

1976/56. The geology of Three Hummock Island.

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Three Hummock Island is situated in Bass Strait, approximately 45 km north-west of Smithton. There are two airfields on the island catering for light planes. The older comprises a pair of short, well grassed strips, situated in the small cleared and developed area near the homestead in the extreme south-west of the island. The second airfield has been recently constructed to allow rapid access to the Telecom radio-telephone repeater station, located on South Hummock. This field comprises two strips, one 850 m in length, and is fully fenced. It is connected to the repeater station by a high grade gravel road 4 km in length.

Other tracks about the island, used for stock management and mutton birding are in a poor and deteriorating condition. Many of those conspicuous on the 1968 air-photos cannot be followed on the ground through rapid regrowth areas.

The Commonwealth Lighthouse Service maintains an unmanned beacon on Cape Rochon in the north-east, which can be serviced by air or sea. Field work was undertaken in the period 13-24 July.

TOPOGRAPHY

The island is roughly circular in shape, with segments of higher ground in the north-east (centred on North Hummock, and including Middle Hummock) and in the south (centred on South Hummock and extending from Cape Adamson in the east to Granite Hill in the west). The flat, low-lying, poorly-drained country forming the central part of the island extends to the coast on a wide frontage behind West Telegraph Beach, and a narrow frontage at East Telegraph Beach.

Typically, the land rises rapidly from the coastal platform at present sea level, to a height of 40-50 m within 500 m of the shore. This level is maintained with little variation and negligible outcrop over much of the island, being relieved by occasional small hills of bedrock (the Hummocks) and swampy depressions. It appears that the plain is a persistent marine erosional level carrying sparse accumulations of late marine sediments, all with a copious soil cover derived mainly from reworked windblown sand. Stabilised recent sand dune terrain occupies some 3 km² behind Home Beach in the south-west, and a further 6 km² behind West Telegraph Beach. A large, active sand-blow behind West Telegraph Beach was not investigated.

The coastal zone shows a rocky granite shore platform backed by degraded cliff-forms surmounted by tors, and relieved by occasional small sandy coves. Sea caves occur at or near present sea level, and are usually roofed with cemented boulder talus. Major beaches constitute only some 10 km of the coastline and are apparently stable at Coulomb and East Telegraph Bay, while Home Beach in the south-west is developing a sand-spit centrally and eroding at the eastern end during storms.

Inland topography is subdued, consisting of well vegetated plains, marshes and low conical hills.

GEOLOGY

The islands within 40 km of Cape Grim [CQ046937], on the north-west headland of the State, show diverse geology. The Tertiary volcanic rocks of Cape Grim occur sporadically to the north for 20 km, composing Trefoil

[CQ045995] and Steep Islands [CR040070], and the islets of North Black Rock [CR004164] and South Black Rock [BR960064]. The predominantly quartzite Precambrian succession of Woolnorth Point [CQ076984] crops out at intervals for some 30 km to the north, through Bird [CR070025] and Stack Islands [CR118025] to Cape Keraudren [CR109254], the northern tip of Hunter Island. Granite is unknown in the extreme north-west of the Tasmanian mainland, but is reputed to compose Penguin Islet [CR146060], and forms the basement of Three Hummock Island. These islands represent outcrops of north-south tracts of contrasting rock types, with geological boundaries obscured by sea water.

ALBATROSS ISLAND

The exception to this pattern is Albatross Island [CR009288], 2 km north and 11 km west of Cape Keraudren. The island is elongate north-south and is about one kilometre in length and 0.25 km in width. From aerial inspection, it is composed of a succession of coarse conglomerate beds dipping some 45° west, producing a small level summit, a western dip slope and a precipitous scarp to the east. The conspicuous, regular and persistent bedding is defined by preferential erosion of less bouldery horizons. The rock matrix is a liverish brown in colour, relieved by darker and lighter fragments including white (?quartz) boulders of football size, or larger.

The rock is unlike the Tertiary agglomerates of the area and more regularly bedded, and is different from anything located among the Precambrian succession of Hunter Island. However siltstones and mudstones (interpreted as overlying the main quartzite unit of Hunter Island) include deep red-brown and dark grey members. Although the conglomerate is thought to be of Precambrian age, no comparable lithological type is known in the Woolnorth area. The north-south strike and steep westerly dips are common to Albatross Island and the west coast of Hunter Island.

THREE HUMMOCK ISLAND

The geological structure of Three Hummock Island is simple, consisting of a single granite pluton, with only small rare inclusions of original host sediments (in states of partial alteration), and a nearly continuous veneer of Cainozoic deposits. The island has a coastline length of some 50 km, of which some 10 km consists of major sandy beaches, and 40 km of nearly continuous granite outcrop, giving adequate opportunity to observe progressive variation in textural and mineralogical composition.

Granite

The granite is typically a coarsely porphyritic biotite-muscovite granite, with a variable content of tabular feldspar phenocrysts occasionally 30 mm, commonly 100 mm, and rarely 150 mm in length.

West Coast. In the west of the island, about Burgess Point and the headland to the south, the granite is uniform, with prismatic feldspar phenocrysts 30 or 40 mm in length, and biotite more abundant than muscovite. Xenoliths are small and rare, flow alignment barely perceptible and local increases in biotite concentration occur only as diffuse shadowy swirls. The occasional aplitic dykes have irregular margins and elongate lensoid form. Tourmaline occurs rarely in small pegmatite segregations. North of Coulomb Bay, the bedrock remains homogeneous granite with sparse feldspar phenocrysts attaining 60 mm in length. Biotite and muscovite occur in the matrix: xenoliths are small and scarce, and aplite and microgranite dykes are rare. From North West Cape towards Rape Bay, a progressive conspicuous increase in feldspar phenocryst size and frequency, and an increase in the proportion of muscovite, is noted. Tourmaline, seen previously only in veins, dykes and pegmatite

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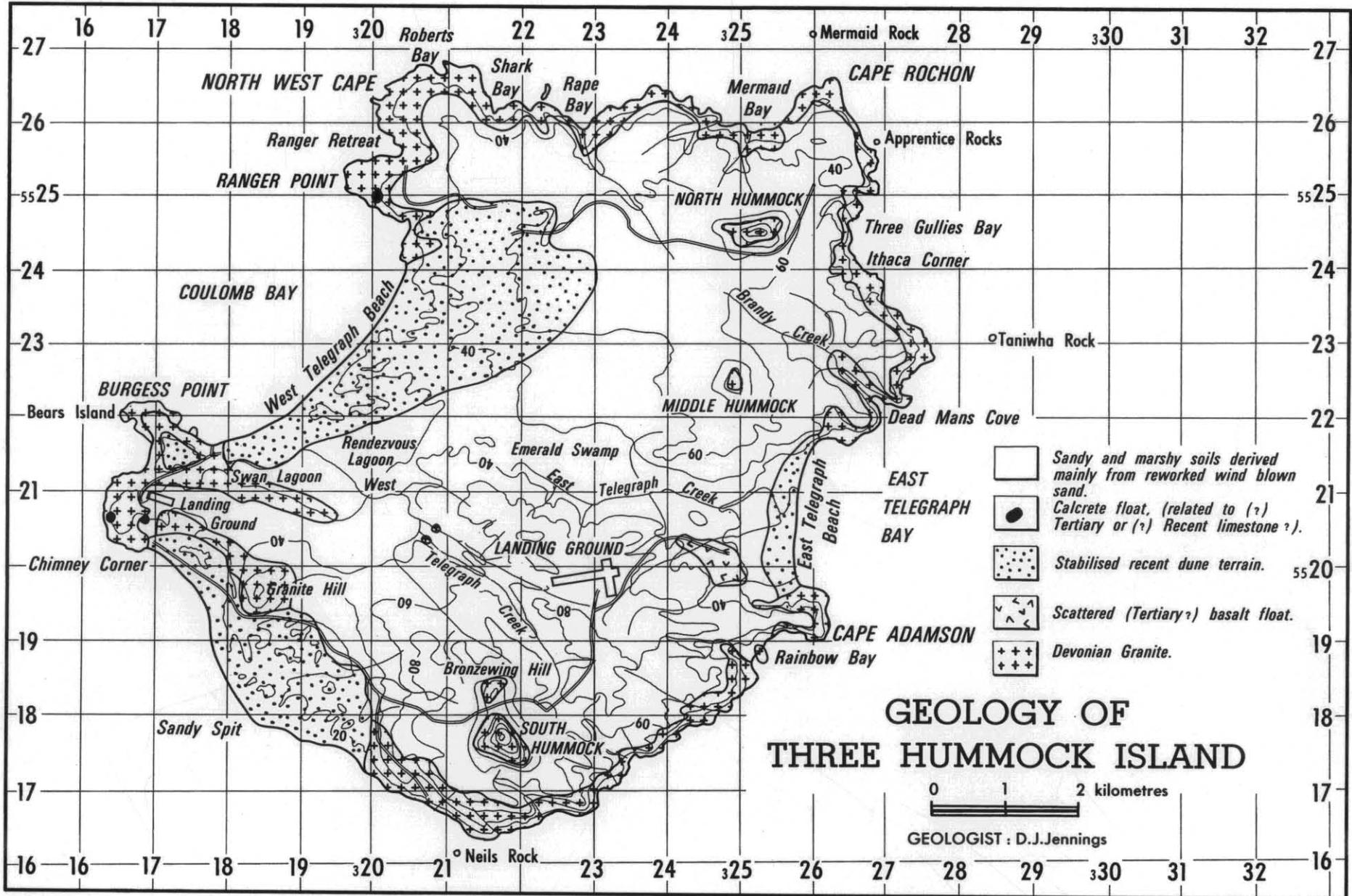
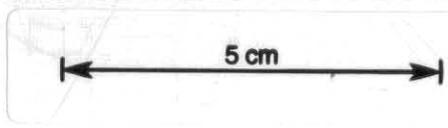


Figure 1.



segregations, occurs occasionally as bunches of radiating crystals in the matrix of the rock. On the shores of Roberts Bay, tourmaline occurs abundantly in pegmatites, tourmaline-muscovite microgranite dykes, and in the porphyritic biotite-muscovite-tourmaline granite bedrock.

North Coast. Traversing easterly along the northern coast platform, the tendency for the feldspar phenocrysts to increase both in size and number persists, and flow alignment is often conspicuous. Biotite is consistent, while muscovite varies in amount. Tourmaline, which can usually be detected in the rock matrix, becomes locally abundant adjacent to common tourmaline-muscovite microgranite and pegmatite dykes. Concentrations of close-packed, above-average size feldspar phenocrysts, associated with occasional small xenoliths, form irregular-shaped swirled patches several metres in extent. One isolated xenolith included minute grains of garnet. Biotite in the rock shows two contrasting habits; the first, typical abundant randomly-dispersed flakes; the second, phenocrysts, rarely closer than 200 mm, consisting of prismatic aggregates of flakes attaining 25 mm in length and 10 mm in diameter. Rusty staining and amorphous iron-rich alteration products located in several pegmatite segregations are apparently the result of weathering and breakdown of tourmaline.

East Coast. The bedrock of the subdued coastline between Cape Rochon and East Telegraph Bay persists as coarse-grained, feldspar-porphyritic, biotite-muscovite granite, with tourmaline common in dykes, veins and pegmatite segregations, and often in the matrix of the rock. Shows of 'heavy' minerals on the beaches are invariably dominated by sub-angular tourmaline grains, with some topaz and negligible amounts of other minerals. Some coves produce almost monomineralic gravel patches of sub-angular feldspar phenocrysts up to 60 mm in length. Among these are rare, eroded, rounded biotite phenocrysts some 10 mm in diameter. Xenoliths, never abundant, are invariably present, both isolated in homogenous bedrock, and more commonly among dense concentrations of feldspar super-phenocrysts in irregular swirled patches, often with interstitial tourmaline. The coastline south of Ithaca Corner is characterised by a series of undulating, near-horizontal lensoid sheet-intrusions of banded microgranite and aplite, with abundant pegmatite segregations and vugs, transgressed by successive generations of more vertical dyke intrusions.

South Coast. The rocks at Cape Adamson south of East Telegraph Bay, are markedly different from those further north. Although some muscovite and tourmaline persist, they are much less common. The granite is coarser, darker (with increased biotite content), and the feldspar component is concentrated in numerous irregularly-distributed euhedral phenocrysts of feldspar, frequently 120-150 mm in length. Xenoliths are common, variable in composition, sometimes zoned, frequently elongated, and occasionally associated in 'pudding-stone' accumulations with super-phenocrysts. Apparently identical feldspar crystals penetrate the xenolith boundaries, and locally are included within, (or develop within) the xenolith margins.

A coarse-grained, muscovite-deficient, xenolith-rich, abundantly super-porphyritic variety of mafic granite constitutes the rugged south-east shore line.

Inland outcrops. Rock exposure away from the coast is poor and is usually confined to the low hills, where the granite appears similar to that on the adjacent coast. North and Middle Hummock provide sufficient exposure to indicate a granite composition of the Cape Rochon type. South Hummock is composed of the south-west coast mafic variety and Granite Hill is composed of the Burgess Point type.

Banded granite

Several good examples of pseudo?-sedimentary banding of minerals within the granite were observed. On the western side of Cape Rochon, opposite Mermaid Rock, as many as thirty distinct repeated dark mineral bands occur, associated occasionally with perfectly aligned 50 mm to 80 mm feldspar phenocrysts. The banded mineral appears to be exclusively biotite with wisps of tourmaline randomly disposed, suggesting a later development. On the eastern side of Cape Rochon, opposite Apprentice Rocks, several metres of repetitive mafic banding are displayed, showing divergence, cross-cutting and cut-out relationships and irregular concentrations of small xenoliths and super-phenocrysts of feldspar.

Extremely rapidly repeated mafic banding is exposed at Chimney Corner in the west of the island, with some 50 repetitions in 3 m. The biotite bands dip and swirl, lens-out, bifurcate and cross-cut. In an adjacent well-exposed section, several mafic bands swing progressively through 180° in 5 m, sandwiching a train of perfectly aligned feldspar phenocrysts, suggesting a trough-like depositional surface or highly mobile material deformed after 'deposition'.

Irregularities in biotite distribution are not uncommon, but well developed banding was not seen in the north-west or south-east.

Rafts, roof-pendants and xenolith patches

The only indications of the host bedrock into which the granite was intruded are the included fragments preserved within the granite. Three major exposures of this material occur, in progressively higher states of metamorphism and assimilation. The least altered, and topographically highest outcrop is on the peak of South Hummock and is exposed by roadworks for the Telecom Repeater Station. Here a raft or pendant of hornfelsed, fine-grained sediments, including grey and khaki fine-grained micaceous sandstone, is exposed for a distance of 18 m.

On the southern shore platform, opposite Neils Rock, the granite is grossly contaminated and carries abundant large and often close-packed xenoliths over a distance of 200 m. The major raft, some 8 m long and 3 or 4 m wide, is indurated and hornfelsed, but retains flaggy bedding, and tassellated ends where intrusion of granite has followed bedding planes. Feldspar phenocrysts, frequently 150 mm in length, are common and form concentrations, both among the xenoliths and associated with examples of repetitive pseudo-sedimentary bedding.

Some 1.5 km further west, the granite of a small headland includes a raft, some 80 m in length, of dark hybrid rock (possibly mobilised, digested sediment), with variable mineralogy, included tracts of granite, indubitable sediment and 'pudding-stone' features.

Possible Tertiary sediments and basalt

Limestone. The home paddock, south of the landing strip in the west of the island, carries a copious float of large rounded and sculptured boulders of limey material, of the sort common at Cape Portland and Cape Barren Island associated with Tertiary limestone. However no outcrop was located at this locality, but a low grassy hummock, in the centre of the paddock could be limestone. Vaguely similar material forms a float and series of lenses overlying granite, but underlying fairly recent dune sand rich in shell fragments, and may be developing currently on redistribution of calcite by ground water. Samples for further study were collected from the top of the cliffs

west of the homestead, from Ranger Point in the north-west, and some more compact material from a boulder on the coastal platform west of the homestead.

Grits and gravels. Evidence of other possible Tertiary deposits is extremely rare, largely due to windblown sand and vegetation cover, and lack of man-made exposures. Material excavated during the airfield construction was used to pave the road to South Hummock. The cuttings at the airstrip exposed a deposit of redistributed rotten granite debris with a high angular quartz and high clay content, but included extremely rare perfectly rounded quartzite pebbles to 25 mm. Settling after agitation with water resulted in a high degree of compaction, due largely to wide grading of components, but partly (perhaps) to clay cementation. Horizons in the sediment showed enrichment in dark mineral which proved to be entirely tourmaline.

Basalt. A small locality about one kilometre west of East Telegraph Beach was once cleared for agricultural purposes, but has now reverted to Silver Tussock and prickly mimosa. The area of some 0.3 km² is covered with brown sandy loam with occasional isolated or accumulated patches of basalt boulders. A break in slope to the east may define the margin of the basalt 'patch', and a creek bed to the south, also with local shows of basalt boulders, may indicate a southern boundary. No other evidence of Tertiary volcanic rocks was seen on the island, except for travelled pebbles on the beaches around the island, conspicuously more common in the south and west and relatively rare in the north-east.

Superficial sand cover. A film of windblown sand in original or redistributed form covers most of the island, and probably differs in age of deposition from place to place. It is the major component of the soils, and extends high on the flanks of the hills.

The hummocky terrain of stabilised recent dunes with peaks exceeding 40 m, is conspicuous behind Home Beach in the south-west, and West Telegraph Beach in the west. Similarity of development and maturity suggest a similar age of formation. Lagoons trapped behind these dunes preserve major tree trunks in their growth position indicating the invasion of sand and its stabilisation as quite recent.

ECONOMIC GEOLOGY

No indications of economic mineral concentrations were observed and there is no obvious target for further investigation. Traversing inland was sparse, and outcrops negligible. A tract of country some 1.5 km wide in the east to 2.5 km wide in the west extends across the island with no known rock outcrop. Simple geophysical means might indicate a possible bedrock configuration in this area. The relatively low-lying, ill-exposed region in the centre of the island may represent the outcrop of preserved pre-granite sediment (as on Clarke Island), but there is no evidence to suggest this.

RECOMMENDATIONS

Basically, there seems little objection to declaration of Three Hummock Island as a Native Reserve.

The original ecology has not been seriously disturbed and the inaccessibility should render it relatively easy to police. No economic deposits are suspected at the present time, on the limited information currently available. The scope for a number of interesting research projects is obvious. These include studies on:

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- (1) Granite petrology, and progressive variation in relation to muscovite and tourmaline.
 - (2) Structures within granite plutons, with particular relevance to flow alignment and systematic and repetitive mineral accumulation.
 - (3) Granite contamination, related to included rafts of bedrock; xenoliths and their composition.
 - (4) Tertiary or recent limestones. (Should the samples collected prove to be Tertiary in age, some bore holes in the home paddock may be required).
 - (5) Geomorphology on a regional scale, involving the search for preserved remnants of elevated marine sediments.
 - (6) The unknown east-west tract through the centre of the island; the establishment of bedrock configuration by geophysical means.

In making recommendations regarding Three Hummock Island it must be stressed that to attempt a reconstruction of the development of the Bass Strait throughout geological time, all existing information must be readily available. By its very nature, information must be gathered from sites which are few and far between. Three Hummock Island is a vital piece of the jigsaw. Unimpeded access to research geologists should be guaranteed.

[16 September 1976]