

Development of a paired kerogen-pyrite sulfur isotope proxy to track marine biogeochemical cycling and organic remineralization

SELVA MARIANA MARROQUÍN AND ALEX L. SESSIONS

California Institute of Technology

Presenting Author: selvam@caltech.edu

The sulfur isotope ratios of barite, carbonate-associated sulfate (CAS), and pyrite in marine sediments have been studied to help reconstruct the redox history of Earth's oceans. While useful, a significant limitation has been that the S isotope record of pyrite convolves the fractionation between pyrite and sulfate associated with microbial sulfate reduction (ϵ_{MSR}) with the porewater isotopic gradient (open- or closed-system behavior). Sulfur bound into organic molecules is also ubiquitous, and constitutes another potential isotopic archive. We are working to develop a new proxy based on the difference in sulfur isotope composition between coeval kerogen sulfur and pyrite (ek-p), that we believe will help us reconstruct past changes in carbon and sulfur cycling. Here, we present preliminary data from two marine cores collected off of the northwestern coast of Australia on IODP cruise 363. We measured total organic carbon (TOC), Fe speciation, and paired kerogen and pyrite $\delta^{34}\text{S}$ values. Despite similar average TOC (0.7 and 0.9 wt%), total iron (1.21 and 1.41 wt%), pyrite (0.51 and 0.63 wt%), and organic sulfur (0.02 wt% for both) contents, ek-p varied significantly between the two sites. Site U1482 ek-p values range from 13 to 26‰, whereas values are more consistent in U1483, ranging from 18 to 13‰. U1482 has a slower average sedimentation rate (< 8 cm/kyr) and deeper sulfate methane transition zone (SMTZ) (~100 m), relative to U1483 (8-12 cm/kyr and ~60 m SMTZ). We hypothesize that the greater variation in ek-p is driven by these differences, though we cannot yet pinpoint a single, dominant environmental control.