The paleoatmospheric CO_2 at the end of Neoproterozoic

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Atmospheric CO_2 concentration is an important factor controlling the Earth's surface temperatures and chemical processes. High atmospheric CO_2 concentration lowers the pH of the precipitation and by greenhouse effect increases air temperature, both leading to intensified weathering. This kind information is recorded in weathering crusts (paleosols). However, Precambrian paleosols have a relatively low preservation potential and are commonly preserved as denudation surfaces rather than as complete weathering profiles. As a result, the atmospheric pCO_2 estimates obtained from paleosols can vary by more than an order of magnitude.

The ca 560–600 Ma old Neoproterozoic Baltic paleosol records environmental conditions at the time of final oxygenation of the atmosphere and the emergence of multicellular life. Well preserved lateritic, kaolinite-rich Baltic paleosol with hematite/goethite rich duricrust is similar to modern oxisols and most likely formed in warm and humid climate [1,2] during about $2x10^5$ to $1x10^6$ years [3].

The pCO_2 estimates using 10 well characterized Baltic paleosol profiles with different denudation levels show a large range between 1-100 PIAL. There is a clear correlation between the completeness of the paleosol profile and the estimated atmospheric pCO_2 concentrations. Our results show that, first, the atmospheric pCO_2 levels were nearly two orders of magnitude higher than in modern atmosphere at the very end of Neoproterozoic, and secondly, the pCO_2 levels can be strongly underestimated using a single weathering profile of unknown denudation level underlining that pCO_2 concentrations estimated using paleosols are merely tentative minimum values if the preservation of paleosol profile(s) is not critically assessed.

[1].Liivamägi *et al*. (2014), *Geology* **42**, 323-326. [2] Liivamägi *et al*. (2015), *Precambrian Res*. **256**, 170-188. [3] Driese *et al*. (2018), *Precambrian Res*. **310**, 165-178.