

**A GEOMORPHOLOGICAL RECONNAISSANCE OF
COËTIVY ATOLL (SEYCHELLES, INDIAN OCEAN)**

BY

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ABSTRACT

A preliminary geomorphological description is given of this sandy Holocene island, fringed by discontinuous beachrocks. There is no evidence of past sea levels higher than the present one.

INTRODUCTION

Located in the western Indian Ocean about 145 miles SSE of Mahé, at a distance of a few dozen miles from the southernmost tip of the Seychelles Bank (7°05' to 11' S - 56°15' to 18' E), Coëtivy is a sandy, elongated, whale-shaped island, 9 km long and 0.25 to 1.6 km wide, stretching in a NNE to SSW direction. This island was formed on the east side of an almost rectangular shoal, which is about 180 km² in surface area, 20 to 30 m deep, and rises steeply from depths of more than 2500 m. The island bears the name of the Chevalier de Coëtivy, who sighted it on 3 July 1771 while in command of the "Ile de France" (Lionnet, 1970).

Although large collections of marine and terrestrial fauna were made at Coëtivy in 1905 (Gardiner & Cooper, 1907), as late as 1970 Stoddart regretted that no account had been written on this island and to our knowledge, none has been written since.

In addition to the 1:200 000 chart n° 724 published by the Hydrographic Office of the British Navy, a more detailed map (1:12 500) was published in 1979 (n° 204P) by the British Directorate of Overseas Survey for the Republic of the Seychelles. Information on the physical factors which influence reef evolution in the Indian Ocean has been summarized by Stoddart (1971). The local spring tidal range can be estimated at about 1.5 m.

This paper is based on geomorphological observations made on 10 January 1986 by members on an international expedition that reached Coëtivy aboard the R/V "Professor Shtokman" of the Institute of Oceanology of the Academy of Sciences of the U.S.S.R. (for a preliminary report on this expedition, see Kaplin et al., 1986).

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GEOMORPHOLOGICAL FEATURES OF COETIVY ISLAND

Coëtivy Island consists of sandy sediments that have accumulated, for the most part, on the northern section of an isolated strip of reef flat, 13 km long and 1.2 to 2.2 km wide.

Along the east coast a dead reef flat, almost completely capped by foraminiferal sand and coral debris, is exposed here and there at low tide. No distinct edge to the reef flat can be distinguished because it consists of a more or less wide strip of green sea grass Thalassodendron ciliatum (= Cymodocea ciliata), which slopes gently oceanwards, and baffles the wave action (Fig. 1).

The beach, generally two or three dozen metres wide, consists of white sand and of beachrock. The beachrock, which is mostly restricted to the east coast, is always found to be less than 1 m above MSL, i.e. within the vertical range of the present tide and normal wave action. A schematic profile, representative of the southeast shore is shown in Fig. 2.

The beachrock of the east coast consists of calcirudite and calcarenite deposits rich in coral, coralline algae, foraminifers and alciornarian spicules. Residual porosity of the total rock volume ranges between 30 and 50 %. Intergranular cements consist of a) aragonite isopachous fringes which commonly exhibit truncated crystals, b) fibrous aragonite rims and c) micritic rims all of which exhibit textural patterns that are typical of those found in sands lithified in the marine vadose (intertidal) environment.

In the central part of the east coast the beachrock extends offshore forming a spit out to the middle of the reef flat (Fig. 3), indicating erosion and a landward migration of the shoreline. The composition and the intergranular cements of the beachrock spit are similar to those described above. The distribution of beachrock around the island is shown schematically in Fig. 4, together with the main geomorphological features observed in the island. Traces of erosion (exposed roots of vegetation, sand cliffs on the beach, etc.) are particularly common on the western side of the island, where Gardiner & Cooper (1907) noted similar erosion features back in 1905.

A profile measured by theodolite levelling across transect E-E' is shown in Fig. 5.

Along the northeast coast of the island, the white colour of the beach is completely obscured by a thick cover of dead Thalassodendron, which forms mounds up to 2 m high (Fig. 6).

One or two lines of recent discontinuous coastal ridges are commonly found behind the shoreline. Sand dunes have developed mainly near the northeast and the southern coasts. Remnants of older coastal ridges delimit the shape of a former, smaller island, and swampy depressions commonly form along the central axis of the island.

No evidence could be found in Coëtivy of Pleistocene or Late Holocene stillstand above present sea level. Although the island has generally prograded laterally during the late Holocene, erosion appears to have been predominant, at least since the beginning of this century.

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Figure 1. The east margin of Coëtivy consists most of the time of a gently sloping Thalassodendron (=Cymodocea) seaweed cover. The water level is 0.15 m below MSL.

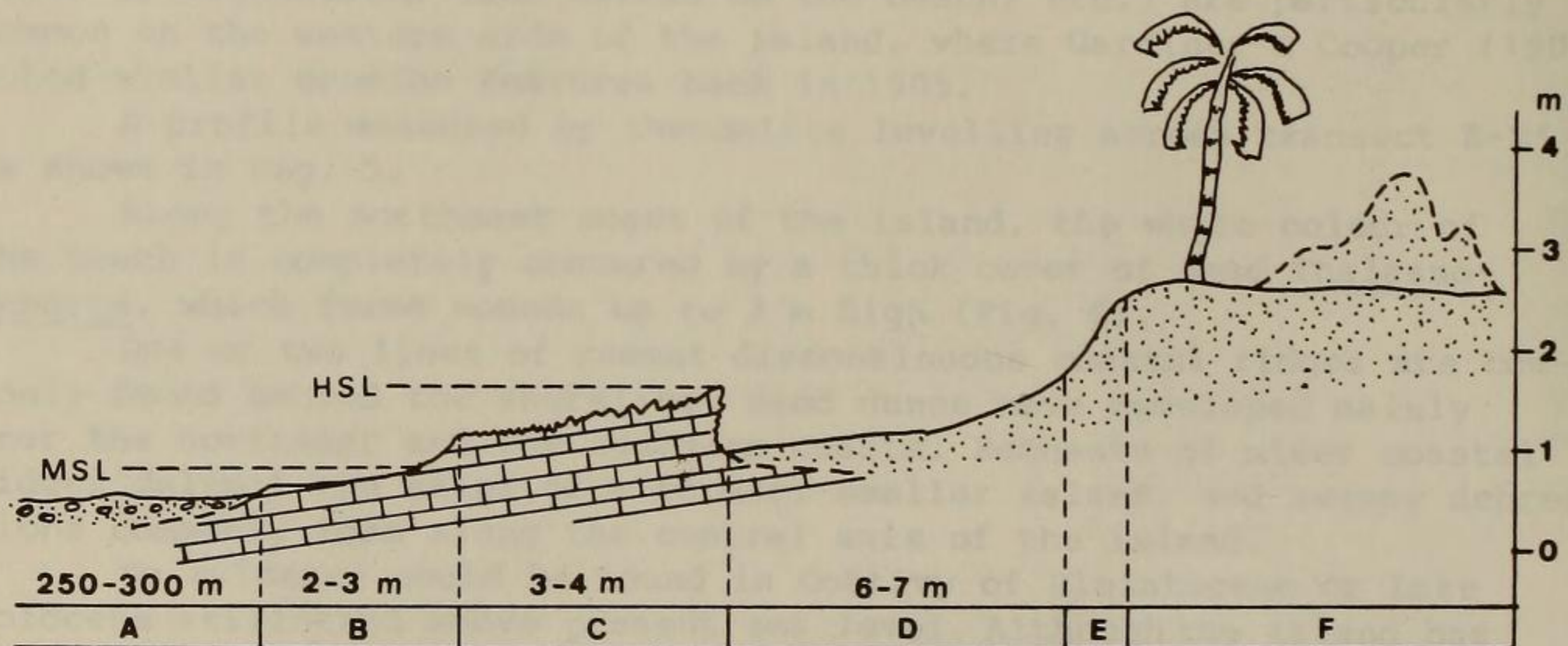


Figure 2. Schematic idealized profile of the southeast shore of Coëtivy. A : reef flat ; B-C : beachrock ; D : sandy beach ; E : erosion slope ; F : island surface. Elevations are given approximately above the zero of marine charts.

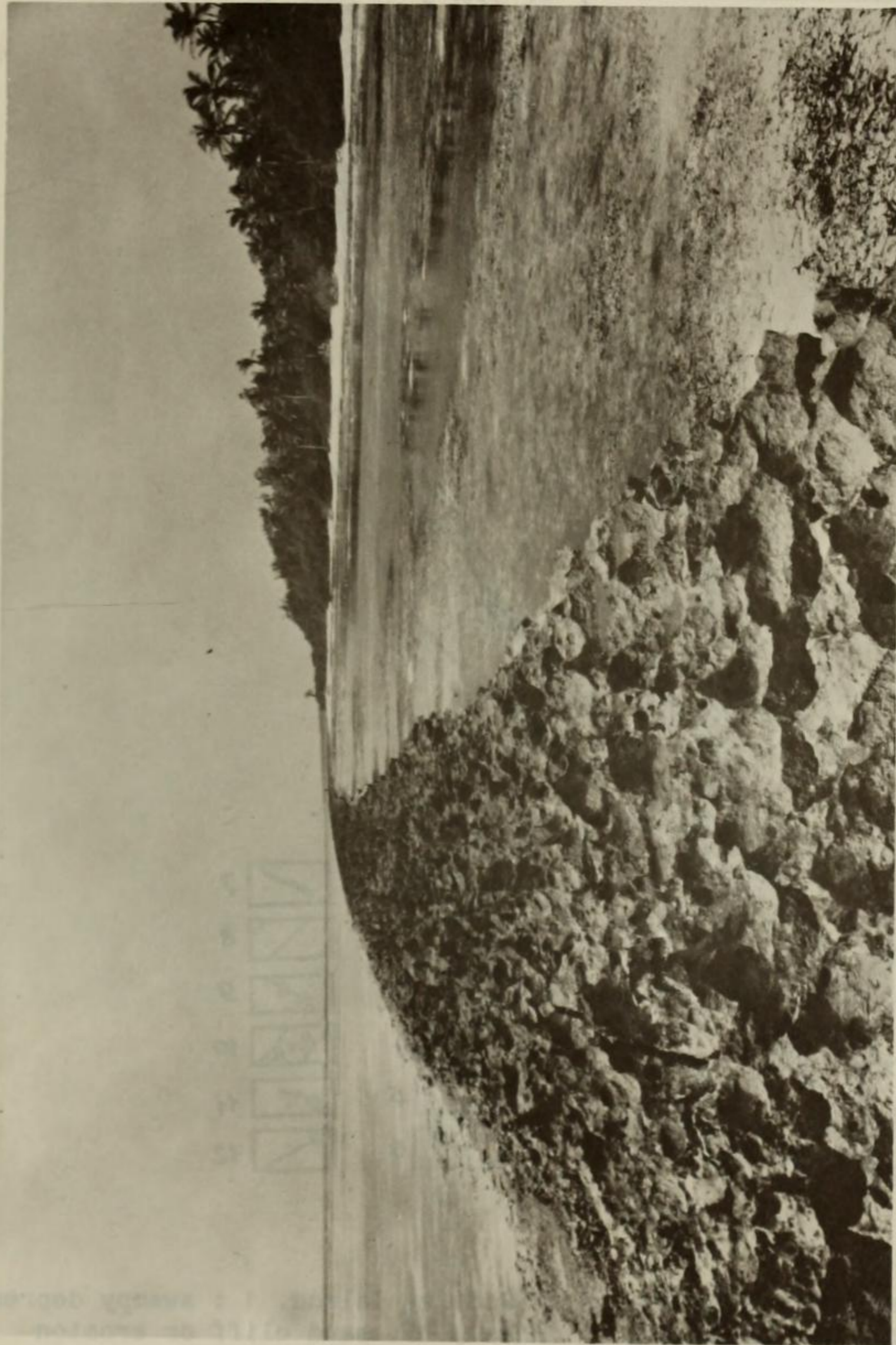


Figure 3. This beachrock spit stretching into the middle of the reef flat marks the position of a former shoreline. The water level is 0.15 m below MSL.

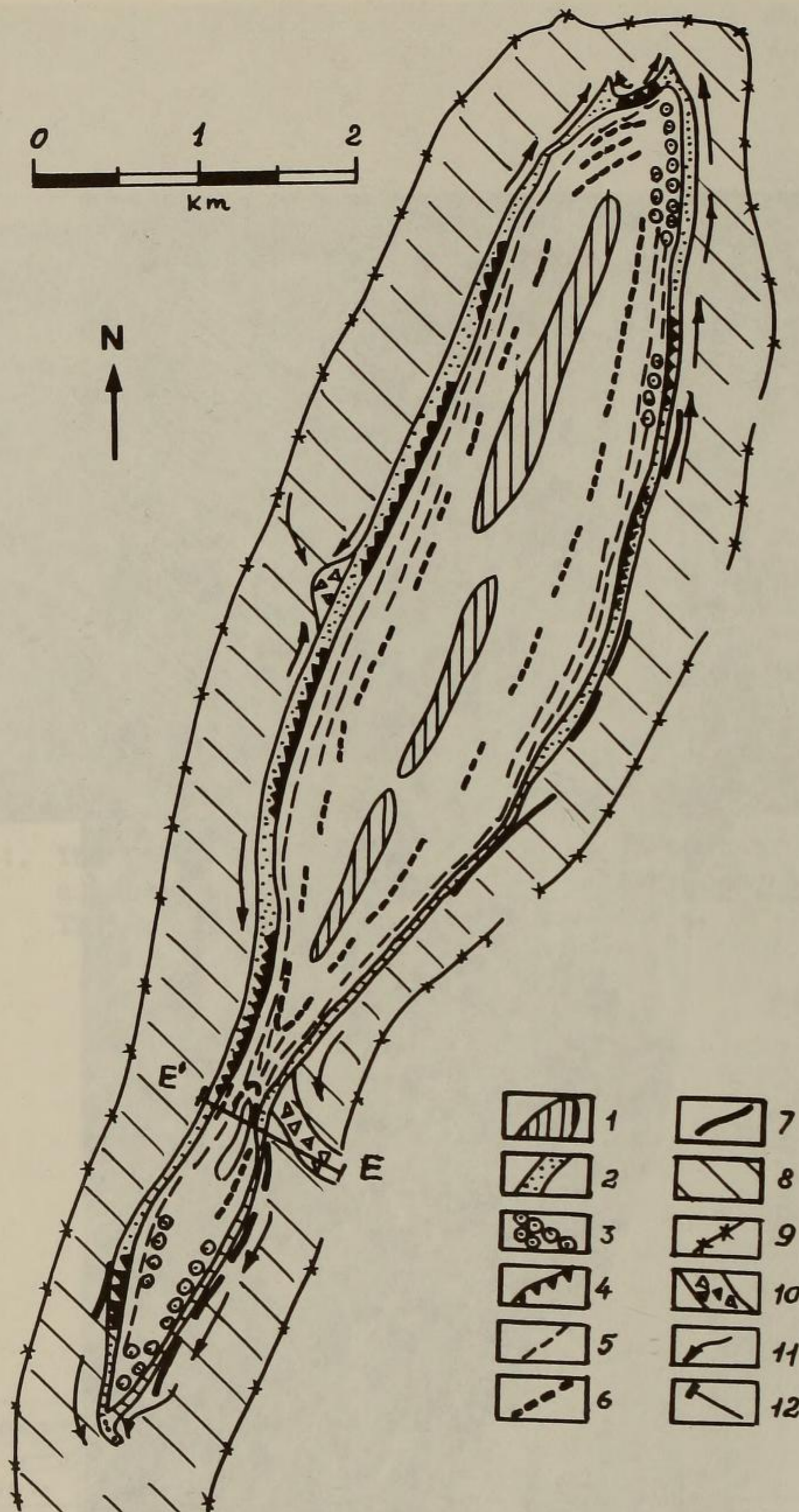


Figure 4. Geomorphological sketch of Coëtivy Island. 1 : swampy depression ; 2 : beach ; 3 : dunes ; 4 : sand cliff or erosion slope ; 5 : modern coastal ridge ; 6 : ancient coastal ridge ; 7 : beachrock ; 8 : reef flat ; 9 : outer reef margin ; 10 : accumulation of massive debris ; 11 : direction of sediment migration ; 12 : location of the E-E' cross-section (see Fig. 5).

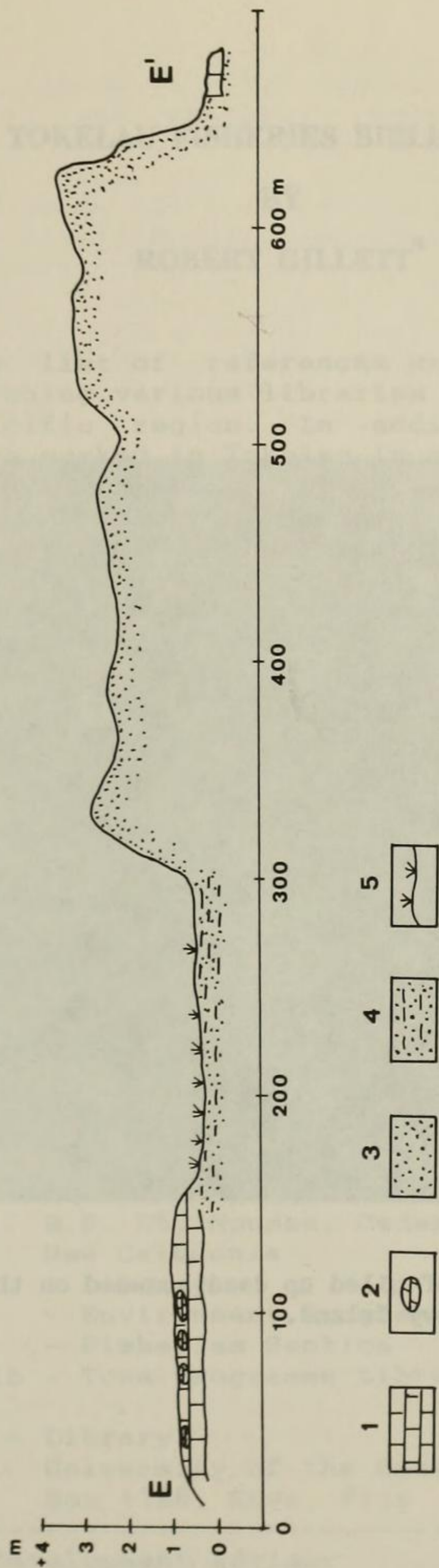


Figure 5. Cross-section in the south part of Coëtivy Island (for location, see Fig. 4). 1 : reef rock ; 2 : boulder debris of corals and reef rock ; 3 : sand ; 4 : silty sand ; 5 : seaweeds. Altitudes are related to the zero of marine charts.



Figure 6. Accumulation of piled up dead seaweed on the northeast coast of Coëtivy Island.