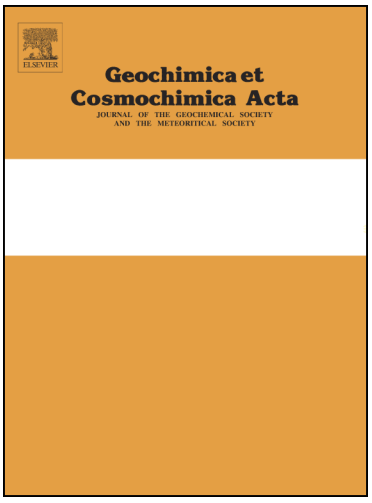

The Effects of Metamorphism on Iron Mineralogy and the Iron Speciation Redox Proxy

Sarah P. Slotznick, John M. Eiler, Woodward W. Fischer

PII: S0016-7037(17)30765-2
DOI: https://doi.org/10.1016/j.gca.2017.12.003
Reference: GCA 10576

To appear in: *Geochimica et Cosmochimica Acta*

Received Date: 30 January 2017
Accepted Date: 4 December 2017

Please cite this article as: Slotznick, S.P., Eiler, J.M., Fischer, W.W., The Effects of Metamorphism on Iron Mineralogy and the Iron Speciation Redox Proxy, *Geochimica et Cosmochimica Acta* (2017), doi: https://doi.org/10.1016/j.gca.2017.12.003

The Effects of Metamorphism on Iron Mineralogy and the Iron Speciation Redox Proxy

Sarah P. Slotznick[12*], John M. Eiler[1], Woodward W. Fischer[1]

[1] Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA 91125, USA

[2] Present Address: Earth & Planetary Science Department, University of California Berkeley, Berkeley, CA 94720, USA

* sslotz@berkeley.edu

Abstract

As the most abundant transition metal in the Earth's crust, iron is a key player in the planetary redox budget. Observations of iron minerals in the sedimentary record have been used to describe surface atmospheric and aqueous redox environments over the evolution of our planet; the most common method applied is iron speciation, a geochemical sequential extraction method in which proportions of different iron minerals are compared to calibrations from modern sediments to determine water-column redox state. Less is known about how this proxy records information through post-depositional processes, including diagenesis and metamorphism. To get insight into this, we examined how the iron mineral groups/pools (silicates, oxides, sulfides, etc.) and paleoredox proxy interpretations can be affected by known metamorphic processes. Well known metamorphic reactions occurring in sub-chlorite to kyanite rocks are able to move iron between different iron pools along a range of proxy vectors, potentially affecting paleoredox results. To quantify the effect strength of these reactions, we examined mineralogical and geochemical data from two classic localities where Silurian-Devonian shales, sandstones, and carbonates deposited in a marine sedimentary basin with oxygenated seawater (based on global and local biological constraints) have been regionally metamorphosed from lower-greenschist facies to granulite facies: Waits River and Gile Mountain Formations, Vermont, USA and the Waterville and Sangerville-Vassalboro Formations, Maine, USA. Plotting iron speciation ratios determined for samples from these