Preliminary Study on the Holocene Carbonate Deposition of Taiping-Dao, Nansha(Spratly) Islands

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Abstract

Taiping-Dao, the largest islet of the Nansha Islands of South China Sea, is a sand cay developed on Holocene coral reef. Reef-flat surface of the islet was surveyed. Most of the flat is covered by coral cobbles/shingles and bioclastic sands; living corals only occur along the margin. Carbon 14 dating of reef rocks taken on the reef-flat surface and in drill cores indicates that the Holocene reef development began about 7.9 ka and the reef flat and sand cay might have started to build up 4.7 ka and kept expanding in a progradation mode since then.

Introduction

Taiping Dao, located at 10˚23'N and 114˚22'E, is the largest islet of the Nansha Islands, South China Sea. The islet is at the northwest margin of the Zheng He Reef, and measures about 1350 m in NE-SW direction and 350 m in NW-SE direction at its maximum. The subsurface sequence of Taipiong-Dao consists of entirely carbonate sediments and developed under the impacts of Pleistocene glacio-eustasy (Gong et al., 2003, Gong et al., 2005). In this presentation, we report the preliminary results of our survey on the Holocene sedimentation of Taipiong-Dao.

Results

The islet itself is entirely covered by bioclastic sands and guano deposits. Beaches form all around the islet, however beach rocks only develop along the north coast. Except for being slightly cemented, and being stained by guano and humus matter, the sands on the island are basically the same as the beach sands in terms of grain size and constitutes. Both are composed of fine- to medium-grained bioclastic sands mostly derived from corals. Evidently, the islet is capped by sand cay above coral reef and stabilized by vegetation in its latest stage of development.

On the reef flat, the surface sediments vary from inner flat to outer flat as shown in Figure 1. The sedimentary facies, from inner to outer flat, can be identified to be: (1) bioclastic sands/ gravels, (2) bioclastic sands/gravels with sparse sea grass, (3) bioclastic sands/gravels with dense sea grass, (4) coral boulders/shingles, (5) living reefs. It is evident that the wave energy reduces from the outer flat to the inner flat. The facies pattern is basically similar on all sides of the Taiping Dao. There are no obvious windward or leeward characteristics observed. Except for the beach rocks, the distinctions between the lagoon and open water coasts are also insignificant.

The biocalstic sands/gravels are commonly stabilized by sea grass *Thalassia* on the inner to middle part of the reef flat. The distribution of sea grass differs from that of previous study (Lewis and Lin, 1994). Whether this is a seasonal feature or a long-tern

trend requires further study. If we ignore the sea grass factor, the sedimentary facies on the reef flat can be simplified as living reef along the margin, coral shingles/boulders on the outer flat and bioclastic sands/gravels on the inner flat.

Short borehole cores were taken on the reef flat and thin-sections were made. The locations of the cores are plotted in Figure 1. In four of the cores, pristine corals were recovered for AMS-C^{14} dating. The radiocarbon ages were corrected using CALIB Program v.5.0.1 by Stuiver and Reimer, and listed in Table 1. The inner flat is dated from 3718±92 cal yrBP to 3075±105 cal yrBP, while the outer flat is dated to be 1193±71 cal yrBP.

It caught our attention that the reef-flat development is only active along the margin where living corals occur below 2m in water depth. There are ver scarce living corals on the reef flat, except for occasionally occurring micro-atolls of *Porites* corals. This observation is consistent to report by Dai and Fan (1994). Dai and Fan (1994) pointed out that the paucity in coral abundance had not resulted from fishing or other human activities.

In reefs of the Indo-Pacific areas, the reef flats, especially the inner flats, are typically the places of high abundance of living corals. The lacking of living corals on reef flat of the Taiping Dao is unusual and therefore requires explanation. According to our preliminary measurements and previous reports (Chen and Huang, 1981; Chen and Hsia, 1982), we tentatively consider high sea-surface temperature is the reason for paucity of living corals on reef flat of the Taiping Dao.

Short cores drilled on the reef flat reveal that, below a thin veneer of sediments, the reef flat is mostly composed of algal-coral boundstones and well lithified. Such occurrence suggests that the flat is truly built by reef growth but not sediments accumulation, and its upward growth has ceased. The preliminary results of AMS-C^{14} dating (Table 1) also indicate the reef flat has ceased its upward development a few thousands years ago, and likely developed in a progradation mode. Whether the cease of upward growth is due to diminishing space limited by sea level, or due to that sea-surface has been too warm for a few thousands years requires further study.

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Table 1. AMS radiocarbon dating of fossil corals from reef-flat surface and drill cores of the Taiping-Dao.

Sample No.	material	radiocarbon age	calibrated age
East-1	coral	3856±30 BP	3718±92 cal yrBP
West-3	coral	3483±35 BP	3273±86 cal yrBP
West-5	coral	3322±35 BP	3075±105 cal yrBP
West-7a	coral	1712±30 BP	1193±71 cal yrBP
- 9 m	coral	4662±55 BP	4761±115 cal yrBP
-11.8 m	coral	4757±65 BP	4924±104 calyrBP
-21 m	coral	7487±30 BP	7864±87 cal yrBP

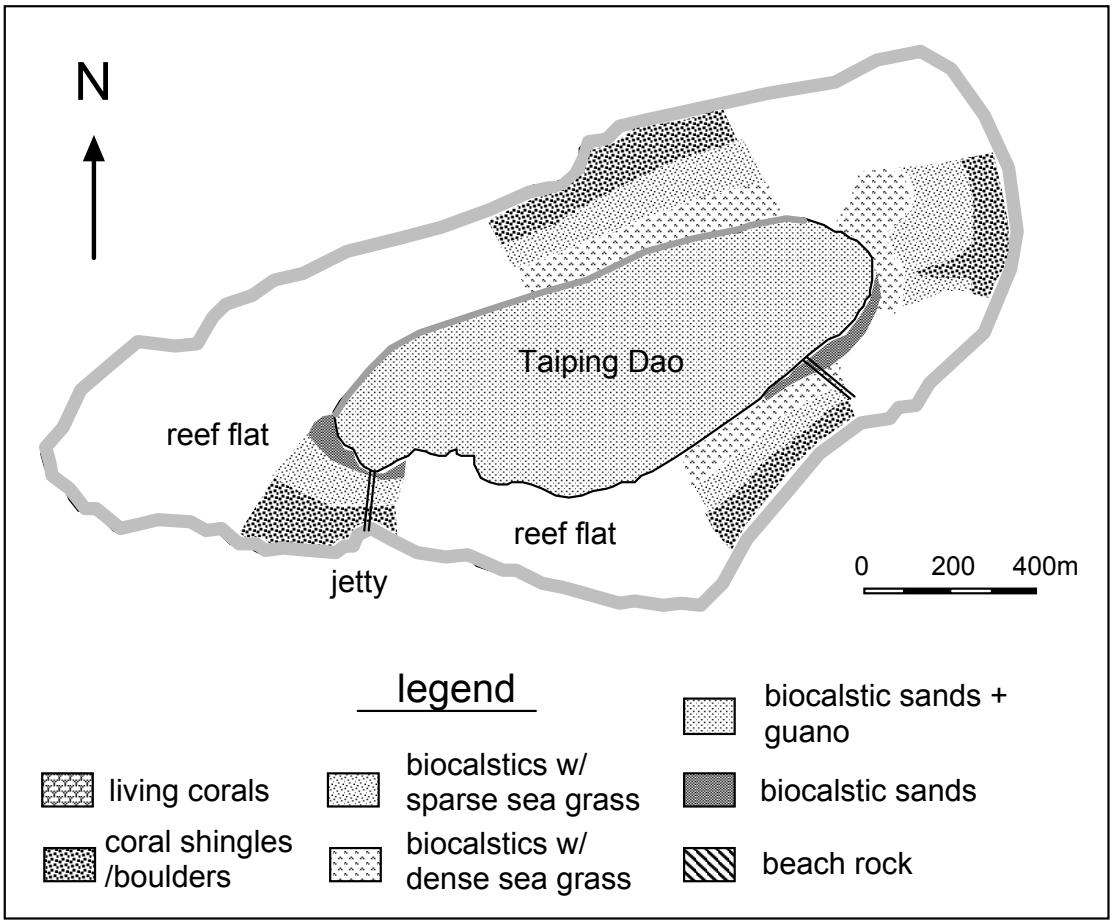

Figure 1. Sedimentary facies of the islet and reef flat of Taiping Dao, Nansha Islands.