# An abrupt change in the Nitrogen cycle and redox conditions of surface environments in Ediacaran-Cambrian as recorded in Carbonate Associated Nitrate (CAN)

M.G. PROKOPENKO[1,2], F. CORSETTI[2], R.G. GAINES[1], S. LOYD[3], J. KAUFMAN[4] AND W.M. BERELSON[2]

[1]Dept. of Geology, Pomona College, Claremont, CA, 91767, USA (prokopen@usc.edu)
[2]Dept of Earth Sciences, USC, Los Angeles, CA, 90089, USA
[3]Dept. of Earth and Space Sciences, UCLA, Los Angeles, CA, 90095, USA
[4]Dept. of Geology and Earth System Science Interdisciplinary Center, Univ. of Maryland at College Park, College Park, MD, 20742, USA

The Ediacaran-Cambrian transition witnessed a major restructuring of the planetary biota, however the accompanying changes in major biogeochemical cycles, inlcuding that of O2, are less well constrained. We developed a novel approach of determining nitrate content in carbonates as a proxy for the availability of dissolved O2 and applied it to investigate changes in O2 and nitrogen cycles through this important transition in Earth history. Nitrogen (N) may be present in the environment in six different oxidation states, from N3- in ammonium to N5+ in nitrate, with the oxidation state dictated by the ambient environmental redox state: under anoxic conditions, fixed inorganic N is likely to be stable in form of ammonium, while in the presence of dissolved O2, the main form is nitrate. Therefore, the abundance of nitrate should reflect availibility of dissolved O2, but geologic records of oceanic nitrate have not been previously explored.

We surveyed the concentrations of CAN in carbonates from the ~2.3 Ga year old Duitschland Formation (South Africa), the ~1.4 Ga year old Belt Supergroup (Montana, USA), a series of deep and shallow water limestones spanning ~ 800 to 540 Ma years from Death Valley (California, USA) and north-western Mexico, as well as a set of early to late Phanerozoic carbonates. We found a distinct step function increase in the levels of measured CAN between 600 and 540 Ma. We argue that a sharp nitrate increase, recorded in these carbonates may reflect a rapid increase in atmospheric O2 through this time period, which would have led to rapid transformation of fixed N to oxidized forms (from ammonium to nitrate). In the Duitschland Formation, which has been suggested to contain a geochemical record of the first transient O2 "whiffs" in Earth history, we found evidence for a transient presence of CAN between 2.2 and 2.4 Ga. However, a significant degree of dolomitization of many samples calls for further investigation of CAN dynamics with respect to this common diagenetic process.

# Impact of basalt weathering and plant recycling on Mg transport from the soil to the river under permafrost environment: A stable Mg isotope study in Central Siberia.

PROKUSHKIN A.S.[1], MAVROMATIS V.[2], POKROVSKY O.S.[2] AND VIERS J.[2]

[1]V.N. Sukachev Institute of Forest, SB RAS, Akademgorodok, Krasnoyarsk, Russia, prokushkin@ksc.krasn.ru (*)
[2]GET, CNRS, UMR 5563, Toulouse, France, mavromat@get.obs-mip.fr, oleg@get.obs-mip.fr, viers@get.obs-mip.fr

To unravel the different sources of Mg generated by basalt weathering in Central Siberia under permafrost conditions and larch deciduous forest, we measured the Mg isotopic composition of large rivers (Nizhnaya Tunguska and Kochechum, tributary of Enisey) and a small stream, snow, surface flow, interstitial soil solutions, plant biomass, litter and soils. During winter baseflow, the dissolved Mg isotope composition of large rivers is significantly lighter compared to the source basaltic rocks and atmospheric deposition, suggesting a deep undergournd source such as sedimentary carbonate rocks. During spring flood and in the summer-fall season, $\delta^{26}$Mg increases by 0.3-0.2 ‰ and approaches the Mg isotope comosition of ground vegetation (dwarf shrubs, mosses) and soil organic horizon. Overall riverine waters are 0.6-1.0 ‰ lighter than the unaltered bedrock and deep minerals soil horizon.

Despite low variability of Mg isotopic composition between *Larix gmelinii* organs (i.e. stem wood, roots, needles etc.), there is a 0.2-0.3 ‰ enrichment in $\delta^{26}$Mg of larch needles in the course of growing season, from June to September. It likely demonstrates plant uptake of isotopically heavier Mg along with the progressive thawing of mineral soil (deepen soil active layer). Taken together, Mg isotope approach indicates the important contribution of vegetation (larch needles, mosses and dwarf shrubs) in riverine Mg isotope signature and help to reveal the contribution of isotopically light carbonates or sedimentary rocks in large rivers of Central Siberian Plateau.

www.minersoc.org
DOI:10.1180/minmag.2013.077.5.16