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NEWSLETTER

Vol. 5, No. 4

Contents

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Cover photo: Control of granite landform by sheeting joints, Po Toi Island (J.M. Nash)

Geological Society of Hong Kong Newsletter, Vol. 5, No. 4, pp 1-8 (1987)

One Hundred Radiocarbon Dates from Hong Kong

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Introduction

In Hong Kong, the growth of interest in the geology of superficial deposits and the sustained interest in archaeology have caused the total number of radiocarbon dates to reach the landmark of one hundred recently. In this paper, a list of all radiocarbon dates from Hong Kong known to the author is presented for easy reference. I would be extremely grateful if anyone could inform me of any errors and/or omissions.

For convenience, the list of radiocarbon dates is divided into two, of archaeological and geological interests respectively. These two tables are preceded by a list of the laboratories used for the radiocarbon dating, together with their code references. Figure 1 is a location map of the sites in Hong Kong from which material has been radiocarbon dated.

The sample elevation for the geological materials are given in metres above or below Principal Datum (mPD) which, in Hong Kong, is approximately 1.2m below the mean sea level. Elevations have not been shown for the archeaological sites, but according to Meacham (personal communication), with the exception of Care Village and Sha Tsui (15 m and -1.5 mPD respectively), all were obtained from 3.5 to 9 mPD. Details given after the sample location are in the order of sample type, radiocarbon age in years Before Present (BP-taken as 1950) using the Libby half-life of 5 568 years, laboratory code and source or sources of further information. A discussion on the geological implications of some of these radiocarbon dates may be found in Yim (1986).

Table 3 Laboratory codes

Code	Laboratory
ANU	Australian National University, Canberra, Australia
ARL	Australian Radiometric Laboratories, Sydney, Australia
BETA	Beta Analytic, Florida, U.S.A.
CS	CSIRO Division of Soils, Adelaide, Australia
GIF	National Centre for Scientific Research, Gif-sur-Yvette, France
HAR	Atomic Energy Research Establishment, Harwell, U.K.
I	Teledyne Isotopes, New Jersey, U.S.A.
KWG	Institute of Geography, Guangzhou, China
R	Institute of Nuclear Sciences, Lower Hutt, New Zealand
SI	South China Sea Institute of Oceanology, Guangzhou, China

Table 2 Prehistoric and modern materials

Location	C_{14} Source	C_{14} Date	Laboratory	Reference
CARE VILLAGE	charcoal	4 220 ± 110	HAR-6842	Wellings (1986)
CHUNG HOM WAN	charcoal	4 570 ± 130	I-8827	Bard (1976)
FU DEI WAN	charcoal	1 280 ± 70	HAR-4994	Cameron (1984)
HAI DEI WAN	charcoal	5 100 ± 100	HAR-2522	Williams (1980)
HAI DEI WAN	charcoal	3 360 ± 80	HAR-3589	Williams (1980)
HAI DEI WAN	charcoal	3 200 ± 160	ANU-2223	Meacham (1982)
HAI DEI WAN	shell	1980 ± 70	HAR-2268	Williams (1980)
LO SO SHING	shell	1 900 ± 70	HAR-2075	Meacham (1979) Cameron (1979)
LO SO SHING	shell	1 800 ± 70	HAR-3587	Meacham (1980)
LO SO SHING	shell	1 390 ± 80	I-9924	Meacham (1979) Cameron (1979)
PO YUE WAN	pottery	6 260 ± 130	HAR-6811	Meacham (1986)
PO YUE WAN	pottery	6 100 ± 160	ARL-146	Meacham (1986)
PO YUE WAN	pottery	5 610 ± 80	HAR-6812	Meacham (1986)
PO YUE WAN	shell	3 780 ± 70	HAR-4698	Williams (1982)
PO YUE WAN	shell	3 740 ± 80	HAR-4697	Williams (1982)
PO YUE WAN	shell	3 730 ± 70	HAR-4700	Williams (1982)
PO YUE WAN	shell	3 680 ± 70	HAR-4699	Williams (1982)
PO YUE WAN	shell	3 060 ± 110	BETA-15957	Crawford (1986)
PO YUE WAN	shell	2 960 ± 90	BETA-15959	Crawford (1986)
PUI O	charcoal	1 610 ± 70	BETA-13224	Meacham (1986a)
SHA TSUI, HIGH ISLAND	wood	660 ± 80	HAR-867	Bard (1976a)
SHAM WAN	charcoal	4 000 ± 300	R-4585/1	Meacham (1978)
SHAM WAN	shell	3 830 ± 95	I-10058	Meacham (1978)
SHAM WAN	shell (Turbo sp.)	3,740 ± 95	I-10057	Meacham (1978)
SHAM WAN	shell	3 110 ± 95	I-10056	Meacham (1978)
SHAM WAN	charcoal specks	2 500 ± 600	R-4585/1	Meacham (1978)
SHAM WAN	shell (Tegula argyrostoma)	2 485 ± 85	I-9554	Meacham (1978)

Table 2 Prehistoric and modern materials (continued)

Location	C_{14} Source	C_{14} Date	Laboratory	Reference
SHAM WAN	fish bone	2 110 ± 95	I-10050	Meacham (1978)
SHAM WAN	shell (Crassostrea gigas)	1 210 ± 90	I-10052	Meacham (1978)
SHAM WAN	charcoal specks	866 ± 194	R-4585/4	Meacham (1978)
SHAM WAN	human bone (dated by organic residue)	799 ± 373	R-4585/5B	Meacham (1978)
SHAM WAN	charred bone (dated by carbonate)	330 ± 100	I-10051	Meacham (1978)
SHAM WAN	charcoal specks	<315 ± 115	ANU-1360	Meacham (1978)
SHAM WAN	fish bone (Pomadasys)	<280	I-9925	Meacham (1978)
SHAM WAN	fish bone	<280	I-9926	Meacham (1978)
SHAM WAN	fish bone	<280	I-9927	Meacham (1978)
SHAM WAN	human bone (dated by carbonate)	<165	R-4585/5A	Meacham (1978)
SHAM WAN	charcoal specks	modern	R-4585/3	Meacham (1978)
SHAM WAN TSUEN	pottery	5 760 ± 160	HAR-6613	Meacham (1986)
SHAM WAN TSUEN	organic soil	1 250 ± 150	HAR-5521	Cameron & Williams (1984)
SHEK KOK TSUI	charcoal	1 370 ± 100	unknown	Meacham (1979a)
SHEK PIK	charcoal	3 270 ± 90	ANU-2222	Meacham (1982)
SHEK PIK	shell	1 930 ± 90	ANU-2225B	Meacham (1982)
SHEK PIK	shell	1 700 ± 80	ANU-2225A	Meacham (1982)
SHEK PIK	charcoal	1 320 ± 180	ANU-2226	Meacham (1982)
TAI KWAI WAN	shell	1 780 ± 100	HAR-2603	Meacham (1979)
TAI KWAI WAN	charcoal	1 250 ± 88	HAR-2611	Meacham (1979)
TAI LONG	pottery	2 810 ± 90	HAR-5470	Meacham (1986)
TAI LONG	charcoal	1 655 ± 55	unknown	Meacham (1979a)
TAI LONG	shell	400 ± 80	HAR-3588	Meacham (1982a)
TUNG KWU	pottery	5 800 ± 500	ARL-239	Meacham (1986)
YI LONG	charcoal	1 550 ± 120	HAR-2396	Meacham (1979a)
YI LONG	charcoal	1 460 ± 90	HAR-2074)	Meacham (1979a)

Table 3 Radiocarbon dates of geological materials

Borehole site	Altitude (m P.D.)	C_{14} Source	C_{14} Date	Lab.Ref.*	Reference
ADMIRALTY	-7.3	wood	6 520 ± 130	GIF-4387	Meacham (1979b)
ARGYLE	-11	shell (oysters, bivalves and snails)	7 020 ± 160	GIF-4813	Meacham (1980)
CHEK LAP KOK M14	-23.3	wood	>35 230	BETA-4136	RMP ENCON (1982)
CHEK LAP KOK M20	-15.8	wood	16 420 ± 660	BETA-4137	RMP ENCON (1982)
CHEK LAP KOK M28	-25.5	wood	26 770 ± 840	BETA-4139	RMP ENCON (1982)
CHEK LAP KOK M28	-24.2	wood	37 590 ± 1 590	BETA-4138	RMP ENCON (1982)
CHEK LAP KOK M35	-26.5	wood	33 440 ± 1 740	BETA-4140	RMP ENCON (1982)
CHEK LAP KOK M55	-20	wood	18 220 ± 440	BETA-4141	RMP ENCON (1982)
CHEK LAP KOK M59	-36.5	wood	36 480 ± 830	BETA-4142	RMP ENCON (1982)
CHEK LAP KOK M64	-37.5	wood	20 000 ± 270	BETA-4143	RMP ENCON (1982)
CHEK LAP KOK M67	-25.5	wood	27 660 ± 590	BETA-4144	RMP ENCON (1982)
CHEK LAP KOK B13/13A	-28.44	wood	>40 000	CS 621	Strange & Shaw (1986)
CHUNG HOM WAN	1.2	wood	5, 455 ± 105	I-8830	Bard (1976)
DEEP BAY CLP/E1	-7.66 to -7.72	organic	10 060 ± 130	CS 621	Langford et al. (1988)
EAST HARBOUR CROSSING	-20	shell (<u>Crassostrea gigas</u>)	34 880 ± 1 230	ANU-5965	Yim (unpub. work)
EAST HARBOUR CROSSING	-20	shell (<u>Ostrea</u> sp.)	39 910 ± 2 460	ANU-5966	Yim (unpub. work)
EAST HARBOUR CROSSING	-20	shell (<u>Andara</u> sp.)	39 460 ± 2 320	ANU-5967	Yim (unpub. work)
EAST HARBOUR CROSSING	-20	shell (bivalves and snails)	31 500 ± 2 000	ANU-5968	Yim (unpub. work)
HA WAN TSUEN, SAN TIN	0.8	organic mud	520 ± 112	SI-86/121	Langford et al. (1988)
HIGH ISLAND EAST DAM	-12	wood	5 980 ± 180	KWG-286	Yim (1984)
HIGH ISLAND WEST DAM	-20.15	wood	>40 000	I-7950	Kendall (1976)
HIGH ISLAND WEST DAM	-20	wood	>40 000	I-7949	Kendall (1976)
HIGH ISLAND WEST DAM	-20	wood	>36 600	ANU-1359	Kendall (1976)
HIGH ISLAND WEST DAM	-17.43	shell (oysters, bivalves and snails)	7 920 ± 110	HAR-871	Kendall (1976)
HIGH ISLAND WEST DAM	-17.03	wood	7 830 ± 140	HAR-869	Kendall (1976)

Table 3 Radiocarbon dates of geological materials (continued)

Borehole site	Altitude (m P.D.)	C_{14} Source	C_{14} Date	Lab.Ref.*	Reference
HIGH ISLAND WEST DAM	-16.13	shell (oysters, bivalves and snails)	7 790 ± 90	HAR-870	Kendall (1976)
HIGH ISLAND WEST DAM	-16.13	wood	6 640 ± 100	HAR-868	Kendall (1976)
JUNK BAY JBSI/1A	-19.50 to -19.88	shell	8 080 ± 130	CS 619	Strange & Shaw (1986)
LAI CHI KOK	-14.1	wood	8 785 ± 125	I-8269	Meacham (1976)
LAI CHI KOK BAY	-17	shell	7 790 ± 150	GIF-5243	Meacham (1982)
LOK MA CHAU, SAN TIN	0.4	rootlet	5 475 ± 155	SI-86/123	Langford et al. (1988)
LOK MA CHAU, SAN TIN	0.3	rootlet	5 093 ± 130	SI-86/124	Langford et al. (1988)
NGON PING, YUEN LONG	0.9	wood	1 899 ± 93	SI-86/109	Langford et al. (1988)
PING SHAN, YUEN LONG	0.2	organic mud	3 110 ± 185	SI-86/122	Langford et al. (1988)
PRINCE EDWARD	-11	shell (oysters and bivalves)	6 580 ± 130	GIF-4558	Meacham (1979b)
SHAN HAU TSUEN, YUEN LONG	15.5	peaty clay	21 648 ± 1 082	SI-86/108	Langford et al. (1988)
SHA TIN	-15.5	wood	23 270 ± 720	KWG-280	Whiteside (1984)
SHAM WAN	-1 to -2.6	shell	5 520 ± 110	I-10059	Meacham (1978)
SHAM WAN	0.6 to 1.4	shell	3 870 ± 80	HAR-3589	Meacham (1980)
SHEUNG WAN	-17	shell (Crassostrea gigas)	36 230 ± 680	KWG-482	Yim (1986)
SHEUNG WAN	-15.5	wood	31 450 ± 610	KWG-483	Yim (1986)
SHEUNG WAN	-18	shell (Crassostrea gigas)	30 560 ± 580	KWG-569	Yim (1986)
SHEUNG WAN	-20	organic mud	18 710 ± 520	KWG-408	Yim (1986)
SHEUNG WAN	-17	shell (Crassostrea gigas)	45 700 ± 2 000	ANU-5964	Yim (unpub. work)
SHEUNG WAN	-16.5	wood	8 600 ± 270	KWG-407	Yim (1986)
SHEUNG WAN	-16.5	organic mud	8 520 ± 270	KWG-407	Yim (1986)
TIN HAU	-10.6	wood	20 410 ± 610	KWG-287	Willis & Shirlaw (1984)

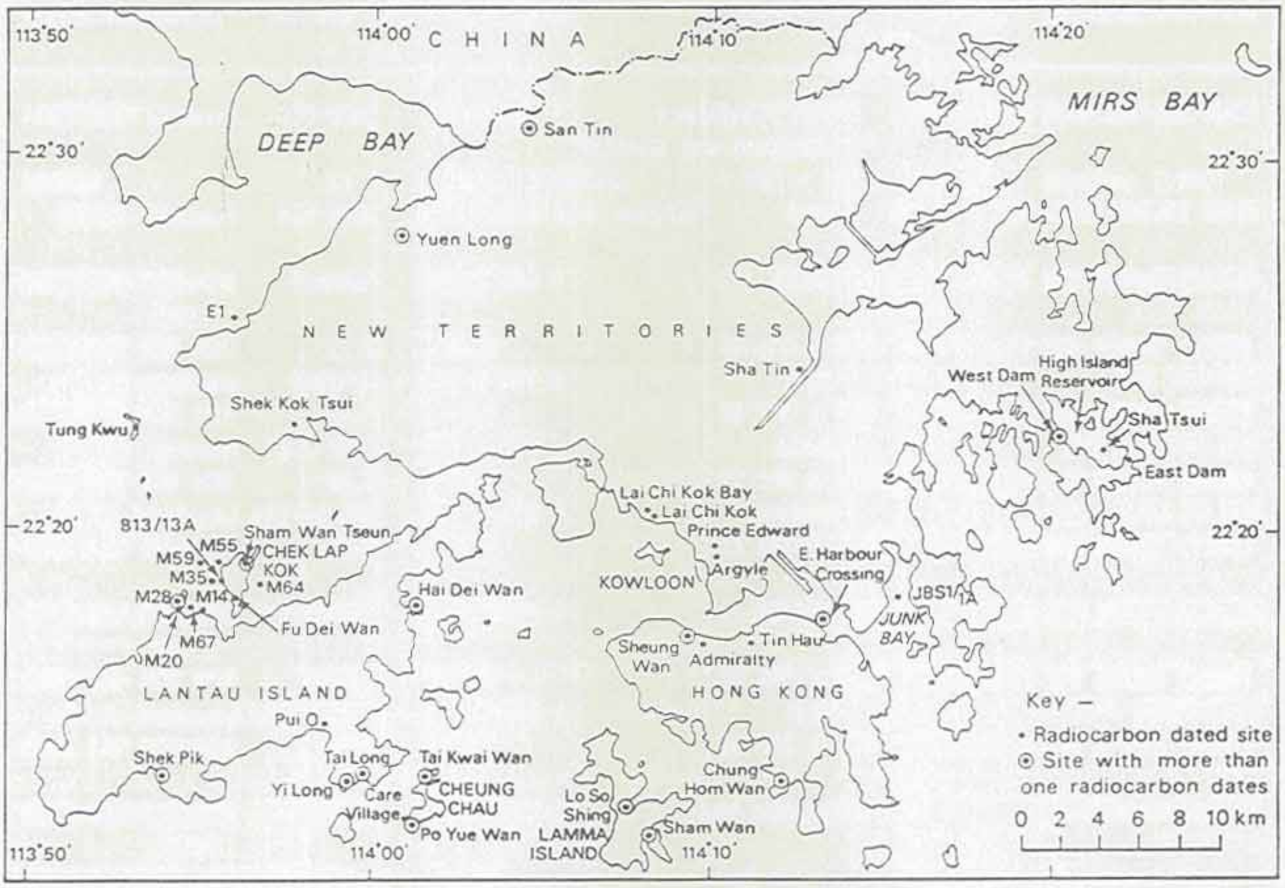

Figure 1 Location map of sites of radiocarbon dated material

Acknowledgements

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Conference notice and call for abstracts

1989 International Symposium on Geology and Geophysics of South China Sea

January 1989, Guangzhou

To be organised jointly by the Guangdong Provincial Society of Oceanology and Limnology, the Guangdong Provincial Society of Petroleum and The Geological Society of Hong Kong.

The Symposium will invite several geologists and geophysicists of world repute to speak at the meeting.

The Symposium aims at providing an opportunity for discussion and mutual exchange of experiences, and to promote cooperation between scientists concerned with the marine geology and geophysics of the South China Sea.

Papers: Papers contributed to the Symposium are encouraged to reflect the recent advances in research in geology and geophysics, as well as hydrocarbon potential of the South China Sea and adjacent areas, including: sedimentology, geochemistry, regional tectonics, regional geophysics, petrology of Cenozoic basalt and its geochemistry, regional petroleum geology, neo-tectonic movement and crustal stability in the continental margin areas, marine heat flow and marine geophysics, recent developments in offshore oil-gas exploration in Southeast Asian Countries.

Abstracts: Up to a single page of single-spaced type in English, or 1500 characters in Chinese, should be sent to the Symposium Secretariat at the address below, before 31st August 1988. Abstracts will be subject to refereeing prior to acceptance.

Registration Fee: Symposium registration will be US$200 for each participant. Details of accommodation and meals will be given in the Second Circular.

Details are contained in the First Circular, available from:

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or contact The Secretary of the GSHK (Dr Richard Langford, 3-667916), for a copy of the First Circular.

Geological Society of Hong Kong Newsletter, Vol. 5(4), pp 9 - 13 (1987)

Petrographic Study of Metamorphism in Tuffs of the Tai Mo Shan Formation, Northwestern New Territories, Hong Kong

Jerry Ho L. P. and R. L. Langford

Geotechnical Control Office, Hong Kong

Abstract

The pyroclastic rocks in the metamorphosed belt in the northwestern New Territories can be split into four types; non-schistose metatuff, slightly schistose metatuff, quartz-sericite schist and mylonitic schist. These rocks are products of dynamic metamorphism and hydrothermal alteration in a regional metamorphic belt affecting pyroclastic rocks of the Jurassic Tai Mo Shan Formation. Carbonate-rich fluid has been important in the metamorphic process, which is of low-grade greenschist facies.

Introduction

In the northwest New Territories of Hong Kong is a belt of regionally metamorphosed rocks. Within this belt the effects of dynamic metamorphism and hydrothermal alteration vary considerably, giving a range of metamorphic rock types. The belt affects the Carboniferous San Tin Group (Chan, 1987), the Jurassic Repulse Bay Volcanic Group, and intrusions of granite and granodiorite within these strata.

There is a northeast-trending thrust fault between the metamorphosed sedimentary rocks of the San Tin Group (Langford et al, in preparation) to the northwest and the metamorphosed tuffs of the Repulse Bay Volcanic Group. This fault dips northwest at angles varying from 35° to 50°, and has been named the Pak Fu Shan - Mouse Island Fault (Burnett & Lai, 1985); it is one of the major faults in the Lo Wu - Tuen Mun Fault Zone. Fault activity has taken place repeatedly from the late Paleozoic to at least the late Jurassic - early Cretaceous (Burnett & Lai, 1985).

This paper deals with the metamorphic rock types found in the Tai Mo Shan Formation (Addison, 1986), which forms part of the Repulse Bay Volcanic Group. The metatuff types are arranged in northeast-trending zones in a belt at least 7 km wide. Adjacent to the thrust the volcanic and sedimentary rocks possess a dominant schistosity. Further southeast, schistose metatuffs are found only in narrow zones. In general, the spacing between these altered zones increases with increasing distance from the fault. A 2 km part of this belt adjacent to the faulted contact with the San Tin Group has been studied in detail, and forms the basis of this paper; this study area is shown in Figure 1.

Petrography

A total of 45 samples from southeast of the fault, with 34 thin sections, were selected for study from the Hong Kong Rock Collection of the Geological Survey Section, Geotechnical Control Office. Most of the samples studied have mineral assemblages of calcite-feldspar-quartz-sericite±biotite, chlorite, pyrite and opaque oxide. Based on the mineralogy and texture, the samples may be classified into one of four metamorphic categories: non-schistose metatuff, slightly schistose metatuff, quartz-sericite schist, and mylonitic schist. In addition, non-metamorphosed tuff was studied to provide a reference point for determining the extent of metamorphism.

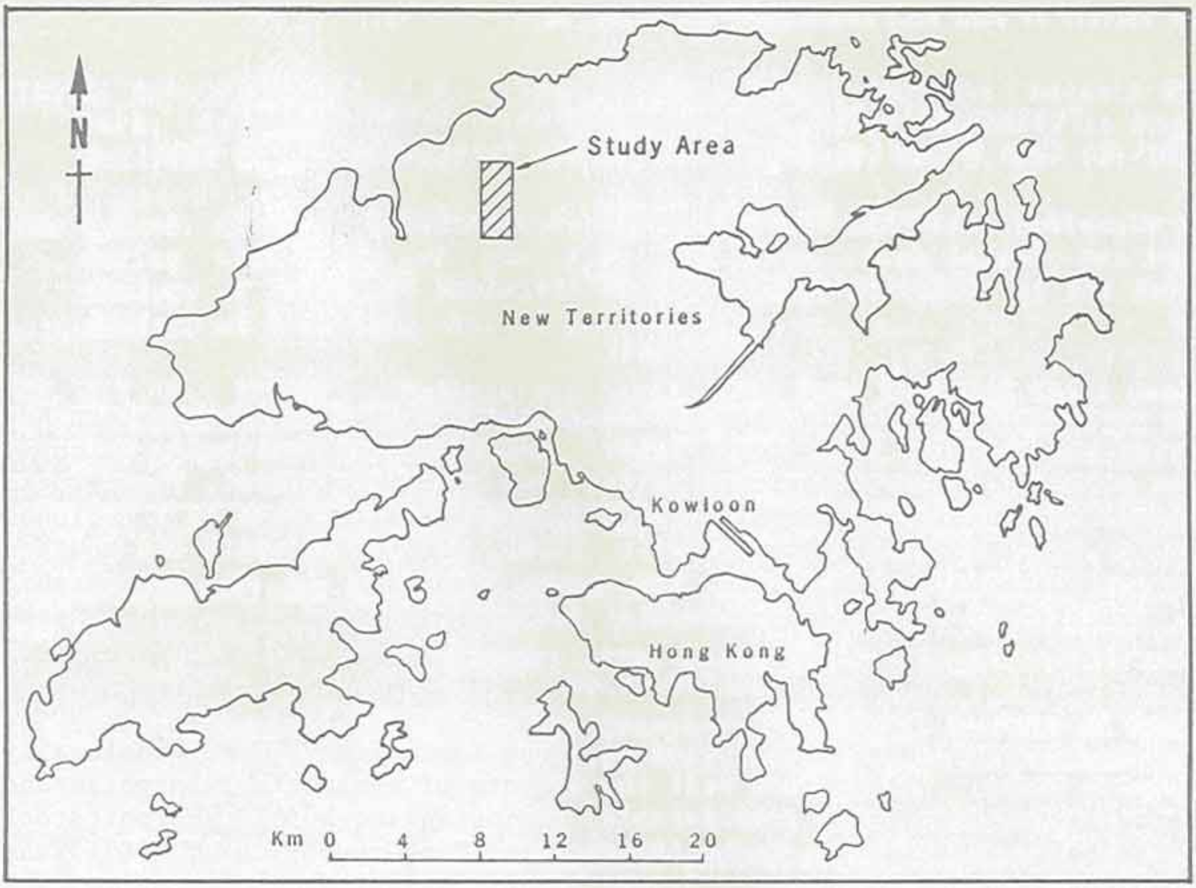

Figure 1 Location map

Non-metamorphosed tuff

The typical rock type of the Tai Mo Shan Formation in its type area is lapilli-bearing coarse ash crystal tuff (Addison, 1986). The rocks generally vary from pale to dark grey in colour, and are massive and uniform in composition. Lapilli of quartz, feldspar and recrystallized volcanic glass are the most conspicuous field characteristics.

In thin section the rocks show considerable variation in the abundance of crystals and in the relative proportions of the crystal types present. Together with lithic fragments, pyroclasts of quartz, plagioclase, alkali feldspar and biotite make up the bulk of the rock. Epidote is often present, particularly as an alteration in the plagioclase.

Non-schistose metatuff

This rock type is dark grey when fresh, and resembles non-metamorphosed tuff in hand specimen. The rock weathers to a deep reddish-brown colour. Lapilli of quartz and feldspar are conspicuous, and lithic fragments which have been flattened or streaked are common. The non-schistose metatuff outcrops between the generally narrower zones of schistose varieties.

Thin sections show that sericite has developed in the matrix, but the original pyroclastic texture is preserved. The pyroclastic quartz crystals retain their original features, and are large, sub-rounded, embayed, fractured, and strained. Some quartz lapilli show evidence of granulation and polygonization (recrystallization of large, strained crystals to smaller unstrained grains). The feldspars are strongly altered, some being replaced by calcite, others by sericite and quartz. Biotite, if present, forms as a secondary growth rimming feldspar crystals or forms as an aggregate largely or totally replacing feldspar (Plate 1). Primary biotite is difficult to distinguish. Sericite intergrown with polycrystalline quartz forms the major part of the matrix, but the sericite shows no preferred orientation, and there is no resulting schistosity to be seen in hand specimen. Fine-grained calcite may form a minor part of the matrix. Epidote is found in this rock, as it is in the non-metamorphosed tuffs, mostly within plagioclase crystals.

Slightly schistose metatuff

This rock type is generally pale to dark grey in colour, and weathers to a reddish, yellow-brown colour. Schistosity is readily apparent in the rock, as are relict lapilli of quartz and pseudomorphs after feldspar. Lithic clasts retaining their pyroclastic flattened and streaked forms are still visible. The texture of the rocks in this category is better shown in weathered samples; fresh samples are almost featureless. Slightly schistose metatuff usually outcrops in zones ranging in width from 5 to 200 m. These zones typically form sharp ridges and run parallel or sub-parallel to the northeast trend of the fault. The spacing between the bands increases southwards with increasing distance from the fault.

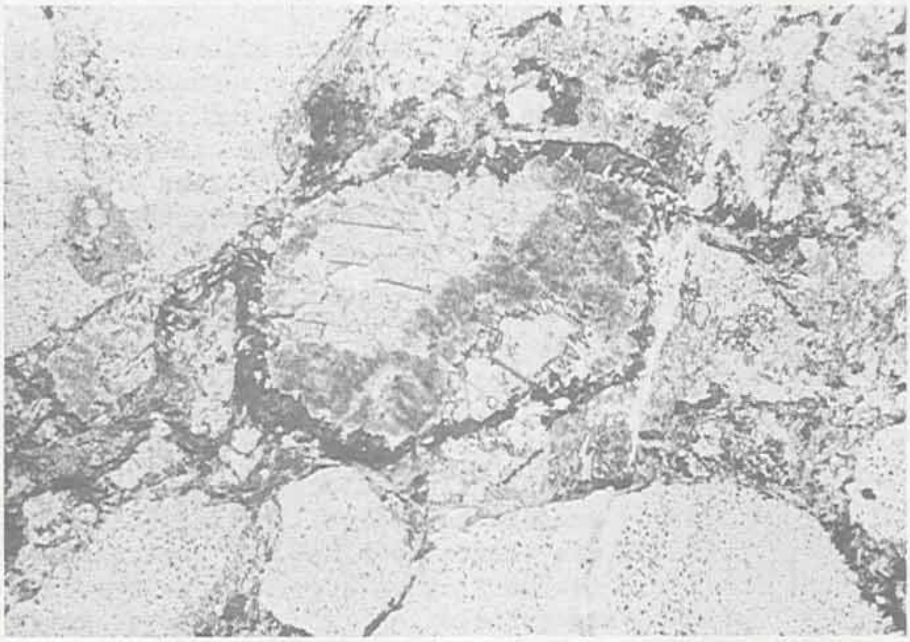

Plate 1 Feldspar partially replaced by calcite and rimmed by biotite, plane light, x 40.

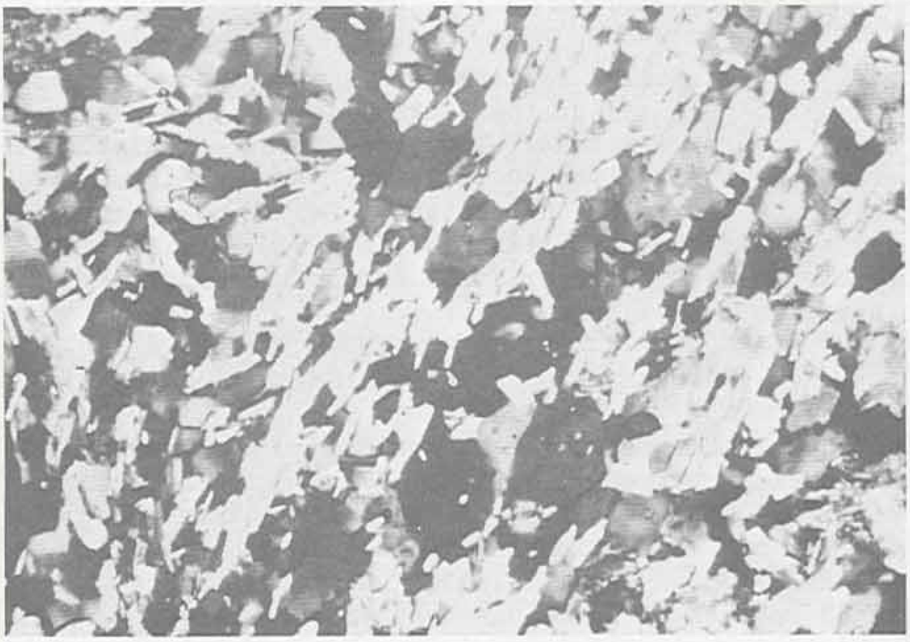

Plate 2 Matrix of polycrystalline quartz intergrown with sericite, cross polars, x 100.

The original rock texture can still be inferred from the mineral assemblage, surviving quartz lapilli and scattered lithic lapilli. Thin section studies show that sericite is abundant in the rocks of this category. The matrix is composed mainly of polycrystalline quartz intergrown with sericite (Plate 2). Schistosity is shown by the preferred orientation of the sericite. Quartz lapilli retain pyroclastic features such as sub-rounding, embayment, straining and fracturing, but secondary polygonization and granulation are very common. The feldspars are deeply altered, both to sericitic pseudomorphs and biotite. Calcite can be seen replacing feldspars or forming pseudomorphs after feldspar. Lithic fragments are metamorphosed to fine-grained quartz and sericite only. The slightly schistose metatuff shows a large variation in the percentage of relict crystals. However, these metatuffs have very similar mineral assemblages, seen for example in the compositions and habits of the plagioclase. The metatuffs with fewer relicts have higher percentages of sericite in the matrix, suggesting that the rocks have undergone a higher degree of alteration.

A progressive change from lapilli-rich metatuff to lapilli-deficient metatuff has been observed in a borehole core. Biotite, as pseudomorphs after feldspar is found only in the upper portion of the core, and there is an increase in amount of recrystallization and in the degree of alteration of feldspar with depth; plagioclase feldspar seems to alter more than potassium feldspar. Schistosity is better developed and the percentage of calcite increases at depth in this borehole.

Quartz-sericite schist

The quartz-sericite schist is generally pale grey to grey in colour, weathering to yellowish white or brown. The rocks of this category are mainly confined to a 2 km wide zone southeast of the main fault. Strong schistosity is shown by the preferred orientation of the abundant polycrystalline sericite and quartz in the matrix. Quartz, present as relict lapilli within this matrix, is the only mineral recognizable in hand specimen. Relict quartz lapilli retain some primary pyroclastic features; they are embayed, fractured and strained. Secondary polygonization and granulation is very common. Relict feldspars can generally only be recognized by the form of the sericite pseudomorphs, and secondary biotite is present in a few rocks of this category.

Mylonitic schist

The mylonitic schist is strongly foliated and weathers to a reddish, yellow-brown colour. It is also confined to the 2 km wide zone southeast of the main fault, forming narrow zones within the quartz-sericite schist. The width of the zones is variable, ranging from 50 to 300 m. The schistosity is sub-parallel to the trend of the fault. Bands containing augen of dynamically broken and streaked quartz relicts are still visible in hand specimen, while metamorphic minerals form the bulk of the rock. The matrix is composed wholly of fine-grained quartz, sericite and chlorite.

Discussion

Fluids have played a important role in metamorphic processes within the fault belt, partly by enhancing recrystallization. Water is the commonest fluid present in such belts, and has the effect of weakening quartz grains so that they deform initially by elongation and ultimately by streaking-out, rather than by fracturing (Etheridge & Vernon, 1983). High water pressure in a fault zone has the added effect of lowering the attrition between grains, thus further weakening the zone and allowing sliding to take place more easily.

Calcite is not common in the schists and mylonitic schists, and it is believed that high shear stress may have prevented the calcite from precipitating within the shear zone. Away from the fault, where shear stress was lower, fluid played a more important part in the metamorphism. The fluid was probably carbonate-rich. Fractures filled with calcite are seen in some thin sections, and these hydrofractures may indicate that at times fluid pressure exceeded the lithostatic rock pressure.

Summary

Outcrops of the various metatuffs are related to the northeast-trending fault which forms the boundary between Carboniferous and Jurassic rocks. Non-schistose metatuff and narrow zones of slightly schistose metatuff are dominant away from the fault. Outcrops of quartz-sericite schist and mylonitic schist are confined to a 2 km wide zone adjacent to the fault.

Non-schistose metatuff resembles unaltered Tai Mo Shan Formation, but thin section studies show the growth of secondary biotite and the replacement of feldspar by calcite. Sericite grows with a preferred orientation and gives schistosity to the slightly schistose metatuff. The schists are dominated by a metamorphic matrix composed mainly of fine-grained quartz and sericite; foliation is readily seen in the rocks. Relict pyroclasts are usually only of quartz, and the extent of recrystallization is such that the original pyroclastic texture is largely destroyed.

Carbonate-rich fluids have played a important role in metamorphic processes within the fault zone. This is shown by the presence of both calcite pseudomorphs after feldspar and calcite veins. The major mineral assemblage produced in this fluid-rich metamorphic process is calcite-feldspar - quartz - sericite ± biotite, chlorite, pyrite and opaque oxide. The regional metamorphism is therefore low-grade greenschist facies, and is the same as found by Chan (1987) in the adjacent Carboniferous rocks. No evidence was found of the earlier, higher-grade metamorphism seen by Chan.

Acknowledgments

The authors are grateful to Mr R.S. Arthurton, Dr R. Addison and Mr K.W. Lai for their valuable advice and discussion. This paper is published with the permission of the Director of Civil Engineering Services of the Hong Kong Government.

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Geological Society of Hong Kong Newsletter, Vol. 5, No. 4, pp 14-19 (1987)

Field excursion to Lai Chi Chong and Cheung Sheung

R. Addison & P. J. Strange

Geotechnical Control Office, Hong Kong

Introduction

The following notes refer to localities numbered on the geological sketch map (Figure 1), as visited during the field trip held on the 18th of October, 1987.

Access

The field excursion commenced at Tai Pak Kok ferry pier, and ended at Sham Chung Wan ferry pier, with the party using a privately-hired boat. It is also possible to reach the area of this excursion by public ferry, from the Ma Liu Shui (Chinese University) ferry pier, or by walking into the area from the road at Yung Shue Au which runs around the southern end of Kei Ling Ha Hoi (Three Fathoms Cove). Public transport is available along the road from Sai Kung to Sai O.

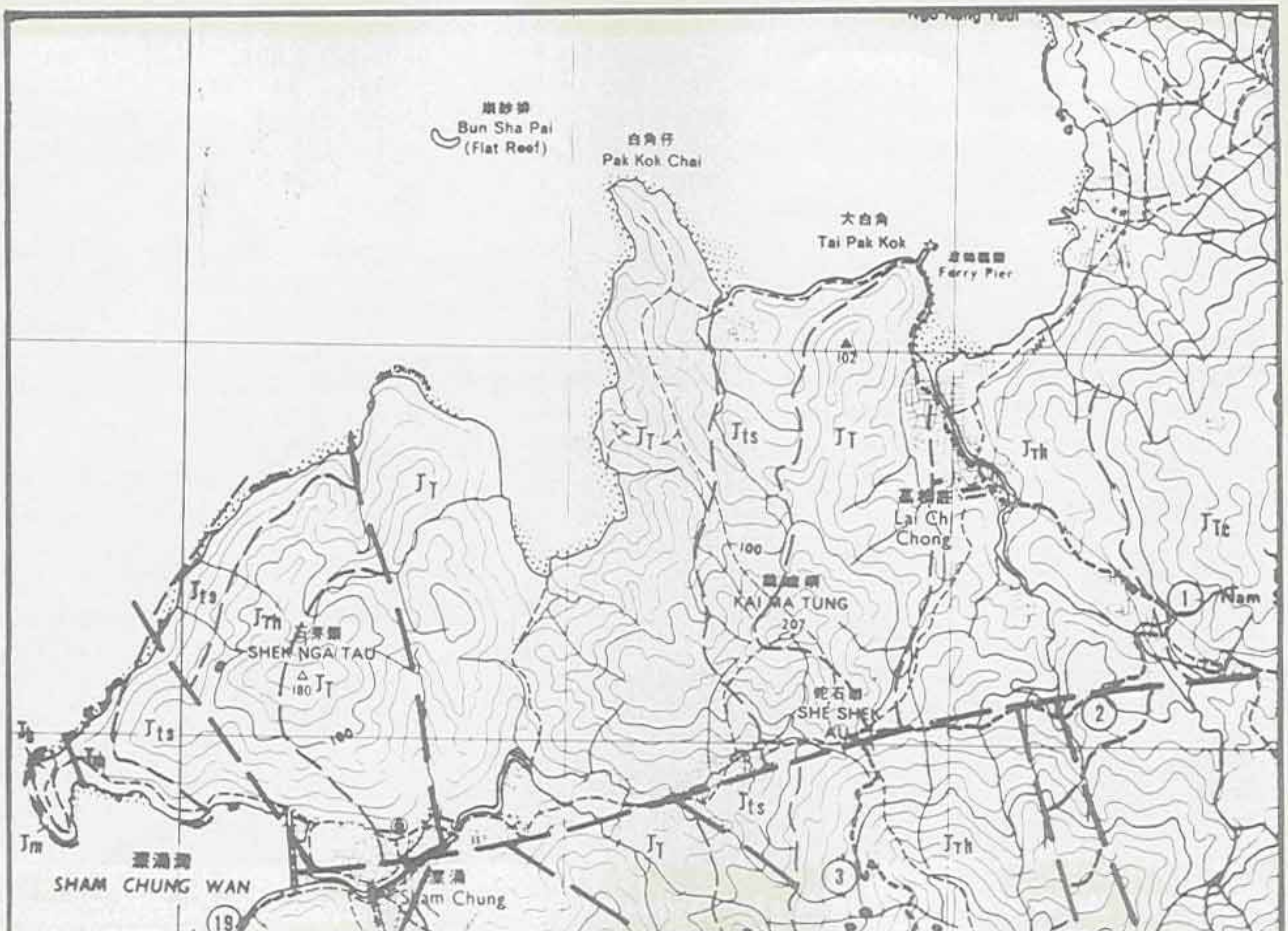
Geological features of interest

Locality numbers refer to Figure 1.

Locality Number	Description
1	Boulders in this area are of lapilli-coarse ash lithic crystal tuff of the variety found around Long Harbour. In general, this rock unit is characterised by broken pink feldspar crystals, small cuboidal fine sandstone clasts and larger clasts of aphanitic quartz- and feldspar-phyric rhyolite.
2	The path in this vicinity follows an east-west striking lineament, which probably represents a fault. We have crossed onto the rhyolite, which is dark grey, with very conspicuous large euhedral crystals of white feldspar and quartz. As will be seen during the traverse, the rock has a strong flow-banding which, in some outcrops, is contorted. The rhyolite is widely jointed and forms hillside tors.
3 to 4	At higher points along the traverse, the disposition of the rhyolite lava unit over the underlying sediments can be appreciated. The mudstones and tuffites can be seen on the ridge to the north and similar weathered debris are visible on the slopes below the footpath. The rhyolite at this point must be dipping gently towards the northeast.
5	The contact of the rhyolite with the sediments parallels the line of the footpath, about 100 m downslope. It can also be seen in the hillsides away to the southwest, where blocks and small tors of rhyolite stand above small landslips in the mudstones.
6 to 7	Here the footpath reaches its highest point on the traverse. Descending southwards, we cross onto outcrops of mudstone and conglomerate, with the conglomerate forming particularly well-defined features which dip north-northeastward. The eastward dip of the conglomerate outcrops is clearly shown on the oblique aerial photographs at Plates 1a and b.

Plate 1a Escarpments of easterly-dipping conglomerate interbedded with plant-bearing mudstone to the west of Cheung Sheung. Oblique aerial photograph looking northeastward.

Plate 1b Oblique aerial photograph looking southeastward across the conglomerate escarpment towards Cheung Sheung.



Jтc	Lapilli-coarse-ash tuff	— — —	Fault
Jтh	Rhyolite	– – – –	Geological boundary
Jт	Tuffs, welded and nonwelded coarse-ash	- - - - - - -	Footpath
Jтe	Eutaxitic welded tuff	(2)	Point of geological interest-see text
Jts / cg	Bedded tuffs, and tuffites with conglomerates and mudstones		
Jb	Sedimentary breccia		
Jm	Mudstones with invertebrate fossils		

Based on Allen & Stephens 1 : 50 000 geological map and additional mapping by R. Addison and P. J. Strange, Geotechnical Control Office.

Figure 1 Sketch map of the geology of Sham Chung and Cheung Sheung

The pebbles of the conglomerate may give a clue to the relative ages of the succession around Lai Chi Chong. Pebbles of black aphanitic volcanic rocks, often finely flow-banded, may originate from the rhyolitic lava sequences which extend northward from Clear Water bay to High Island.

8 Mudstones with interlayered conglomerate beds and with thin tuffite horizons have yielded abundant well preserved plant remains (Wai, 1986).

9 Outcrops of rhyolite at this locality are very much thinner than was noted between localities 2 and 6. The succession may be attenuated across the fault in the valley to the north.

The succession of volcanic rocks which overlie the sediments may be examined, a short distance upslope.

10 A relatively thin unit of eutaxitic welded tuff can be seen in weathered outcrops in the footpath, but blocks of rock on the hillside beside the path demonstrate the well-defined texture of flattened pumice fragments.

Further up the footpath, outcrops of Long Harbour coarse ash tuffs occur again.

The steep footpath known as Jacob's Ladder descends into Yung Shue Au village. Superficial deposits, mainly from debris flows, occupy the valley floor. On reaching the lowlands, near the village, a wide alluvial tract is seen.

11 On the shoreline, dark grey, thinly bedded cherty tuffites and mudstones are exposed at low tide.

12 Well exposed wave-cut surfaces show horizons of block-bearing tuffs and tuffites, with channel erosion surfaces cutting into a lower reddened unit. Reddening of the lower unit probably indicates the development of a weathering profile within the tuffs during a break in the deposition of the sequence.

Plate 2 Well-bedded waterlain tuffs and tuffites.

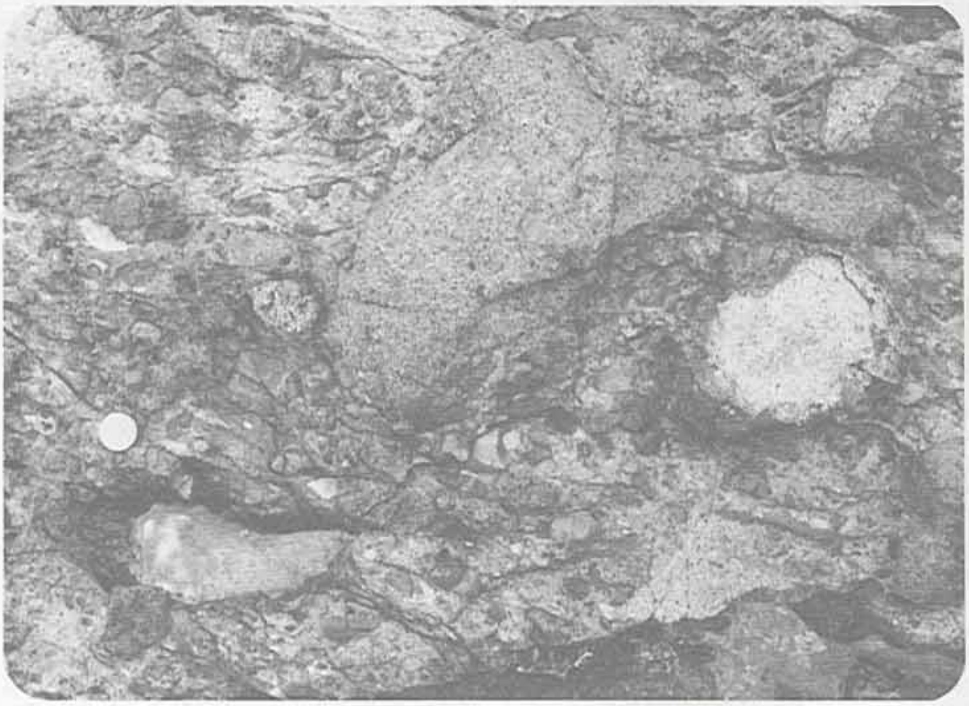


Plate 3 Polymict breccia with clasts of tuff, lava and mudstone.

Locality	Description
13	Along the shoreline, red breccias are exposed below the high-water mark. The clasts of these rocks are exclusively sedimentary in origin, and some show a pre-existing foliation. The horizon may represent the local base of the Mesozoic succession.
14	Beds of pale grey fine-grained tuffites and dark grey mudstones dip gently to the northeast, and are probably faulted against outcrops to the south. Plant remains also occur within these beds.
15	Well exposed sequences of water-lain tuffs and tuffites (Plate 2) dip to the northeast. Horizons of cross-bedded cinder-like deposits and of accretionary lapilli can be found.

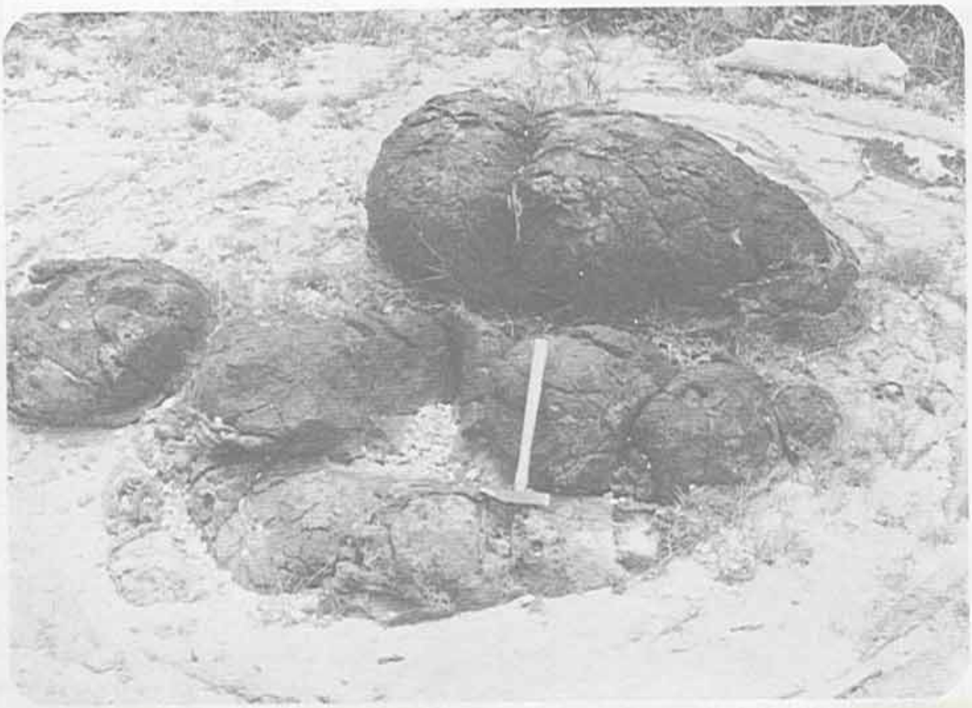


Plate 4 Spheroidal weathering forms of corestones in coarse ash tuff.

Locality	Description
16	Faulted outcrops of breccio-conglomerate occur that are rich in large and small clasts of volcanic origin (Plate 3). Adjacent outcrops are of coarse ash tuff with lapilli of grey mudstone.
17	Further outcrops of coarse ash tuff with lapilli of grey mudstone and chert. Note the spheroidal weathering forms along the shore (Plate 4).
18 to 19	Once more, outcrops of flow-banded rhyolite (Plate 5). The rock weathers to a cream or pale grey colour and is characterised by the presence of bipyramidal quartz crystals. Feldspars are present but are not conspicuous. These rocks are difficult to identify in the field, but in thin sections can be seen to be composed of clustered quartz and feldspar phenocrysts in a fine-grained, flow-banded groundmass which contains flow-oriented feldspar microlites.

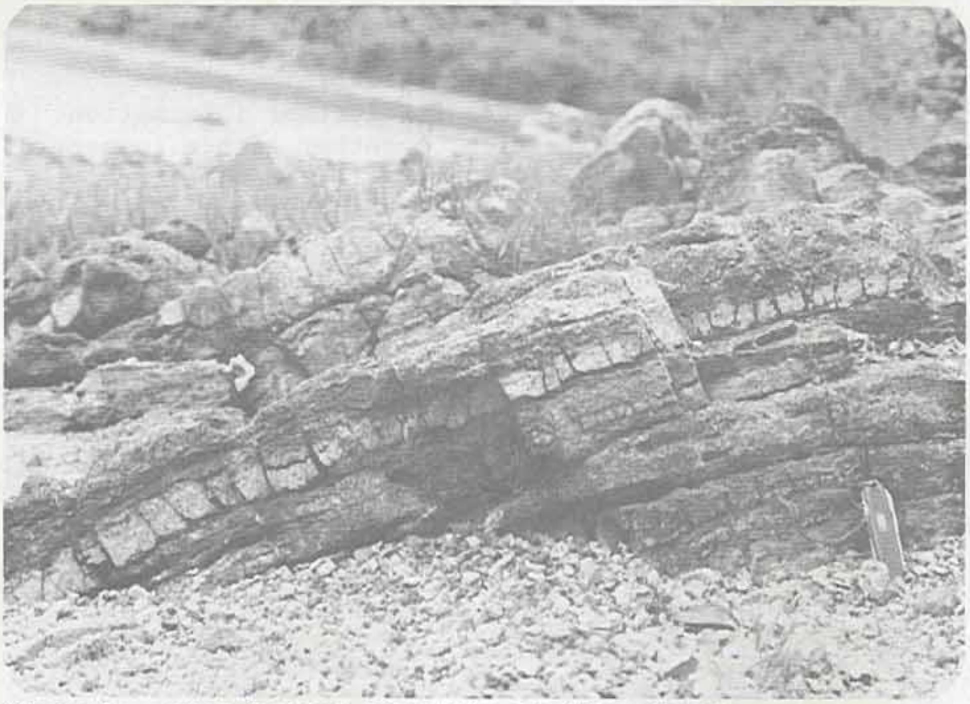


Plate 5 Flow banded rhyolite at Sham Chung.

Acknowledgements

The authors would like to thank Mr K. Law for his help in drafting the geological sketch map. The field photographs were taken by Mr H.T. Yu and the aerial views by Mr A. Hansen. The paper is published with the permission of the Director of Civil Engineering Services of the Hong Kong Government.

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Publication notice: Abstracts No. 5

ABSTRACTS No.5, 59p. Abstracts of papers presented at the meeting on Future Sea-level Rise and Coastal Development, held at the University of Hong Kong, April 1988. *Incl. 2 abst., 4 extended abst., general information & bibliog. More details in the next Issue of the Newsletter, or contact GSHK Secretary.

1987 in retrospect

1987 was always going to be a relatively quiet year after the high level of activity in 1986, which culminated in the LANDPLAN Conference. During 1987, many members were busy assisting Peter Whiteside in editing the LANDPLAN Proceedings. Three lecture meetings, including one held jointly with the Geotechnical Group of the HKIE, had to be cancelled when the intended speakers were unable to make their planned visits to Hong Kong. As always, however, there was a full programme of field excursions, including three visits to China.

The major event of the year was a one-day seminar in December on Marine resources of Sand, organised by the Marine Studies Group. This seminar, supported by some excellent poster displays, aroused great interest both within and outside the Society, and some 180 persons attended.

Summary of programme

Seminar: Marine Sources of Sand - Organised by the Marine Studies Group. The Proceedings of this seminar are now available. Please contact Mr Peter Whiteside, telephone 3-7213684, for further information. A more detailed notice of this publication, together with a summary of the seminar, will appear in the next issue of this Newsletter.

Lectures: January Major strike-slip faulting in the North and West Pacific
Speaker : Dr R. McWhae

February: Ancient landscapes and the evolution of the Southeast Australian Highlands
Speaker : Dr G. Taylor

Field meetings and excursions:

Ping Chau	(January)
North Guangdong	(10 days, April)
North Western New Territories	(May)
Tolo Channel	(July)
Shenzhen	(July)
Double Island	(August)
Shek Uk Shan	(October)
Joss House Bay	(December)
Western Guangdong	(8 days, December)

Mailing lists

The mailing lists for the Newsletter, and the notices for lectures and field excursions, are held by the Secretary of the GSHK, Dr Richard Langford (3-667916). Queries relating to the distribution of these items should be made to Dr Langford, in the first instance. The 1988 membership renewal/ application forms included a section allowing members to indicate whether they wished to be notified of the activities of either of the two specialist groups. If readers indicated a wish to be included on a specialist mailing list, but have not yet received any relevant notices, please contact the Secretary of either of these groups. The contacts are:

Secretary of the Marine Studies Group: Dr Raynor Shaw, telephone: 3-7230441
G.C.O., 6/F Empire Centre, 68 Mody Road, Tsim Sha Tsui East, Kowloon.

Secretary of the Teachers Group: Mr Keung Hon Ming, telephone (home) 0-6490036
Flat E, 26/F, Block 20, City One, Sha Tin, N.T.

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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 titles are given in full.

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

Cover photo: Control of granite landform by sheeting joints, Po Toi Island (J.M. Nash)

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