Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.22684

The coupled redox evolution of Earth's atmosphere and ocean through geologic time

DALTON HARDISTY[1] AND KIMBERLY V. LAU[2]

[1]Michigan State University
[2]The Pennsylvania State University
Presenting Author: hardist1@msu.edu

The availability and distribution of marine dissolved oxygen and related redox-sensitive elemental cycles have changed dramatically over the last four billion years. Here, we compile geochemical proxy records to synthesize recent quantitative and conceptual advances in determining the coupled redox evolution of the atmosphere and ocean. Specifically, we compile a variety of paleoredox proxy records from the Sedimentary Geochemical Paleoenvironmental Project database and other sources and determine the times at which multiple proxies reveal changes in steady-state surface redox conditions. The modern mass balance and redox sensitivity of co-evolving proxies are used to constrain coupled ocean-atmosphere redox dynamics and feedbacks with biological and geologic evolution. The results obtained from the compiled redox proxies allow us to reconstruct the initial atmospheric oxygenation at the Great Oxidation Event to the eventual ventilation of the ocean to a modern-like redox state. This includes reconstructing both atmospheric oxygen levels as well as specific redox regimes (e.g., nitrogenous). This work highlights progress over the last decade in developing a clearer and more defined picture of long-term oxygenation of the atmosphere and oceans across Earth history, while also identifying gaps and next steps.