



Geochemistry of pyrite from diamictites of the Hamersley Basin, Western Australia with implications for the GOE and Paleoproterozoic ice ages.

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Sediments of the ca. 2400 Ma Turee Creek Group of Western Australia span the oxygenation of Earth's surface resulting from the 'Great Oxidation Event' (GOE). Diamictite within the Boolgeeda Iron Formation from the Boundary Ridge section at Duck Creek Syncline have been correlated to the glaciogenic Meteorite Bore Member of the Turee Creek Group at Hardey Syncline (Martin, 1999). The Meteorite Bore Member is thought to be correlative and time-equivalent with the Paleoproterozoic glacial diamictites of North America. If diamictite units at Boundary Ridge represent worldwide Paleoproterozoic glaciations, they should record the disappearance of mass independently fractionated (MIF) sulfur. Triple S-isotope compositions for pyrites from the Boundary Ridge sections measured by in situ multi-collector ion microprobe yielded both mass-dependent and mass-independently fractionated (MIF) S isotope values ($\Delta^{33}\text{S}$ values from -0.65 to 6.27‰). Trace element heterogeneities were found by measurements at multiple spatial scales within rounded pyrites in the Boundary Ridge section, signifying multiple generations of pyrite from sulfur processed in an anoxic atmosphere. S-isotope data from pyrite in the Boundary Ridge diamictites analyzed in this study and previous work (Williford et al., 2011) define multiple $\delta^{34}\text{S}$ vs. $\delta^{33}\text{S}$ arrays, linked to a source of detrital pyrite from the overlying Hamersley and Fortescue groups. Authigenic pyrite in an overlying shale unit from Boundary Ridge plot along the terrestrial fractionation line but retain positive MIF-S and detrital pyrite, results that are incompatible with a correlation to North American Paleoproterozoic glacially-influenced successions where the MIF-S signal permanently disappears. The diamictites at the Duck Creek Syncline are older than the Meteorite Bore Member because of their stratigraphic position within the Boolgeeda Iron Formation underlying the Turee Creek Group, which is separated from the Meteorite Bore Member by nearly 1000 m of Kungarra shale at Hardey Syncline.