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# The lithologic composition of Earth's emerged lands reconstructed from the chemistry of terrigenous sediments

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Despite its importance for the biological and atmospheric evolution of our planet, the question how the lithological composition of Earth's landmasses evolved from around 3.5 Ga to present is still a matter of considerable debate. Furthermore, the type of rocks that build the continents are an expression of the prevailing rock forming mechanisms and thus the geodynamic regime that was at work. Therefore, a good understanding of the lithological and chemical composition of Archean continents is crucial to gain a comprehensive picture of Earth's evolution.

Lately, the view that Earth's continents were dominated by basaltic rocks until around 3.0 Ga became increasingly popular. The subsequent rapid transformation from mafic to felsic continents has been used to argue for the onset of plate tectonics at 3.0 Ga and to suggest that the change in the chemical composition of the emerged continents initiated the Great Oxidation Event. Here we present a summary of our work over the past three years (Greber et al., 2017, Greber and Dauphas 2019, Ptáček et al., accepted) that challenges this view. Reconstructing the composition of past continents is difficult because erosion and crustal reworking may have modified the geologic record in deep time, so direct examination of the nature of igneous rocks could provide a biased perspective on the nature of the continents through time. A less biased record is provided by terrigenous sediments that average the composition of rocks exposed to weathering on emerged lands. We use the Ti isotopic, major and trace element composition of fine grained terrigenous sediments (shales) as a proxy for the average composition of the emerged continents in the past. Our model shows that since 3.5 Ga, the landmasses that were subjected to erosion were dominated by felsic rocks. Furthermore, our reconstructed relative abundance of felsic, mafic and komatiitic rocks in the Archean is close to that currently observed in Archean terrains. The combination of Ti isotopes and element abundances also indicates that the rocks exposed to weathering in the Archean resemble that of modern type calc-alkaline rocks and that tholeiitic rocks (e.g. Icelandites) were of subordinate importance.

To summarize, the lithological composition of the Paleoarchean continents should no longer be used as argument against the existence of subduction zones at that time. Instead, their nature rather supports that some form of subduction process was already operating since the early Archean.

References: Greber N.D., et al (2017), Science **357**, 1271–1274; Greber N.D. and Dauphas N. (2019), GCA **255**, 247–264; Ptáček M.P., Dauphas N. and Greber N.D. (accepted), EPSL.