

## Geochemistry of the Salton Sea, CA

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The Salton Sea is a saline, closed basin lake 70 meters below MSL in the southern desert of California. The sea has a surface area of 945 km<sup>2</sup>, a volume of 9.25 km<sup>3</sup>, a mean depth of 9 m, and an annual inflow of 1,600 million m<sup>3</sup>. The sea formed in 1905, and is sustained by excess irrigation water from the Colorado River and municipal wastewater. It is hyper-eutrophic due to fertilizer inputs from farm runoff, and has recently been identified as containing the highest density of fish of any body of water of this size. The salinity is currently 43,000-mg/kg, containing 10,200-mg/kg sulfate and 16,800-mg/kg chloride. The salinity of the sea is rising and there are concerns that within a few decades the fish will be gone. Plans are being considered for construction of a salt repository to control salinization and maintain the sea as a refuge for migratory waterfowl. Additionally, there is interest in reducing the phosphate loading to reduce algae blooms and improve water quality. Sulfate reduction is a major process of organic matter oxidation within the sediments and extensive outgassing of hydrogen sulfide occurs during wind events. Periods of anoxia throughout the water column can occur during the hot summer months and massive fish kills are common. Calcite, gypsum, pyrite, and green rust (II) are precipitating and accumulating in the sediments. We conducted an extensive sampling of the sediments and measured the amounts of these minerals. We have estimated the annual rate of mineral formation based on mass balance calculations and geochemical calculations. This information is needed to determine the rate salinity increase and the timetable for construction of a salt repository. Laboratory experiments indicate that coprecipitation of phosphate with calcite is an important mechanism reducing the internal loading of P and limiting algae blooms. Thus, source control of P from farmers' fields will lead to significant reductions in algae blooms and a reduction in hydrogen sulfide production.

## Iron isotopes in an Archean paleosol

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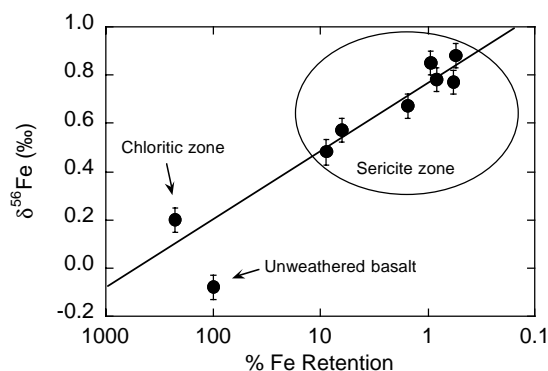
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### Motivation and Methods

The Fe-depleted Mt. Roe #2 (W. Australia) paleosol was formed ~ 2.75 Ga. Low pO<sub>2</sub> in the Archean atmosphere probably facilitated Fe loss. We have analysed the Fe isotope composition of this paleosol to gain insight into the mechanisms of Fe mobilization.

Iron isotope compositions were determined by high-resolution multiple-collector ICP-MS (Neptune, ThermoFinnigan MAT, Bremen, Germany). Prior to analysis, Fe was extracted from samples using anion exchange chromatography. Instrument mass bias was corrected with a Cu "element spike". Using a high-resolution entrance slit and low-resolution collector slits, isobaric interferences from ArO<sup>+</sup>, ArN<sup>+</sup> and ArOH<sup>+</sup> were resolved sufficiently to observe a mass-dependent relationship between δ<sup>56</sup>Fe and δ<sup>57</sup>Fe. External precision (1 σ) on δ<sup>56</sup>Fe and δ<sup>57</sup>Fe was better than ± 0.05 and 0.08 ‰, respectively.

**Figure 1: δ<sup>56</sup>Fe vs. % Fe retention**



Results are shown in Fig. 1. δ<sup>56</sup>Fe is reported relative to the IRMM standard. Fe retention is calculated relative to the underlying basalt on a Ti-normalized basis.

δ<sup>56</sup>Fe of the basalt parent material is ~ -0.1 ‰; all other samples are enriched in <sup>56</sup>Fe. Fe isotope fractionation confirms that low Fe concentrations in the sericite zone result from Fe loss, and reveals preferential loss of light Fe isotopes. δ<sup>56</sup>Fe in the sericite zone fits a Rayleigh trend (α ~ 1.00012) with initial δ<sup>56</sup>Fe similar to chloritic Fe. The data are consistent with Fe loss during chlorite formation and a kinetic isotope effect during weathering (Brantley et al., 2001), although other mechanisms are possible.

### Reference

Brantley, S.L., Liermann, L. and Bullen, T.D. (2001), *Geology* **29**, 535-538.