First measurements of magnesium isotopic compositions of two modern Bahamian island lake stromatolites

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The formation of impressive modern irregular hard stromatolitic mounds have previously been identified and studied in the turbid seasonally hypersaline Storr's Lake on San Salvador Island in the Bahamas. The high turbidity (and light reddish-brown color) of the shallow lake (<2m) is caused from suspended algal and bacterial debris, leading to rapid attenuation of sunlight in the water. Water chemistry and two stromatoltic mounds collected in January 2016 were investigated. Both mounds were collected within the deep part of the lake (water depth was greater than 110cm when collected). One of the samples chosen was buried in soft organic-rich calcareous ooze, but the other was not. Lake water was supersaturated with respect to calcite and aragonite (and dolomite), conductivity 1.2x seawater and pH ~8.4.

Precipitation of carbonate minerals in stromatolites is considered to be induced by metabolic ativities of microbes – through production and degredation of extracellular polymeric substance and processes that modify pH and alkalinity. Varaiations in mineralogy (high-Mg calcite and aragonite) have been ascribed to early diagenesis and authigenic mineral formation and/or changes in lake water chemistry. Both mounds show a distinct trend of >70% high-Mg calcite in the top irregular surface and >70% aragonite in the interior with almost perfect correlation between % high-Mg calcite (and aragonite) and Mg/Ca and Sr/Ca. Initial results indicate that the samples have overall similar Mg isotopic compositions, with the aragonic layers ~0.2 permil heavier than the high-Mg calcite layers. However, it is estimated that >80% of the Mg measured in these layers is coming from the high-Mg calcite and not the aragonite. The isotopic offset between lake water and the stromatolites ranges from -1.9 to -2.2 permil, similar to marine high-Mg calcite previously reported.