suburbs of Guangzhou, Lanshi (Nanhai county) and Gulao (Gaohe county). Planktonic foramaniferal fossils have also found in sandy clay beds in which a boat relic of the Qin and Han Dynasties was found near the Cultural Bureau of Guangzhou. Thus it appears that the sea once reached inland as far as these places. This line stretches roughly from Huangpu, through the Cultural Bureau of Guangzhou, Seven Star hills, Foshan city and Lanshi, to Gulao. This coincides with Gulao-Guangzhou

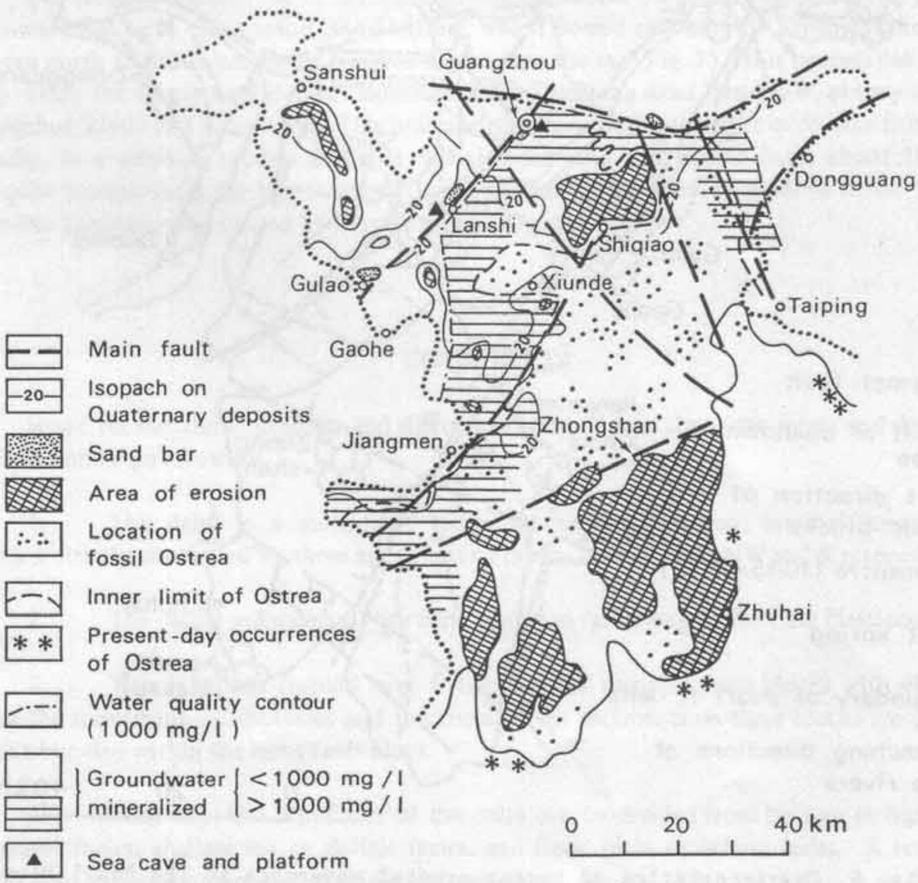

Fig. 5 Relations between faults and ancient shorelines

fault, also suggesting control of the fault over the ancient coastline. To the south of this line, the mineral content of groundwater in the Quaternary sediments is more than 100 mg/l, mainly sodium chloride. To the north of it, the mineral content of the groundwater is less than 1000 mg/1, and the water is fresh. Some scholars (SU, 1946; ZHANG, 1980) believe that the salty groundwater in this region was formed when sea water replaced the fresh water in the sediment, at the time the delta was submerged. Thus, the present northern limit of salty groundwater of sodium chloride type represents basically the place where the sea water reached at that time. The salty groundwater may help to demarcate the ancient high tide level while the Ostrea "line" may provide an indication of the low tide mark (Fig. 5).

In the south of Huangpu and the north of Xiunde counties, the limit of the Ostrea shell shows bulges to the west, possibly indicating two ancient bays, one located at the intersection of the Xinhui-Shiqiao and Baini-Linshan faults, the other at the intersection of the Guangzhou-Luofushan and Hualong-Huangge faults.

EFFECT OF RECENT CRUSTAL MOVEMENT ON THE DEVELOPMENT OF THE PEARL RIVER DELTA.

The recent crustal movement in the area of the Pearl River Delta still bears the features of the early activity of the delta. The central part of the Xijiang and Beijiang delta and the Dongjiang delta are still subsiding. In the Xiunde county and Nanhai county sectors of the Xijiang and Beijiang delta, the average yearly rate of subsidence is 2.2 mm, the greatest being 4.2 mm. In the Dongjiang delta, the rate of subsidence is 2 mm. Some of the Neolithic sites discovered in the region are located 1-3 m below the flood plain. On the other hand, the margins of the delta and the Wuguishan region appear to be areas of arch block-fault uplift which was resulted in piedmont erosion surfaces with heights of 150-180 m, 100-120 m and 40-50 m respectively (HUANG, 1974) as well as well-developed pluvial fans at the north and east foothills of Wuguishan. Three rows of sand bars can be

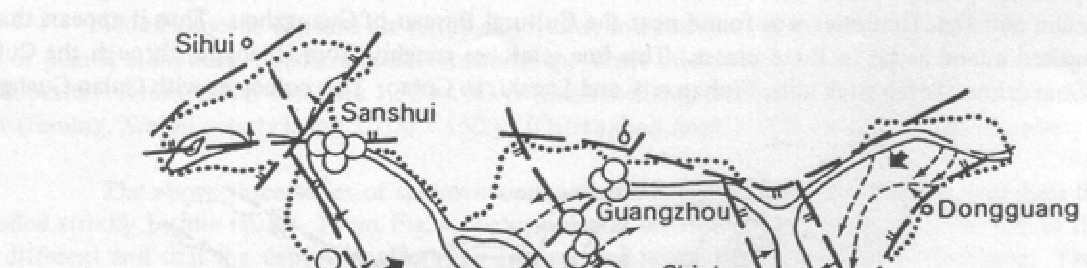

Fig. 6 Characteristics of recent crustal movements in the Pearl River Delta

seen at Tangjiawan, two of which, far from the sea coast, have become laterites. The tombolo linking Gongbei, Zhuhai city and Aomen (Macau), has now emerged 5-6 m above the mean tide level, and the surface (about 1.5 m thick) of this tombolo has become laterite. At Zhangjiabian, Zhongshan county, the top part of the Ostrea shell bed, which originally lay under the low tide level, now lies 0.2 m above the mean tide level. At Tianxin village of Sanxiang Commune, south of the Wuguishan fault, two alluvial terraces distributed parallel to the above fault line lie 5 m and 2 m above the modern alluvial plain respectively. This is attributed to recent movement of the fault. Though the terraces are located south of the fault cliff and seem to be on the hanging wall, they are in fact located in the fault zone. The modern fault cliff is not primary, but secondary.

Besides the features mentioned above, recent movements of the Pearl River Delta include tilting of the central block from west to east and of the eastern block from east to west. It may be said that the tilting has caused the Beijiang, the branch of Xijiang and other branches to flow to the east and join at the Pearl River estuary at present (Figs. 4 and 6).

According to seismic records (ZHANG, 1980), from 1045 A.D. to 1973 nearly all the epicentres in the Xijiang-Beijiang delta were concentrated along the Hekou fault, Xinhui-Shiqiao fault, north Wuguishan fault and Baini-Linshan fault (Fig. 6). A few are located near the Xijiang fault. This seismic activity is evidently the result of the uplift of the western part of the central block, which caused the whole basement to be inclined toward the east. The fault block slid down the direction of dip of the Xijiang fault and stress did not accumulate on the surface of the fault, so few earthquakes occurred along it. However, as the fault block slid to the east, compression and shearing occurred on the faults in the eastern part of the Pearl River Delta. As a result, earthquakes occurred there frequently (Fig. 6).

The rate of subsidence of the Pearl River Delta is generally not great, and the horizontal shear movement caused by it is much smaller. Thus, though many historical earthquakes have occurred in the Pearl River Delta, their magnitudes have been small.

The extensive eastward tilting of the block of the Xijiang and Beijiang delta has caused the rivers to converge to the east. The large quantity of sands and muds carried by the rivers are accumulated rapidly in Wanqingsha, in near the Pearl River estuary. Thus this region is rapidly building out toward the sea.

The recent movement of of the Xijiang fault has caused the south-eastern part of the fault block to be uplifted toward the west. As a result, the Tanjiang, which flowed east into the Xijiang in the late Pleistocene, now flows from north to south, across the Yingzhou lake, into the sea (Fig. 1). This process can be demonstrated in two ways. First, the Quaternary deposit isopachs of the Tangjiang delta trend E-W, as they do in other places such as Shuangshui, Liyue and Fengsheng. This indicates that the Tangjiang might once have flowed from west to east. Secondly, in a drillhole section at Liyue fluvial-facies sand and pebble beds, about 10 m thick at the bottom, are quite distinct from the lake facies, deltaic facies and flood plain facies above them. This fluvial facies indicates that the Tanjiang once flowed by Liyue into the Xijiang.

CONCLUSION

Based on the above analyses and discussions, some ideas about the origin and development of the Pearl River Delta can be put forward.

1. The delta is a multi-fault block, whose configuration, internal structure and ancient coastlines are a 1 strictly controlled by three active sets of faults, trending NE, NW and E respectively.

2. The oldest sediments of the delta found so far belong to the Late Pleistocene.

3. The delta was formed over a basement of unstable fault blocks with different rates and magnitudes of the movement. Lithofacies and thickness of the sediments on these blocks are different not only between blocks but also within the same fault block.

4. Generally, the lithofacies of the delta can be divided from bottom to top into three parts: fluvial sand-gravel facies, shallow sea or deltaic facies, and flood plain or deltaic facies. A transgression began about 6,000 yr. ago, corresponding to the Middle Holocene.

5. The recent crustal movements of the delta have inherited the tectonic features of block faulting that occurred before the origin of the delta. Besides the uplifts along the fault block of the Wuguishan and marginal fault blocks, as well as the subsidence in central part of the delta, it has been found that there is tilting from west to east in the Xijiang and Beijiang delta. Thus the movements havq caused seismic activity to concentrate along faults in eastern Xijiang.

6. Other effects of the faulting are the dominant southeastward direction of the river courses and the diversion of the Tangjiang.

ACKNOWLEDGEMENTS

The authors thank Dr D.R. Workman of the University of Hong Kong for reviewing the original version of this paper and MR T.B. Wong of the University of Hong Kong for fair drawing the figures.

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MARINE STUDIES GROUP

The 1985-1986 session has now started with meetings being planned in the fields of estuarine sedimentation and hydraulics, marine geophysics, palynology and other microfossil studies, stratigraphic breaks, sea level changes in the SE Pacific area, etc.

The bound volume of the proceedings of the recent GSHK-MSG Seminar on the "Marine Geology of Hong Kong and the Pearl River Mouth" will be on sale soon.

The Marine Studies Group of the Geological Society is open to all members of the Society. Many new members have joined the GSHK in the last year and some of these may be interested in joining the MSG. If you wish to be on the MSG circulation list please contact the Secretary of the Marine Studies Group:-

Mr Peter Whiteside,
1C London Court,
Realty Gardens,
41, Conduit Road,
Hong Kong.

Tel. No. 5-592466 (Home)
3-7449731 (Office)

The annual dinner of the MSG will take place on Friday, 10th January 1986 at the Royal Hong Kong Yacht Club. (The Jumbo floating restaurant was rejected as the venue because of the risk of certain over-enthusiastic members attempting grab sampling over the side during the proceedings).

All members who wish to attend should contact the MSG Secretary as soon as possible.

P. Whiteside

MARINE STUDIES GROUP

Seminar on the Marine Geology of the Pearl River Mouth area

The first Marine Studies Group meeting of the 1985/86 session was held on Friday 20th September and consisted of a full day Seminar on the topic of the marine geology of the Pearl River Mouth area.

The Seminar was planned with two ideas in mind, firstly to review some of the main topics discussed in the various technical meetings of the 84/5 session and secondly to provide an occasion for inviting members of the South China Sea Institute of Oceanology to Hong Kong. This invitation to the SCSIO was by way of a return for the visit paid last year to SCSIO in Guangzhou by members of the GSHK.

The Seminar was thus planned to consist of contributions from both Hong Kong and the SCSIO. The titles of the main contributions were as follows:

Cenozoic tectonics of the South China Sea area
(Dr D.R. Workman)

Quaternary deposits and active faults in the Pearl River mouth area
(Prof. Liu Yi-xuan)

Submarine seismic survey from Daya Bay to Dungan Island
(Prof. Xia Kan-ran)

Geological aspects of the sea adjacent to China
(Prof. Fan Shi-qing)

Oceanographic studies in the Pearl River mouth
(Mr N. Ridley-Thomas)

Borehole data on the Quaternary of Hong Kong
(Dr R. Shaw)

Alluvial deposits in the Boca Tigris Channel
(Mr D. Pascall)

Channel development on the South China Sea shelf
(Mr R.S. Arthurton)

The range of topics covered the early structural development of the South China Sea Basin and shelf, the sedimentary environments which developed, and their possible continuations up to and during the Quaternary. Particular attention was paid to sedimentation and erosion as they were affected by sea-level changes and recent fault movements. Speakers and contributors from the floor attempted to correlate borehole data with various sea-level stands.

In his opening remarks Dr A.W. Malone, Chairman of the Marine Studies Group, recalled how only a few years ago very little was known of the marine sediments in the area. With a greater need for information for civil works, research such as that carried out by the Geological Survey of GCO was increasing. Following these opening remarks the main contributions were presented.

Of particular interest to workers in Hong Kong was the idea, discussed by Professor Liu, that the main faults which developed at the early stages of the opening up of the South China Sea in the Cenozoic, have continued to be active and to dictate the pattern of marine sedimentations. The elongate sedimentary basins which Dr Workman described as forming on the South China continental shelf in the Cenozoic and in which sediments accumulated on Mesozoic basement were the subject of marine seismic refraction surveys described by Professor Xia. The seismic work, although not definitive, suggested that these older fault-bounded basins were capable of being detected. Professor Fan in his contribution pointed out the significance of the fact that in these offshore basins the age of the sediments at outcrop increased away from shore.

Moving to the present day, Professor Fan described the results of some side-scan sonar profiling and how it revealed that the main sediment transport in the Pearl River is down the west side of the estuary. This point was again made by Mr Ridley-Thomas when he described the results of oceanographic studies in the area. In particular, the location of the mixing zone of salt water with fresh water was affected by this and also by the season.

Dr Shaw described some very detailed logging of key marine boreholes and how they suggested that beneath the Holocene marine mud there were mottled weathered zones within a sequence of Late Pleistocene mainly lacustrine sediments. The sediment type further up the Pearl River channel was described by Mr Pascall who referred to a very recent sand deposit overlying an older, possibly oxidised one.

In the final contribution, Mr Arthurton discussed the bathymetry, origin and stability of the seabed channels in the area, linking the channel morphology to the tidal flow during the Holocene transgression.

Both during and after the main seminar contributions, there were questions and points raised from the floor. Mr Lai gave evidence to support the view that fault-bounded sedimentary basins were active in the Tertiary, while Mr Howat and Dr Langford discussed the thought that Holocene marine mud may in part be debris flow material. Many other points were made on the full range of topics.

The Society has decided to issue in typescript form the proceedings of this Seminar. Since this will be available soon, the above report on the Seminar has been kept very brief.

Professor Xia, who chaired the afternoon session of the Seminar, spoke for all present when he formally thanked the speakers for their contributions to this very interesting Seminar.

Peter Whiteside,
Secretary, Marine Studies Group

MEMBERSHIP NEWS

The Society welcomes the following new members who have joined since the issue of the last Newsletter (to 31st October): Chan Chi Duen, Cheung Kam Hoi, Chow Siu Choi, K. Gardner, D.L. Hall, Ho Leung Ping, Ho Suk Ching (Miss), A.W. Jukes, Kwan Kam Chau, Lai Kwok Leung, Lam Wing Po, Leung Chi Nang, Leung Yee Chiu, Liu Heung Lan (Mrs), Luk Oi Yi (Miss), Nam Ho Fung Mee (Mrs), G.K. Nieuwenhuijs, J.A. Reaburn-Shaw (Mrs), Tam Kwok Kwan, Dr J.L. Ternan, Yeung Kam Chuen.

Members are reminded that to be informed of regular meetings of the Marine Studies Group or the Teacher's Group, they should join the group, (no extra subscription). Enquiries should be addressed to Peter Whiteside (K-7449731) for the Marine Studies Group and Keung Hon Ming (H-401684) for the Teacher's Group.

FORTHCOMING PROGRAMME

30 November, Saturday.	**Field excursion** to south coast of Lamma Island. Meet at the HYF pier at Sok Kwu Wan at 9 a.m. (there is a ferry from Central at 8 a.m.). Bring lunch.
2 December, Monday. Museum of History, Kowloon Park, 6 p.m. (near Tsimshatsui Station)	**Lecture meeting** "Palynology and its Applications" by Dr J. Ince and "Clastic Sedimentology - its Applications in the Oil and Gas Industry" by Dr C.P. Sladen, both of B.P. Petroleum Development, Ltd., Guangzhou Office

VISIT FROM THE GUANGDONG SEISMOLOGICAL BUREAU

A group from the Guangdong Seismological Bureau visited Hong Kong in July. The party, Mr Gao Cheng-fan, Deputy Head of the Bureau, Mr Ren Zhen-huan, Mr He Qi-yi, Mr Wei Bo-lin, Mr Peng Cheng-guang, Mr Chen En-min and Mr Pan Jin-xiong, arrived on July 8 and stayed for seven days.

The group's first visit was to the Geotechnical Control Office of the Hong Kong Government, where they were welcomed by the Acting Deputy Head of the Office, Mr H.B. Phillipson, and shown round the office. Later on the first day, our guests visited the Hong Kong Polytechnic and were received by Dr K.H. Lai, the Acting Head of the Civil and Structural Engineering Department. They visited the Soil Mechanics, Rock Mechanics and Seismological Engineering Laboratories there. That evening the guests attended a dinner function hosted by the Society.

On the next day members of the Society accompanied the visitors to the Yuen Long area for a geological field visit. They studied with great interest the extension of the Linhua Shan Fault in that area and made observations on the characteristics of the fault zone in the Lau Fau Shan district, as well as the fault zone between the Lok Ma Chau and Repulse Bay Formations at Ku Tung.

The Vice-Chairman of the Society, Mr K.W. Lee, took the guests to see the final stages of work on the Mass Transit Railway's underground station at Tai Koo Shing in the morning of July 10. The visiting party then went to the Department of Geography and Geology at the Hong Kong University and toured the geological exhibits there. In the afternoon the guests visited the Hong Kong Royal Observatory, where they were welcomed by the Acting Director, Dr H.K. Lam, who introduced the Observatory's Seismological Observation Station, various meteorological instruments and Typhoon Detection Centre.

That evening our Society organised a seminar on Guangdong Seismology/Geology at the Geological Laboratory at the Hong Kong Polytechnic and invited three of our guests to make short presentations. Attendance was high; a total of 57 members were present - the highest for any Society seminar/talk on record. The seminar was chaired jointly by Mr K.W. Lee and Mr M.J. Atherton. After short introductory speeches by our Acting Chairman and the Bureau's Deputy Director, Mr E.M. Chen gave an account of his field study at Hainan Island and results of his investigation of the Qiongzhou Earthquake in 1605. This was followed by Mr B.L. Wei's discussion of earthquake-inducing seismic structures of the 1981 Haifeng Earthquake. Finally, Mr J.X. Pan delivered a paper on the seismic structures of the Xinfengiang Reservoir in Guangdong. After the seminar, the Society organised a western style dinner party for our guests and a dozen or so Society members.

On July 11 Mr C.M. Lee took the group to visit the Lai Keng area where they saw the faults at Lai Chi Kok and Lei Muk Shue, and then to Bridge's Pool to study the Port Island Formation. The party also managed a trip to see the Tolo Channel Fault, with the aid of a vessel on loan from Binnie & Partners.

The next morning Dr R. Shaw of GCO took the visitors to see Quaternary deposits taken from the cores of the marine boreholes at Chek Lap Kok. Afterwards, the visiting party were guests of honour at a luncheon party organized by Dr Stephen Hui, Honorary member, and ended their stay with some more relaxed and general sightseeing.

The visit was a follow up of the visit to the Bureau and the site of the 1605 earthquake at Hainan Island by a 10-member party from our Society in April this year. We would like to take this opportunity to extend our sincere thanks to the Geotechnical Control Office, the Royal Observatory, the Mass Transit Railway Corporation, the University of Hong Kong, the Hong Kong Polytechnic, Charles Haswell & Partners, and Binnie & Partners for their support in assisting the Society in various ways during the visit.

K.W. Lai
Geotechnical Control Office

CHINESE ANTARCTIC RESEARCH EXPEDITION

At a meeting organized by Wen Wu Po, Pei Hua Education Foundation and the World Centre Trade Club on September 5th, Dr Liu Xiao-han, a member of the Chinese National Antarctic Research Expedition, gave a talk on the expeditions geological survey work in the Fildes peninsula, Antarctica, and the geological characteristics of Antarctica.

Dr Liu first gave an outline of the general geology of Antarctica and the way in which the Chinese team organized their first expedition. He then went on to discuss the geology, and in particular the structural geology, and work done by the team on paleontology, paleomagnetism and radioactivity dating of rocks and minerals. The talk was illustrated with some excellent slides.

Most of those present were members of the Geological Society. Dr Liu presented the Society with some booklets, maps and other Antarctic memorabilia. It is hoped in the not too distant future there will be an opportunity for members of the expedition to address a meeting of the Society.

Lee Kwan Wing

會議開始時由馮教授介紹了主講人——劉小漢博士的簡歷。馮教授於六十年代在澳洲塔斯曼尼亞從事射電天文學研究，曾被邀請到南極參予物理學研究，由於某種原因未能實現，否則馮教授成爲第一個到南極去考察的中國人。

劉博士的報告分爲兩部份：第一部份着重介紹了南極的自然地理概況，中國組織第一個南極考察隊的經過和到南極開展工作的情況，通過幻燈片讓與會者欣賞到南極美麗的自然風光，各種野生動物生態，還有那千姿百態的冰山和冰帽。

第二部份主要介紹南極的地質概況，諸如地層、岩性組合，礦產資源，重點是該區的大地構造特徵。主講者從收集到的地質資料結合野外考察的記錄，運用板塊學說進行了深入淺出的講述。同時介紹了野外工作中進行古生物地層對比，古地磁測試，地層和岩石的放射性元素年齡測定，岩礦標本採集。由於時間倉促，中國科學院地質研究所未能及時對上述各項樣品的測試和鑑定提供全部結果。因而劉博士在這次報告會未便運用這些最新成果去論證他的大地構造觀點和檢驗前人的假說與推論。

在講演過程中及會後，不少與會熱烈提出許多問題與劉博士研討，使會議因此延長了一個多小時，大家希望明年有機會再次與中國南極考察隊員共同研討，使這塊人類尚未開發的大陸有所認識。

會後劉小漢博士代表中國南極考察隊向香港大學和香港地質學會贈送紀念品，其中有長城站的首日封。在此香港地質學會謹向中國南極考察隊表示衷心感謝，並祝他們今後在南極考察中取得更豐碩的成果，爲人類作出更大的貢獻。

中國科學院南海海洋研究所代表團應邀訪港

黎權偉

以徐恭昭所長爲團長的中國科學院南海海洋研究所代表團應我會邀請訪問了香港，與我會進行了學術交流。成員包括該所海洋構造研究室的劉以宣副教授、夏戡原副教授和海洋沉積研究主任范時清先生。

九月十八日清晨，代表團乘天湖號抵達本港，受到我會代表的熱烈歡迎。當天上午隨即訪問了香港政府土力工程處，該處處長Dr. Brand 和各副處長親切地接見了貴賓。地質學會主席Dr. Burnett 給客人們介紹了土力工程處的工作，並讓客人們參觀了該處一些部門如滑坡警報系統等。下午地質調查組負責人Arthurton 先生帶領參觀了該組的辦公室，介紹了香港重新繪製地質圖的進程和香港海域的海底地質調查概況。晚上由我會海洋組Dr. Malone等設晚宴熱情款待了貴賓。

九月十九日上午代表團與Dr. Malone等共同討論和交流如何開展香港及鄰近海域的海洋地質研究工作，爲了雙方學術交流創造了良好的開端。當天下午由我會帶領代表團到美孚、沙田等地觀察了荔枝角——赤門海峽斷裂帶的地質地貌特徵。

九月廿日由我會海洋組與海洋所代表團在香港大學召開了一整天的海洋地質學術研討會。出席會議的有土力工程處、土木工程處、香港大學、理工學院、顧問工程公司等地質工程人員卅七人，其中有兩位從蛇口來的爲南海石油作科學研究的美國地質學家。有十人在會上作了學術報告。南海海洋研究所的專家們也在會上介紹了他們的科研成果。其中有劉以宣先生的“珠江口—紅海灣沿海第四紀地質與活動斷裂”，夏戡原先生的“南海淺海區海底地震儀的首次試驗”和范時清先生的“中國鄰近海洋地質學問題”。他們的學術報告引起與會者極大的興趣，開濶了大家的眼界，相互交流了香港及其鄰近海域的海洋地質工作。（編者按：該項論題內容摘要，將於下期通訊刊出。）

九月廿一日。Dr. Shaw帶領代表團參觀了從赤鱲角鑽探取得的海底岩心。互相交換了第四紀沉積的意見。

九月廿三日，由地質學會帶領代表團到元朗山下村參觀了一個第四紀地質剖面，並且參觀了羅湖——屯門斷裂帶在米埔山、屯門、流浮山及光鼻咀等地的露頭。

九月廿五日晚上，南海海洋研究所代表團圓滿完成這次回訪，滿載着友誼乘船回穗。

廣東省地震局代表團回訪香港紀實

李作明

應我會邀請，由廣東省地震局高承范副局長率領包括任鎮寰先生，何啓義先生，魏柏林先生，陳恩民先生，彭承光先生和潘建雄先生的七人代表團於七月八日抵達香港，開展了爲時八日的友好回訪活動。

七月八日中午，代表團一行甫抵紅磡車站就受到香港地質學會和土力工程處的代表熱烈迎接。首先訪問了香港政府土力工程處，受到了代理副處長兼總工程師Phillipson 等的歡迎和殷切接待，他向客人們介紹了土力工程處的職能，並帶引他們參觀了電子計算機中心，地質測量組和製圖室等，參觀了香港正在開展一比二萬比例尺的地質測量的成果。土力工程處的地質師和工程師們並與代表團一起共進午餐。

下午四時客人們訪問了香港理工學院，該院土木與結構工程學系代主任賴鈞衍博士會見了他們。客人們參觀了土力學、地質學及岩石力學和地震工程實驗室。晚上香港地質學會設宴爲客人們洗塵。

九日，由地質學會兩個委員陪同前往元朗地區作地質考察，他們以濃厚興趣觀察了蓮花山斷裂在香港元朗地區的延伸，注意了流浮山地區該斷裂北帶的特點及古洞地區落馬州組與淺水灣組接觸帶斷裂特徵，他們上山下坡找證據，隨時記錄、素描和照象。

十日，由李坤榮副會長陪同，客人們參觀了地下鐵路公司太古城地下車站緊張施工情況。隨後訪問了香港大學地質地理系並參觀了地質陳列館。下午二時半應邀訪問了香港天文台。該台署理台長林鴻鈞博士等隆重歡迎他們，介紹和帶引他們參觀了天文台地震觀測站，各種儀表和台風觀測中心等。

晚上，我會假香港理工學院地質實驗室組織了廣東地震地質學術報告會，三位客人作了報告，會員踴躍參加，計有五十七位會員出席，爲歷年來研討會及報告會出席人數最多的一次，會議由李坤榮先生及Atherton先生主持。在主席和高副局長簡短發言之後，接着陳恩民先生介紹他實地長期考察發現的海南島一六〇五年大地震的調查報告；魏柏林先生介紹了一九八一年廣東省海豐地震的發震構造特徵；潘建雄先生闡述了廣東省新豐江水庫誘發地震構造。大家以極大興趣取了他們以大量幻燈片及圖表的精彩報告，會後，我會設西宴招待客人，十多位會員也參加了宴會。

十一日，由李作明陪同到荔景地區，客人們參觀了荔枝角斷裂及梨木樹斷裂。而後前往新娘潭觀察赤洲組，同時參觀了赤門海峽斷裂，並由賓尼顧問公司提供遊艇泛遊峽灣鳥瞰該大斷裂延伸特點。

十二日，由土力工程處Shaw博士帶領他們參觀了由赤鱲角海上鑽孔取得的岩心，了解第四紀沉積特點。中午代表團拜訪了我會榮譽會員許士芬博士，許博士盛情設午宴款待了貴賓。

十三日一早，代表團就登上了太平山頂鳥瞰維多里亞海港和香港九龍市區風光，隨後遊覽了海洋公園。

經過一周緊張而又緊密的活動，十五日客人們結束了對香港的訪問，由李坤榮先生代表學會設午宴歡送。下午代表團乘最後一班直通車回穗。

由我會於四月間首次組織了十位成員訪問了廣東省地震局及參觀了海南島一六〇五年大地震遺址和該局這次很快成功地回訪香港，標誌着粵港兩地地震地質界學術交流和互訪已獲得了成功和良好的開端，相信今後會不斷加強。

最後，應該指出香港政府土力工程處，香港天文台，香港地下鐵路公司，香港大學，香港理工學院，查理士夏士威顧問公司及賓尼顧問公司等熱情協助我會等接待客人們參觀訪問，我會表示衷心感謝。

中國南極考察隊地質報告會紀實

李坤榮

一九八五年九月五日下午在香港大學舉行了中國南極考察隊地質報告。該報告會由香港文滙報、香港培華教育基金會、香港世界貿易中心會共同主辦。由香港大學物理系馮戩雲教授主持。當天共有卅餘位人士參加，大半是香港地質學會會員。許士芬博士亦有出席。

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。來稿以簡為主。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為限。請盡量減少插圖及附表等，而所有圖表請另外分頁。

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封面圖片：蒙Dr. D.R. Workman借出
香港大鵬灣平洲南岸之傾斜泥岩及粉砂岩

香港地質學會

通　訊

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