Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.22628

Reconstructing Neoproterozoic oceans through an integrated petrographic and geochemical analysis of marine carbonate cements

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Sedimentary basins with well-preserved Precambrian carbonate platforms have been used as archives of the chemistry of global seawater, including the investigation of changes in ocean chemistry associated with profound Neoproterozoic climate change and to understand the relationship between ocean chemistry and the development of complex life across the Precambrian-Cambrian boundary. However, diagenetic overprints often preclude or bias accurate reconstructions of ocean chemistry. Here, we present geochemical data associated with early marine cements for a well exposed succession of the Sturtian and Marinoan glaciations (Jacadigo Group, of the southern Amazon Craton; Freitas et al., 2021). We combine detailed petrographic observations with carbonate U/Pb geochronology, targeted microfacies-specific analysis of carbon and oxygen isotopes, radiogenic strontium isotopes, and selected element ratios (e.g., Mn/Sr; Sr/Ca; Mg/Ca).

Using careful microfacies investigation to inform isotope and element analysis, we: **i)** provide a geochronological framework for this Neo-Proterozoic succession, demonstrating that it records carbonate successions after both the Sturtian and Marinoan glaciations; **ii)** show that pristine geochemical signatures of Cryogenian and early Ediacaran seawater environments are preserved, and **iii)** discuss how paired U/Pb and $^{87}Sr/^{86}Sr$ isotope constraints can serve as a robust indicator of local diagenetic events that selectively disturb the pristine geochemical record of some marine cements. Our study highlights the fact that this stratigraphic section of the Amazon Craton has great potential as an archive of Neoproterozoic seawater chemistry, in the context of episodes of global glaciations, major tectonic reorganizations, and the emergence of complex life.

References:

Freitas et al., 2021. Cryogenian glaciostatic and eustatic fluctuations and massive Marinoan-related deposition of Fe and Mn in the Urucum District, Brazil. Geology, 49 (12), 1478-1483.