

# Upper Slope Detailed Modern Reef Morphologies: Unique Archive of a Well-Established High Amplitude Sea Level Transgression, Lighthouse and Central Barrier Reefs (Belize)

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## Abstract

In the past 500 ky, Earth has witnessed unprecedented dramatic cyclic changes in climate that translated in unusually high amplitude, 100-130 m sea-level fluctuations. One of these late Quaternary transgressions only occurred in the last 20 ky since the Last Glacial Maximum when the Belize isolated carbonate platforms, such as the Lighthouse Reef, and the Barrier Reef itself were exposed, forming islands or coastlines with imposing coastal cliffs. High-Resolution Multi-beam Echo Sounder (MBES) data sets were acquired along segments of the leeward and windward margin of the Lighthouse Reef and drone-based photogrammetry along windward margin segments of the central Barrier Reef from a few meters of water depth down to 400 m. Data sets were processed and displayed in high resolution 3D bathymetric models. Punctuated sea level rise, during the uppermost Pleistocene and early/middle Holocene deglaciation, has produced a series of typical transgressive morphological features on the upper slopes of the Lighthouse Reef and central Barrier Reef such as notches and overhangs in the deep fore reefs (120-70 m), drowned terraces and ridges in the outer fore reefs (70-25 m), and three sets of spurs and groves in the inner fore reefs (25 to a few meters). Submerged terraces, ridges, and sets of spurs and groves are interpreted to form by reef backstepping during short intervals of punctuated rapid sea-level rise.

Occurrence of those transgressive morphological features, at specific water depths, along the Belize margin upper slopes is compared with similar features along the atoll upper slopes in the Maldives Archipelago and the mixed carbonate siliciclastic shelf edge in the Gulf of Papua. Alternatively, terraces, in particular in a water depth range between 40-60 m, could correspond to the re-occupation of older terraces formed during the previous sea-level lowering, subsequent to the previous highstand interglacial interval, such as Marine Isotope Stage 3. Relatively well-developed deeper terraces, in a depth range between 250-300 m on the lee side margin of Lighthouse Reef, are interpreted to correspond to partially drowned Pliocene platform that back-stepped to the current platform location.