Radiogenic and stable Sr isotope records preceding the Sturtian snowball earth event

N. L. SARVIAN[1], A.D. JACOBSON[1], M. T. HURTGEN[1], M.R. OSBURN[1], A.C. MALOOF[2]

[1] Department of Earth and Planetary Sciences, Northwestern University, Evanston, IL
[2] Department of Geosciences, Princeton University, Princeton, NJ
(*nilou@earth.northwestern.edu)

Large negative $\delta^{13}C$ excursions precede global glaciations in the Neoproterozoic, but causal mechanisms remain unknown. To address this problem, we used a high-precision TIMS method[1] to measure radiogenic and stable strontium isotope ratios ($^{87}Sr/^{86}Sr$ and $\delta^{88/86}Sr$) in carbonate rocks composing the Copper Cap Formation (Mackenzie Mountains, Canada), which was deposited prior to the Sturtian glaciation (~717 – 662 Ma)[2]. With these data, we aim to understand how chemical weathering, hydrothermal alteration, carbonate burial, and other factors contributed to environmental change during the ~25 Myr runup to the first Snowball Earth event.

$^{87}Sr/^{86}Sr$ and $\delta^{88/86}Sr$ range from 0.706 to 0.714 and 0.30‰ to 0.51‰. All $\delta^{88/86}Sr$ are higher than the average for Phanerozoic carbonates[3]. Above ~250 m, $^{87}Sr/^{86}Sr$ ranges between 0.7064 and 0.7068. The two proxies appear to positively covary to ~300 m but diverge thereafter. Relatively high $^{87}Sr/^{86}Sr$ below ~250 m may indicate late-stage diagenetic overprinting.

Further work will be done to investigate the effect of diagenesis on these values by examining the paragenetic history of the carbonate rocks. A coupled $^{87}Sr/^{86}Sr$ and $\delta^{88/86}Sr$ model will be constructed to better understand what mechanisms, whether primary or secondary, drove the observed signals.

[1]Andrews et al. (2016) [2]Rooney et al. (2014)
[3]Vollstaedt et al. (2014) [4]Cox et al. (2016)