

Towards a global view of past ocean oxygen: applications of thallium isotopes and multi-proxy data synthesis

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Ocean oxygenation is closely linked with climate, productivity, and ocean circulation, and plays an important role in modulating nutrient cycles (e.g., carbon and nitrogen). Ocean deoxygenation observed in the past few decades has made it imperative to understand the magnitude and extremes of ocean oxygen variability beyond instrumental records and the underlying driving mechanisms on various timescales. I will highlight recent advances on the thallium isotope proxy system in reconstructing the globally integrated ocean oxygen reservoir, which is becoming a powerful tool in facilitating better data and model comparisons from a global perspective. Recent advances in paleo-oxygen proxies, including thallium isotopes, and numerical models are also allowing scientists to work together to synthesize proxy records and model simulations in multiple time periods through the PO2 (Past Ocean Oxygenation) Past Global Changes (PAGES) working group. The ongoing group efforts are currently focused on 0-200,000 years ago, and the data synthesis will incorporate both qualitative to quantitative oxygen proxies (e.g., sedimentary features, redox-sensitive metals and metal isotopes, biomarkers, nitrogen isotopes, foraminifera assemblages, foraminifera morphometrics, foraminiferal trace elements, and benthic foraminifera carbon isotope gradient) to cover the full water column (intermediate and benthic) and global ocean oxygen content, and productivity records with a unified metadata structure. The resulting three-dimensional ocean oxygen distribution with information on global ocean oxygen changes will ultimately contribute to a proxy-model approach to investigating forcing mechanisms of ocean oxygen variations.