Differences between leeward and windward carbonate margins: results from Bahamian investigations

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Factors governing carbonate slopes sedimentation are generally less known than those for siliciclastic ones. The Bahamian banks are surrounded by well-developed slopes. Their study could lead to a better comprehension of carbonate system slope development for older periods. Over the past decades, the Little Bahamas Bank (LBB) in the Caribbean has been the targets of a series oceanographic cruises being Carambar (2010), Carambar 1.5 (2014) and Carambar 2 (2016-2017). Bathymetric data covering some 24,270 km² of seabed, high-resolution seismic lines running over 6,398 km a of seafloor, 6, 398 km of high-resolution seismic and 42 sediment cores ranging from 177 to 4,873 m water depth were collected covering the upper slope through to the abyssal plain of the LBB depositional system. The data obtained allowed a comparison of sedimentary processes on the leeward and windward margins of the Bahamian platforms. Processes are similar on both types of slopes with density cascading being the the main factor supplying sediment to the slopes with tidal flushing. Hurricanes seem to be rarely and only locally recorded. The impact of alongslope current is also pronounced according to the presence of erosion structures and contourite drifts on middle and lower slopes. They also impact for some part the distribution of carbonate mounds. Similarities between these processes induce many analogies between the two slope geometries. Bahamian upper slopes are generally marked by terraces and escarpments that were formed during meltwater pulses punctuating the last sea-level rise. These flat and narrow small carbonate factories allowed early carbonate production that supplied the upper slope prograding wedges during the Holocene. Sedimentation rates decrease from the bank margin to the lower slope on both the leeward and windward slopes. The present-day geometries of leeward margins can show some differences with windward ones. On the slope of the western Great Bahama Bank, the high sedimentation rates related to the leeward position and high offbank sediment transport by the trade winds and passing cold-weather fronts induce a deeper extent of the Holocene wedge and allow for the development of erosion structures like gullies. Other factors, independent of wind direction, may also influence slope geometries, like banks facies variation on the shallow-water banks, or distance between the island and margins of the shallow-water bank.