The Cryogenian carbon isotope record of Death Valley, California

NELSON, L.L.[1], AHM, A-S.C.[2], MACDONALD, F.A.[3], HIGGINS, J.A.[2], SMITH, E.F.[1]

[1] Department of Earth and Planetary Sciences, Johns Hopkins University, 3400 N. Charles Street, Olin Hall, Baltimore, MD 21218, USA

[2] Department of Geosciences, Princeton University, Guyot Hall, Princeton, NJ 08544, USA

[3] Department of Earth Science, University of California Santa Barbara, Santa Barbara, CA 93106, USA

In Death Valley, California, carbonate strata deposited during the ca. 660-640 Ma Cryogenian non-glacial interlude contain both negative and positive carbon isotope excursions correlative to perturbations that have been linked to Neoproterozoic climate instability and/or oxygenation through the carbon cycle. However, in the Thorndike submember – immediately below the Marinoan glacial diamictite – carbon isotope variability corresponds to a laterally discontinuous dolomitization front. Limestone samples within this unit preserve highly enriched $\delta^{13}C$ values, while stratigraphically equivalent dolostone samples preserve consistently lower $\delta^{13}C$ values with relative depletions of up to 10‰. Field observations and clast tests indicate the extreme shift in $\delta^{13}C$ values is a product of early marine dolomitization. Geochemical tracers of diagenesis ($\delta^{44}Ca$ and $\delta^{26}Mg$ values) suggest this isotopic variability arose as diagenetic fluids evolved in a restricted platform setting, indicating that the carbon isotope composition of these carbonate rocks may not reflect global seawater or be controlled by the global carbon cycle.