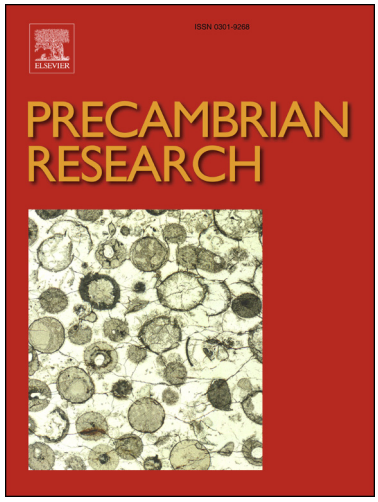

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Petrology and Geochemistry of the Boolgeeda Iron Formation, Hamersley Basin, Western Australia

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Abstract

The Boolgeeda Iron Formation and overlying Turee Creek Group, Hamersley Basin, Western Australia, represent a conformable succession of sediment deposited between 2.45 - 2.22 Ga. This interval of geologic history is of significant interest because it spans the Great Oxidation Event (GOE), when oxygen first accumulated in Earth's atmosphere. Here we present geochemical and petrographic data from the uppermost 40 meters of the Boolgeeda Iron Formation and an additional 40 meters of the overlying Kungarra Formation mudstones, as sampled from the Turee Creek Drilling Project 1 drill core (TCDP1). This core captures the termination of BIF deposition in the Hamersley Basin and coincides with a global decline in BIF deposition in the Paleoproterozoic. We provide a continuous, high resolution chemostratigraphic dataset of major and trace element concentrations, and assess the relationship between the rise of atmospheric oxygen and the subsequent decline in BIF deposition. We also highlight the interplay between local and global controls on the preservation of redox signatures, including the rise and fall of local base-level, input of weathered continental material, influx of reduced sulfur species associated with the continental weathering, and global increases in atmospheric oxygen. We interpret Boolgeeda deposition to have taken place under shallow water, oxic conditions. Intermittent periods of oxidative weathering led to influxes of redox sensitive trace elements from land as continental sulfide minerals were weathered. This also led to the temporary disappearance of S-MIF, but O_2 remained below the threshold capable of completely eliminating S isotope signatures associated with the S-MIF recycling.

Keywords: Boolgeeda Iron Formation; Turee Creek Group; Hamersley Basin; Banded Iron Formation; Great Oxidation Event; Trace elements