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Multiple isotope (O, S, Sr) constraints on the early Paleoproterozoic Great Oxidation Event from the Minas Supergroup, Minas Basin, Brazil

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The early Paleoproterozoic (2.5 – 2.1 Ga) was a period of major environmental and climatic upheavals, marked by the rise of atmospheric oxygen and the onset of multiple glaciations, the oldest one starting at ca. 2.45 Ga of possible global extension (Snowball Earth event). This is at odd with the sedimentary successions of similar age in the Minas Basin, São Francisco Craton, for which no unequivocal glacial sediments have been reported so far. In this work, we present paleoenvironmental reconstructions based on sedimentological analyses coupled with Sr, O and S and isotope compositions of barite ($BaSO_4$) preserved in ca. 2.45 Ga dolomites and limestones from the Gandarela Formation. Sedimentological analyses show that depositional environments corresponded to an open carbonate platform, probably connected to a large oceanic domain. Despite extensive dolomitization and low-grade metamorphism, Sr isotopes in barite show a sea-water signature, suggesting barite precipitated directly in the sea-water column or during early diagenesis and was not chemically modified by post-depositional processes. Sulfate $\delta^{18}O$ values of barite are highly variable, ranging from up to +17.6 ‰ to -12.7 ‰ (VSMOW). The strongly depleted oxygen isotope composition measured in two samples (values < -10 ‰) could be indicative of continental sulfide oxidation by glacial meltwater, supporting glacial conditions in the São Francisco Craton during the early Paleoproterozoic, as already evidenced in other cratons. Coupled with quadruple S isotopes on barite sulfate, which carry a signal of the oxygenation of the atmosphere through the transition from mass independent to mass dependent isotope fractionation, these results bring new insights on the major paleoenvironmental changes that occurred during the early Paleoproterozoic.