Assessing the potential of redox sensitive trace metals to capture climate variability in an equatorial meromictic lake

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Redox sensitive trace metals (RSTM) are useful paleo-proxies which can unravel chemical histories of the earth's oceans and atmosphere. In aquatic systems RSTM are easily mobilized and partitioned between solid and dissolved reservoirs. For example, within the water column molybdenum (Mo) is depleted below the chemocline when free sulfide is present, and is enriched—higher than average crustal abundances—below the sediment water interface. Traditionally researchers use RSTM to focus upon the evolution of the early earth, however modern studies of the earth's climate are less common.

The Galápagos islands offer a unique study site to test the potential of RSTM to understand modern climate variability. The islands are ideal due to the existence of isolated crater lakes and archipelago's location at the center of action for El Niño. For this study, we selected a ~23 m deep, hyper saline meromictic crater lake. Previous climate research of this lake demonstrated a strong stratification response to seasonal and interannual climate events. To document climate variability we measured RSTM in the lake water column and particulate matter. To capture suspended particulate matter, sediment traps were deployed on a buoy anchor line at; 1 m below the surface, the chemocline and 1 m above the lake bottom. Water column samples were collected every meter at the deepest point of the lake using a Van Dorn water sampler. Inductively coupled plasma mass spectrometry (ICP-MS) was used to measure RSTM of all samples collected.

Our preliminary results point to a promising relationship between El Niño cycles, strength of stratification, and distribution of RSTM between solid and dissolved phases. We observe RSTM fluxes between reservoirs which coincide to increases in strength of euxinia within the lake. Additionally, many RSTM are highly concentrated and record a strong contrast between surface waters and the chemocline. Our results indicate that RSTM partitioning and mobilization respond rapidly to large scale climate events and could be used as proxy tool for the paleoclimate community.