# REPORTS OF MEETINGS

## SYMPOSIUM ON THE QUATERNARY COASTLINE OF CHINA

A symposium to discuss and review the Quaternary coastline (sea-level) in East China was held in Changzhou City, Jiangsu Province, November 4-9, 1985. This is the second symposium sponsored by the CHQUA Coastline Subcommission (or Subcommission on the Quaternary Coastline of China) which was set up in Xiamen, Fujian Province, on November, 1982, with Professor Ren Mei-e elected as Chairman and Professor Liu Zechun as Secretary-General. The secretariat is in the Geography Department, Nanjing Normal University, Nanjing, P.R.C.

Changzhou is a beautiful, medium-sized industrial city of China, situated in the deltaic plain of the Changjiang (Yangtze River) where many prehistoric human sites have been discovered. The second symposium was jointly organized by the CHQUA Coastline Subcommission and Archaological Association of Jiangsu.

Some 100 delegates from all parts of China took part in the conference. About 50 papers were read, with emphasis on changes in coastline morphology of the Changjiang Delta during the Holocene in relation to prehistoric human sites. Field excursions were made to neolithic sites and to examine sediments near Tai Hu Lake and on the bank of the Changjiang. The fact that the bottom of Tai Hu Lake consists essentially of Xiashu loess with only a thin cover of recent lacustrine mud and the wide distribution of archaeological sites in the plain around the lake and on the lake bottom proves that Tai Hu Lake did not evolve from a lagoon but was formed by the flooding of a low-lying alluvial during the past few thousand years.

Proceedings of the first symposium have been published by China Ocean Press, Beijing (in Chinese, with English abstracts). The Proceedings volume for the second symposium is now in press and will be available soon.

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## SEA-LEVEL AND ENVIRONMENTAL CHANGES IN SHELF AREAS OF THE WESTERN INDIAN OCEAN

It is well known that the present level of the oceans corresponds to an unstable, interglacial high position, which dates back only some 6,000 years and was very seldom reached in the past. During the Quaternary, assuming that isotopic ratios of oxygen in oceanic cores can be used as proxies of the ocean water volume, the sea level can be estimated at more than 20 m below the present situation during 75% of the time, and more than 40-50 m during 50% of the time. This means that wide areas of continental shelves were exposed repeatedly during long periods to subaerial conditions and that their last submergence dates only from postglacial times.

The study of the paleogeographic evolution of the shelf areas is one of the main aims of Project IGCP-200, which has formed a special working group on this topic, led by P.A. Kaplin (USSR). In January and February 1986, under the auspices of IGCP-200, an international expedition of the R/V "Professor Shtokman," of the Institute of Oceanology of the Academy of Sciences of the USSR, was specially devoted to paleogeographic shelf investigations in the western Indian Ocean, in areas where previous sea-level data were scarce or nonexistent.

Research was conducted mostly along selected transects, across the Seychelles Bank, or perpendicular to the coasts of northwest Madagascar. In each transect several techniques were used: continuous bathymetric and Sparker profiling; sounding of the upper strata of sediments with an echosounder-sedimentograph "Atlas-Deso 10" type; dredging of surface sediments from the sea floor and sampling of water at various depths for analysis of suspended matter; continuous coring, 62 to 127 mm in diameter, up to 4 m long, using vibro-piston and percussion techniques; surveying of selected areas with side scan sonar and submarine video-recording and photography; last, but not least, geomorphological surveying on land and levelling of coastal features in the emerged parts of the transects.

Altogether, 14 transects were investigated, 30 continuous cores were collected and coastal geomorphology observations were conducted in Mahé, Coëtivy and Farquhar Islands (Seychelles), Saint-Joseph (Amirantes), near Fandrina, Ankifi, Antany Mora Island, the Bombetoka Bay and Betobaka (Madagascar). Brief geomorphological observations of elevated marine terraces were also made in areas near Dar es Salam (Tanzania) and Mombasa and Malindi (Kenya).

The Seychelles Bank consists of coral reef limestone capping a granite bedrock, which is exposed in high islands (Mahé, Praslin, etc.) (Figure 1). The coral limestone forms an outer rim, developing discontinuously around the bank, and a number of inner patches, the highest of which reach depths of −20 to −15 m. The relief of the limestone corresponds either to older Quaternary reefs, especially where it is most prominent, or to new Holocene reefs deposited directly above the granitic bedrock.

On the slopes of the outer rim and of the patches, marks of marine abrasion are found mostly between −110 and −105 m, between −72 and −65 m, and at about −32 m (Figure 2). Localized depressions are widespread between −50 and −65 m.

The paleogeographic evolution can be summarized a follows. During the last glaciation period, the Seychelles Bank was a wide single island where weathering and karst processes were active. Several valleys of paleo-river beds, reaching the outer slope

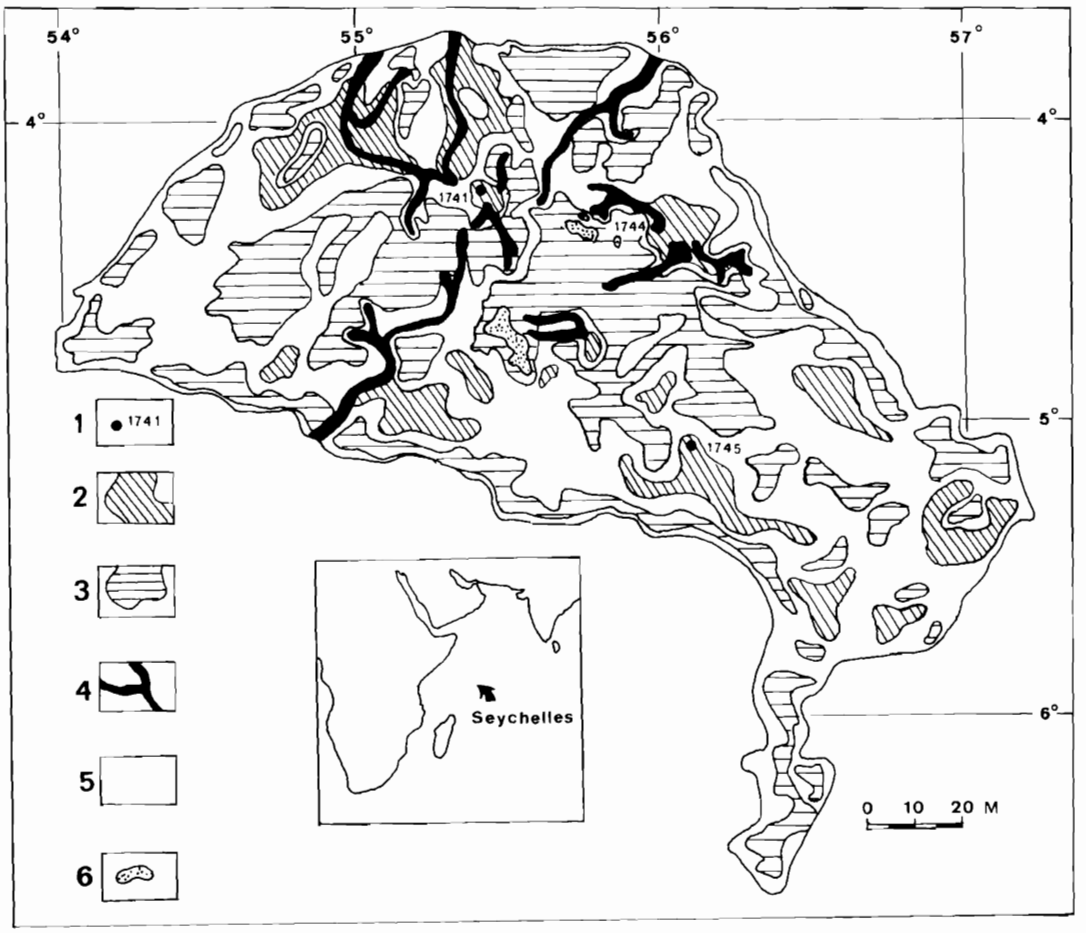


Figure 1. Schematic geomorphological map of the Seychelles Bank. (1) Location of the cores represented in Figure 2; (2) Depressions (paleolagoons) situated at depths of 50-60 m; (3) Surfaces and terraces located at depths varying between 15 and 45 m; (4) Paleoriver valley; (5) Polygenetic surfaces located at depths varying between 45 and 60 m; (6) Emerged land and present reefs.

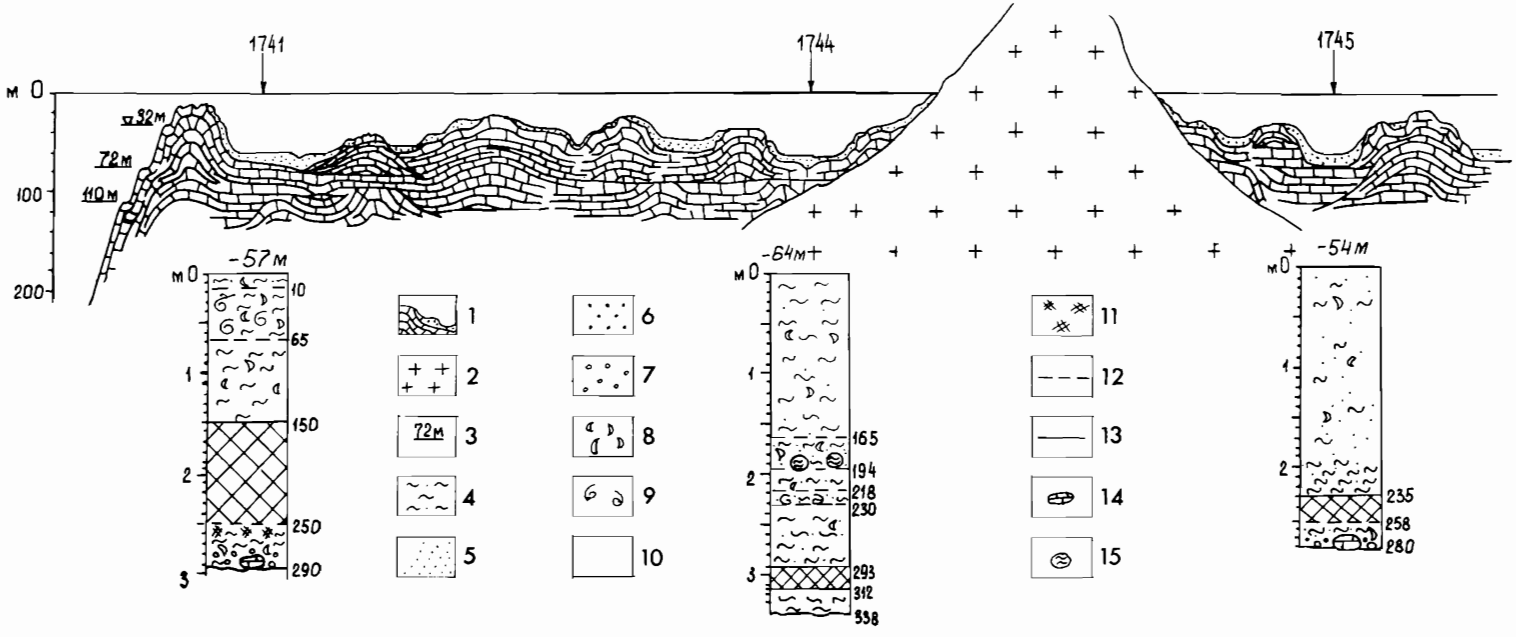


Figure 2. Diagrammatic profile of the geological setting of the Seychelles Bank. No horizontal scale. for the location of the cores, see Figure 1. The lengths of cores given are below the sea floor. (1) Coral reef limestone and unconsolidated carbonate sediments; (2) Granite bedrock; (3) Level of a terrace; (4) Silty clay carbonate sediments; (5) Silt; (6) Sand; (7) Gravel; (8) Shell fragments; (9) Shells and coral fragments; (10) Peat; (11) Sparse vegetal remains; (12) Gradual transition between layers; (13) Sharp transition between layers; (14) Limestone fragment; (15) Clay ball.

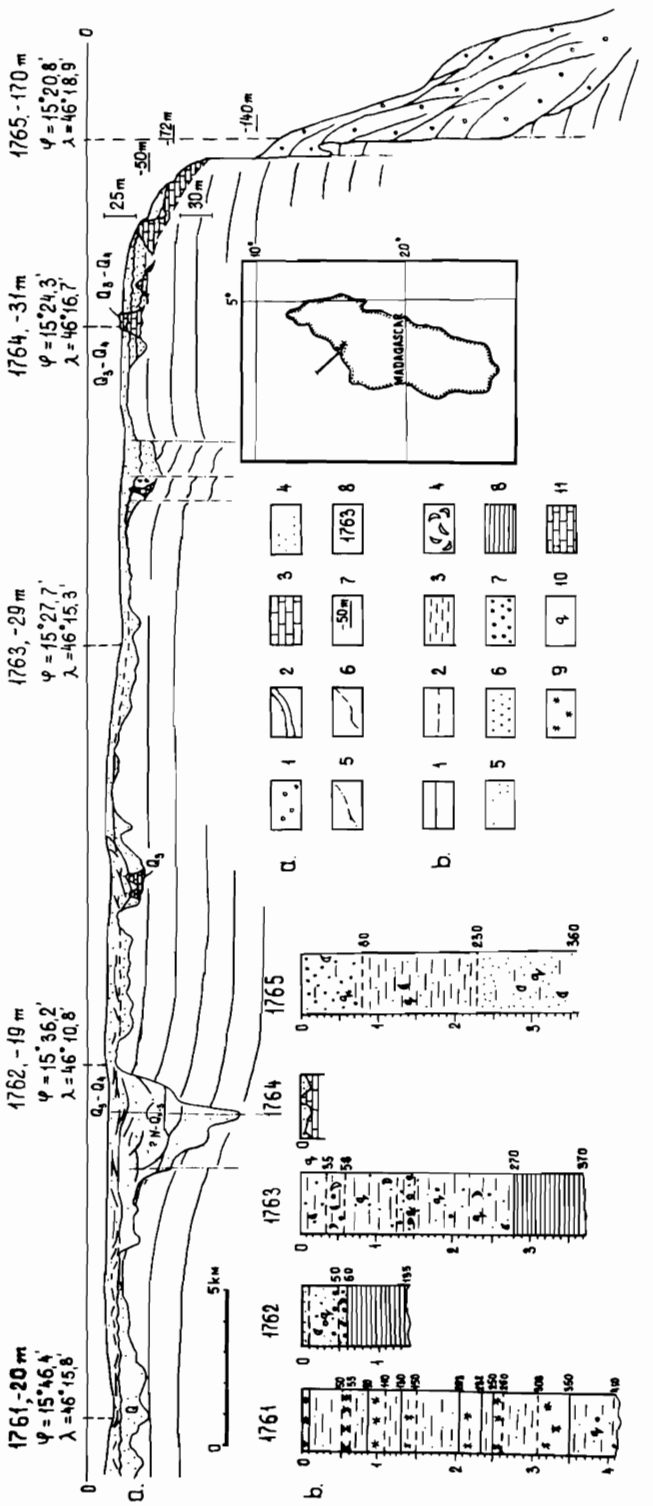


Figure 3. Bombetoka transect (Madagascar). a (1) Deposits of the upper part of the continental slope; (2) Consolidated shelf deposits; (3) Quaternary reefs; (4) Soft shelf deposits; (5) Fault; (6) Seismic (acoustic) boundary; (7) Level of a terrace; (8) Number of core. b (1) Sharp transition between layers; (2) Gradual transition between layers; (3) Pelitic clay; (4) Detritic carbonate; (5) Alivrite; (6) Sand; (7) Gravel; (8) Alluvial sandy clay (paleodelta); (9) Mica; (10) Quartz; (11) Limestone.

or the inner depressions, appear clearly. Clay sediments including quartzitic silts and sands issued from the weathering of granite and the demolition of debris material.

When the post-glacial sea-level rise reached −60 to −70 m, sea water penetrated into the inner depressions, forming a number of lagoons and leaving coarse carbonate debris and coral fragments (Figure 2b). A little later, mangrove vegetation developed in the lagoons; remains of this mangrove are found as peat layers at depths varying between −56 and −67 m. A transgressive set of carbonate detritic sediments was left above the peat layers.

On the shelf of northwest Madagascar four transects were investigated between Cape d'Ambre and Cape St-André, and 15 cores of bottom sediments collected.

As in the Seychelles, evidence of the minimum position reached by the sea during the last glaciation could not be obtained. This is due to the shallowness of the water in these areas, which seldom exceeds 60 m above the Seychelles Bank, and 40 m above the shelf of northwest Madagascar. In the upper part of the continental slope of Madagascar however, marks left by lower sea levels have been detected at depths of 140-160 m, 72 m, and 50 m respectively (Figure 3a). Similarly, the occurrence of platforms at −110 m, −72 m, and −32 m has been observed on the outer slope of the Seychelles Bank.

During late Glacial times the shelf of Madagascar was an emerged lowland with a set of paleorivers and paleodelta formations. In core no. 1763, collected at a depth of 29 m (Figure 3b), marine sediments (horiz. 0-270 cm) cap a layer of greenish-gray sandy clays (horiz. 270-370 cm) which have been affected by secondary processes of diagenesis. The latter sediments are alluvial in origin and seem to correspond to the upper part of a layer of cross-bedded deltaic sediments. In core no. 1762, as in other cores collected on the northwest shelf of Madagascar, reddish-brown, greenish-brown, and yellowish crusts of weathering, apparently *in situ*, were found beneath the marine sediments.

Generally speaking, marine influence was found to start on the shelf when sea level was some 40 m below the present one. At this same depth, on the outer part of the shelf, off Cape St-Sébastien (core no. 1753, 12°34'1 S, 48°10'1 E, −50 m) typical lagoon sediments with *Halimeda* detritus were found.

Some effects of the rise in sea level above the shelf can also be found at much greater depths. In core no. 1759 (13°24'6 S, 47°50'5 E), for example, collected 1400 m deep, the lower part of the column (horiz. 90-125 cm) consists of silty clay, terrigenous mud, mixed with coarser grained carbonate material. The upper part of the core, which is much coarser than the underlying sediments, consists of pelithomorphic mud with shell fragments. These facies variations can be explained by the environmental conditions prevailing on the shelf. In fact, at the initial phase of the transgression, mainly terrigenous clay material was carried off from the shelf. It was only at a later period that more carbonate material could penetrate into the pelagic zone.

Two horizons of coarser material are found in the upper part of some cores, both in the Seychelles Bank and in northwest Madagascar. In the Amirantes Bank, two samples of shell material collected from the upper coarser horizon in 1983 by an expedition made by the R/V "Academician Petrovskiy" were dated by radiocarbon 2000±200 BP (MGU964) (Badyukov *et al.*, Oceanology, Moscow, 1986, in press). These coarser horizons may result either from oscillations of sea level or from variations in lithodynamics in relation to periods of increased wave activity of climatic origin.

Two similar coarser layers have also been found in some cores on the northwest Madagascar shelf, where the water depth is usually less than 40 to 50 m. Here the sediments are much more terrigenous in the lower part of the cores than on the Seychelles Bank, but the carbonate content increases in the upper part. In some cases paleodelta formations could also be found.

The radiometric dating of several samples collected in 1986 is expected to provide further interesting information on the local sea-level position at various periods of time, and more details on the deposition of layers of coarser sediments in the upper parts of the cores.

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