Formation of Paleoproterozoic laterite through interactions among minerals, fluids, and life

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The relative mobility of Fe in Paleoproterozoic paleosols has been used to constrain the timing of proposed increases in the pO_2 level, where net Fe losses are interpreted to reflect Fe mobilization during weathering under an anoxic atmosphere, and Fe retention is interpreted to reflect oxidation *in place* during weathering under an O_2-bearing atmosphere. The 2.2 Ga paleosols that developed on the Hekpoort Basalt of the Pretoria Group, South Africa, are particularly important because they have been considered to be one of the youngest Fe-depleted paleosols, potentially placing constraints on the pO_2 level and the timing of the inferred Great Oxidation Event (GOE).

We investigate Fe and O isotope variations in the complete section of lateritic weathering profile developed in the Hekpoort paleosol from Botswana that were studied by Beukes et al. (2002) and Yang and Holland (2003). Beukes et al. (2002) suggested that the Hekpoort laterite profiles were developed through processes that were similar to those that occur in modern laterites. Our isotope data are well explained through fluid-rock interaction involving transport of aqueous Fe^{2+} through the system during paleosol evolution.