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# The effects of secondary alteration on Precambrian sedimentary records deserve attention

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Precambrian sedimentary successions archive geochemical information critical to reconstructing the redox landscapes of Earth's early environments. However, reading those archives is complicated by the physical and chemical changes sediments undergo during burial diagenesis and metamorphism. Recrystallization and multi-stage mineralization can profoundly alter or altogether erase primary sedimentary textures and overprint pristine geochemical proxy signals. Because of this, bulk geochemical approaches, such as powder-based analysis or wet-chemical extractions, are particularly difficult to interpret since the various sedimentary components become mixed during such analysis, and the measured data integrate geochemical signatures from different processes operating at disparate times. The multiple, often contradictory, ideas regarding the environmental meaning of paleoredox proxy signals from the Paleoproterozoic Francevillian [1] [2] and Onega basins [3] [4] exemplify this difficulty and highlight the need for careful assessments of bulk data, especially as the Francevillian Basin potentially preserves clues of early eukaryote evolution [5].

Here we report results using high-resolution SIMS and XANES techniques to better understand the pyrite S isotope record ($^{34}$S) of both basins and thereby better identify and interpret the paleoenvironmental information they preserve. Our findings show that, instead of low oceanic sulfate levels, the isotopically heavy pyrite from postulated ocean deoxygenation intervals reflect complex diagenetic processes in organic-rich depositional environments that traversed the oil window. As such, they cast doubt on the classical interpretation of the bulk $^{34}$S data and caution against using such data to reconstruct ancient ocean redox structure.

[1] Ossa Ossa *et al.* (2018), *EPSL* **486**, 70-83.
[2] Mayika *et al.* (2020), *Geology* **48**, 1099-1104.
[3] Asael *et al. (2013), Chem. Geol*. **362**, 193-210.
[4] Mänd *et al. (2020), Nat. Geo.* **13**, 302-306.
[5] El Albani *et al. (2010), Nature* **466**, 100-104.