Kolloquium:

What we can learn about the ancient Earth surface and atmosphere from Proterozoic ‘soils’

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Ancient “soils” (paleosols), although rare in the geological record, provide an important and fascinating archive for us to study the remnants of the interface between the atmosphere and lithosphere. Previous work identified an important transition in the Fe(II)/Fe(III) redox state of Proterozoic paleosols between ca. 2.4-2.2 Ga that helped initially define Earth’s Great Oxidation Event. However, what we know about Earth’s atmospheric oxygenation has expanded significantly in the last two decades from new geochemical proxies developed and applied to the marine rock record. By contrast, the application of these modern trace element and stable isotopic proxies to paleosols has lagged behind and thus detailed paleosols studies can still provide new insights into chemical weathering processes and redox state of the ancient atmosphere.

The talk will span a history of existing paleosol research, the application of major and trace element geochemistry to studying ancient paleosols, new constraints and implications derived from trace element (Mo, U, REE) and stable metal isotope (Cr, Fe) data, as well as some of the complications involved in attempting to disentangle primary pedogenic information from paleosols. The talk will focus on data from modern weathering profiles compared to those from two paleosols formed on mafic rocks before (ca. 2.45 Ga) and after (ca. 1.85 Ga) Earth’s Great Oxidation Event.