Chapter 6
Altered and Weathered Rocks

Classification

Rock alteration takes several forms in the rocks of Chek Lap Kok. Hydrothermal alteration by heated water passing through the rock results in kaolinization of the granite (Plate 19). Rocks can also be altered by weathering processes close to the surface. Chemical alteration and progressive mechanical disintegration create a weathered profile that ultimately provides the material for the formation of superficial deposits through mass wasting, surface erosion and subsequent deposition.

Kaolinization

The altered rocks were formed dominantly by the process of hydrothermal activity, which takes the form of kaolinization of the granite (Plate 19). Kaolinization is confined to an area of about 11 ha to the east of the test embankment and an area of about 8 ha east of Sham Wan.

The area of kaolinization east of the test embankment is sharply bounded to the east, with unaltered fine-grained granite exposed in a stream bed (1112 1901) less than 50 m from the zone of alteration. Deeply

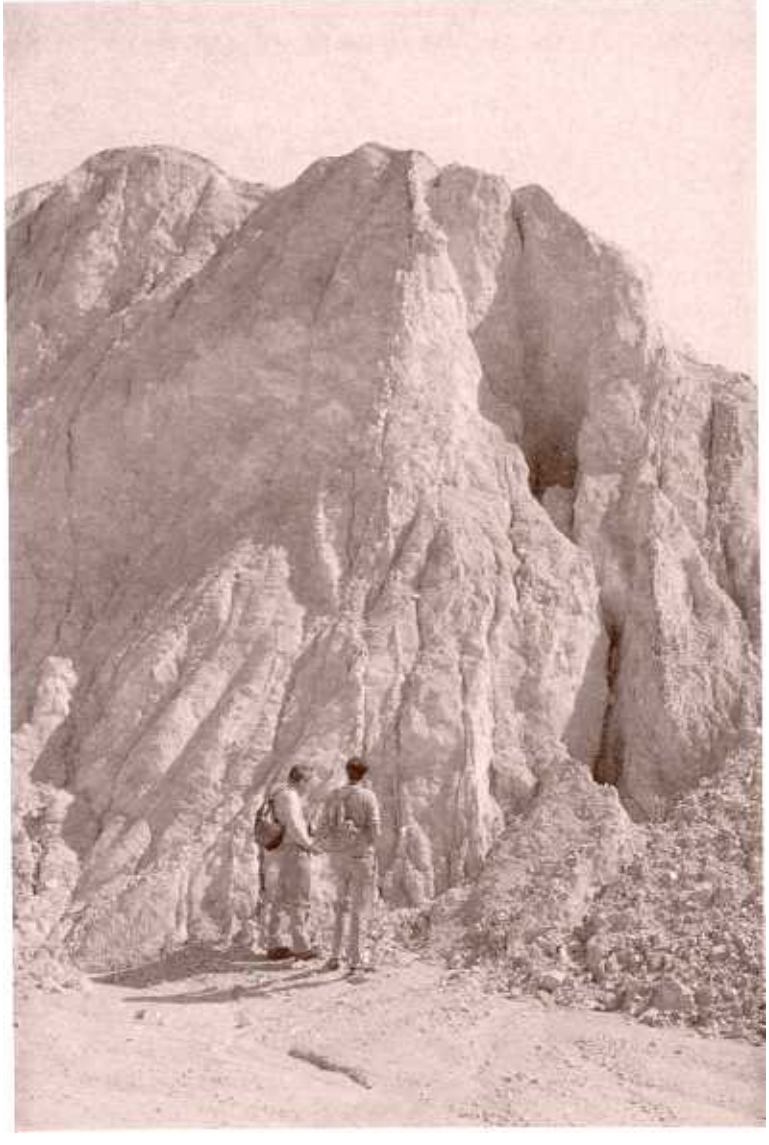

Plate 19 - Deeply Weathered Kaolinized Granite with Thin Quartz Veins, in the Old Kaolin Mine East of the Test Embankment (1104 1901)

weathered granite occurs on the ridges of Fu Tau Shan to the south and to the north, but is not accompanied by kaolinization. The kaolinization is not readily apparent in the borrow area, although the granite is deeply weathered. The western boundary of the kaolinization is unclear, as the weathered granite has been extensively excavated for kaolin even though the mineral may not be present in significant amounts.

Kaolinization has been recorded near the northern tip of the island, the area to the east of Sham Wan having been commercially mined in the 60s. The area is strewn with quartz vein debris and is deeply weathered (Plate 20).

Weathering

An extensive mantle of weathered rock overlies fresh rock in most of the island (Plate 21, Figure 9). The weathered mantle usually consists of material that retains the original texture of the rock, and consists of a mixture of Grades IV-VI (Geotechnical Control Office, 1988b) material and relatively fresh corestones. The estimated volume of the weathered mantle is 21 million m^3, but could be as low as 14 million m^3 or as high as 28 million m^3. Compared with the volume of the island, this gives an average of 20% weathered mantle above sea-level or 25% above 8 mPD.

The deeply weathered hilltops and ridges are prone to gullying, a process often exacerbated by mining activity. This is well illustrated in the aerial photographs from the early 1960s (Plate 22), which contrasts with the more recent trend towards revegetation over most areas (Plate 23). However, certain deeply gullied areas, outside those areas affected by mining, remain susceptible to further erosion. Plate 24 illustrates the regrowth of dense, low vegetation below steep, gullied weathered granite with quartz veins to the north of Fu Tau Shan (188 111).

Details

Granite. The granite has weathering features typical of those observed elsewhere in the Territory, for example in the nearby hills of Tsing Shan and Tai Lam (Langford *et al*, 1989). The ridge tops are commonly eroded to expose a pale granular soil. The best exposures of this phenomenon are near the summit of Fu Tau Shan (111 183). Deep gullies in brownish to pinkish white completely weathered fine-grained granite have exposed resistant quartz veins. Gullying also occurs on the flanks of Fu Tau Shan and in the areas of kaolinization.

Plate 20 - Abandoned Kaolin and Quartz Mine below the Instrument Approach System, East of Sham Wan (122 199)

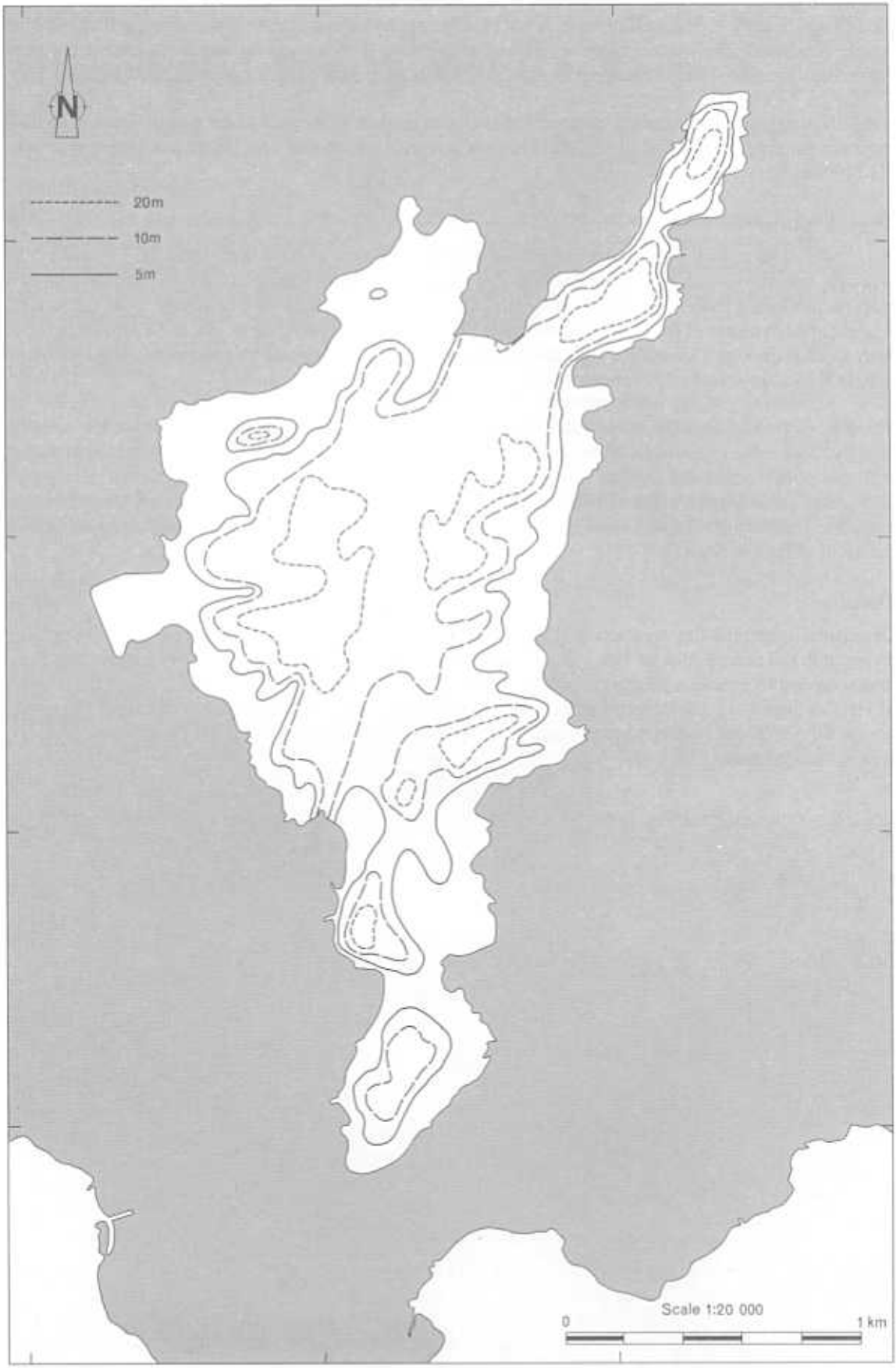

Figure 9 - Thickness of Weathered Profile (Grade IV - VI) in the Island

The northern peninsula, on the east side of Sham Wan, has a history of stone quarrying, and weathering depths are mostly less than 10 m. This increases over the old kaolin mine, where weathering and mineralization probably extend to sea-level. To the west of Sham Wan the rock quality is very good, with very little weathering and few joints. The hillsides are characterized by exposed sheets of rock and corestones.

The main range of granite hills on the east side of the island are capped by around 10 m of weathered rock, but extensive sheets of exposed rock can be seen on the flanks, particularly east of Fu Tau Shan (112 188). The coastal aspect of these hills is characterized by abundant corestones sitting in a thin mantle of soil. Further south, the hills are dominated by the wide dykes, and the granite is thought to be capped by only a thin weathered zone.

The corestones exposed in the kaolin mine and borrow are usually weathered, and concentric exfoliation around the corestones is well displayed in the borrow area (109 191). The weathered rock disintegrates to form a uniform pale silty sand.

A fine example of lamellar fracturing can be seen in highly weathered megacrystic fine-grained granite near the northern tip of the island (1248 2022). The fracturing dips gently, and has a similar orientation to sheeting joints seen in adjacent solid exposure.

Dykes and Veins. The basic dykes in particular often exhibit a distinctive weathering pattern. Being rich in ferro-magnesian minerals, they weather deeply, but can exhibit small-scale spheroidal weathering, for example near Kwo Lo Wan (1156 1827) (Plate 7). Coastal exposures of basic dykes are often marked by a slight hollow where the more easily weathered dyke is eroded. This is well displayed in a 0.4 m wide dyke at Fui Yiu Wan (1203 1964) (Plate 12). These dykes can also exhibit a markedly carious surface, accentuated by a mineral boxwork in the rock, for example in a coastal exposure near Fu Tei Wan (1076 1819).

Quartz veins often form upstanding ribs in the surrounding weathered granite. In coastal exposures, they usually lie along lines of weakness in the granite exhibiting deeper erosion. There are excellent examples of quartz vein ribs and sheets both in and around the kaolin mines east of the test embankment and east of Sham Wan. Plate 19, taken within the former mine (1104 1901), illustrates how a narrow quartz vein protects the adjacent weathered and kaolinized granite from erosion. Plate 9 (1111 1912) illustrates a quartz

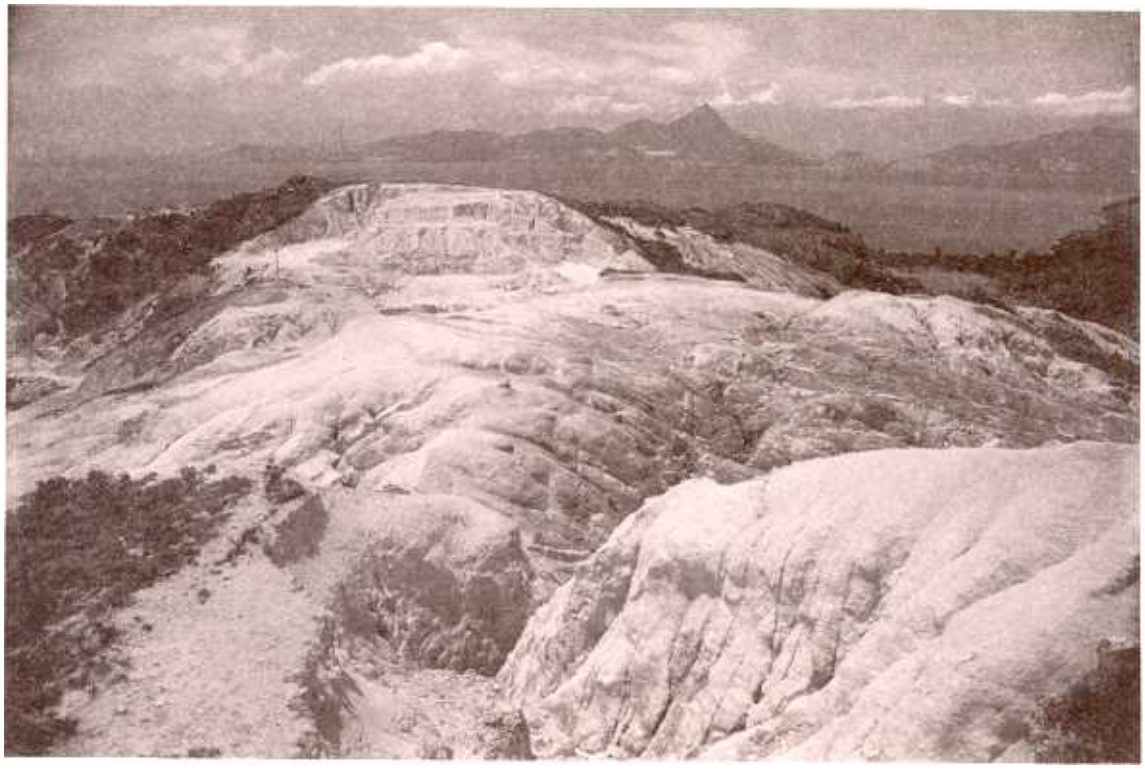

Plate 21 - Deeply Weathered and Eroded Granite on Fu Tau Shan, with the Disused Kaolin Mine in the Background

Plate 22 - 1964 Aerial Photograph (2940) Showing Low Vegetation and Extensive Erosion in the Island

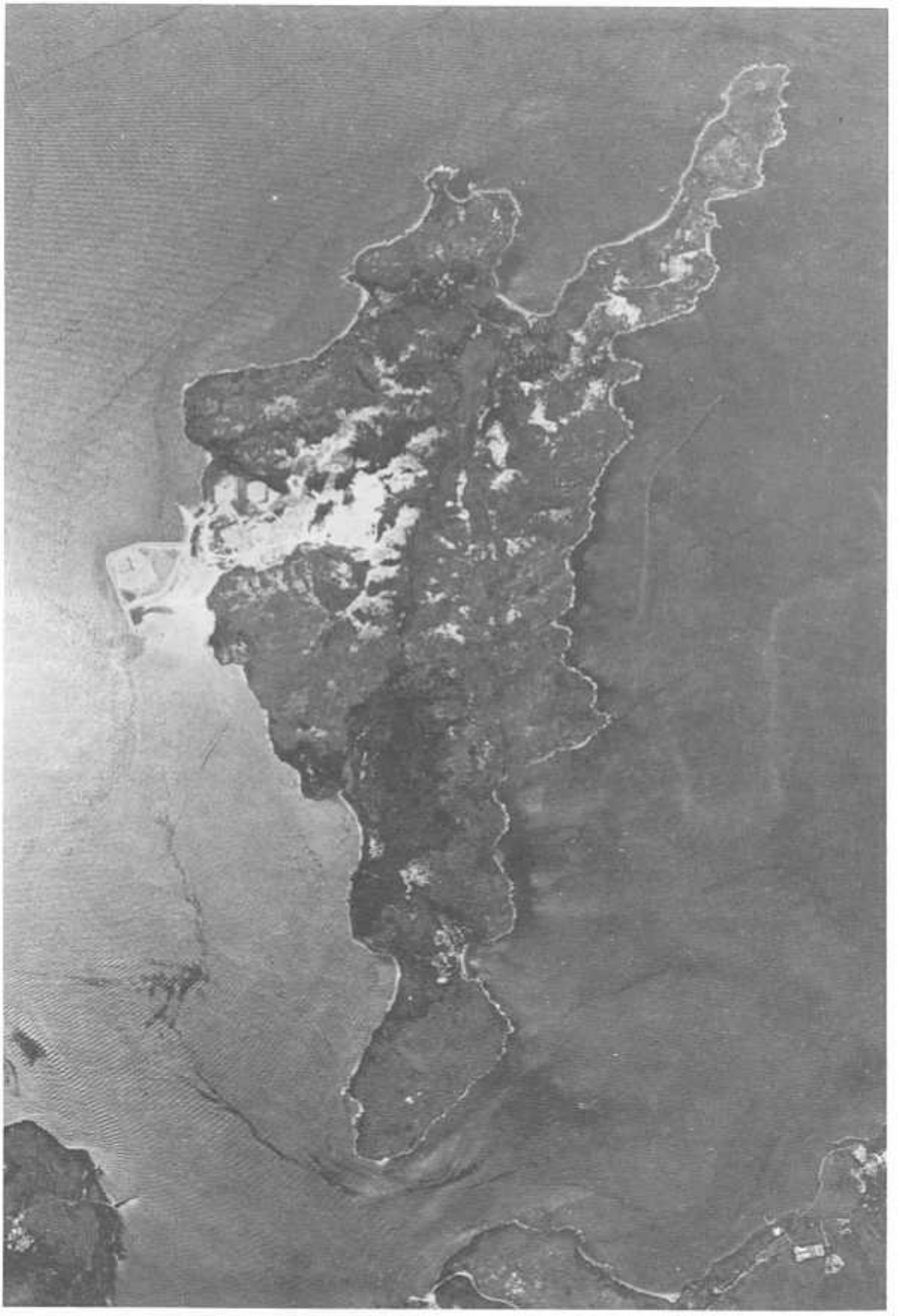

Plate 23 - 1988 Aerial Photograph (A12182) Showing Revegetation, Mining, Borrow and Reclamation in the Island

Plate 24 - Vegetation Regrowth Encroaching on Gullied Weathered Granite with Quartz Veins, North of Fu Tau Shan (185 111)

vein exposed in a gully in weathered granite east of the test embankment broken down into tablets. The disintegration of the vein gives a mosaic-like appearance before erosion causes complete collapse. A similar feature south of Cheung Sha Lan (1101 1930) shows progressive overturning of the mosaic-like wall of vein quartz due to soil creep.

The rhyolite dykes have little compositional contrast with the surrounding granite and the only readily observable weathering contrast is in the abundance of hard, resistant corestones. The soil derived from weathering of the aphanitic groundmass is much more clayey than that of granite, but this feature is not well seen in the limited exposures. The dykes form good corestones, on the southern peninsula for example.