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# Calcium isotopic composition of inland lakes and ponds on a Bahamian carbonate island

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Ten water samples from the carbonate island of San Salvador in The Bahamas were analyzed for Mg, Ca, and Sr elemental concentrations and Ca isotopes ($d^{44/40}Ca$) to distinguish between the source of Ca in the fresh, saline, and brackish waters. Roughly half of the island is covered by lakes separated by narrow ridges of lithified dunes. The lakes and karst (e.g., blue holes, caves) formed due to sea level fluctuations, carbonate dissolution, and presence of eogenetic (diagenetically immature) carbonates. Many show tidal fluctuations. Potential sources of Ca include seawater, sea salt aerosols, dissolution of eogenetic carbonates, and dolomitization.

Measured $d^{44/40}Ca$ values fall between shallow groundwater (+0.91‰ relative to SRM 915a) and seawater (+1.90‰) suggesting a mixture of Ca derived from seawater and dissolution of carbonate rocks. The well water had no detectible Mg, but elevated Sr content suggesting carbonate rock dissolution and not seawater contributes to the dissolved ions. $d^{44/40}Ca$ is similar to that expected for calcite, but not aragonite. Inkwell Blue Hole surface water had Ca content lower than seawater and falls on a mixing line between well water and seawater. Two karsted depressions (Pain Pond, Crescent Pond) have Ca content and $d^{44/40}Ca$ that are similar to seawater. Two pre-highstand lakes (Reckley Hill Pond, Osprey Lake) have $d^{44/40}Ca$ identical to seawater, but Ca content is elevated due to evaporation. These samples fall on either the mixing line for Mg vs Ca between well water and seawater or an extension of this line to higher concentrations due to evaporation. Two samples that fall off this line are highstand lakes (Salt Pond, Storrs Lake) which appear impacted by Mg loss relative to Ca due to dolomitization and/or precipitation of high-Mg calcite. The impact on $d^{44/40}Ca$ is notable in the smaller Salt Pond where there is evidence of shallow dolomitization and gypsum precipitation (upper <5cm of sediment). Little Lake (pre-highstand) had high Mg (compared to Ca). This lake has elevated ammonia unlike the other lakes that have been monitored, and periodically becomes eutrophic. This could be due to its proximity to Cockburn Town where human impact is likely.