

Mixed Carbonates and Siliciclastics in the Quaternary of Southern Belize: Pleistocene Turning Points in Reef Development Controlled by Sea-Level Change

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The southern shelf of Belize (Central America) is a classic location of a mixed carbonate-siliciclastic system. Whereas the knowledge of the Holocene deposits in the area is extensive, data on the Pleistocene system are fragmentary. Open questions include the nature of the reef foundations (carbonate versus siliciclastics), the ages of the deposits including the initiation of the barrier reef, and the response of the mixed system to sea-level fluctuations. Six up to 105 m long borings were made on the southern Belize shelf in order to better understand the history of this mixed system. U-series dating in the Pleistocene was not possible due to diagenetic alteration, however, lithostratigraphy, strontium isotopes and calcareous nannofossil biostratigraphy were used to constrain stratigraphic ages. Our results support the contention that the Quaternary development in Belize was quite similar to that of other major barrier reefs where significant reef growth only began after the onset of high-amplitude, eccentricity-controlled sea-level changes and as late as during the long and warm marine isotope stage (MIS) 11, some 400 ka ago. In Belize, early Pleistocene sections include mollusc-rich wackestones, rare coral packstones, and marls, which were deposited under low to moderate energy conditions in a ramp setting around 1 Ma, during high sea levels of marine isotope stage (MIS) 25 and possibly earlier (MIS 31, 37). The Belize shelf was subaerially exposed for most of the mid Pleistocene and dominated by siliciclastic sedimentation, possibly during MIS 24-12 when highstands were comparatively low. Continuous reefs at the shelf margin were developing during highstands. In the late Pleistocene, beginning with MIS 11, the southern shelf was entirely flooded and carbonates started to dominate once more. Reefs developed on top of siliciclastic deposits on the shelf. A continuous barrier reef came into existence and largely developed on top of carbonates at the shelf margin. During late Pleistocene lowstands, siliciclastics presumably did not no longer reach the shelf margin anymore because of the topographic high of the barrier reef platform. The Quaternary Belize example may serve as a model for reconstructing ancient mixed systems in icehouse worlds, however, any extrapolations are limited by the fact that fast-growing Scleractinian reef-builders had not yet evolved in the Paleozoic.