A shallow-to-deepwater geochemical transect of a Neoproterozoic Marinoan cap dolostone (Noonday Formation, Death Valley region)

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The Neoproterozoic era was characterized by some of the most significant perturbative events in the history of Earth's surface: two severe glacial "Snowball Earth" episodes, the reorganization of the marine carbon cycle, an important rise in atmospheric oxygen concentrations, and ultimately, the emergence of metazoa. The Death Valley region preserves some of the thickest post-Marinoan cap dolostones in the world, and includes both shallow and deep water cap dolostone facies [1], providing a unique opportunity to examine spatial heterogeneity in the deglacial Marinoan snowball ocean (~635 Myr ago). We sampled multiple sections across the Death Valley region for high resolution stable isotope and trace element chemostratigraphy (more than 400 samples total) with the goal of examining geochemical evolution of the ancient carbonate platform in the direct snowball aftermath.

Similar to the Keilberg cap dolostone in NW Namibia [2], we find $\delta^{13}C_{carb}$ and $\delta^{18}O_{carb}$ profiles that are largely comparable in shape with depth in the sequence, but offset from one another as a function of position on the platform. A trend towards isotopically light $\delta^{13}C_{carb}$ and $\delta^{18}O_{carb}$ values in the most distal sections appears diagenetic at first glance, but trace element data, notably Mn/Sr and Y/Ho, indicate that these light values may be primary, and suggest complex chemical heterogeneity in the Marinoan post-snowball ocean. Preliminary $\delta^{13}C_{org}$ and $\delta^{15}N_{org}$ data reveal suppressed carbon isotope fractionation between C_{carb} and C_{org}, as well as sufficiently oxidizing conditions for a modern-like nitrification / denitrification cycle. Our findings highlight the utility of a high-resolution chemostratigraphic approach, and provide new insight into environmental conditions in the direct aftermath of the Marinoan snowball Earth.

[1] Petterson *et al.* (2011) *Geol Soc America Bull* **123,** 1317–1336. [2] Hoffman *et al.* (2007) EPSL **258**, 114–131.