Protracted cooling from Neoproterozoic metamorphic events in the NW Highlands, Scotland investigated using garnet Lu-Hf and Sm-Nd geochronology

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The Moine Supergroup of the Northern Highland Terrane in Scotland records several orogenic events. The earliest of these is the Knoydartian (830-740 Ma). All previously published evidence for this event comes from West Inverness-shire. Lu-Hf and Sm-Nd garnet geochronology records much more widespread Neoproterozoic metamorphism, with evidence from Shetland to Mull. This data also shows that the Morar Group has been affected by the Renlandian event of the Valhalla Orogen. It also demonstrates that the younger limit of Morar Group deposition is older than previously thought (>950 Ma).

All of the samples all record a systematic difference between the Lu-Hf and Sm-Nd ages, the Sm-Nd ages being 10-20% younger than the Lu-Hf ones. Garnet cores and rims have been dated using Lu-Hf and Sm-Nd and the difference between the cores and rims is the same for both isotopic systems. This suggests that the difference between Sm-Nd and Lu-Hf is due to the difference in closure temperatures. One exception gives Lu-Hf and Sm-Nd ages which are within error and could suggest that this sample records garnet growth in both isotopic systems or relates to very fast cooling.

Iron Oxidation and Reverse Electron Flow In a Photoferrotroph

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Biological iron oxidation is of interest to geobiologists as an oxygen independent mechanism of ferric iron production. *Rhodopseudomonas palustris* TIE-1 is a versatile purple phototroph with the ability to grow using ferrous iron (Fe[II]) as the sole electron donor. Previous studies showed that the *pio* operon, encoding an outer membrane porin, a decaheme cytochrome, and a high potential iron protein (HiPIP), are vital to Fe(II) oxidation. This work further explores the iron oxidation pathway through *in vitro* characterization of the HiPIP and *in vivo* visualization of photosynthetic electron transport with flash induced absorbance spectrometry. *In vitro* studies showed that the HiPIP can donate electrons to the reaction center at a rate much slower that that found in energy generation. Our *in vivo* studies, however, show that antimycin (a bc_1 complex inhibitor) blocks reduction of the quinone pool by Fe(II), indicating that electrons may reduce the quinone pool of the cell through the bc_1 complex instead of through the reaction center as previously thought. We have also found that the quinone pool of *R. palustris* TIE-1 is reduced by Fe(II) over short time scales even in mutants lacking the *pio* genes, although the precise rates of this reaction were not determined. These results indicate that the mechanisms of iron oxidation are more complex than originally thought, and that the path electrons take from Fe(II) to carbon reduction is similar to the pathway found in acidophillic Fe(II) oxidation.

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