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# Extreme carbon and nitrogen isotopic signatures overlapping the Fortescue excursion preserved in the 2.7 Ga Carajás basin, Brazil

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The nitrogen isotopic composition of sedimentary rocks is controlled by metabolic activity and redox speciation in the water column. Therefore, changes in the dominating nitrogen biogeochemical cycle's pathways have frequently been used to uncover the joint evolution of the atmosphere, the ocean and the biosphere. The transition from anoxic to oxygenated environments leading to the Great Oxidation Event (GOE) deserves a particular focus, especially as its timing and mechanisms remain debated.

Here we report new data from the Carajás basin, Amazonian Craton, Brazil. Samples from three Neoarchean drill cores through the Serra Sul and Azul formations, aged between 2.72 and 2.68 Ga and representative of shallow to deep oceanic settings [1], have been analyzed for their carbon and nitrogen abundances and isotopic compositions. These sediments display extremely positive $\delta^{15}N$ values of up to +35.1‰ combined with extremely negative $\delta^{13}C_{org}$ values down to -51.7‰, similar to those observed in the 2.72 Ga Tumbiana formation in Australia [2,3]. The drivers of this unique isotopic excursion occurring ≈300 million years before the GOE and named the Fortescue excursion are controversial, and two hypotheses have been put forward: (i) partial oxidation of ammonium through nitrification followed by complete denitrification, thus indicating the onset of an aerobic nitrogen cycling [2] and (ii) ammonia volatilization in anoxic, highly alkaline conditions typical of restricted lacustrine environments [3].

The Carajás basin has uncovered a new occurrence of the 2.7 Ga extreme $^{15}N$-enrichments and $^{13}C$-depletions event from oceanic settings. Whether this event is related to widespread redox changes in marine chemistry or rather reflect a peculiar signal related to restricted alkaline conditions still needs to be discussed, but in any case it points towards environmental conditions specific to this particular Neoarchean interval.

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