Stable calcium, magnesium and carbon isotopic compositions of two modern Bahamian lake stromatolites

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Two modern irregular hard stromatolitic mounds were sampled from the turbid seasonally hypersaline Storr's Lake on San Salvador Island in the Bahamas. Living planktonic, motile microorganisms and suspended algal and bacterial debris create the high turbidity (and light reddish-brown color) of the shallow lake (<2m) and rapidly attenuate sunlight in the water column. Both stromatolitic mounds were collected within the deep part of the lake (water depth >110cm when collected in January 2016 following Hurricane Joaquin which passed over the island in October 2015). One was buried in soft organic-rich calcareous ooze, but the other was not. Lake water had a conductivity 1.2 x seawater, pH ~8.4, and little variation in major cations with depth. The water was supersatured with respect to calcite and aragonite (and dolomite) and more saturated than seawater.

Precipitation of carbonate minerals in stromatolites is generally considered to be an organomineralization process induced by metabolic activities of microbes forming laminae. Carbon (C) isotopes of these samples show both photosynthesis (evidenced by high C isotope values) and extracellular polymeric substance (EPS) degradation (evidenced by low C isotope values) control organo-mineralization. This agrees with previous data which found both phototropic and heterotrophic bacterial taxa.

Results from magnesium (Mg) isotope measurements indicate that seawater is probably the primary source of Mg for the lake water. The two mounds have overall similar Mg isotopic compositions controlled by the mineralogy of the solid. High-Mg calcite was dominant in the top irregular surfaces and aragonite in the interior. The aragonitic layers were ~0.2 permil heavier than the high-Mg calcite layers, and the isotoipc offset from lake water is similar to marine biogenic carbonates previously reported. New measurements will be reported of the calcium (Ca) isotopic composition of the lake water and stromatolitc mounds.