

# Chapter 1

## Introduction

### Location and Physiography

This report describes the geology of Tsing Yi and surrounding offshore area, and is covered by the Hong Kong Geological Survey 1:5 000 map sheets 6-SE-B (Tsuen Wan) and 10-NE-B,D (Tsing Yi). The 1:5 000 map sheets cover an area of some 1 625 ha (Figure 1), including the offshore area north and east as far as the Sham Tseng - Tsuen Wan coastline, and is referred to in this report as 'the district'. The district occupies a region of rugged topography dominated by a central range of hills. The highest peak in the south of the island, at one time referred to as Tsing Yi Hill, is 334 m, and that in the northwest is 218 m. Much of the lowland area in the eastern, southern and western parts of the island is formed of reclaimed ground, including a large area in the northeast that once separated Tsing Yi from the smaller island of Nga Ying Chau (Plate 1).

The island of Tsing Yi is separated from the mainland by the Rambler Channel to the east and the Tsing Yi Channel to the north (see Figure 6). To the west, the Ma Wan Channel separates Tsing Yi from the islands of Ma Wan and Lantau; this passage is to be crossed by the Tsing Ma Bridge as part of the Lantau Fixed Crossing. The Rambler Channel has a maximum depth of 23 m in the north, where currents have scoured to rockhead. To the north of the island, two minor channels trend almost parallel to the main axis of the Tsing Yi Channel. These are interpreted by Evans (1986) as ebb (northern) and flood (southern) channels. The greatest water depth in the district is to the west, where currents have scoured to bedrock at 55 m in the Ma Wan Channel. The main tidal flow is through this channel, leaving the Tsing Yi and Rambler channels as more sheltered straits. In the southwest of the district, a sand bank has been exploited as fill; the seabed topography in this area is now artificially levelled at around -30 m.

The coastal areas are dominantly industrial with container and oil storage facilities being the main developments in the south and west, and shipyards occupying much of the northeastern coastline. Commercial and residential developments in the northeast serve a population of some 500 000, and many new roads



*Plate 1 - Northeast Tsing Yi Showing Urban Development on Reclaimed Land, September 1992*

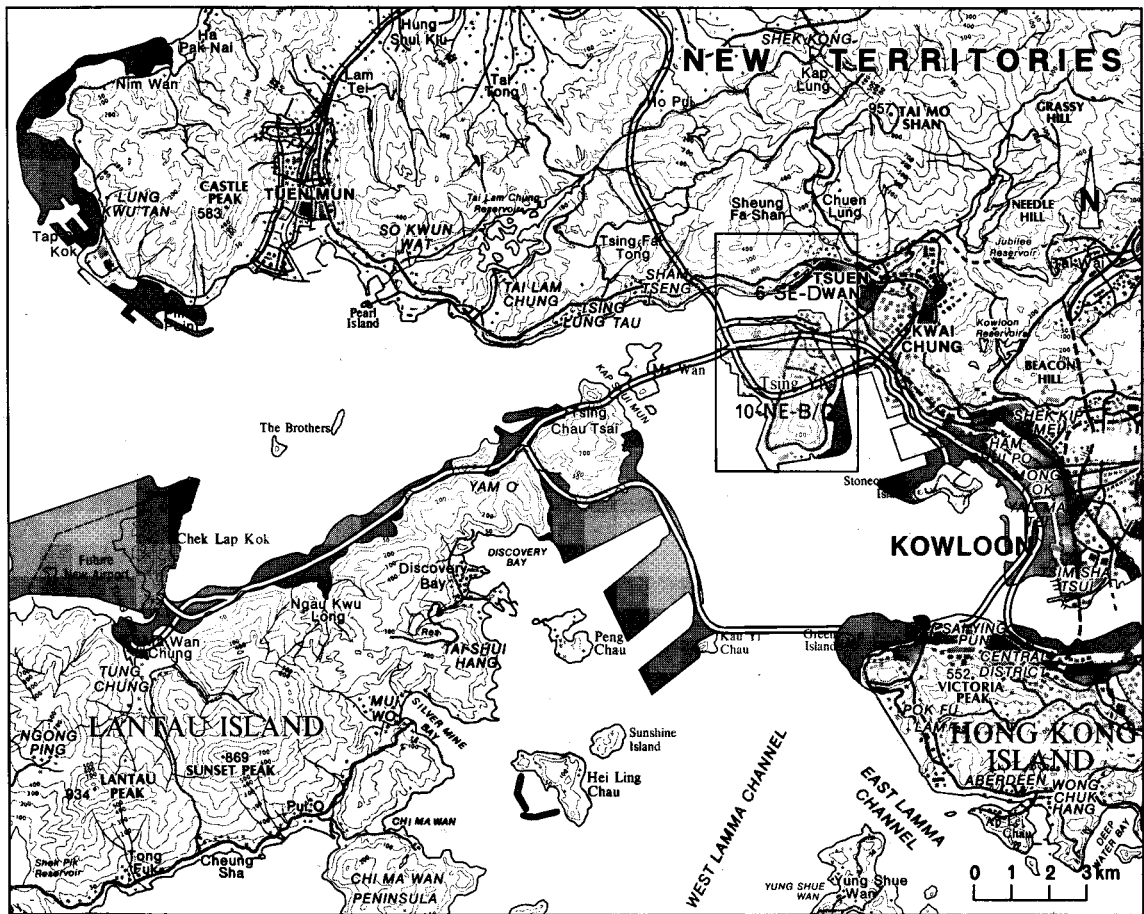


Figure 1 - Location Map of Major Infrastructure Developments Related to Tsing Yi

and buildings are presently under construction. The northwestern part of the island is the site of major infrastructure projects associated with the building of transport links to the new airport at Chek Lap Kok and the new port on Lantau Island.

### Previous Work

The first geological investigations in Hong Kong were undertaken by Brock, Uglow, Schofield and Williams between 1923 and 1927 under an agreement between the Colonial Office and the University of British Columbia. In 1936, Brock *et al* published a geological map of Hong Kong at a scale of 1:84 480, and several papers relating to this work were published by Brock & Schofield (1926), Uglow (1926), Williams (1943) and Williams *et al* (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 scale of 1:50 000 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 commenced the 1:20 000 mapping programme (Figure 2). Bennett (1984a; 1984b; 1984c) reviewed the stratigraphy and tectonics of the Territory, and the 1:20 000 geological maps covering the Tsing Yi district were published as Sheet 6 (Langford *et al*, 1988) and Sheet 10 (Langford *et al*, 1991). The terrain characteristics, superficial deposits and engineering geology are described in the Geotechnical Areas Studies Programme Report No. II, Central New Territories (GCO, 1987).

### The New Port and Airport Projects

This report is the third in a series of geological reports and associated 1:5 000-scale map sheets covering the development areas of Lantau and Tsing Yi.

The new airport at Chek Lap Kok and new port facilities at North Lantau and Tsing Yi are massive projects which require the construction of extensive infrastructure, including road and rail links. In the past, some of the problems encountered in major infrastructure developments in Hong Kong have been

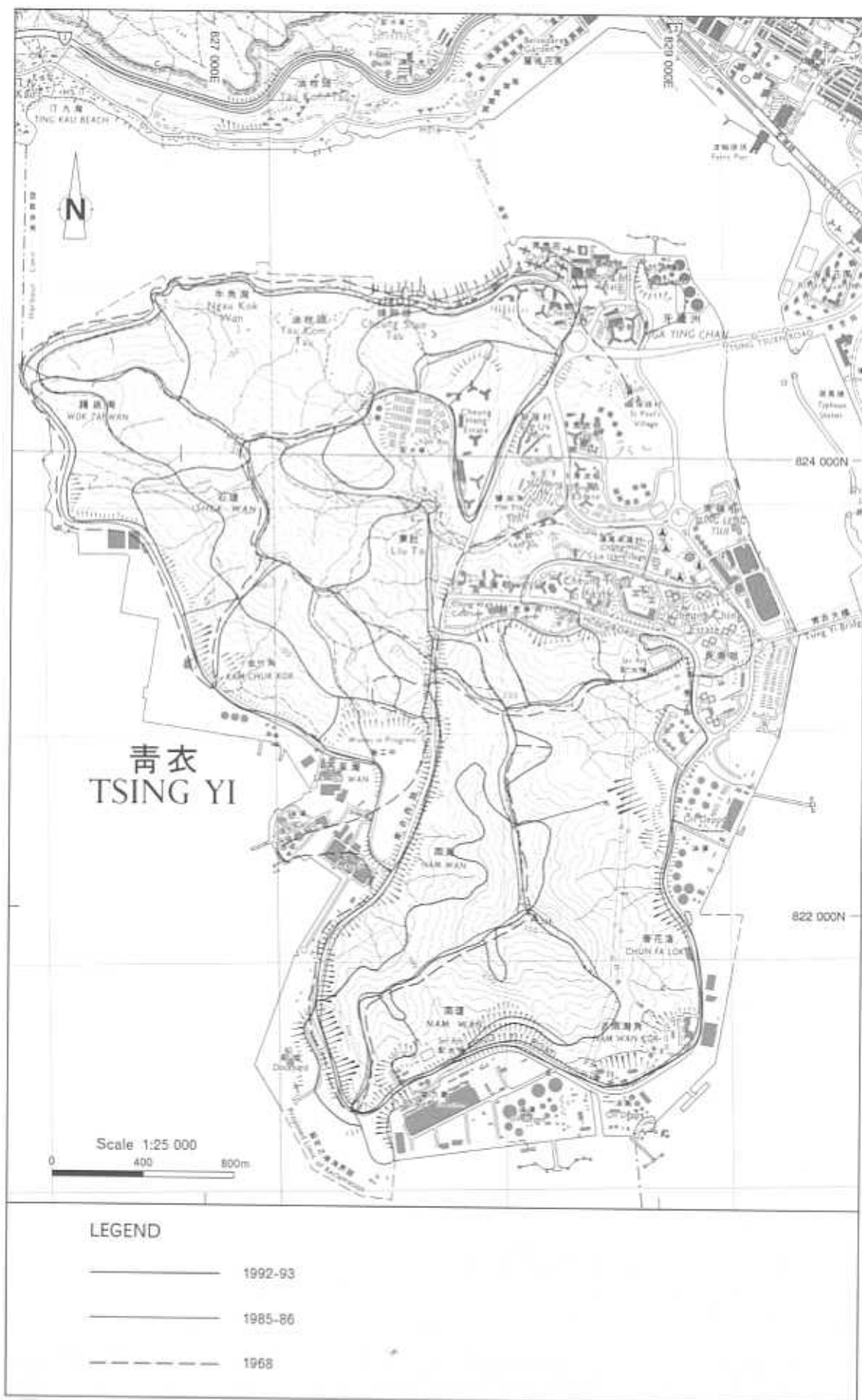


Figure 2 - Traverses Undertaken during 1968, 1985-86 and 1992-93 Field Surveys

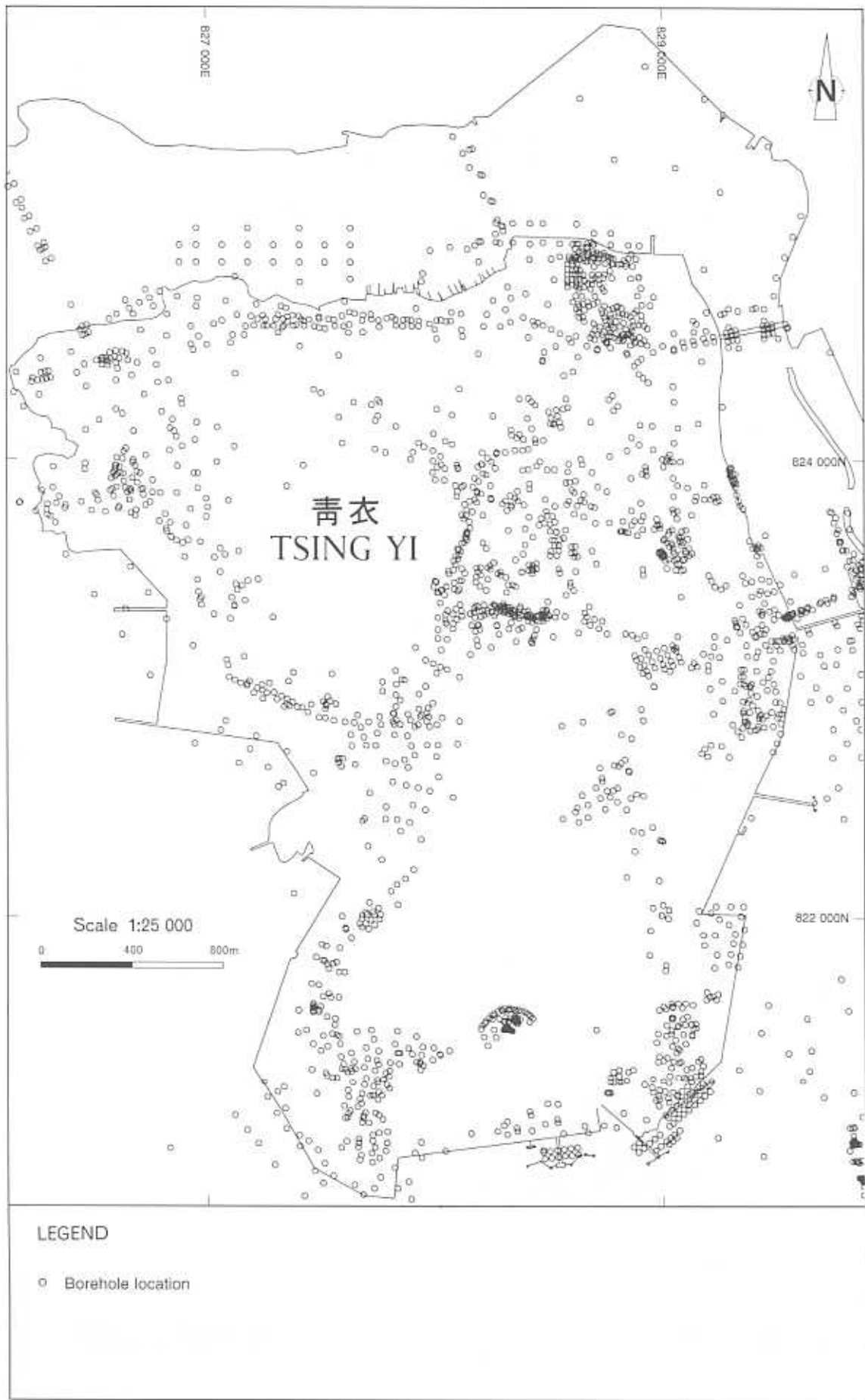


Figure 3 - Locations of Boreholes Drilled for Tsing Yi Infrastructure Development Projects



Figure 4 - Locations of Seismic Lines around Tsing Yi

attributed to insufficient geotechnical and geological knowledge. A previous regional geotechnical area study of North Lantau (GCO, 1988b) indicated that much of the area is influenced by high to extreme geotechnical constraints to development.

In view of the size and scope of the port and airport developments proposed for North Lantau and Tsing Yi, it was decided by the Geotechnical Engineering Office (GEO), previously the Geotechnical Control Office, that detailed geological mapping of Tsing Yi should be undertaken, and this commenced in October 1992.

This report covers the area of the proposed container terminal CT9, Route 3, and the eastern landfall of the Lantau Fixed Crossing. The main purpose of this study was to carry out detailed baseline geological mapping to provide information on rock structure, texture and composition, and superficial sediment distribution for use by engineers involved with the infrastructure development. An additional aim was to supplement existing published geological data with more detailed information for improved understanding of broader geological issues in Hong Kong.

## **Data Sources**

A large volume of Tsing Yi borehole data exists from site investigations carried out between 1970 and the early 1980s and more recently from the new airport project (Figure 3). This large data set was compiled onto a computer database to allow easy retrieval, evaluation and interpretation. The report text is based on a review of site investigation information up to December 1992. However, the database is regularly updated as new information is received and should therefore be of continuing interest to all those involved with geotechnical appraisals or design in the district.

The nature and distribution of offshore superficial sediments has been mapped using shallow seismic profiles, borehole logs, and CPT traces from several surveys. These surveys were originally carried out in preparation for the Lantau Fixed Crossing, Port and Airport Development Strategy (PADS), offshore sand resource exploration and site investigations for reclamations. The geophysical data were shot using a 100 Joule 'boomer' source. This provides good resolution in the superficial sediments but at the expense of identifying structure in the bedrock. A total length of 72 km of seismic profiles was examined for this project (Figure 4).

From a total of 73 new rock samples collected, some 60 specimens were thin-sectioned; 46 samples were sent to the University of Nottingham for whole-rock major- and trace-element geochemical analysis, and four samples were sent for Rare Earth Element analysis at Royal Holloway and Bedford New College, London.

Aerial photographs taken over the last 30 years, particularly those taken in 1963, were invaluable in mapping the onshore superficial deposits. A Landsat satellite image of the Pearl River Estuary, although at a small scale, gave an excellent overview of the district and supplied further evidence of structural trends determined from field mapping.

The 1:5 000 geological maps which accompany this report supplement existing published information contained in the 1:20 000 geological maps. They are based on new field surveys and include much detailed interpretation of the sub-surface geology based largely on new information, mostly from boreholes and offshore seismic traverses. Each 1:5 000 sheet area is represented by one geological map showing the solid and superficial geology.

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. The powders used in geochemical analysis are also retained in the Hong Kong Geological Survey archives, and a split is kept at the British Geological Survey, Keyworth.