$\delta^{15}N$ and $\delta^{13}C$ isotopes of Proterozoic McArthur basin, Australia: redox proxies for atmospheric pO_2

APRIL V. SHANNON[1], GRANT M. COX, AMBER JARRETT[2], MARCUS KUNZMANN[3]

[1]Gothenburg University, april.shannon@gu.se
[2]Geoscience Australia, Amber.jarrett@ga.gov.au
[3]CSIRO, Marcus.Kunzmann@csiro.au

The greater McArthur basin is of significant interest in that it is of the oldest and most extensive hydrocarbon-bearing basins preserved, and spans ~1 Gyr of Earth's history, from the Paleoproterozoic to the Neoproterozoic.

Uncertainty persists in our understanding of atmospheric and oceanic redox during the Proterozoic. Recent studies suggest the possibility of a Mesoproterozoic oxygenation event (Gilleaudeau et al. (2016) GPL 2, 178-187), while other studies suggest a continuing low atmospheric pO_2 (Planavsky et al. (2016) PNAS 113, 2550-2551). Using a $\delta^{13}C$ & $\delta^{15}N$ record with trace metal data from organic-rich shales as proxies, provides insights on oceanic redox conditions.

Results indicate an overall increase in oxidation throughout the Proterozoic. Carbon isotopes suggest increasing organic carbon burial. Increases in V/Mo ratios coupled with decreasing Mo abundances support increasing oceanic redox. A trend to lighter N isotopes followed by an increase to heavier $\delta^{15}N$ is thought to be associated with an initial increase in Mo-based nitrogen fixation efficiency, followed by an increased availability of aerobic nitrogen cycling (i.e. and abundance of NO_3^- and NO_2^-) to support the dominance of denitrification and anammox processes. Previous models that call for no significant growth in atmospheric oxygen post GOE is not supported by this data set. Carbon, nitrogen and trace metals together present evidence of an overall increase in oceanic redox throughout the Proterozoic.