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CORAL CAYS OF THE CAPRICORN AND BUNKER GROUPS, GREAT BARRIER REEF PROVINCE, AUSTRALIA

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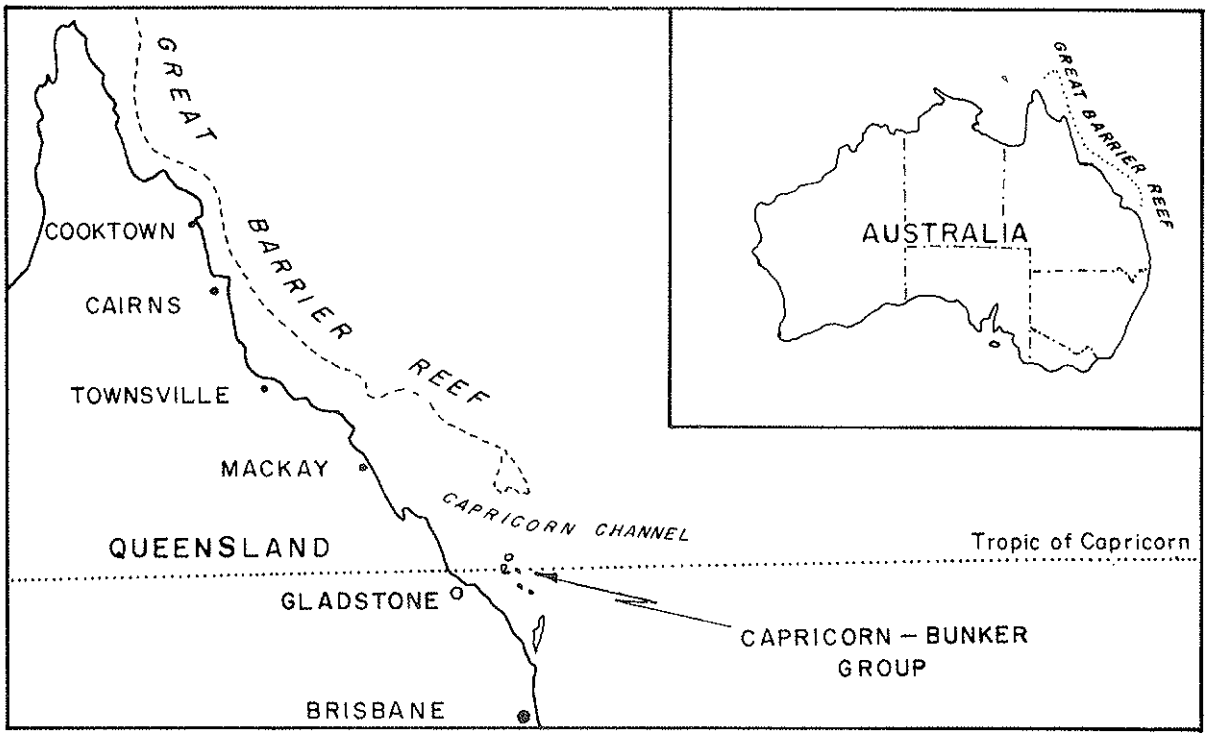

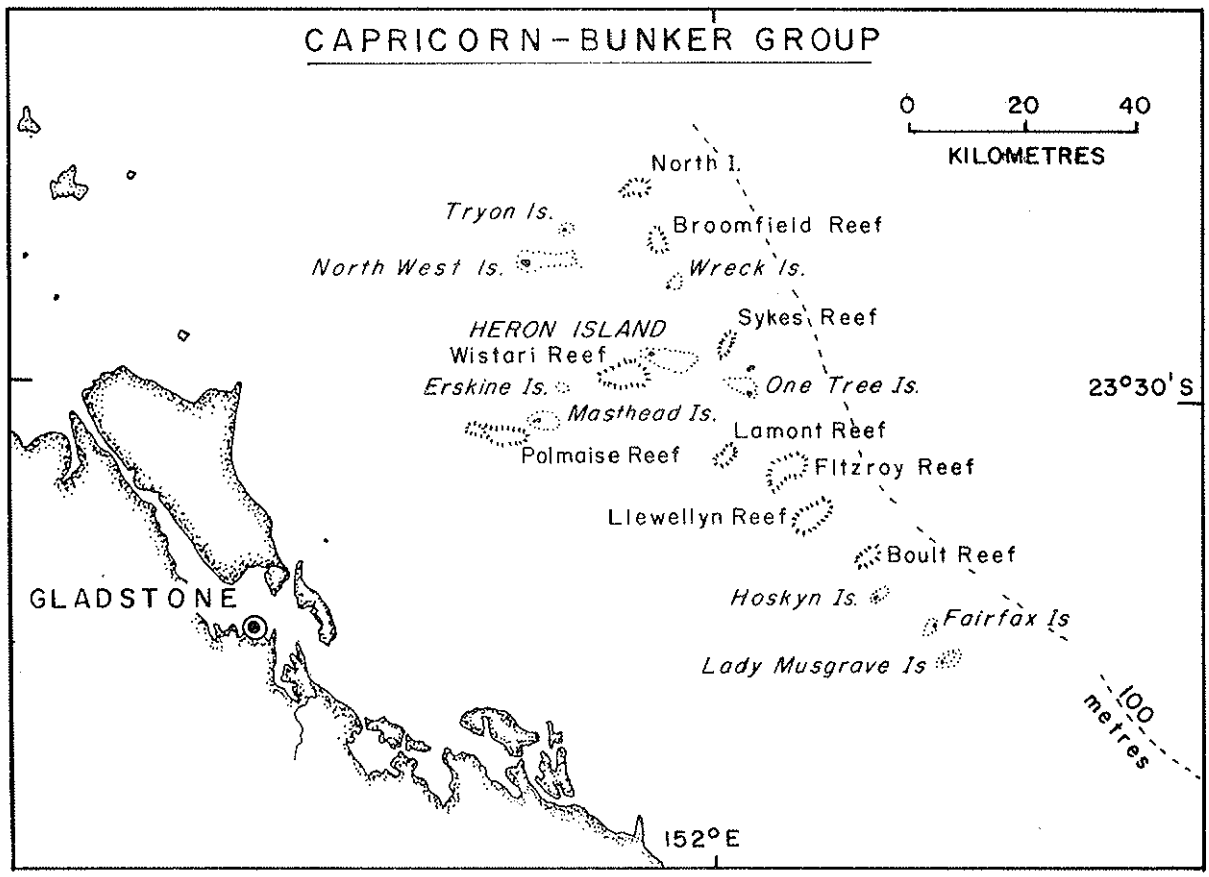

Fig. 1. Location of the Capricorn and Bunker Groups.

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Introduction

The islands and reefs of the Capricorn and Bunker Groups are situated astride the Tropic of Capricorn at the southern end of the Great Barrier Reef Province and approximately 80 kilometres east of Gladstone which is situated on the central coast of Queensland (Fig. 1).

The Capricorn Group of islands consists of nine coral cays: North Island, Tryon Island, North West Island, Wilson Island, Wreck Island, Masthead Island, Heron Island, and One Tree Island. A tourist Resort and Marine Scientific Research Station have been established on Heron Island. A manned lighthouse operates at North Island and the Australian Museum conducts a field research station on One Tree Island. The Bunker Group consists of five coral cays: Lady Musgrave Island, Fairfax Islands (West and East), and Hoskyn Islands (West and East).

Morphological changes occurring between 1936 and 1973 are evident when comparing previous plans of these coral cays (Steers, 1938) with recent vertical aerial photographs. Changes are catagorised into two groups; those related to natural phenomena and secondly, those caused by human interference.

Previous work

The earliest scientific description of the Capricorn and Bunker Groups is that of Jukes (1847) who visited the area in 1843 on the voyage of H.M.S. *Fly*. Saville-Kent (1893) and Agassiz (1898) make brief references to the Groups. Steers (1937, 1938) provided the first detailed descriptions and sketches of most islands of the Groups.

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The regional location, bathymetry, and physiography of this area has been discussed by various authors (Maxwell, 1968; Maiklem, 1968, 1970; Maxwell and Maiklem, 1964) and the island vegetation has been mentioned by several workers (MacGillivray and Rodway, 1931; Fosberg and Thorne, 1961; Gillham, 1963; Cribb, 1965, 1969; Domm, 1971).

Steers (1938) and Domm (1971) provide an introduction to the Groups and both papers should be read in conjunction with this article.

Reefs with coral cays

Four distinct reef types (Maxwell, 1968) occur within the Capricorn and Bunker Groups (Figs. 2, 3, 4 and 5):

1. Platform Reefs:- Tyron, Wreck, North, Wilson, and Erskine Reefs.
2. Lagoonal Platform Reefs:- Heron, and One Tree Reefs.
3. Elongate Platform Reefs:- North West, and Masthead Reefs.
4. Closed Ring Reefs:- Lady Musgrave, Fairfax, and Hoskyn Reefs.

The reader is referred to Maiklem (1968) and Maxwell (1968) for detailed discussions concerning the zonation of individual reef types.

The coral cays belong to two distinct types (Fairbridge, 1950):

1. Vegetated sand cays:- North West, Heron, Masthead, Erskine, Wilson, Wreck, Tryon, North, Fairfax (West), and Hoskyn (West).
2. Shingle cays:- One Tree, Lady Musgrave, Fairfax (East), and Hoskyn (East).

The sand cays are all located to the lee of their reef flat, whereas the shingle cays, with the exception of Lady Musgrave, are located on the windward side.

The following brief descriptions are provided to assist interpretation of the vertical aerial photographs (Plates 1-9) and to allow comparisons to be drawn between present cay morphology and that illustrated in sketches made by the Geographical Expedition to the Great Barrier Reef in 1936 (Figs. 6 and 7).

Capricorn Group

Heron Island (Plate 1)

A sandy beach, 15-30 metres wide at low tide, surrounds the cay. Exposed beachrock occurs on the southern, northern, and eastern beaches. Vegetation consists of a central zone of *Pisonia grandis* and an outer zone of *Casuarina equisetifolia, Scaevola taccada,* and *Tournefortia argentea*. *Pandanus tectorius* occurs over the centre of the cay. A Tourist Resort and Research Station have been developed on the western end of the cay.

Changes occurring since 1936 are related to the natural elements and to human interference. Sand erosion on the northern and eastern beaches has exposed new occurrences of beachrock. The construction of a retaining wall and a boat harbour have drastically altered the western end of the cay.

North West Island (Plate 2)

This is the largest sand cay of the Group. A sandy beach surrounds the cay and beachrock is only exposed at the eastern end. Vegetation is similar to that occurring on Heron Island.

The eastern area of exposed beachrock is smaller now than in 1936 and the southwestern outcrop is no longer visible.

Masthead Island (Plate 3)

Beachrock is well developed along the southern beach and an occurrence of older beachrock is situated some distance from the beach on the northwestern corner of the cay. Vegetation is similar to that occurring on Heron Island. Prickly Pear, introduced from the Mainland, is now well established over the entire cay.

Considerably more beachrock is now exposed on the southern beach and a spit has formed on the northwestern corner. The shingle and sand spit which was prominent in 1936 has disappeared.

One Tree Island (Plate 4)

This is a shingle cay. Vegetation consists of scattered *Tournefortia argentea* and *Scaevola taccada* with several small groves of *Pisonia grandis*. A small pond of brackish water is situated near the centre of the cay. A temporary Field Research Station conducted by the Australian Museum is located towards the northeastern corner of the cay.

The straight alignment of the western beach in 1936 has been altered by the addition of a small spit near the northwestern end of the beach. The northwestern corner of the cay has extended towards the lagoon.

Tryon Island (Plate 5)

Beachrock occurs along the northwestern and southeastern beaches. The cay is covered with dense vegetation in the same zonations as on the larger sand cays.

The areas of outcropping beachrock have altered considerably since 1936. No exposures can be seen on the northeastern beach, whereas the exposures on the northwestern and southwestern beaches have increased in area.

Wreck Island (Plate 5)

Beachrock is well developed along the southern beach. Vegetation is similar to that on Tryon Island except that the *Pisonia grandis* forest is less well developed.

No apparent changes have occurred since 1936.

North Island (Plate 6)

This is the smallest cay of the Group. A manned lighthouse operates on this island.

Steers (1938) does not describe this island.

Wilson Island (Plate 6)

This island is not a true sand cay because of the quantity of coarse coral shingle present in the sediments. Beachrock is well-developed along the southeastern beach. *Pandanus tectorius* is the dominant vegetation with *Casuarina equisetifolia* restricted to the western side of the cay.

Significant changes have occurred since 1936. Considerable quantities of sand have moved, exposing beachrock on the northern beach and covering formerly exposed beachrock on the southern beach. The sandy beach on the western side has increased in area.

Erskine Island

Beachrock is well developed on the western and northwestern beaches. The vegetation differs from that present on the other cays in that *Pandanus tectorius* and *Casuarina equisetifolia* are absent, and the main vegetation consists of *Tournefortia argentea, Scaevola taccada,* and stunted *Pisonia grandis.*

The cay has increased in size since 1936 and sand now covers most of the formerly exposed beachrock.

Bunker Group

Lady Musgrave Island (Plate 7)

This island is the only shingle cay situated on the leeward reef flat. Beachrock is exposed along the northeastern and eastern beaches and an outcrop of lithified coral conglomerate, similar to that forming the core of the cay, occurs near the southeastern corner. Vegetation consists of *Pisonia grandis, Tournefortia argentea, Casuarina equisetifolia,* and *Pandanus tectorius.* The vegetation is less dense than that of the larger sand cays of the Capricorn Group. A small pond of brackish water is located towards the southern end of the cay.

The shapes of the southeastern and eastern beaches have altered since 1936. Erosion has exposed a larger area of beachrock on the southern beach and the eroded sand has been deposited on the eastern beach partly obscuring the beachrock exposed in 1936 and forming a well-defined beach on the northeastern corner of the cay.

Fairfax Islands (Plate 8)

The eastern cay is composed of shingle and the western of sand and shingle. Interference with the vegetation of the eastern cay occurred as a result of phosphate mining and secondly during the period when the Australian Military Forces used the area as a bombing target. The cay is no longer used for either purposes. Vegetation is dominated by *Pisonia grandis* which is restricted to the centre of the island. Two brackish pools are located towards the eastern end of the island.

The western cay features an elongated sand spit that supports vegetation on its western extremity. Vegetation is similar to that occurring on the larger sand cays of the Capricorn Group. A tin shed, erected by the Australian Navy when the eastern cay was used for bombing practice, is located in the centre of the island. This shed has been occupied for the past three years by Julie Booth who is studying the behaviour of marine turtles.

Steers (1937) mentions the islands. However, he did not provide any sketch of the cays.

Hoskyn Islands (Plate 9)

The eastern cay is composed of shingle and supports vegetation similar to, although less well-developed than, that of Lady Musgrave Island. The western cay is composed of sand and its vegetation is similar to that of the larger sand cays Capricorn Group.

Both cays have increased in size since 1936.

Influences causing morphological changes, 1936-1973

Most cays have changed morphologically as a result of continued erosion of sand on the eastern, southern, and southeastern beaches and subsequent deposition of sand on the western and northwestern beaches. The Southeast Trade Wind which blows for approximately nine months of the year causes this natural pattern to be common within this region (Flood, in press) and accounts for the nett westerly migration of sand on each cay.

Human interference is responsible for significant changes at Heron Island (Plate 10). A concrete retaining wall constructed in the early 1960's on the northwestern corner of the island is responsible for erosion of the western beach (Fig. 8). The wall alignment reflects and refracts onto the western beach those waves approaching the island from a northwesterly and northeasterly direction and considerably increases the erosive energy of waves in that area.

The erosion problem was increased in 1967 by the dredging of a boat harbour into the reef flat to provide access to the tourist resort (Plate 10, fig. 2). Even before cyclone "Emily" (April, 1972)

the retaining walls of the harbour were breached in several places, allowing sand from the western end of the island to move into the harbour and to the deeper water beyond (Plate 10, fig. 3). The boat harbour was redredged in late 1972. Approximately 20,000 cubic metres of sand were placed adjacent to the concrete retaining wall on the northwestern corner of the island in an attempt to lessen its erosive influence (Plate 10, fig. 4). The sand is migrating westward by longshore drift under the influence of the Southeast Trade.

Acknowledgements

The author gratefully acknowledges the use of research facilities at the Department of Geology and Mineralogy, University of Queensland, and at the Heron Island Research Station. I am particularly grateful to Dr. G.R. Orme who organised the fieldtrips and aerial reconnaissance of most cays of the Capricorn and Bunker Groups in 1972. The Co-ordinator-General's Department, Queensland is thanked for reproductions used in Plates 2 and 3. The officers of the No. 2 Sqdn. Royal Australian Air Force, Amberley generously supplied the aerial photographs of the coral cays illustrated in Plates 1 and 4 to 9 inclusive.

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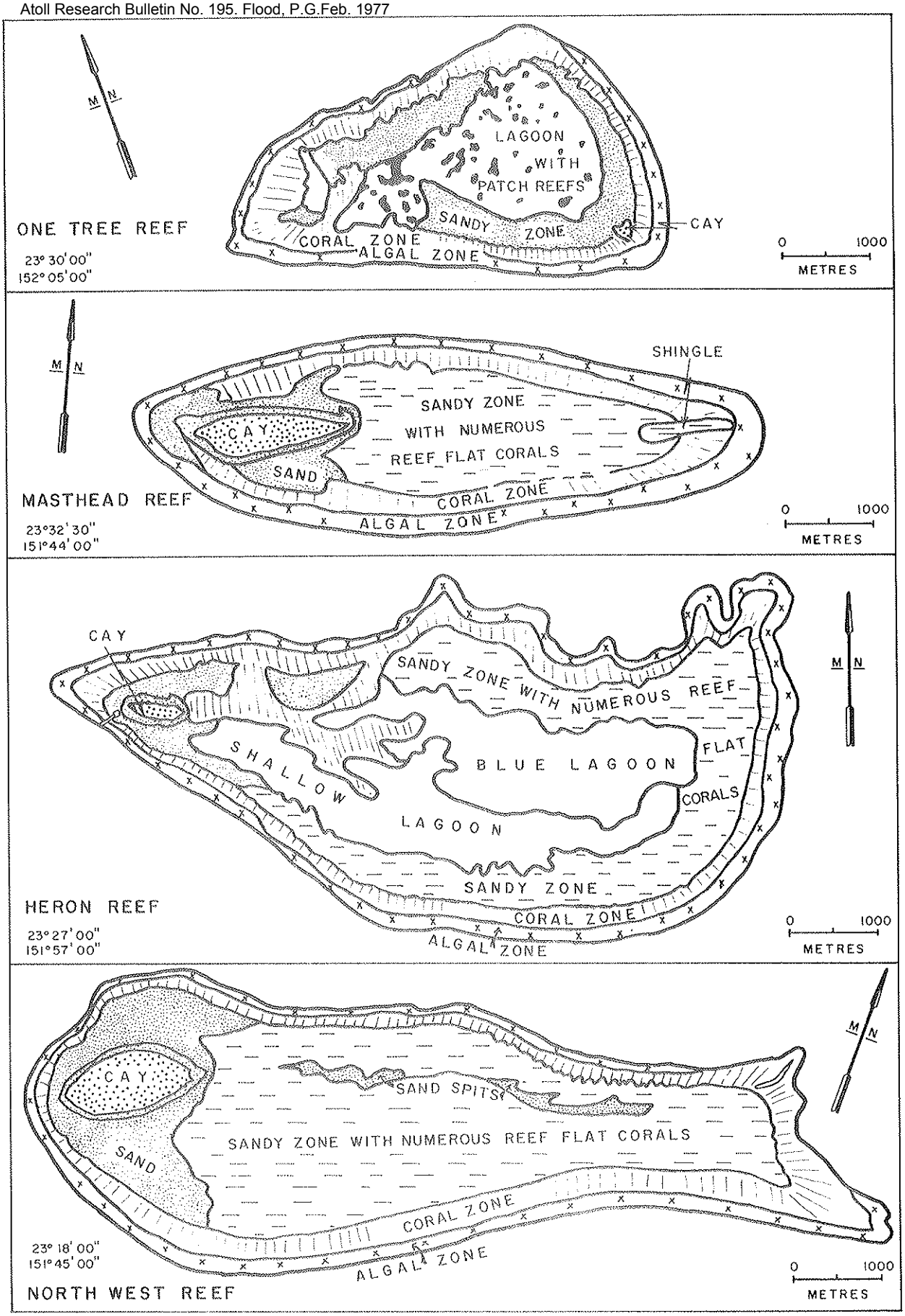

Fig. 2. Reef zonation: One Tree, Masthead, Heron, and North West Reefs.

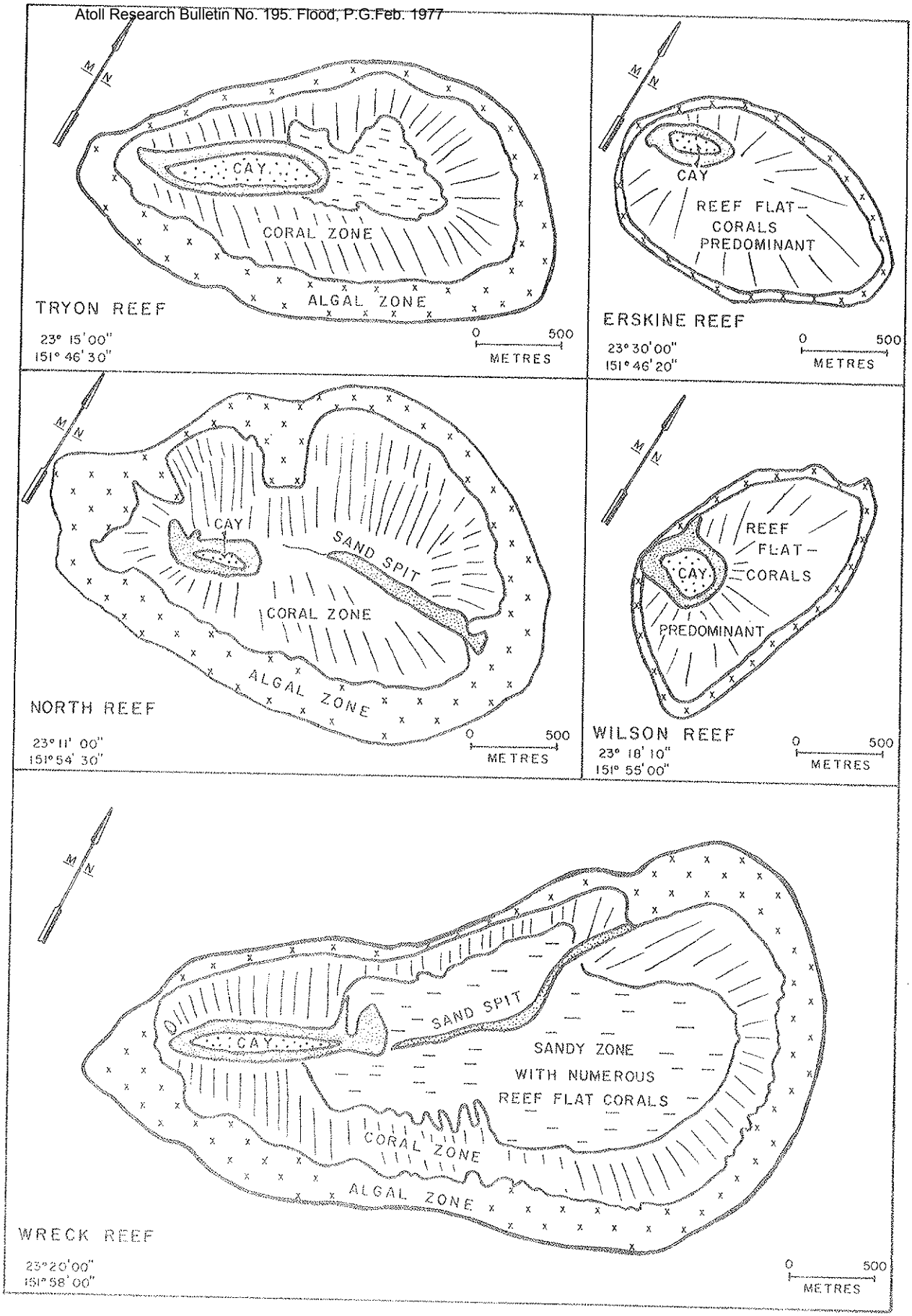

Fig. 3. Reef zonation: Tryon, Erskine, North, Wilson, and Wreck Reefs.

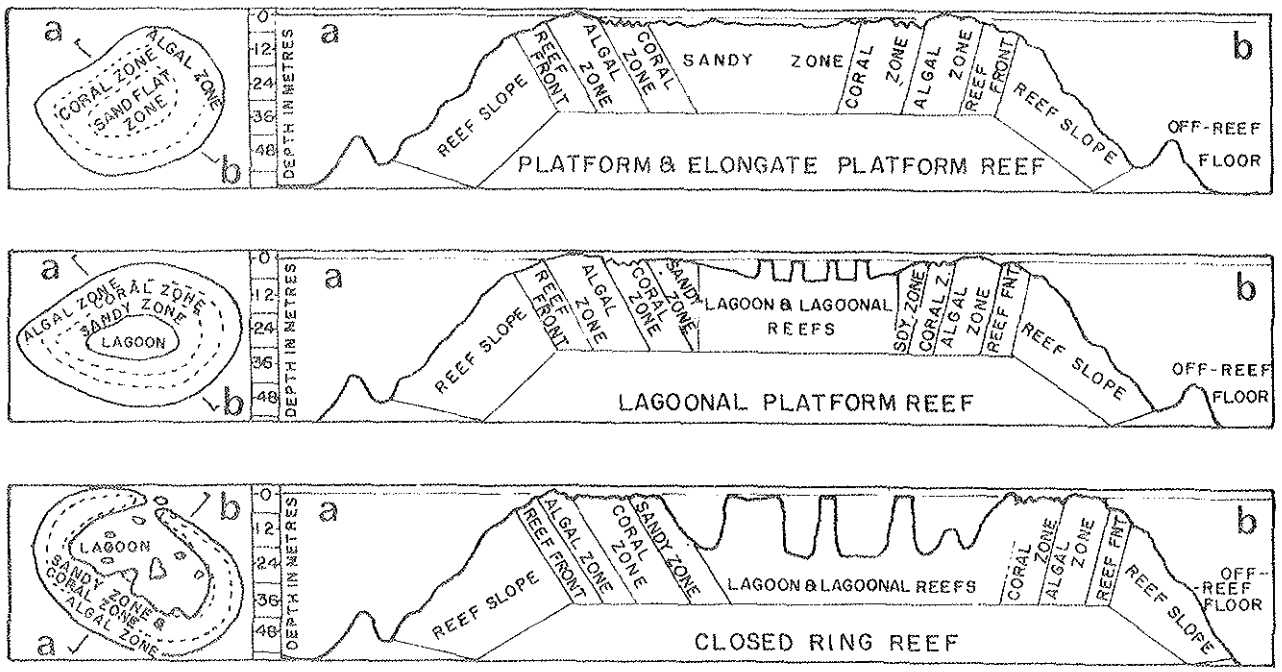

Fig. 4. Physiographic zonation of the reef types of the Capricorn and Bunker Groups (modified from Maxwell, 1968, p.106).

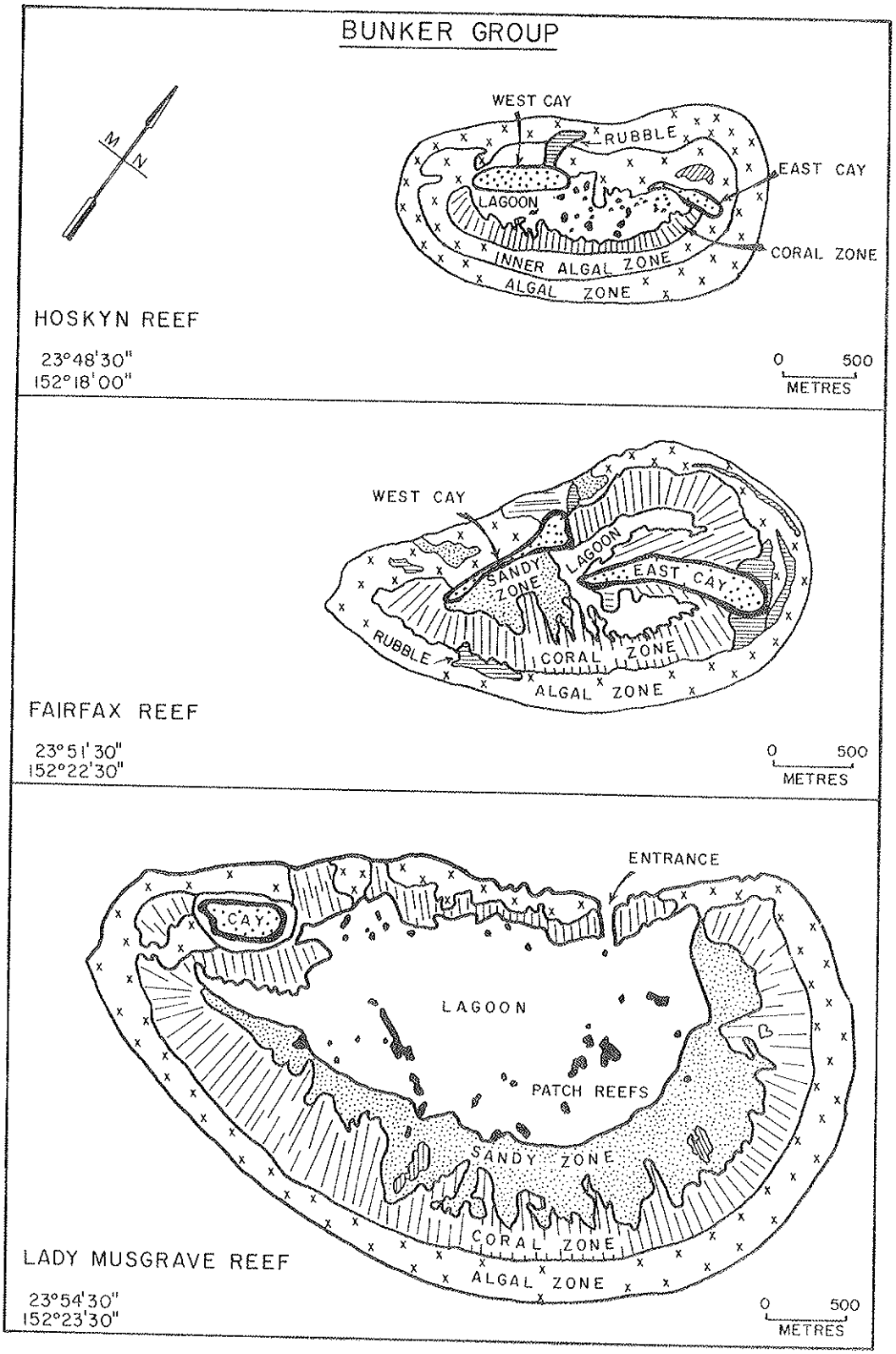

Fig. 5. Reef zonation; Hoskyn, Fairfax, and Lady Musgrave Reefs.

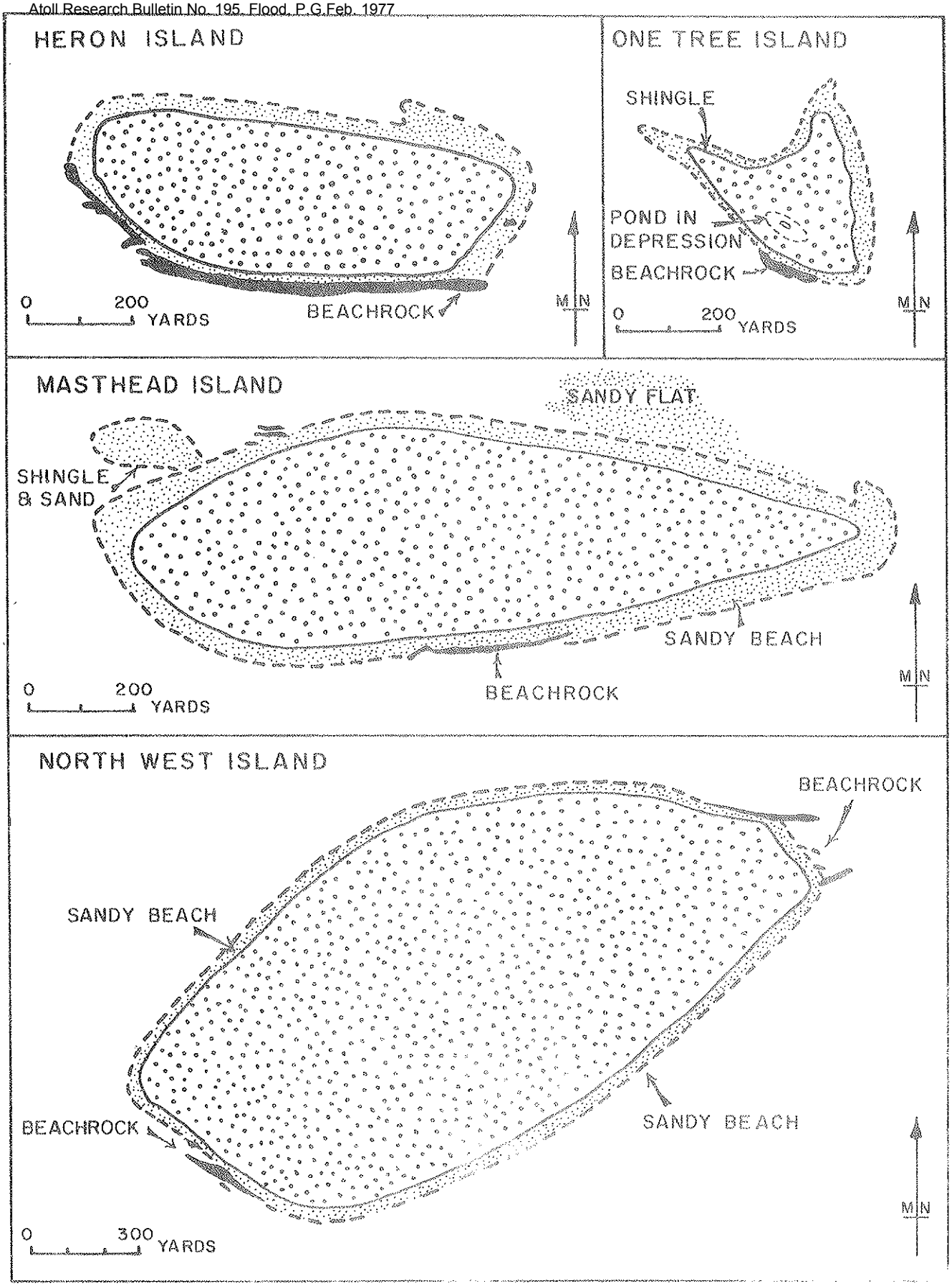

Fig. 6. Shape of [illegible] cays in 1936 [illegible]Steers, 1938): [illegible] One Tree, Masthead, and North West Islands.

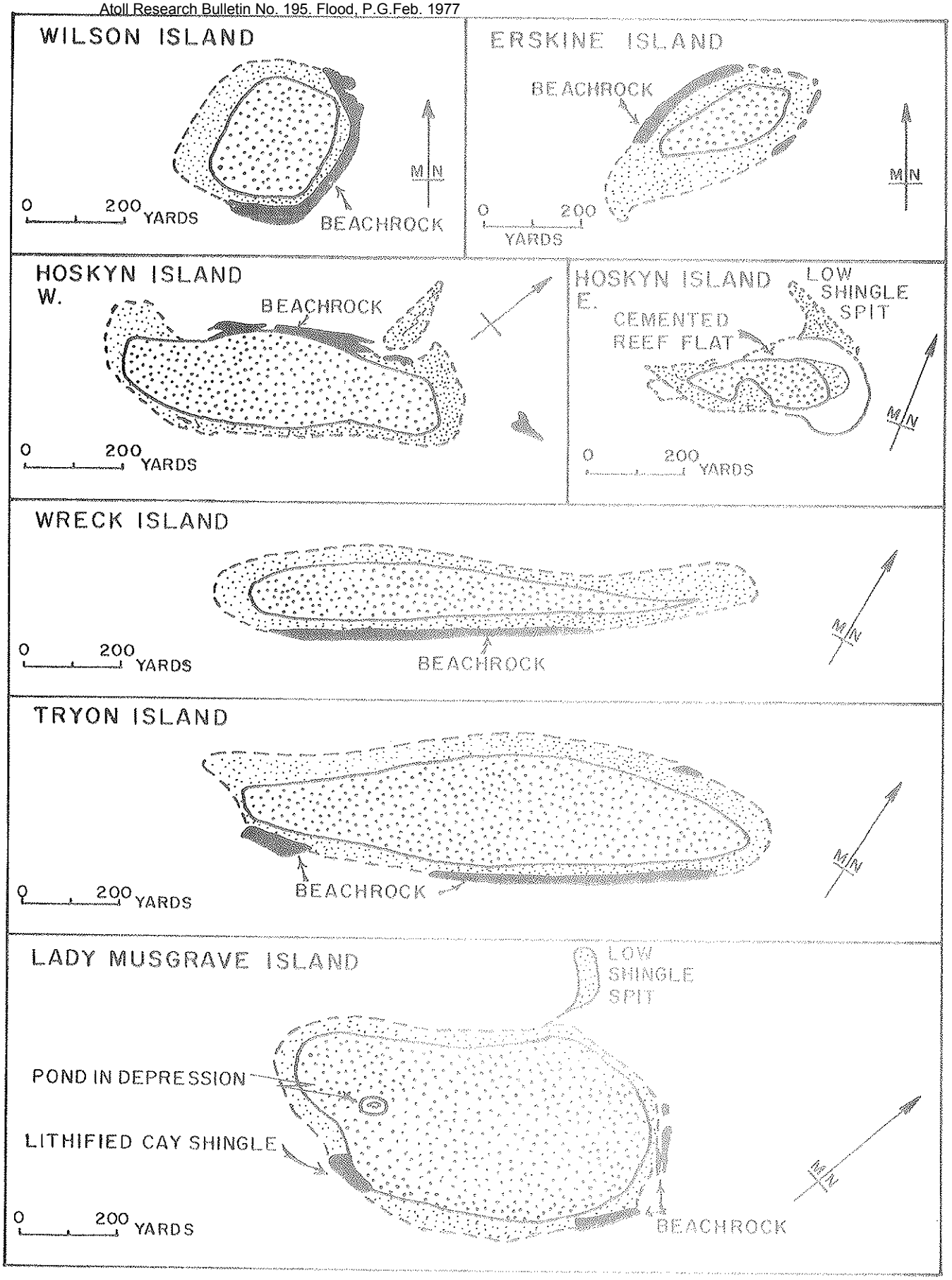

Fig. 7. Shape of coral cays in 1936 (after Steers, 1938): Wilson, Erskine, Hoskyn, Wreck, Tryon, and Lady Musgrave Islands.

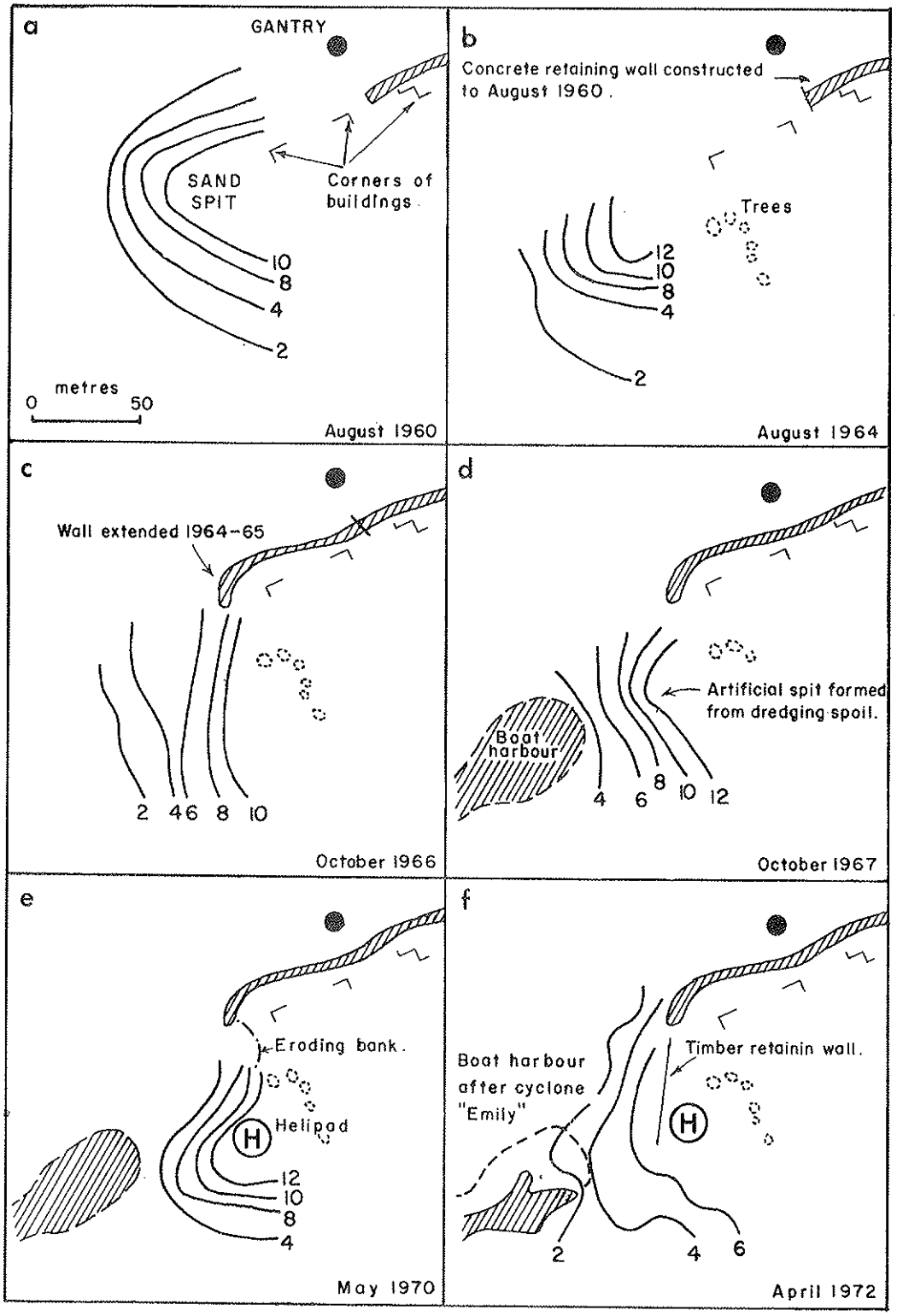

Fig. 8. Sequence of events connected with erosion of the western end of Heron Island (contours are in feet, 1ft.=30.5cm).

PLATE 1

Plate 1. Heron Island. Vertical aerial photograph taken 25.9.73.

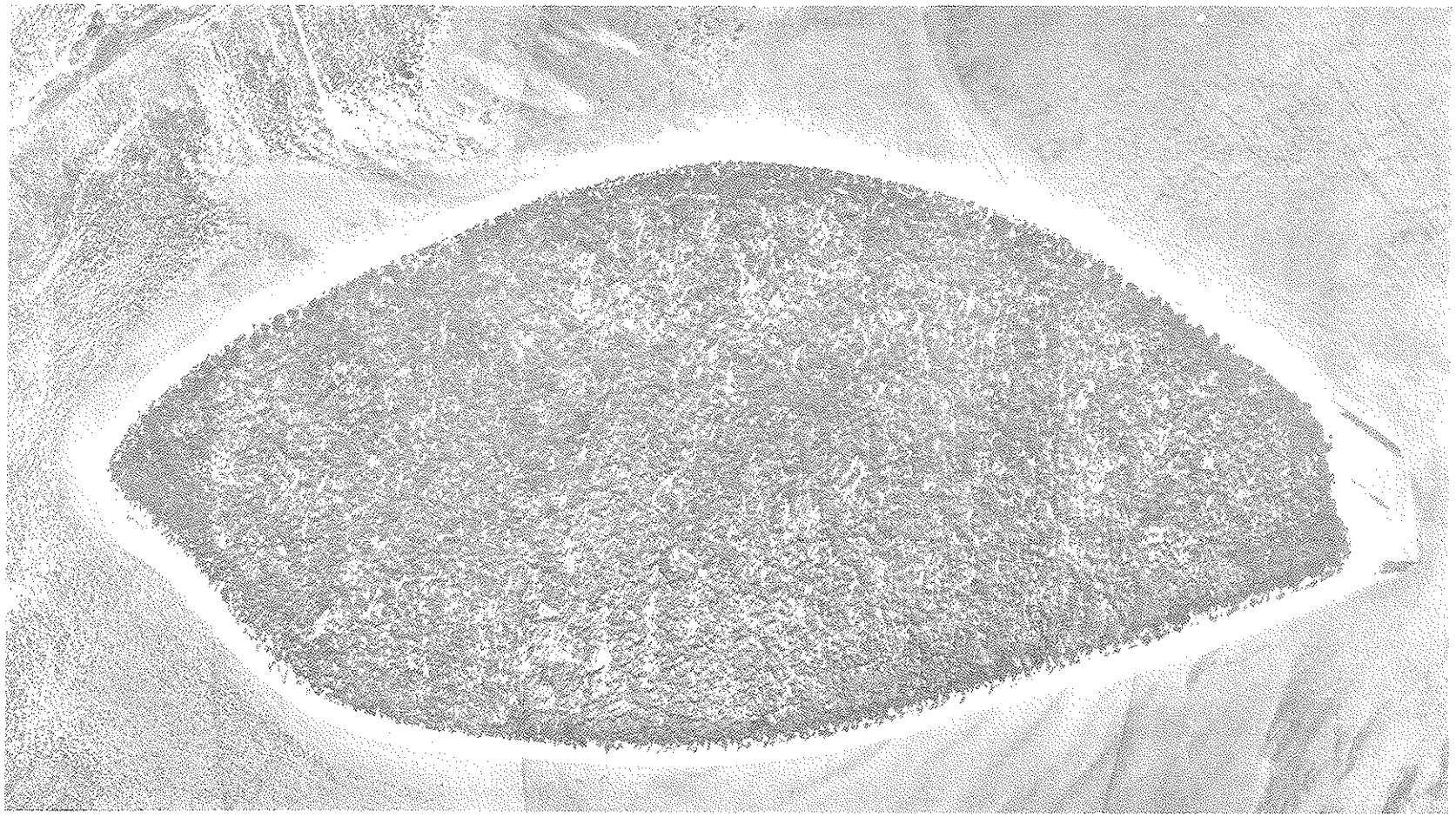

PLATE 2

Plate 2. North West Island. Vertical aerial photograph taken 24.6.72.

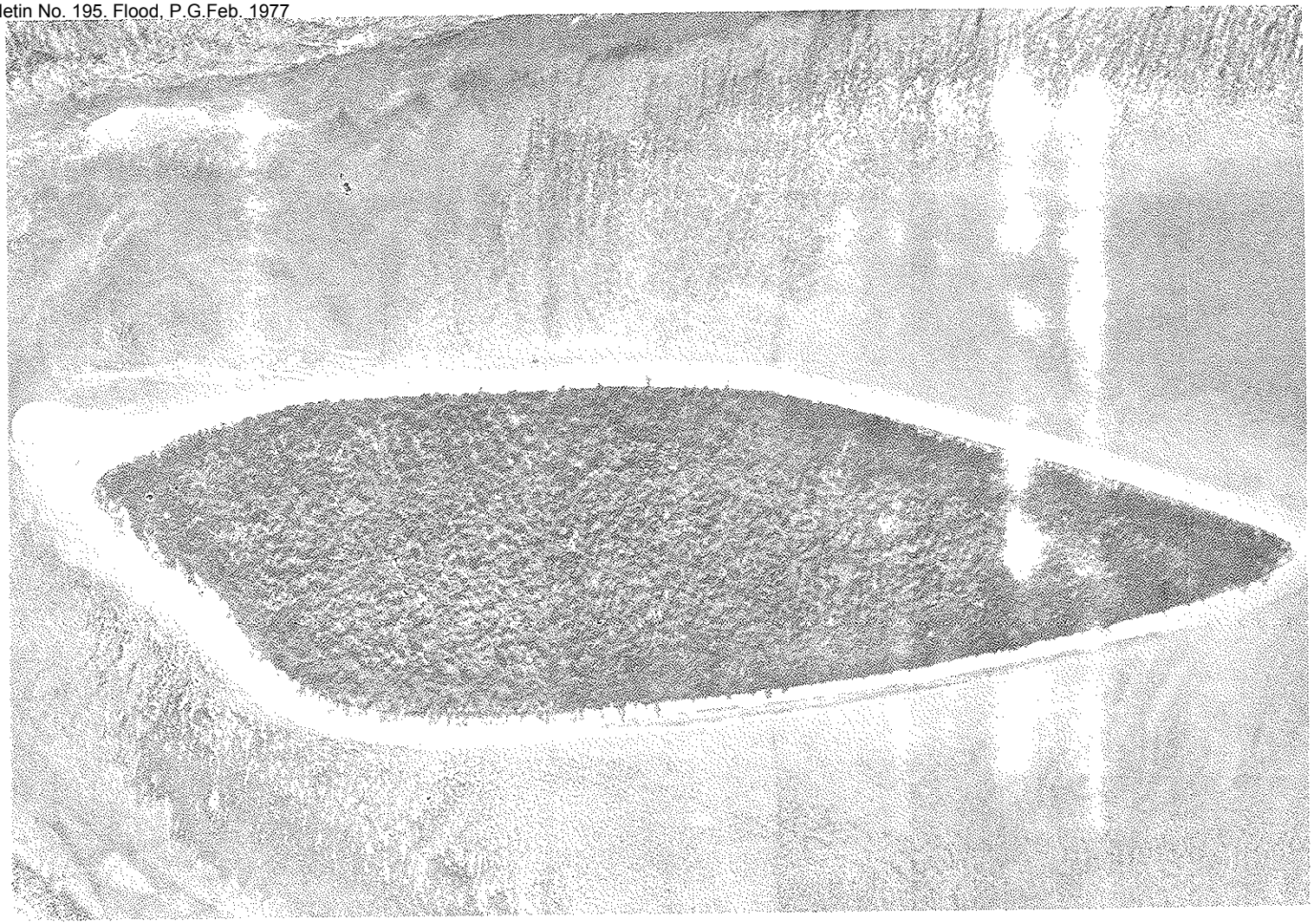

Plate 3. Masthead Island. Vertical aerial photograph taken 24.6.72.

Plate 4. One Tree Island. Vertical aerial photograph taken 25.9.73.

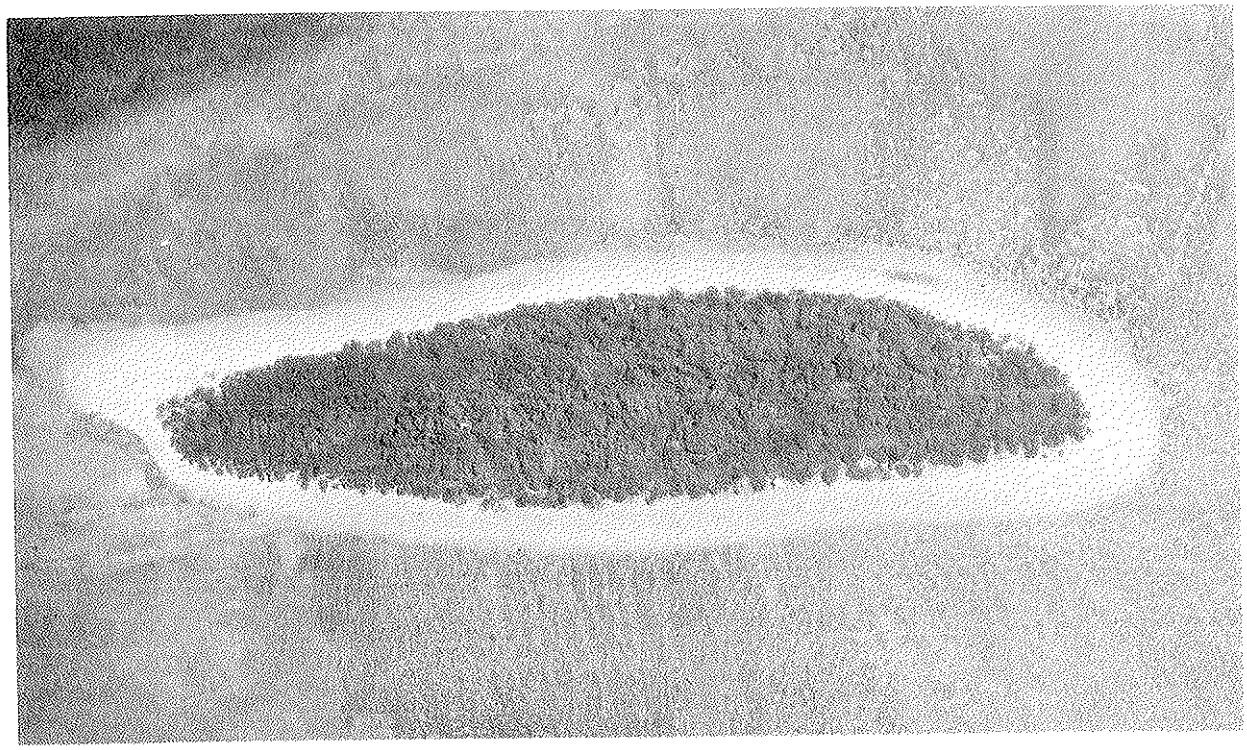

PLATE 5

Plate 5. Tryon Island and Wreck Island. Vertical aerial photograph taken 25.9.73.

NORTH ISLAND

0 300 METRES

WILSON ISLAND

25·9·73

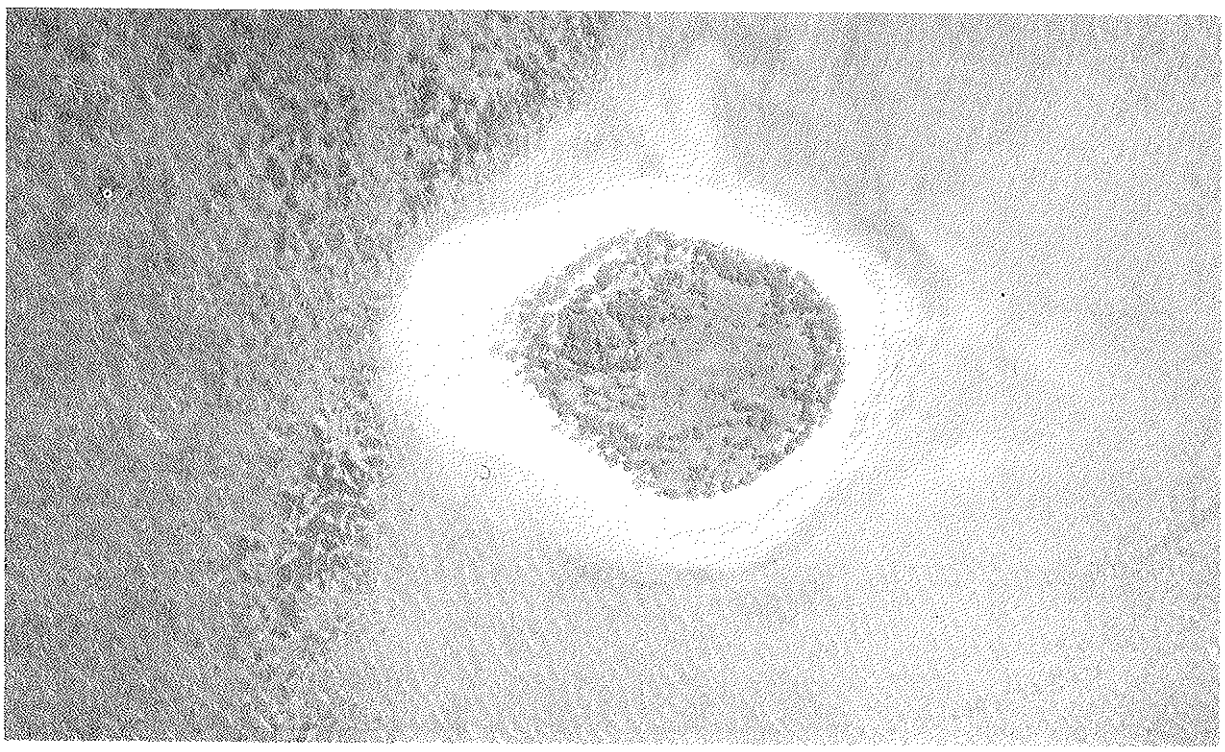

PLATE 6

Plate 6. North Island and Wilson Island. Vertical aerial photograph taken 25.9.73.

PLATE 7

Plate 7. Lady Musgrave Island. Vertical aerial photograph taken 25.9.73.

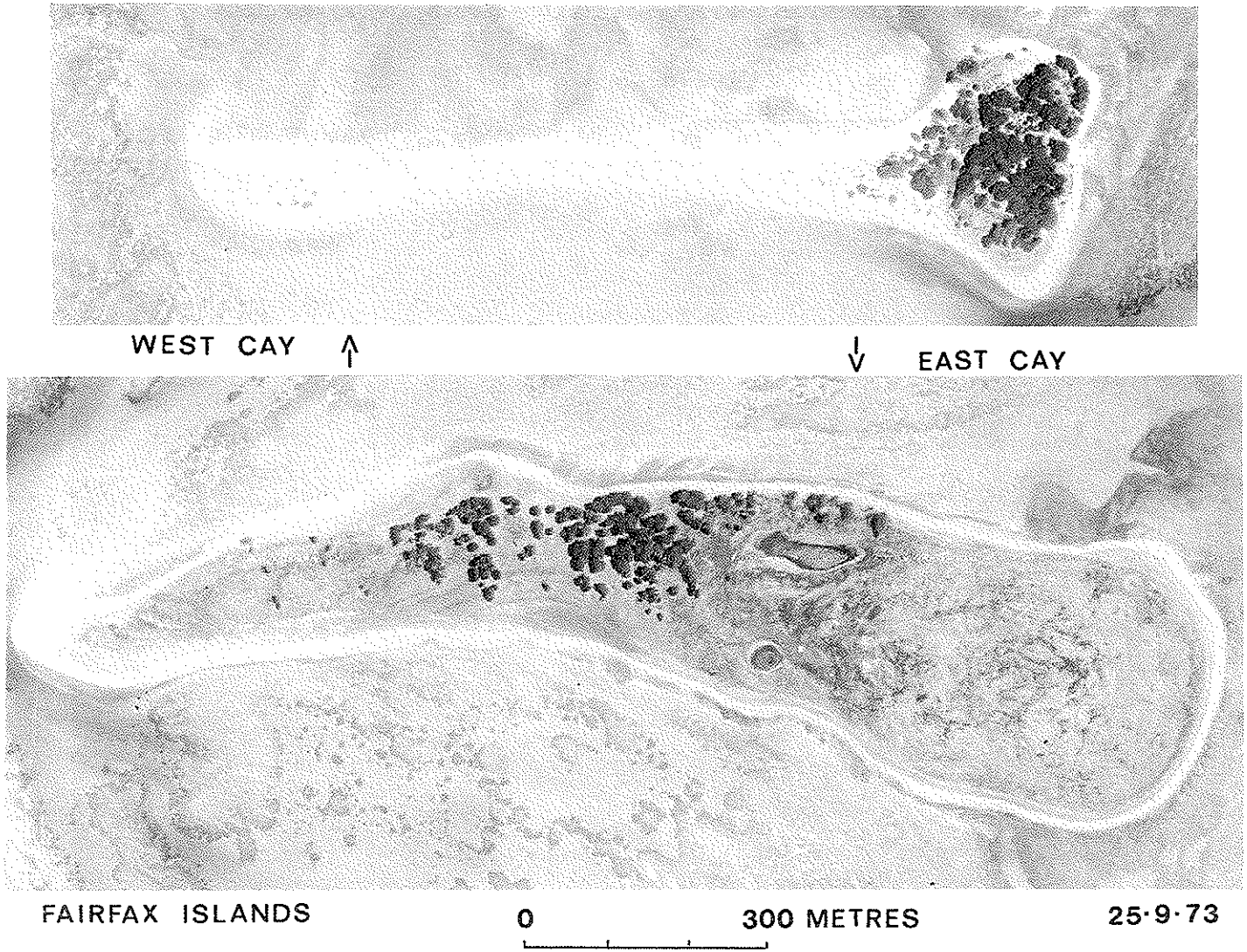

Plate 8. Fairfax Islands. Vertical aerial photographs taken 25.9.73.

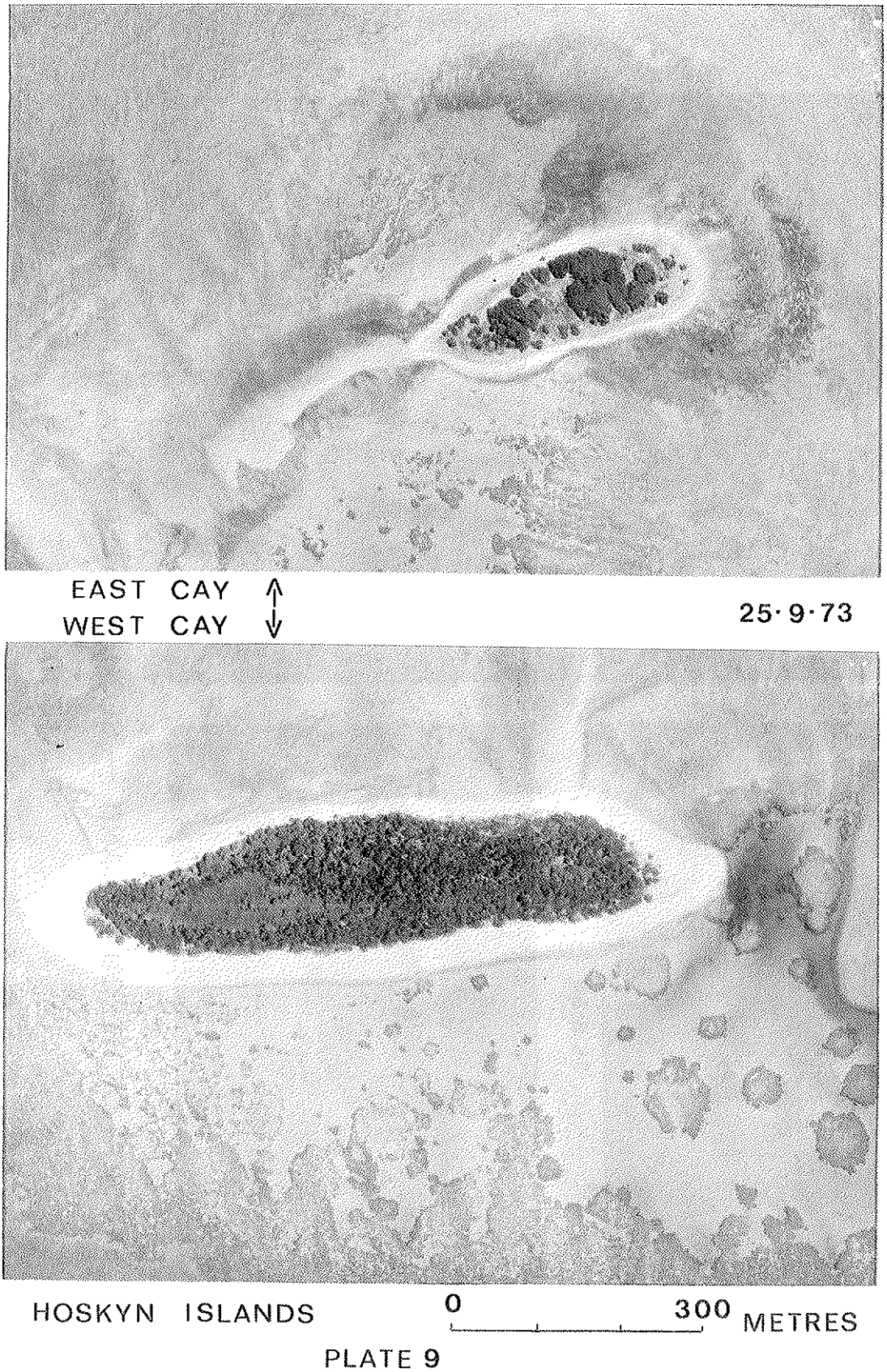

Plate 9. Hoskyn Islands. Vertical aerial photographs taken 25.9.73.

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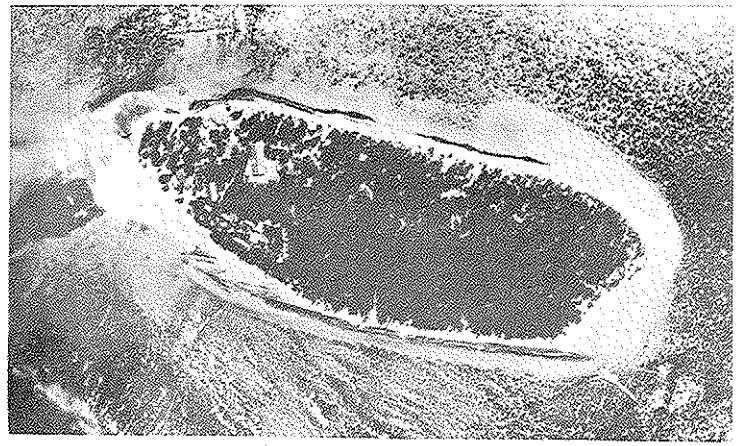

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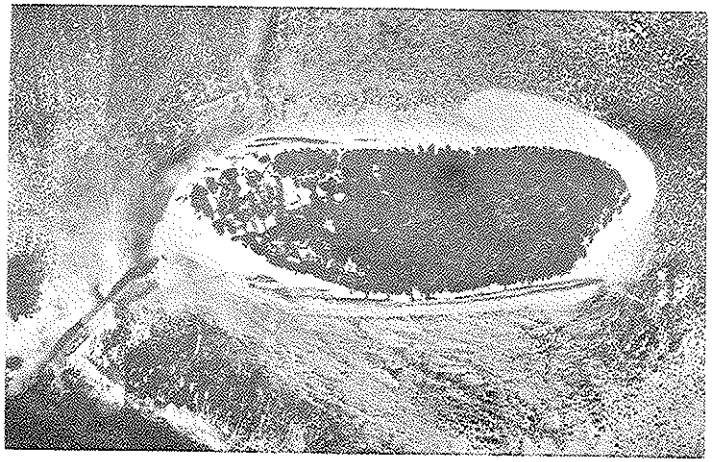

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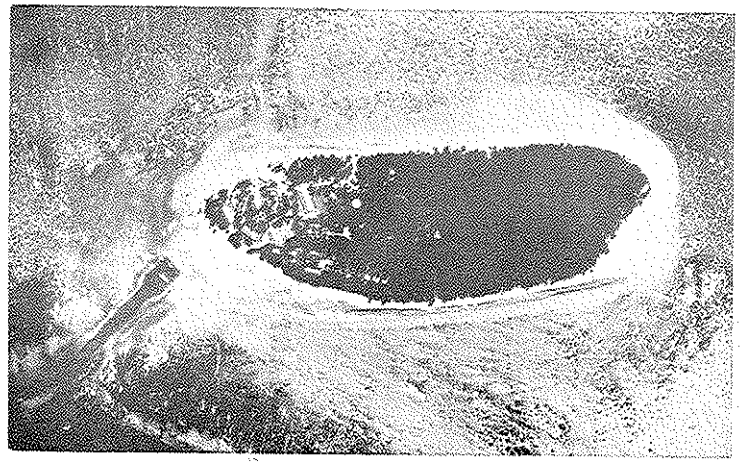

27·9·73

EROSION OF HERON ISLAND — SEQUENTIAL PHOTOGRAPHS, 1964-73.

PLATE 10

Plate 10. Erosion of Heron Island. Sequential vertical aerial photographs 1964 to 1973.