Hematite growth in 2.5 Ga banded iron formation linked to post-depositional oxidation

B. RASMUSSEN[1]*, B. KRAPEZ[1] AND D.M. MEIER[1,2]

[1]Dept of Applied Geology, Curtin University, Kent Street, Bentley, WA 6102, Australia (*correspondence: B.Rasmussen@curtin.edu.au)

[2]School of Earth and Environment, The University of Leeds, Leeds, LS2 9JT, United Kingdom

Banded iron formations (BIFs) are central to interpretations about the composition of the Precambrian ocean, atmosphere and biosphere. Hematite is an important component of many BIFs. Its presence in unmineralized BIF has been used to infer the former presence of ferric oxyhydroxides that formed from the oxidation of dissolved ferrous iron in seawater. However, textural evidence for the timing of hematite growth in BIFs is equivocal.

New results show that hematite in unmineralized BIF from the ~2.5 Ga Brockman Iron Formation, Hamersley Group, Australia, including morphologies previously interpreted to represent ferric oxyhydroxide precipitates, formed via fluid-mediated replacement of iron-silicates and iron-carbonates. Hematite replacement is interpreted to reflect progressive stages of *in situ* alteration of reduced mineral assemblages by oxygen-bearing fluids.

Hematite replacement in unmineralized BIF postdated deposition and possibly metamorphism, and predated modern weathering. It may represent be a distal signature of the processes that were responsible for iron-ore mineralization, which involved the deep infiltration of oxygen-bearing meteoric fluids. The mineral replacement reactions recorded in the Brockman Iron Formation are unlikely to be unique and probably occurred in BIFs elsewhere at some point in their history.

Our results imply that the presence of hematite in BIF may not a reliable proxy for the composition of the precursor sediment or the redox chemistry of the ocean. The oxidation of ferrous-rich phases after deposition suggests that the precursor sediments of BIF originally had a more reduced bulk composition. This raises the possibility that, in an ocean with negligible molecular oxygen and elevated Si and Fe, the growth of iron-rich clay minerals was favoured over hematite.