

Chapter 1

Introduction

Location and Physiography

This report describes the geology of a region containing the Designated Area of the Northwest New Territories, and is covered by parts of the Hong Kong Geological Survey 1:20 000 Map Sheets 2 (San Tin), 5 (Tsing Shan) and 6 (Yuen Long). The area stretches from the northern limits of Tuen Mun through Yuen Long and San Tin to Lo Wu. It has an area of some 6 000 ha and it is shown in Figure 1; it is referred to in this report as the district. The district occupies a low-lying region much of which is only a few metres above sea level. It is some 25 km in length and up to 6 km wide in the vicinity of Yuen Long town (Plate 1). It is bounded to the southwest by the Tsing Shan (Castle Peak) range of hills (583 m) and to the east by the foothills of Tai Mo Shan (957 m). The northern land boundary is formed by Deep Bay and the Sham Chun River.



Plate 1 - Yuen Long Looking South from the Industrial Estate

Much of the area is agricultural, with fish and duck farming predominating in the northeast (Plate 2). Yuen Long, the principal town of the district, was designated as a satellite new town some 15 years ago and has a population approaching 200 000. Another new town, for 135 000 people, is being developed at Tin Shui Wai, whilst Fairview Park, a low-density residential development, covers an area of nearly 200 ha. Many new roads are planned or under construction in the area, and numerous old villages, such as Lau Fau Shan and Ying Lung Wai, are scheduled for modernisation.

Previous Work

The first geological investigations in Hong Kong were undertaken by Brock, Uglow, Schofield & Williams between 1923 and 1927 under an agreement between the Colonial Office and the University of British Columbia. A geological map of Hong Kong was published at a scale of 1:84 480 in 1936, and several papers relating to this work were published by Brock & Schofield (1926), Uglow (1926)



Plate 2 - Fish and Duck Ponds Northeast of Fairview Park

and Williams (1943; 1945). The first memoir, based largely on this work, was produced by Davis (1952), followed later by a detailed description of the geology of the Territory by Ruxton (1960).

In 1971, Allen & Stephens published the first comprehensive geological map at a 1:50 000 scale together with a descriptive report. This survey remained the definitive work on the geology of the Territory until 1982 when the Hong Kong Geological Survey, staffed initially by seconded officers of the then Institute of Geological Sciences (now British Geological Survey), commenced the 1:20 000 mapping programme. Bennett (1984a; 1984b; 1984c) reviewed the stratigraphy and tectonics of the Territory, but the first geological memoir to describe the Yuen Long district was published by Langford *et al* (1989), with accompanying map Sheets 5 & 6 in 1988 and Sheet 2 in 1989. The terrain characteristics, superficial deposits and engineering geology aspects were described in the Geotechnical Areas Studies Programme Report No. IV, North West New Territories (GCO, 1988b).

The first records of marble occurring in the district were from ground investigation boreholes put down at Fairview Park in 1977 (Langford *et al*, 1989) and at Yuen Long in 1980 (Ha *et al*, 1981). It is now known that marble occurs beneath a thick cover of superficial deposits, which masks the complex solid geology of the area, but its wide extent was not suspected judging by the accounts of the geology of the Territory published prior to 1989. Ground investigations conducted in 1987 for the new Light Rail Transport (LRT) depot in Yuen Long discovered cavities within the marble some of which were greater than 20 m in vertical extent. Although the lateral extent of these cavities was unknown, there was concern that their presence could seriously affect development. Further drilling on the LRT site proved more zones of dissolved and highly weathered rock (Plate 3).

The Designated Area Project

In 1987 the Geotechnical Control Office initiated a programme of exploration and deep boring to help delineate the marble substrate, to assist prediction of the cavitous areas within it, and to study its hydrogeology. A new series of geological maps at a scale of 1:5 000 was proposed to record the findings of the survey. Some 40 boreholes were drilled to various depths not exceeding 200 m while two extra boreholes were sunk to over 400 m in depth at the locations shown in Figure 3. These boreholes were continuously sampled by rotary coring in the superficial deposits and the solid rocks. Summary logs of all these boreholes are shown in Appendix 1. Additional information was obtained from the logs of many hundreds of public and private ground investigation boreholes. Where core was not available for inspection, interpretation of the lithology was sometimes possible from colour photographs in the borehole log reports.

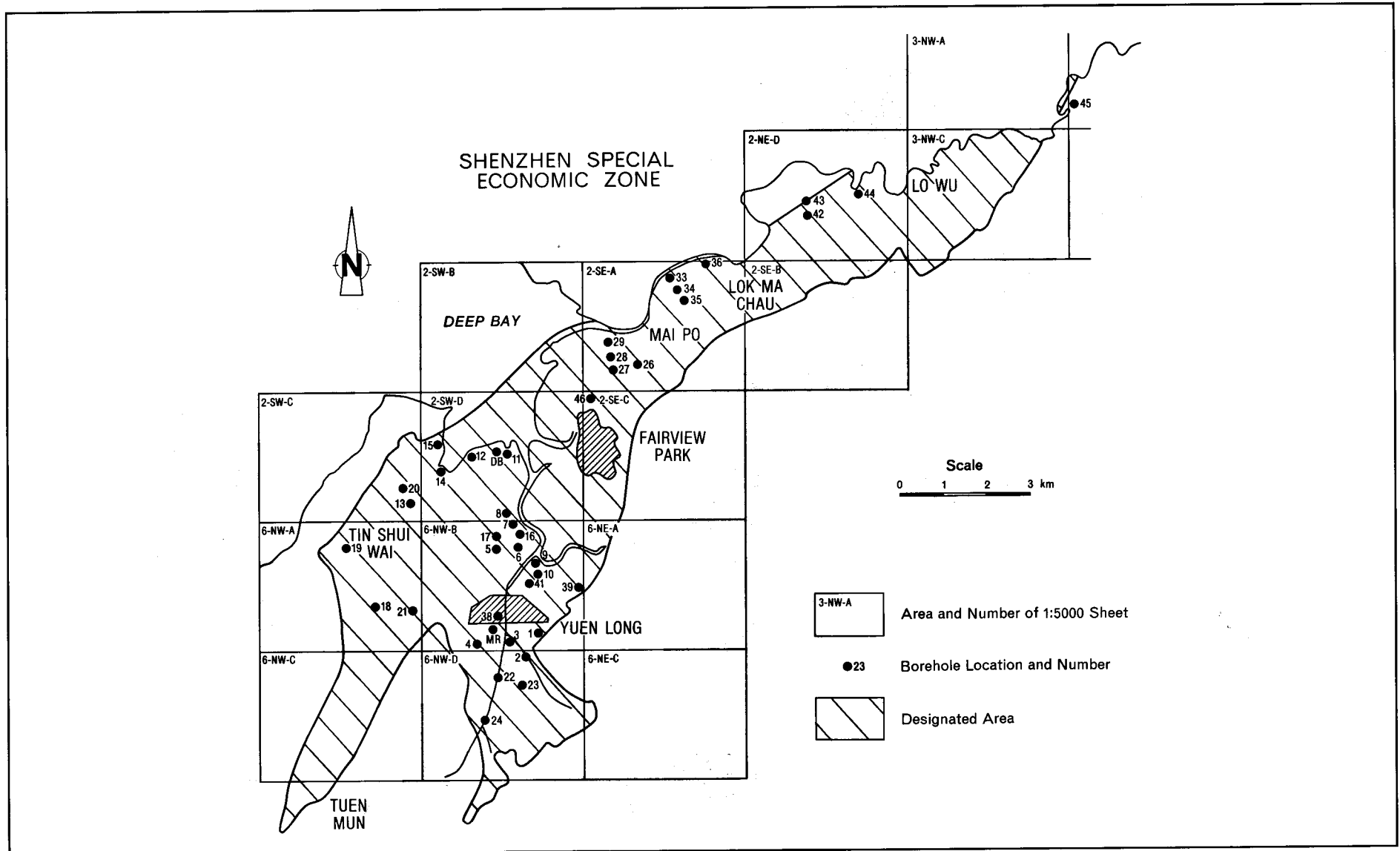


Figure 3 - Location of Boreholes (BGS) Drilled for the Marble Project

From a total of some 5 000 m of core drilled for the Project, some 100 specimens were thin sectioned; 8 samples were sent to the Institute of Geological Sciences of Guangdong Province, People's Republic of China, and 2 samples to the University of Toronto, Canada, for radiocarbon dating. Eight samples were sent to the School of Physics, Newcastle University, for palaeomagnetic assessment; 38 samples were sent to the Stratigraphy and Tectonics Unit of the British Geological Survey for miospore analysis, cathode luminescence and heavy mineral separation (Appendix 2 & 3). Analyses of 27 marble samples to determine lead-oxygen isotope ratios were undertaken by the Isotope Geology Centre of the Natural Environment Research Council in London.

A preliminary assessment of the hydrogeology of the district was made by the Hydrogeological Research Group (HRG) of the British Geological Survey. Some 35 water samples were analysed by HRG to assess groundwater geochemistry, and a duplicate set of analyses was made by the Public Works Central Laboratory in Hong Kong to facilitate comparison and standardisation of the results. The Public Works Central Laboratory also carried out soil classification tests, and the insoluble residues of 12 marble samples were determined.

As an aid to correlation of the strata, several boreholes were tested by a gamma-log probe by Electronic & Geophysical Services Ltd (EGS). EGS were also employed to conduct a local gravity survey of the Yuen Long area to help elucidate the structure and sedimentary sequence present.

In 1988 a visit to the Karst Institute in Guilin, China, for an international conference enabled the author to make comparisons between the limestone structures in a type area of karst development and those buried beneath the superficial deposits of Yuen Long. Exposures of Carboniferous limestone and marble were examined at quarries in the Shenzhen Special Economic Zone which adjoins Hong Kong (Plate4).

The value of aerial photographs in a flat area dominated by man's activities was limited, but some extrapolation of photogeological lineaments was possible from the surrounding uplands (Hansen, 1990). A Landsat image of the Pearl River Estuary, although at a small scale, gave an excellent overview of the district and supplied further evidence of fault lines suspected from borehole data.

The 1:5 000 geological maps which accompany this report are based on the Hong Kong Geological Survey field surveys, now published as maps at a scale of 1:20 000. The present project not only added to their work but also produced a detailed interpretation of the sub-surface geology based largely on new information, mostly from boreholes, obtained since their survey. Each 1:5 000 sheet area is represented by two geological maps, one showing the superficial geology (Series HGP5A) accompanied



Plate 3 - Large Block of Karst Marble (inverted Ma Tin Member) Excavated from the Rockhead at the LRT Site, Yuen Long

by contours on the base of the superficial deposits in metres relative to principal datum, and another depicting the solid geology (Series HGP5B) with contours on the base of completely weathered rock.

All the records from this project, including rock samples, thin sections, manuscript maps and analytical data, are held in the archives of the Hong Kong Geological Survey, Geotechnical Engineering Office. The cores from the two deep boreholes, and representative cores from the other BGS Series boreholes, are also retained in the Hong Kong Geological Survey archives.

As a result of this project the Designated Area was redefined into Scheduled Area No. 2 (Figure 2), which occupies less than half of the territory previously suspected as underlain by soluble bedrock.



Plate 4 - Marble Quarry near Shenzhen Showing Palaeokarst Scarp and Dip Topography. A Small Doline Depression on the Extreme Left is Filled with Superficial Deposits