An oceanic oxidation event coincident with the Shuram carbonate-carbon isotope excursion

DALTON S. HARDISTY[1]*, ZUNLI LU[2], MAGDALENA R. OSBURN[3], NOAH J. PLANAVSKY[4], GANQUING JIANG[5], XIAOLI ZHOU[2], HONG-FEI LING[6], DA LI[6] AND TIMOTHY W. LYONS[1]

[1]University of California, Riverside, USA (*correspondence: dhard003@ucr.edu)
[2]Syracuse Univiersity, Syracuse, USA
[3]Northwestern University, Evanston, USA
[4]Yale University, New Haven, USA
[5]University of Las Vegas, Nevada, USA
[6]Nanjing University, Nanjing, China

The origin of the Ediacaran Shuram negative carbonate-carbon isotope ($\delta^{13}C_{carb}$) excursion (<-10 ‰) remains hotly debated due to its large magnitude and variability in the absence of a coupled excursion in organic carbon ($\delta^{13}C_{org}$). Here we present the first measurements of carbonate iodine-to-calcium ratios (I/Ca) across this $\delta^{13}C_{carb}$ excursion, providing evidence for an oxidation event and against a diagenetic origin[1]. The oxidized iodine species, iodate, is restricted to oxic waters and is the exclusive iodine species incorporated during carbonate precipitation[2], meaning changes in I/Ca can record relative fluctuations in dissolved O_2 concentrations. Further, controls on the total marine iodine reservoir, and hence I/Ca, include the burial and remineralization of organic matter (OM), iodine's biggest sink[2]. I/Ca within the Khufai of Oman and Doushantuo of South China both increase distinctly in phase with the shift to negative $\delta^{13}C_{carb}$ values. Our studies of diagenetic alterations to primary I/Ca ratios of modern and recent carbonates reveal that, if anything, primary I/Ca ratios decrease during carbonate diagenesis. The globally extensive increase in I/Ca is best explained by an increase in the total marine iodine reservoir linked to an oxidation event promoting enhanced OM remineralization, thus supporting previous models for the magnitude of the $\delta^{13}C_{carb}$ excursion and lack of coupled $\delta^{13}C_{org}$ behavior as a result of oxidation of a fossil organic source[3]. However, a decrease in pre-Shuram I/Ca values at the end of the $\delta^{13}C_{carb}$ excursion infers a return to reducing conditions, suggesting that the Shuram does not represent a terminal oxidation event.

[1] Schrag, Higgins, Macdonald & Johnston (2013), *Science* **339**, 540-543 [2] Lu, Jenkyns & Rickaby (2010), *Geology* **38**, 1107-1110 [3] Fike, Grotzinger, Pratt & Summons (2006), *Nature* **444**, 744-747