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The fate of banded iron formations in the deep mantle: Iron oxide reduction kinetics at high temperatures and pressures

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Banded iron formations (BIFs) are Precambrian chemical sediments made of alternating layers of silica and iron oxides (hematite and magnetite) which precipitated in large quantities on the ocean floor from 3.5-1.8 Ga. Although most BIFs were likely subducted into the mantle, their fate after subduction is poorly understood. The mantle generally becomes more reducing with depth, and is thought to be below the iron-wüstite buffer throughout much of the lower mantle. Hence, it is possible that some or all of the iron oxides in deeply subducted BIFs could have reduced to iron metal. The kinetics of the reduction reaction determine how much metal could have been produced from the reduction of BIFs over Earth's history. We have performed a series of FeO reduction kinetics experiments using piston cylinder and multi-anvil devices at pressures between 2 and 20 GPa and temperatures between 700-1400 ^{o}C. In each experiment, an FeO wafer is positioned adjacent to a metal reducing agent in order to simulate the BIF reduction process under deep mantle conditions. We will discuss the results of these experiments and their implications for the structure and dynamics of Earth's deep interior.