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 δ13C values, while stratigraphically equivalent dolostone samples preserve consistently lower δ13C values with relative depletions of up to 10‰. Field observations and clast tests indicate the extreme shift in δ13C values is a product of early marine dolomitization. Geochemical tracers of diagenesis (δ44Ca and δ26Mg 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.