

High-Resolution Biostratigraphy of the Holocene in Cores from the Bahamian Slopes

Emmanuelle Ducassou, Ludivine Chabaud, Sabine Schmidt and Thierry Mulder

Abstract The leeward slopes of the Bahamas are characterized by very high sedimentation rates over the Holocene. Here, we use biostratigraphy based on planktonic foraminifera as a powerful tool to compare and date sediment cores and facies. The study is based on an investigation of four cores collected from the upper slope of the Great Bahama Bank during the CARAMBAR cruise (2010), including determination of eleven radiocarbon dates, analysis of ^{210}Pb excess, and identification of planktonic foraminifer assemblages. The paper presents and discusses the main features used for detailed biostratigraphic points in this area for the middle and late Holocene.

Keywords Biostratigraphy · Planktonic foraminifera · Holocene · Bahamas slopes

Introduction

Sedimentary processes on the slopes of tropical carbonate factories and platforms are less well known than those occurring in siliciclastic systems, despite the abundant literature existing on sedimentation on platform tops. These carbonate environments are characterized by: (1) their lack of a point source, but platforms with steep edges often act as a line source; (2) sediment export to the slopes occurs mostly during sea-level highstands, when sediment production is the highest (Schlager et al. 1994); and (3) off-bank sediment transport is episodic and controlled by tides, storms, and cascading density currents (Cook and Mullins 1983; Eberli 1991).

E. Ducassou (✉) · L. Chabaud · S. Schmidt · T. Mulder
Avenue des Facultés, Université Bordeaux 1, UMR 5805 EPOC, 33405 Talence cedex,
France
e-mail: e.ducassou@epoc.u-bordeaux1.fr

Data collected during the CARAMBAR cruise (2010) off the two largest banks of the Bahamas (Great Bahama Bank, GBB, and Little Bahama Bank, LBB) have been analysed to better understand sedimentary processes in such environments sensitive to climatic and oceanic change (Mulder et al. 2012a, b). This work focuses on the establishment of a high-resolution Holocene biostratigraphy and correlate cores from the leeward GBB slope.

Study Area

The Bahamian archipelago is located on a passive continental margin, making the tectonic influence less important than the effects of both sea-level changes and biogenic production. The archipelago is an isolated carbonate system surrounded by deep channels that receive siliciclastic dust carried only by winds and by surface/bottom currents.

We focused our study on the western leeward margin of the GBB (Fig. 1) which is the largest carbonate platform of the archipelago. In the adjacent Florida Strait, the Florida Current flows northwards (Wang and Mooers 1997). Periodically, hurricanes sweep off mostly fine-grained carbonates from the GBB (Eberli et al. 1997).

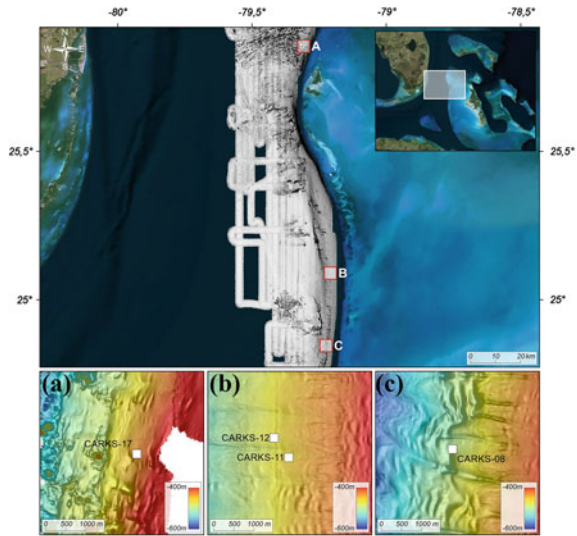
Distinctive morphological domains have been identified along the slope of the GBB, among them gullied slopes (Mulder et al. 2012a). Those gullies appear at ~440 m water depth and extend down to about ~600 m. The disconnection of gullies from the carbonate bank below a water depth of ~440 m, combined with the absence of large-scale failure scars at the gully head, suggests that they form by the activity of plunging currents that reach the sea floor at about 400 m water depth. This density-cascading phenomenon has been noted previously on Bahamian slopes by Wilson and Roberts (1995).

Materials and Methods

This study is based on four piston cores collected from the upper slope of the GBB during the CARAMBAR cruise (2010; Fig. 1). Three of these cores were collected in an upper slope characterized by many gullies (CARKS-11, CARKS-12, and CARKS-08; Fig. 1). Core CARKS-17 was collected in the upper slope north of Bimini Islands (Fig. 1).

These four cores were sampled for biostratigraphy and radiocarbon analyses. Radiocarbon dates were performed on eleven samples, using >10 mg of clean handpicked planktonic foraminifera from the >150 μm fraction. Radiocarbon ages were determined via accelerator mass spectrometry (AMS) at the Laboratoire de Mesure du Carbone 14-Saclay (Paris) under the French Artemis programme.

Fig. 1 General map of the western slope of the Great Bahama Bank and Florida Strait with the bathymetric data collected during the CARAMBAR cruise (2010). **a, b, and c** are enlarged bathymetric maps showing the locations of the four cores used in this study



For faunal analyses, the >150- μm fraction was split into aliquots of at least 300 specimens of planktonic foraminifera for identification, according to the taxonomy of Hemleben et al. (1989). Total assemblages were considered and faunal data are given as percentages of the total number of planktonic foraminifera.

Profiles of ^{210}Pb excess were established for the first few centimetres of the cores to date the uppermost sections. Measurements of ^{210}Pb activity were conducted on dry sediments at the EPOC laboratory (University of Bordeaux) using a semiplanar germanium detector (Schmidt et al. 2009).

Chronological Framework of the Mid- to Late Holocene in the Bahamas Area

Radiocarbon dates show a continuous record over the last 5700 yr cal. BP, and ^{210}Pb excess indicates recent sedimentation on top of CARKS-17 core. The average sedimentation rates over this period were ~ 1.8 m/kyr.

Planktonic foraminiferal assemblage records for the four cores collected from the upper slope of the GBB show a series of bioevents. The main events useful for biostratigraphic purposes in this area are: (1) the last (highest) occurrence (dominant species, >30 %) of *Globigerinoides sacculifer* at ~ 5000 yr cal. BP and the replacement with *Globigerinoides ruber alba* as the dominant species during the late Holocene; (2) the last (highest) occurrence of *Globorotalia menardii*, *Globorotalia tumida tumida* (>15 %), and *Globigerina rubescens* (>10 %) between ~ 2700 and 3200 yr cal. BP; (3) the last (highest) occurrence of *Globorotalia*

truncatulinoidea dextral (>3 %) at ~1600 yr cal. BP; and (4) the last (highest) occurrence (>15 %) of *Globigerinoides ruber rosea* at ~950 yr cal. BP.

Holocene sedimentation rates are closely related to small-amplitude sea-level oscillations as higher sea levels imply greater carbonate production and sedimentation exportation from the bank. These Holocene deposits are identified all along the upper slope of the GBB in the southern part of Bimini Islands on very high resolution seismic profiles (3.5 kHz). They allow regional correlations to be established related to sedimentary/palaeoceanographic processes occurring during the late Holocene.

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