3. MANGROVE SEDIMENTS OF LITTLE CAYMAN

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The various mangrove habitats on Little Cayman are found on three different substrates:

(i) bare rock substrates — which include the following habitats:-

2A(b)* Low *Rhizophora* woodland on salt-pond margins.

2A(c) *Conocarpus* and herbaceous vegetation of rock flats round salt-ponds.

2B(b) *Conocarpus-Laguncularia* scrub of low dissected interior Bluff Limestone.

(ii) sandy, silty and muddy substrates — as in the case of:-

1C(a) *Rhizophora* and *Avicennia* coastal fringes, such as occur on the north coast of South Hole Sound, and on Owen's Island.

(iii) Mangrove-derived peat substrates — Recent (Holocene) accumulations of organic sediments such as underlie:-

2A(a) Tall *Rhizophora* woodland (Tarpon Lake).

2A(b) Low *Rhizophora* woodland on salt-pond margins.

2B(a) Dwarf inland *Rhizophora* scrub in enclosed basins.

The peat substrates are interesting because they contain a sedimentary record of the development of an area of mangroves, and changes in the environment of deposition can be detected in profiles through the peat.

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*These codes refer to the habitat classification of Stoddart (this volume); see below, pp. 67-68.

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The morphology of three areas, each part of a different mangrove habitat, were examined in detail. The depth to bedrock was probed, and the sediment was described from a series of cores through the peats, taken with a small hand-operated 'Davis'-type piston corer.

The three areas examined were:-

(a) Dwarf inland *Rhizophora* scrub (habitat 2B(a)) at 976763.

(b) Low *Rhizophora* woodland on salt-pond margins (habitat 2A(b)), where this occurred on a peat substrate, on the north coast, north of Sparrowhawk Hill, at 998783.

(c) Tall *Rhizophora* woodland at Tarpon Lake, 005757 (The typesite and most extensive stand of habitat 2A(a)).

(a) Dwarf inland *Rhizophora* scrub

This inland basin of dwarf *Rhizophora* scrub (976763), oblong in shape, is colonised almost entirely monospecifically with *Rhizophora mangle,* all less than 2 m in elevation. At the edges of the basin isolated *Conocarpus* may be found, above the general level of the *Rhizophora* canopy, to heights of about 5 m. (the vegetation is represented schematically in Fig. 9).

A north-south transect was examined across the basin. A maximum depth of just over 2 m (205 cms) was recorded, occurring at the northern edge of the basin. This dwarf mangrove is not growing in a symmetrical basin; the basin is deeper at the northern and southern edges with a fairly consistent depth of just over 1 m in the centre. It must be remembered that this basin occurs on the dissected Bluff Limestone, with its characteristically karstic surface, and it is quite probable that this tortuous surface continues under the dwarf mangrove sediments, accounting for some of the variation of the probing in the centre of the basin.

Two kinds of sediments were recovered in cores under this dwarfed inland mangrove scrub:-

(i) Fibrous mangrove peat

Most of the Recent deposits within this basin are of fibrous, mangrove-derived peats. These are compact, well-structured, inelastic deposits, with a generally low moisture content. They are very dusky red in colour (2.5YR2/2 on the Munsell Soil Colour Chart); much of their red colour being due to the pink hue of the cortex of the root material derived from *Rhizophora*. The matrix of the peat is composed of narrow interwoven root fibres derived from *Rhizophora,* though larger root remains of the same species are not uncommon. These peats are homogeneous,and show little change with depth.

(ii) Shelly calcareous marl

Underlying the mangrove peat, but of limited extent, is a shelly marl or fine sand. This is white to off-white and crumbly when dry. The contact between the two sediments is fairly distinct, though root fibres from the peat are common within the marl and presumably penetrated down into the marl at a time when mangroves had colonised the surface. These fibres are intricately involved in the marl and have a covering of carbonate grains.

The carbonate grains composing the calcareous marl are angular to rounded; their surface is irregular under magnification, and it is evident that much of the material is skeletal in origin. The broken skeletal particles are presumably derived largely from the molluscan fauna of the sediment, and are therefore likely to be aragonitic. Some particles appear to be conglomerations of smaller particles though there is no extensive cementing of grains.

The fauna of this marl is dominated by the gastropod *Cerithidea costata* (Da Costa), which varies in length from juveniles of less than 5 mm to specimens of more than 21 mm. More numerous, though less conspicuous than this are the smaller gastropods, *Microdochus floridanus* Rehder. Also present are valves of an unidentified bivalve, probably a juvenile stage of one of the family *Cardiidae*. Another common element in the fauna is the ostracod of the genus *Cyprideis*.

This fauna is typically a fauna of brackish water or intertidal environments; indeed it is very similar indeed to the fauna at present found in Tarpon Lake (see later), and also found in other coastal ponds on Little Cayman. It seems likely that this inland mangrove basin was, at a time of lower sea-level, a brackish-water pool, probably with a fringe of *Rhizophora*. Subsequently the area of *Rhizophora* increased until the basin became entirely mangrove covered. Autochthonous ('in situ') accumulation of mangrove-derived peat continued until the surface reached its present elevation. The surface of the peat in these inland basins of dwarfed *Rhizophora* has been found to be close to present sea-level.

(b) Low *Rhizophora* woodland on salt-pond margins, on the north coast

A north-south transect was run across an area of low *Rhizophora* (4-6 m) which occurs fringing the salt-ponds on the Bluff Limestone plateau on the north coast, north of Sparrowhawk Hill (998783). The peat is generally shallow reaching a maximum depth of 65 cms. Small pools of standing water occur within the transect, and to the east and west are long narrow coastal lagoons, fringed again with *Rhizophora*. Odd trees of *Conocarpus* (6-8 m) occur at the southern end of the transect where the Bluff Limestone begins to rise in elevation. A narrow band of Bluff Limestone protrudes from the centre of the profile (Fig 10B).

The peat is very dark greyish brown (10YR3/2 on the Munsell Soil Colour Chart). Near the surface, it is fibrous and compact, composed largely of small root fibres of *Rhizophora*, with some larger root remains also included. At depth, the fibre content is less, the sediment is more plastic, less structured, and contains specimens of the intertidal gastropod, *Cerithidea costata* (Da Costa).

To the north of the profile there is a cobble ridge with a covering of *Coccoloba*, and boulders from this ridge lie on the surface of the mangrove peat.

The sequence of deposits, though only shallow, seems to suggest a progradation of *Rhizophora* into the coastal lagoon environment. The specimens of *Cerithidea* recovered in the basal peat are indicative of the lagoonal environment, while the fibrous peats are 'in situ' deposits of *Rhizophora*.

(c) Tall *Rhizophora* woodland, Tarpon Lake

A north-south transect was examined from the south shore of Tarpon Lake itself to the coastal beach ridge to the north of Wearis Bay (005757). This transect (Figure 10A) is through tall mangrove woodland, with *Laguncularia* (15-20 m) predominant, and with massive *Rhizophora* (25 m) at the lake shore. Small *Rhizophora* (4-5 m) occur on the inland flank of the beach ridge. The two predominant sediments in this profile are mangrove-derived peats, and pool sediments in Tarpon Lake itself.

(i) Mangrove-derived peats

The average depth of peat in this area is between 2 m and 2.6 m, apparently getting deeper towards Tarpon Lake. The peat varies in colour from dark brown, through dark reddish brown to very dark greyish brown (7.5YR3/2,5YR3/2 and 10YR3/2 on the Munsell Soil Colour Chart); generally being greyer at the surface and becoming redder at depth. The peat is generally more moist than that encountered in inland areas of mangrove.

The peat is fibrous throughout, though generally less so at depth; the matrix being small root fibres of *Rhizophora*, larger root material occurring in places and several large pieces of greenish decomposing wood being recovered from depths of 80 and 100 cm.

Sand grains are found mixed with the peat in cores taken close to the beach ridge. These give the peat a distinctive granular texture. Sand grains may also be traced further away from the beach ridge, and are particularly evident at a depth of about 80 cms below the peat surface.

At the base of two cores examined to bedrock, but not at the base of a third, was found a 10 cm band of white to off-white sandy marl. This band of marl overlies bedrock, and has a fairly distinct interface with the overlying peat. It is granular and poorly consolidated.

The depth of peat overlying bedrock in the Tarpon Lake stand of mangrove (2.0 to 2.6 m) is very similar to the depth to a rock substrate in South Hole Sound, and it is evident that bedrock is generally continuous underneath the whole area. It is possible that the granular marl, of limited distribution at the base of the mangrove-derived peats, is a deposit very similar to the carbonate sands and muds in South Hole Sound.

The mangrove of Tarpon Lake is envisaged as developing on a bedrock floor very similar to the floor of South Hole Sound, and probably originating as marine mangrove of the type now found on the northern shore of South Hole Sound. It is not clear whether the beach ridge preceded the mangroves, with the mangroves filling in the space behind the beach ridge, or whether the mangroves preceded the beach ridge which was constructed outside a belt of truly marine mangrove. Of these two possibilities it is more probable that the mangroves preceded the beach ridge for three reasons. First, there does not seem to be any topographic reason why a beach ridge should be developed in the location that it is if there were not some barrier to its distribution further back onto the shoreline, such as a mangrove fringe. Second, mangrove-derived peat occurs, as substantiated in cores to bedrock within 50 metres of the beach ridge, throughout the profile to bedrock, and indeed pure peat underlies a mixed peat and sand at about 80 cms below the surface. Third, beach ridge sediments have been found to overlie mangrove derived peats on Grand Cayman.

(ii) Tarpon Lake sediments

The waters of Tarpon Lake are stained a foul reddish brown. The sediment flooring the lake, and usually only 10-15 cms below the water surface, and sometimes emerging from the water surface, are of the same colour. These sediments are largely a sand or coarse silt of carbonate grains, but with a relatively high organic content from the mangroves around the lake.

The carbonate grains are irregular in shape, and much of the material is evidently skeletal. The prominent mollusc is the gastropod, *Cerithidea costata* (Da Costa). Also present are the small gastropod, *Microdochus floridanus* Rehder, and valves of the unidentified bivalve, probably of the family *Cardiidae,* and in a juvenile stage. The other common component of the fauna of Tarpon Lake is an ostracod of the genus *Cyprideis.*

The depth of these sediments was not determined, but is probably in excess of 2 m.

Acknowledgements

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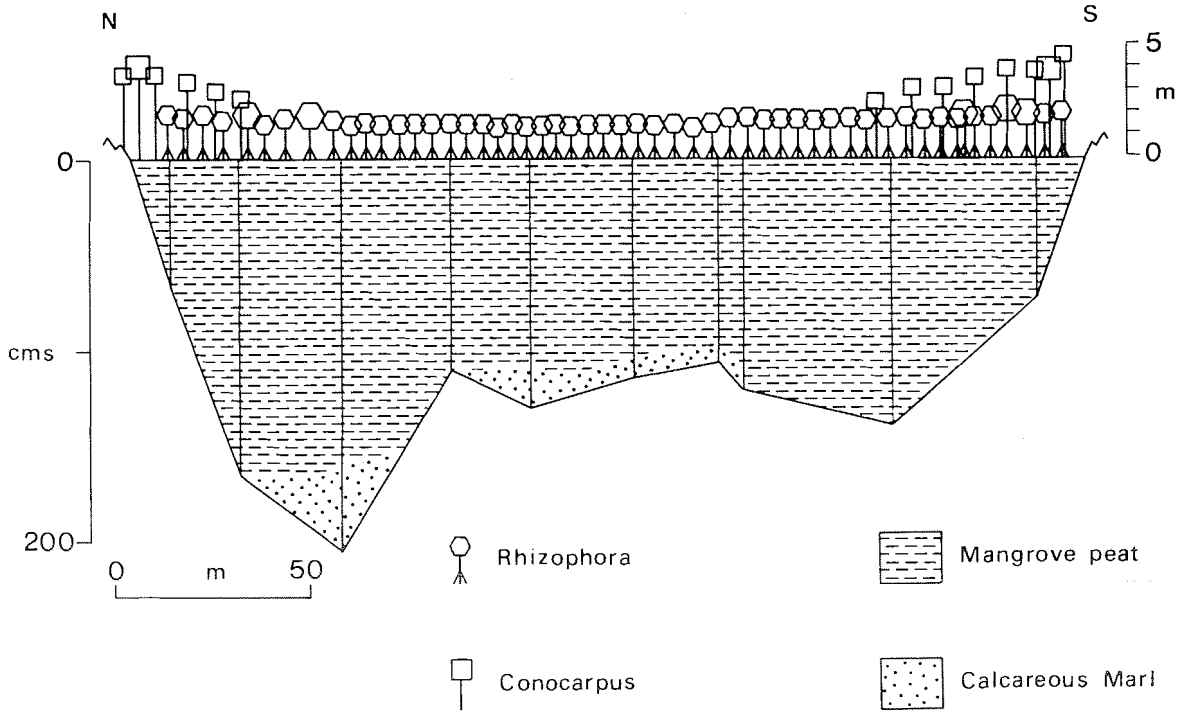

Figure 9. Topographic profile of inland dwarf *Rhizophora* scrub

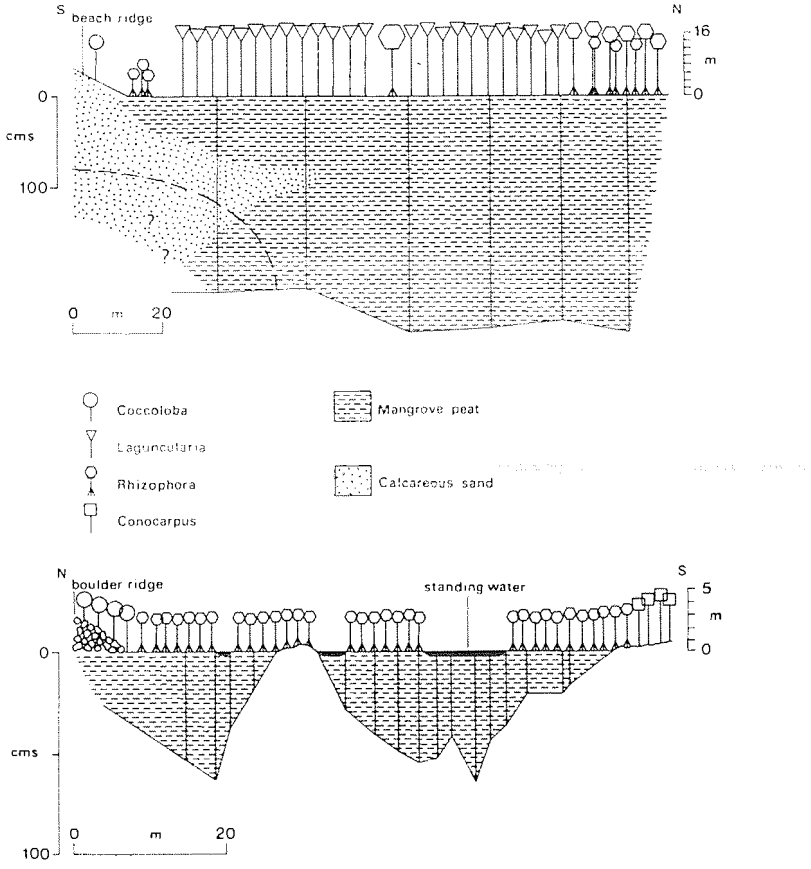

Figure 10. Topographic profiles of
A. *Rhizophora* woodland at Tarpon Lake,
B. North coast salt-pond *Rhizophora* woodland near Sparrowhawk Hill