Facies Distribution and Paleogeographic Evolution of Pleistocene Carbonates in Bonaire, Netherlands Antilles

Jonathan Sulaica[1], Juan Carlos Laya[1], Michael C. Pope[1], and Niall Slowey[2]

[1]Department of Geology and Geophysics, Texas A&M University, MS 3115, College Station, Texas 77843

[2]Department of Oceanography, Texas A&M University, MS 3148, College Station, Texas 77843

GCAGS Explore & Discover Article #00172*
http://www.gcags.org/exploreanddiscover/2016/00172_sulaica_et_al.pdf
Posted September 13, 2016.

*Abstract published in the *GCAGS Transactions* (see footnote reference below) and delivered as a poster presentation at the 66th Annual GCAGS Convention and 63rd Annual GCSSEPM Meeting in Corpus Christi, Texas, September 18–20, 2016.

ABSTRACT

The interaction between the Caribbean and South American plates produced irregular sea-floor topography on Bonaire (part of the Leeward Antilles Islands), which enables the deposition of calcium carbonate sediments. To better understand the nature and post-depositional history of these deposits, the distribution of carbonate facies across Bonaire was investigated. Direct observations (visual and photographic) of exposed Pleistocene carbonate rocks were made, then hand and core samples were collected. The samples were analyzed using thin-section petrography, x-ray diffraction, electron microprobe, and stable-isotope methods. Four terraces occur on Bonaire, and are associated with tectonic uplift and glacio-eustatic sea-level changes (the oldest, highest terrace located at the island center; the lowest, youngest terrace located along the island edge). Correlation to the dated terrace on adjacent islands indicates the youngest terrace is ~125 ky old (last interglacial highstand of sea level). Results from the visual observations and petrographic analysis (e.g., rock constituents, cement habit, mineralogy, and porosity) were used to delineate seven facies: *Acropora palmata* rudstone, *Montastrea annularis* framestone, coralgal grainstone/packstone, mixed coral framestone, *Acropora cervicornis* floatstone, *Amphistegina* sp. grainstone, and dolomite. Facies distribution is related to wave energy and water depth. *Acropora palmata* rudstone and *Montastrea annularis* framestone facies are located on the windward side of the island (deposited in a high wave-energy, barrier reef environment). Mixed coral framestone and *Acropora cervicornis* floatstone facies are located on the leeward side of the island (deposited in a low to medium-wave energy, fringing reef environment). Coralgal grainstone/packstone facies are located on the platform interior (deposited in a low wave-energy, lagoonal environment). *Amphistegina* sp. grainstone facies is located on the platform interior (deposited by eolian processes), and dolomite facies is located at points across the island (formed by diagenesis of other facies). The dolomite displayed microcrystalline and sucrosic textures, and its $\delta^{18}O$ VPDB (Vienna Pee Dee Belemnite) values ranged from -0.7‰ to 2.7‰ and their mean value was 0.7‰. The proposed model of dolomitization is seepage reflux, during which dolomite forms as heavy brine solutions with heavy ^{18}O made by evaporative processes seep into underlying carbonate rocks.

Originally published as: Sulaica, J., J. Carlos Laya, M. C. Pope, and N. Slowey, 2016, Facies distribution and paleogeographic evolution o Pleistocene carbonates in Bonaire, Netherlands Antilles: Gulf Coast Association of Geological Societies Transactions, v. 66, p. 1063.