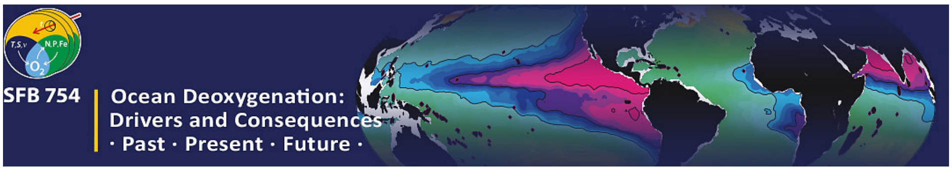

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Constraining global (de)oxygenation during Phanerozoic climate events

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Recent observations of the modern ocean show that the ocean is experiencing progressive deoxygenation. While it is likely that ancient climate events experienced similar variations, our current proxies lack the resolution to definitively fingerprint non-sulfidic, low oxygen bottom waters. Throughout the Phanerozoic there are numerous climatic perturbations with associated extinction events that are associated with carbon cycle perturbations. Carbon isotopes can be driven by multiple parameters, including but not limited to, enhanced organic carbon burial. Redox conditions and sedimentation rates are important factors controlling the magnitude of organic carbon burial. Therein, it is important to constrain ancient non-sulfidic, low oxygen environments which is required to better understand Earth system biogeochemical feedbacks. We will present new data from the modern and ancient record using a new metal isotope system, thallium (Tl), to better constrain the global marine record of the earliest deoxygenation.

The modern ocean mass balance of Tl isotopes suggest that the two dominant sinks are (1) adsorption onto manganese (Mn) oxides and (2) low-temperature oceanic crust alteration, while all the sources of Tl are isotopically indistinguishable. For short-term (million years or less) climate events it is likely that the primary control on seawater Tl isotopes is the burial magnitude of Mn oxides. Importantly, Mn oxide burial requires free oxygen at or near the sediment-water interface. Sediments deposited in reducing conditions have been shown to record the oxic seawater Tl isotope value, which respond to ancient variations in global burial of Mn oxides. Thus we can track initial changes in oceanic oxygen conditions. Initial thallium isotope perturbation during Phanerozoic climate events coincide with with many of the onset of extinction events and volcanism and proceed carbon isotope excursions.

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