Nature and Evolution of Deep-Water Carbonate Drifts in the Past 3 Million Years, Inner Sea of the Maldives Archipelago, Equatorial Indian Ocean

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Abstract

A 200 m-thick deep carbonate sediment drift was first observed on a Shell E-W seismic line north of Gaafaru Falhu atoll in the NE corner of the Maldives Inner Sea, in a range of water depths from ~300 to 500 m. The deep-water sandy drift in the area north of Gaafaru Falhu atoll and an adjacent deeper muddy drift was extensively surveyed via 12 kHz multibeam bathymetry, a 4 kHz sub bottom profiler, multi-channel high resolution seismic reflection, and three box and piston cores. The linked internal geometries of the sandy and muddy drifts, observed in the available seismic data sets, are integrated into a sequence stratigraphic framework. Analyses of two piston cores, collected from the upper part of the muddy drift, and a box core, from the top of the sandy drift, determine the overall downcore lithology variations and made possible the development of high-resolution chrono and cyclo-stratigraphies. In the muddy drift periplatform sequence, downcore cyclic variations in, (1) sediment coarse fraction, (2) Sr counts as proxy for atoll-derived fine aragonite, (3) planktic foraminifer oxygen stable isotope composition, in addition to carbonate preservation and biostratigraphic markers, were determined. These downcore lithologic and geochemical variations in the muddy drift were tied to the seismic lines, imaging the sandy-muddy drifts, to resolve the timing of the carbonate sandy and muddy drift establishment and their overall evolution. Based on the interpretation, the results document the nature and timing of the longer-term evolution of the sandy and muddy drifts over multiple glacial-interglacial sea level

cycles in the last 3 million years. Once the timing of the drifts was determined, the prograding internal architecture of the sandy drift was examined and interpreted in the context of the relatively well-established Plio-Pleistocene sea level fluctuations and the bottom current variations. Detailed analysis of the drift accumulation in tying, at high resolution, sedimentological, isotopic, and geochemical cyclo stratigraphies with seismic imaging, greatly help understand the processes involved in the Plio-Quaternary drift formation in the context of the multiple flooding and exposure of the adjacent atolls.

Keywords: Maldives carbonate system, Pliocene-Quaternary, sandy and muddy drifts, sea-level, strontium, monsoon