Barium isotope variations across the basal Doushantuo Formation: implications for productivity recovery after the Marinoan glaciation

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The accumulation of authigenic Ba in marine sediments are considered to be a useful proxy for assessing changes of export production in the modern [1] and past [2] oceans. Barium isotope compositions of marine sediments have recently been proposed as a novel tool to provide robust constraints on export production [3].

An integrated study with Ba and C isotope compositions and trace metal abundances was carried out in carbonate leachates of the cap dolomite of Doushantuo Formation I (DI) and dolomite of Doushantuo Formation II (DII) from the Jiulongwan section, Yangtze Platform (South China). The results show a wide variation of overall $\delta^{137/134}$Ba values from -0.23‰ to +1.44‰. The $\delta^{137/134}$Ba variation range in DII overlaps the values in modern seawater (+0.23 to +1.1‰).

Two extreme positive Ba isotope excursions have been recorded together with a significant depletion in Ba concentrations in the upper cap dolomites and the basal DII. While the first excursion may most likely be attributed to a loss of light Ba isotopes by fluid leaching, the second one is more promising as being governed by biologic activities. At the DII, the obtained heavier Ba isotope compositions show a distinct positive correlation with 'heavier' C isotopes. Together with a covariation of decreasing nutrient-like metal (Zn, Cd, Ni) concentrations in carbonate leachates, this may argue for an extreme algal bloom along with a depletion of the ambient seawater in bio-available metals and light Ba and C isotopes respectively. The co-variations in bioavailable metals and Ba isotope compositions in carbonate leachates may further promote this novel metal isotope system as a reliable tracer for paleo-productivity changes.

[1] Eagle et al., 2003, Paleoceanography, 18(1), 1021, [2] Paytan et al., 2007, Geology, 35, 1139-1142, [3] Bridgestock et al., 2019, EPSL, 510, 53-63