Carbonate I/[Ca+Mg] records of paleo-redox conditions during the Bitter Springs carbon isotope anomaly

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The Bitter Springs Anomaly (BSA) is characterized by a 8‰ negative $\delta^{13}C$ excursion between 810 and 800 Ma. Eukaryotic diversification around this time interval may be related to oxygenation changes in the surface ocean. We report carbonate associated iodine concentrations, shown as I/[Ca+Mg], for the BSA. This proxy has been used as a surface or upper ocean redox indicator to study important climatic and redox transitions in the Earth history, including the Great Oxidation Event (GOE), Mesozoic Oceanic Anoxic Events and the Paleocene/Eocene Thermal Maximum.

The thermodynamically stable forms of iodine in seawater are iodate (IO_3^-) and iodide (I^-). Iodine speciation change is strongly redox sensitive. IO_3^- can completely be converted to I^- in anoxic basins and Oxygen Minimum Zones (OMZs) in the modern ocean. Because IO_3^- is the only chemical form of iodine that can be incorporated in the structure of carbonate, carbonate precipitated closer to an OMZ should record lower I/[Ca+Mg] and vice versa.

Here we present new results of this proxy in two sections, at Svalbard and Greenland, recording the BSA. More data are being produced for both sections. Several observations are made from the current I/[Ca+Mg] data set: (1) majority of the values are similar to those of the GOE, much lower than the Mesozoic and Cenozoic values; (2) I/[Ca+Mg] spikes appear at the recover phase of BSA and two precursor “mini BSA” events; (3) notably more samples post-BSA do not contain detectable amount of iodine, compared to pre-BSA intervals. (4) the few samples within the peak-BSA seem to indicate anoxia. In the near future, we will confirm and/or reevaluate these observations after completing both records, and then interpret the redox changes across the studied interval.