

ATOLL RESEARCH BULLETIN
NO. 181

SAND CAYS OF TONGATAPU

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Issued by
THE SMITHSONIAN INSTITUTION
Washington, D.C., U.S.A.

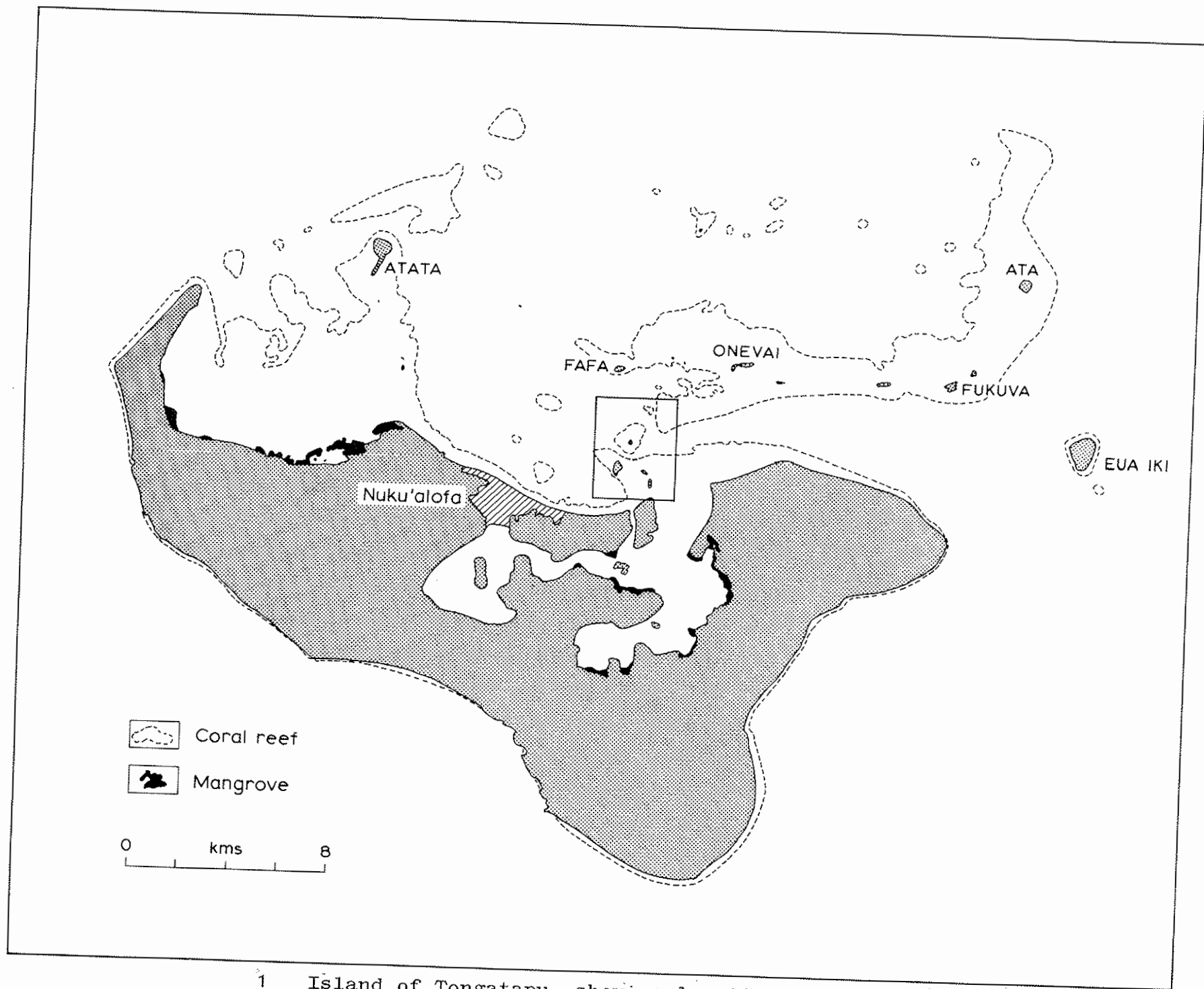
January 15, 1975

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1 Island of Tongatapu, showing location of the

SAND CAYS OF TONGATAPU

by D. R. Stoddart^{1/}

INTRODUCTION

Tongatapu, like Tahiti, was visited by many early European navigators and was one of the first of the South Pacific islands to be charted in any detail. Though it was discovered (and named Amsterdam Island) by Tasman in January 1643 (Sharp 1968, 152-158), the first comments on the sand cays of the surrounding reefs were made by Cook during his second voyage, with the Resolution and Adventure, in October 1773. On this occasion Cook spent less than a week at Tongatapu, anchored in the northwest, and commented that "it would have taken up more time than I could spare to have surveyed these parts Minutely as there are a number of small Islots and reefs of rocks extending to the NE even further than we could see" (1961, 261). His naturalists, the Forsters, did not describe the cays, though Georg Forster remarked on the emersion of reef limestones on Tongatapu and its similarity to the continuing emergence of the land in Scandinavia (1777, I, 453). Cook returned on his last voyage in 1777, with the Resolution and Discovery, and stayed for a month. He anchored near modern Nuku'alofa and landed on Pangaimotu and possibly other islands (1967, 124-125, 155, 890). He charted the area but gave no description of the cays.

D'Entrecasteaux's expedition in seach of La Pérouse, with La Recherche and L'Espérance, visited the area in March and April 1793. The chart of the harbour was revised by Beautemps-Beaupré (1807), and incidental mention of the cays was made by Labillardière (1800) and Rossel (1808). Pangaimotu was best known, for there D'Entrecasteaux established his observatory. Almost immediately afterwards the mission ship Duff called, and Wilson (1799) gave a further chart and description. Thirty years later, Dumont D'Urville called with the Astrolabe (April-May 1827) and also established an observatory on Pangaimotu, where his naturalists, Quoy and Gaimard, landed. He described his stay at Tongatapu (1830-33, IV, 34, 75) and Pâris (1833) added to the chart. In common with the other early expeditions it is not possible to determine which specimens

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(Manuscript received May, 1972--Ed.)

were collected on the cays rather than the main island, since locations are given only as "Tongatapu", but it is likely that many of the land plants and marine molluscs came from Pangaimotu and the surrounding area. Quoy and Gaimard themselves (1833, 331) only explored the reef round Pangaimotu, which they found "rich in Molluscs and Zoophytes of all kinds". Finally, in April 1840, the United States Exploring Expedition under Charles Wilkes (1845) called, and it too established its observatory on Pangaimotu.

In view of this documented history, it is surprising that no account of the sand cays north of Tongatapu exists in the literature, apart from brief notes in the Pacific Islands Pilot, nor are the modern reefs of the southern Tonga Islands at all well known. The opportunity of a brief visit to Nuku'alofa in September 1969, during the Cook Bicentenary Expedition to the South Pacific, was therefore taken to visit four of these islands. No collections could be made, and this account depends on rapid compass traverses and field notes made at that time. It is hoped that this whole complex of reefs and islands can be properly studied now that Nuku'alofa itself is accessible by air.

Tongatapu is one of the southernmost islands of the Tonga Group, on the west side of the Tonga Trench. It is a limestone island 35 km long, with a maximum elevation in the southeast of 61 m. The northern shore of the island is deeply embayed, and its fringing reefs extend offshore to the northwest and northeast, enclosing a shoal platform 25-35 m deep (Figure 1). Small sand cays and some raised limestone islets are situated on these reef flats.

The prevailing winds are the Southeast Trades: 60 per cent of wind observations are from the east and southeast, and about 10 per cent each from the northeast and south. Mean wind speeds are 7-10 kts. Hurricanes occur infrequently during the southern summer, approaching Tongatapu from the north and northwest. Mean annual rainfall at Nuku'alofa is 1784 mm, being highest during January-March and lowest in June; annual totals are rather variable. Mean daily maximum temperatures vary from 25°C in July-September to 29°C in January-March, and mean daily minimum temperatures from 18°C in July-September to 23°C in February-March. The mean of the highest temperatures recorded in each month reaches 31°C in February-March, and the mean of the lowest in each month falls to 13°C in July-August. For a tabulation of climatic data for Nuku'alofa, see Pacific Islands Pilot (II, 1969, 32). The tidal range at Nuku'alofa is 1.22 m at springs and 0.98 m at neaps (Admiralty Tide Tables, III, 1971, 374).

The four islands visited are all sand cays, their vegetation a coconut woodland much altered by man, with a littoral scrub dominated by Hibiscus tiliaceus. By comparison with reef islands in the Cooks, the absence of common littoral species such as Suriana, Pemphis and Tournefortia, and the relative unimportance of Scaevola and Guettarda are remarkable. The reef flats, however, are densely carpeted by sea grasses, absent in the Cooks, though mangroves, while present at Tongatapu, are inconspicuous on the cays visited (cf. Yuncker 1959).

THE CAYS

Makaha'a

Makaha'a (Figure 2) is a small oval sand cay, 310 m long and 170 m in greatest width, area 3.9 ha, on the eastern side of a reef patch isolated from the Tongatapu fringing reefs by a narrow channel about 10 m deep. It is approached through a gap in the encircling reef at its northeast point. The cay was mentioned by Cook in 1777 (Maccoha) and Labillardière in 1793 (Mackaha), but the fullest early account is that by Wilson on 26 April 1797: "We therefore embarked again, and crossed to another, called Mākkahah: this we found well stored with cocoa-nuts, plantains, breadfruit, and sugar-cane, also good fresh water. Upon the beach we found a curious coral rock, much resembling the stump of an old tree, about five feet high and four thick; it was full of holes, in which were a great number of water-snakes..." He encamped on Makaha'a: "the few natives, about thirty in number, became our servants; from whom we could afterwards draw whatever we wanted of the produce, or demand their fish, if we chose it; or improve the island by making what alterations in it we pleased" (Wilson 1797, 233).

The island has aggrading sand beaches on its west and northwest sides, and flat gravel spreads fronting eroded sand cliffs on its east side. These cliffs are 1½-2 m high along most of the east shore (Figure 6), rising to 3 m in the southeast. Beachrock is extensively exposed, especially in the southeast (Figures 7 and 8), and the island is clearly migrating towards the northwest. The eastern cliff is cut in sand, exposing coconut roots, and is marked by fallen coconuts and some large fallen Hernandia. There is a waterhole near the northeast point.

The vegetation is primarily an open coconut woodland with a varied undergrowth of low trees (Hernandia, Leucaena,

Carica, Thespesia, Pandanus), shrubs (Colubrina asiatica, thicket-forming Lantana camara, Rivina humilis), herbs (Hymenocallis, Euphorbia chamissonis, Vigna marina, Passiflora, Leonotis, Cassytha filiformis, Polypodium), and grasses (probably Stenotaphrum and Sorghum). In the southeast this coconut woodland reaches the shore. Elsewhere there is a littoral thicket of Hibiscus tiliaceus scrub, with scattered Guettarda, Calophyllum, Pandanus, Leucaena, and occasional Scaevola. On the aggrading west shore there are patches of pioneer strand vegetation: Sporobolus, Vigna marina and Cassytha. Some species are represented only by seedlings: Morinda and Casuarina in the coconut woodland, Rhizophora on the shore.

Pangaimotu

Pangaimotu (Figure 3) is the largest of the islands considered here, and the closest to Nuku'alofa; it is permanently inhabited and has a long history of human settlement. Water depths between it and the Tongatapu fringing reefs are less than 2 m. The island is roughly triangular, 680 m long N-S and up to 500 m wide, with an area of 22.3 ha. The shores are aggrading except at the extreme eastern and western points; beachrock outcrops only at the latter, at the foot of the beach (Figure 9).

The island was well-known to late eighteenth and early nineteenth century navigators. Cook mentioned it (as Pangymaudoo) in 1777, and D'Entrecasteaux in 1793 (Panghaimodou), Dumont D'Urville in 1827 (Pangal-modou), and Charles Wilkes in 1840 set up shore observatories there. On writer (Anonymous 1810, 68) referred to "Bonghy-Moddoo; on which former navigators pitched their tents, as a convenient spot, on account of its separation from the main Island, to preserve themselves from being too much incommoded by the natives". Cook has little to say of the cay, though Anderson (Cook 1967, 890) recorded that fresh water was available. Water was also found by D'Entrecasteaux: "On avoit aperçu, dans le centre de l'île Panghaimodou, un lieu où étoient creusés plusieurs trous qui fournissoient de l'eau médiocrement bonne ... On creusa tout l'espace où étoient contenues ces petites sources; ce qui forma un réservoir assez grand pour remplir nos barils" (Rossel, 1808, 278). Dumont D'Urville also found the water not of good quality (1830-33, IV, 75). The most detailed account comes from Labillardière (1800, 101): in the interior of the island "nous traversâmes des bois fourrées à l'ombre desquels croissoient le tacca pinnatifida, le saccharum spontaneum, le mussaenda frondosa, l'abrus precatorius, le pouvrier qui sert aux habitans à faire le kava, etc. Nous marchâmes ensuite sur des terrains employés les uns à la

culture des patates, les autres à celle de l'espèce d'igname appelée dioscorea alata: nous voyions d'ailleurs de jeunes plantes de yacoua, pandanus odoratissima, dont les feuilles servent à faire des nattes. Plus loin nous trouvâmes à cause de son écorce dont ils fabriquent des étoffes pour se vêtir. L'hybiscus tiliaceus croissent spontanément sur les bords de ces diverses cultures et tout par la mer ..."

The island is covered with coconut woodland surrounded by a thicket of broadleaf trees; the interior was not investigated. The coastal woodland in the southeast (Figure 10) comprises shrubs of Sophora with Hibiscus, Cordia, Thespesia and Pandanus, fronting taller woodland of Calophyllum, Guettarda, Hernandia and Cocos. Along the north side of the island bushy Hibiscus, Thespesia, Cordia and other trees line a narrow beach; other trees and shrubs include Colubrina, Xylocarpus, Morinda, Leucaena, Pandanus and Cocos, with clumps of Rhizophora in shallow water offshore (Figure 11). Erosion at the east point brings tall trees of Hernandia with Pandanus and Cocos to the water's edge. Along the southeast shore the beach is wider: the trees (Calophyllum, Guettarda, Cocos) are fronted by a wide low shrub zone (Scaevola and Hibiscus) with pioneer herbs and grasses (Ipomoea, Vigna, Sporobolus, Cenchrus). The littoral scrub opens at the western and southern points, where there are settlements. Cocos, Artocarpus and Casuarina are found here, with Sporobolus, Hymenocallis, Ipomoea, Catharanthus, Carica, Passiflora, and other cultivated, decorative and weed species.

There is a white navigation beacon on the southwest coast, 160 m north of the south point.

Manima

Manima (Figure 4), east of Pangaimotu, is a much smaller island (410 m long, up to 110 m wide, area 3 ha), aligned WNW-ESE. It is a low island, reaching about 1 m above high water level, with intertidal fresh sand spits at each end, and with no beachrock exposed. Labillardière in 1793 commented: "L'Ile de Manima offre un terrain peu cultivé; cependant nous y vîmes quelques champs d'ignames, des cocotiers et des bananiers" (1800, 129).

The island is covered with coconut woodland, with partly bare ground beneath, surrounded by a tall and dense fringe of broadleaf woodland. Taro, cassava and eggplant are grown beneath the coconuts, and Stachytarpheta and Polypodium are common. The littoral woodland is dominated by Hibiscus and Thespesia, with Cordia, Pandanus, Leucaena

and Guettarda, and clumps of much taller Hernandia, Calophyllum and Xylocarpus. At the west end there is an area of low shrubs, herbs and grasses: Sporobolus and Cassytha, with Stachytarpheta, Lantana and Leonotis.

Manima is inhabited; in 1969 there were also goats, pigs and dogs on the island.

Oneata

Oneata (Figure 5) is a larger island immediately south of Manima; it is 550 m long, up to 200 m wide, and 7.8 ha in area. Vegetationally it resembles Manima in its coconut woodland fringed with dense Hibiscus scrub. Several early navigators mentioned the island without giving any details; D'Entrecasteaux's experiences there were of a non-scientific nature - "nous fumes bien surpris de voir un chef qui ... permettait à un particulier de notre vaisseau la plus grand liberté avec une des plus jeunes personnes de l'île" (Labillardière, 1800, 129).

The island is a low sand cay; the shores appear stable, though the beaches are narrow, and no beachrock was seen. The coastal vegetation is mainly Hibiscus woodland with Guettarda, Eugenia, Pandanus, and other species, replaced in the northwest by single-species woodland of Cordia and elsewhere by Thespesia. There is almost no pioneer vegetation seaward of the Hibiscus hedge, except for some low Scaevola in the southeast. Inland the littoral scrub rises to a taller woodland of Calophyllum, Cocos and Pandanus, with massive emergent Hernandia.

The coconut woodland over the centre of the island has a highly diverse undercover: trees such as Leucaena and Morinda, shrubs such as Colubrina and Rivina, herbs and grasses such as Stachytarpheta, Solanum nigrum, Boerhavia, Cenchrus and Polypodium. Casuarina trees are found near the houses at the north point, and there is a taro field. Horses, pigs and chickens were seen.

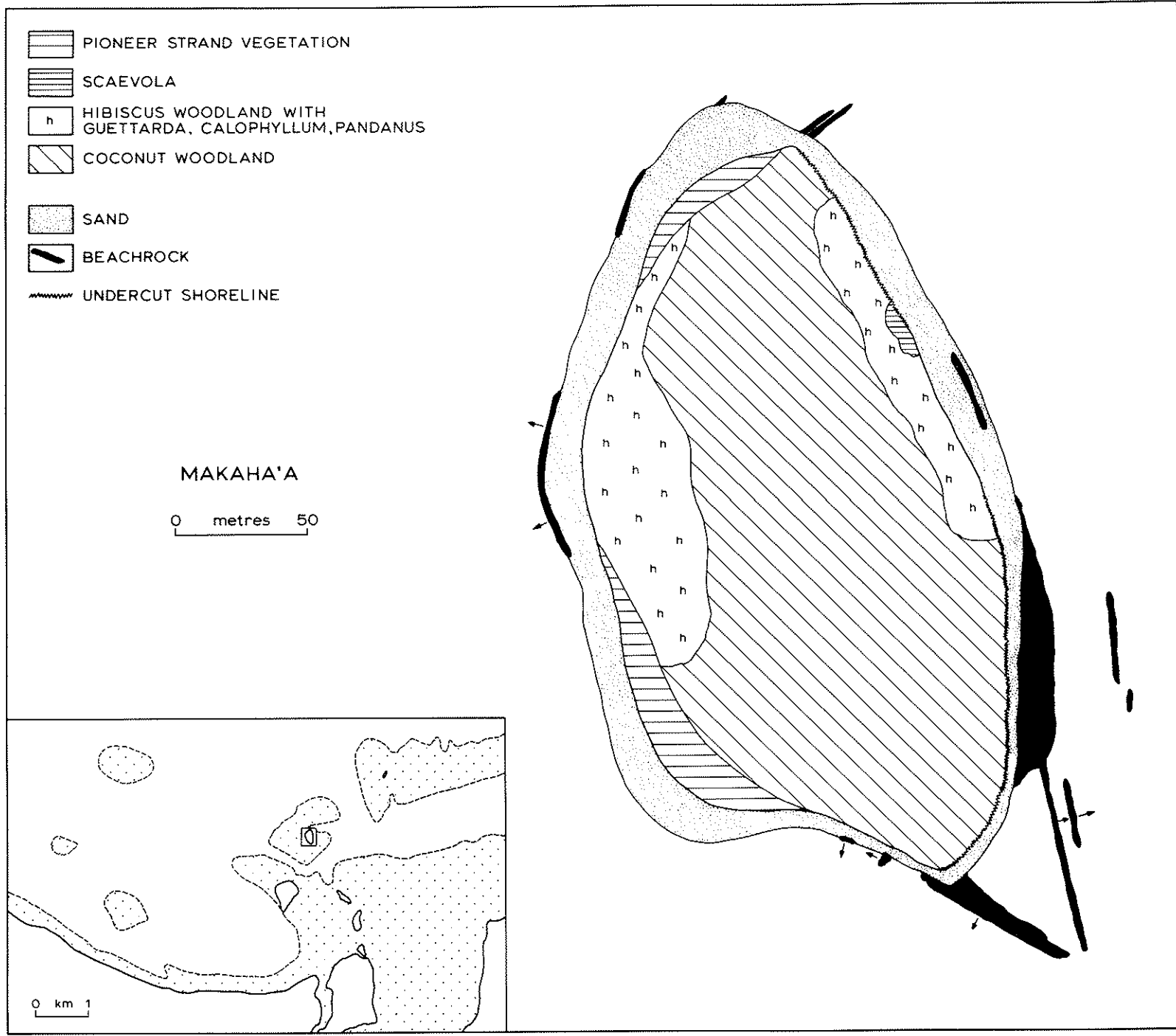
ACKNOWLEDGEMENTS

I thank the Royal Society of London and the Royal Society of New Zealand for the opportunity to take part in the Cook Bicentenary Expedition to the South Pacific in 1969, during which I was able to spend three days at Nuku'alofa. I thank Dr F. R. Fosberg who identified several plants from photographs.

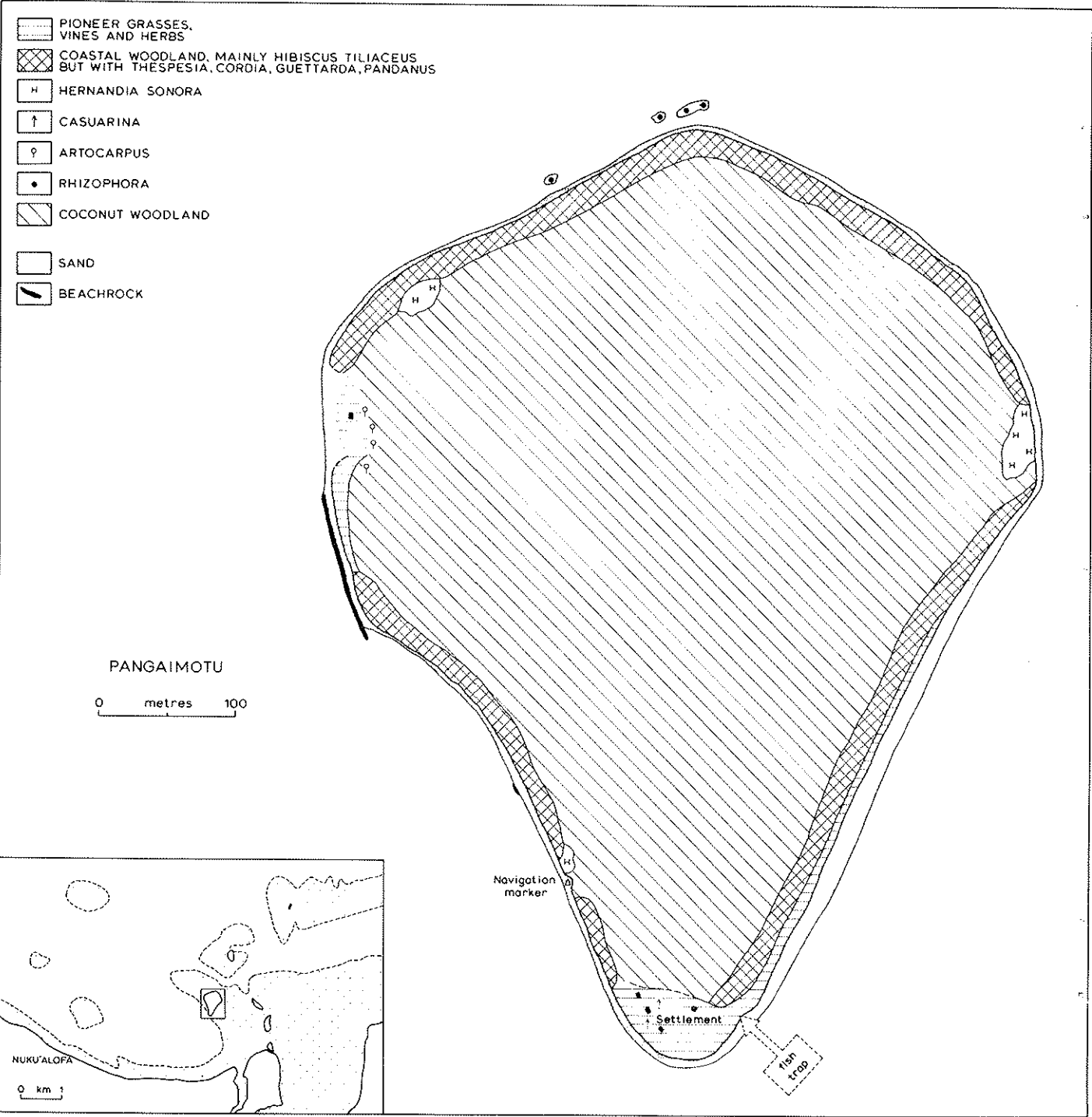
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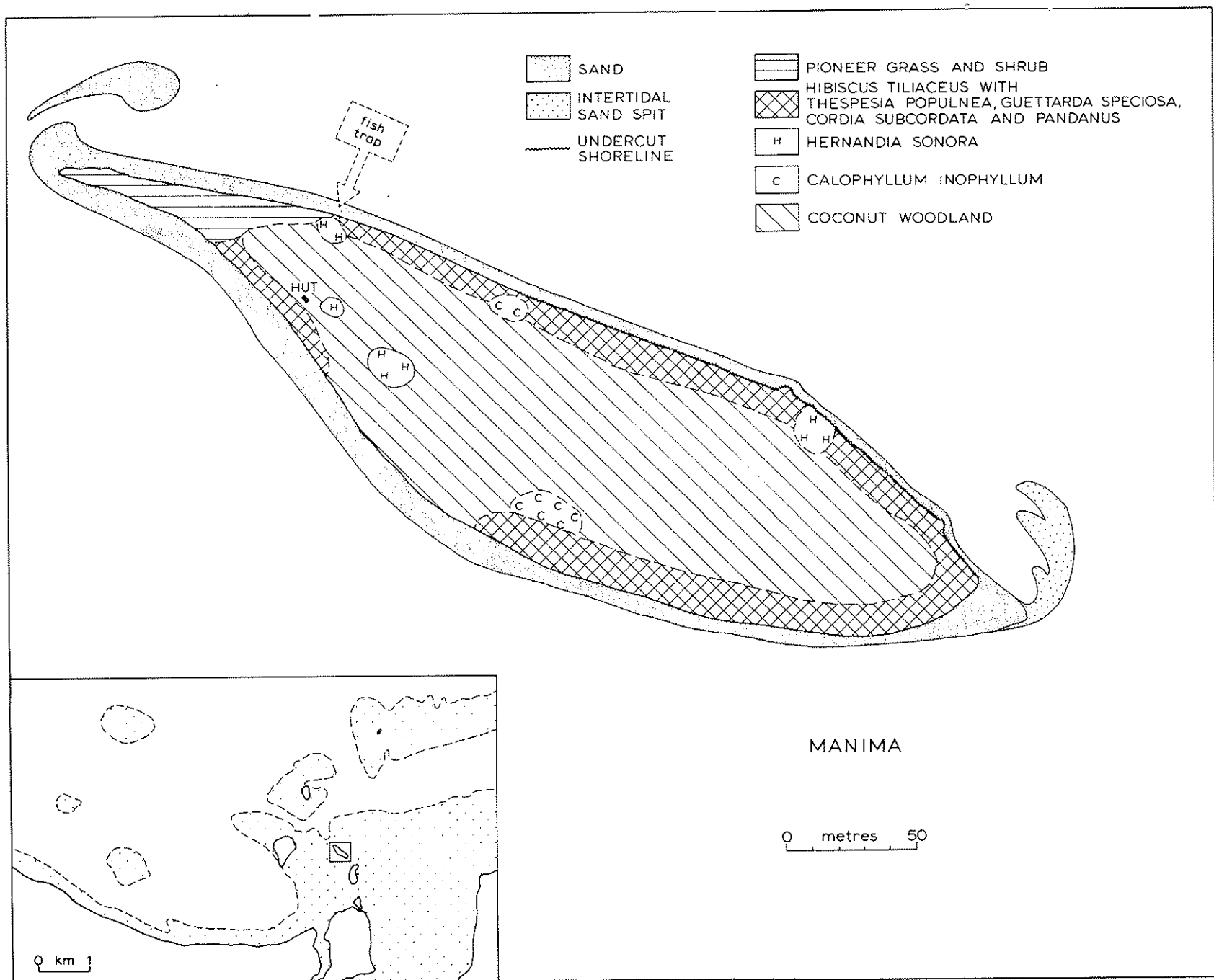
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








2 Makaha'a



3 Pangaimotu

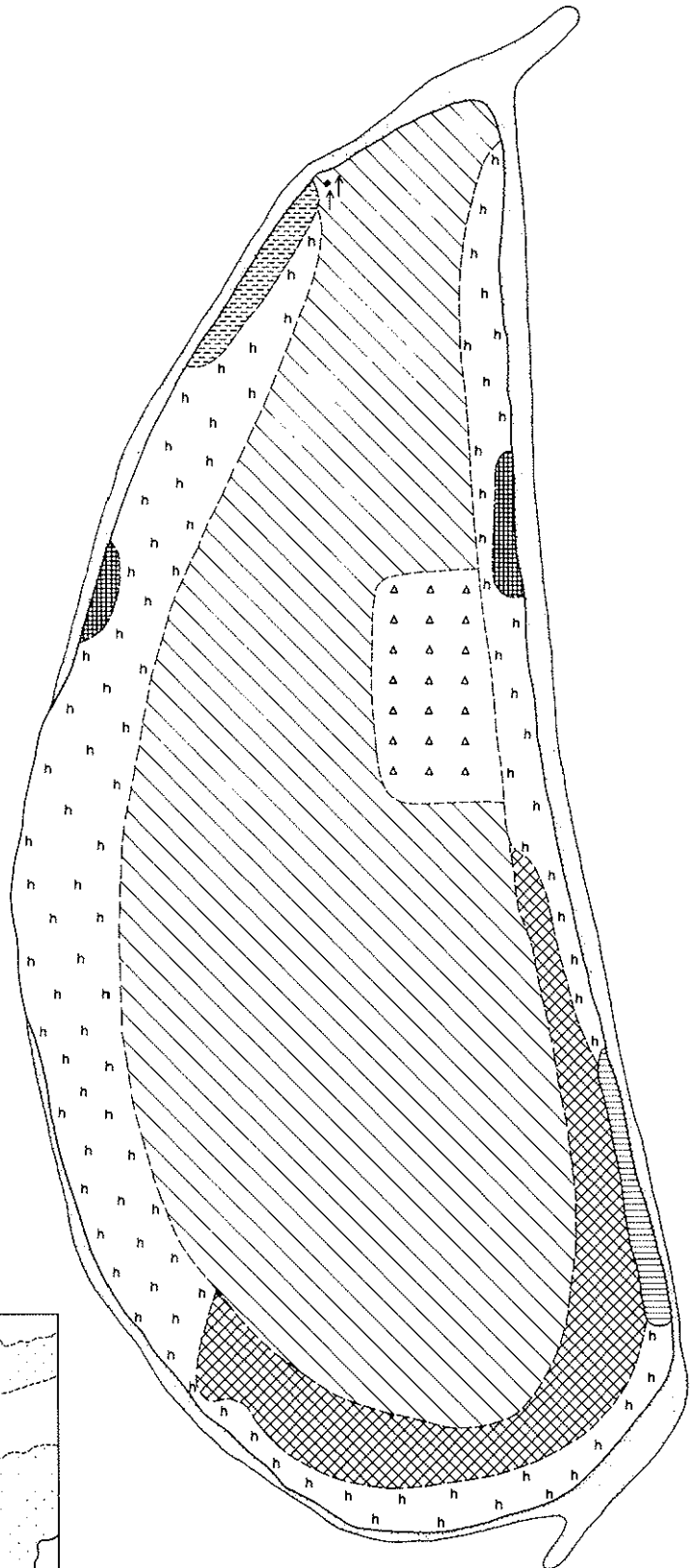
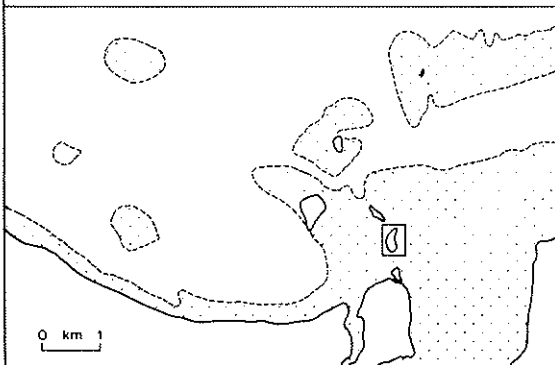


4 Manima

-  SCAEVOLA TACCADA WITH
TOURNEFORTIA ARGENTEA
-  HIBISCUS TILIACEUS WOODLAND
WITH GUETTARDA AND PANDANUS
-  THESPESIA POPULNEA WOODLAND
-  TALL WOODLAND OF CALOPHYLLUM
AND HERNANDIA
-  CORDIA SUBCORDATA WOODLAND
-  COCONUT WOODLAND
-  TARO PLANTATION
-  CASUARINA
-  SAND

ONEATA

0 metres 50





6 Shore erosion on the east coast of Makaha'a



7 Beachrock at the southern point of Makaha'a: view towards the south.



8 Beachrock on the southwest coast, with cliffed shore behind, on Makaha'a.



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