Peering through the diagenetic window for Archean phototrophs

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Because Fe^{2+} can be oxidized by several environmentally-relevant pathways, it is not currently known what process produced banded iron formations prior to the oxygenation of the atmosphere [1]. In contrast, Mn^{2+} is not known to be oxidized by anoxygenic organisms and is not as photochemically reactive as Fe^{2+}. It has therefore been suggested that sedimentary Mn(IV) minerals should be regarded as the geologic marker of oxygenic photosynthesis [2]. Unfortunately, these minerals are some of the first electron acceptors to be reduced during sedimentary diagenesis [3], so their absence in sedimentary rocks of a given age does not necessarily indicate the absence of oxygenic photosynthetic bacteria at that time. Seeing through the window of diagenetic metal reduction is therefore critical to reconstructing a manganese proxy record of the evolution of oxygenic photosynthesis.

Diagenetic carbonate minerals in hematitic cherts of the 3.26 Ga Fig Tree Group preserve a range of rare earth element (REE) distributions with end-members consistent with minimally modified seawater (superchondritic Y/Ho and no middle REE enrichment) and sedimentary pore fluids in iron-reducing diagenetic zones (chondritic Y/Ho and middle REE enrichment). Low Mn/Fe ratios and seawater-like REE distributions are present in ankerite in deep-water hematitic banded iron formation. Ankerite and dolomite in shallow-water jaspers preserve elevated Mn/Fe ratios that correlate inversely with degree of diagenetic alteration inferred by REE distributions. No primary Mn(IV) minerals have been observed in any of these rocks. We show that this pattern is most consistent with a lack of Mn(IV) minerals prior to diagenetic alteration and the absence of oxygenic phototrophs during deposition of Fig Tree banded iron formation.

[1] Dietrich, Tice & Newman (2006) *Current Biology* **16**, R395-R400. [2] Kopp, Kirschvink, Hilburn & Nash (2005) *PNAS* **102**, 11131–11136. [3] Canfield & Thamdrup (2009) *Geobiology* **7**, 385–392.

Dating granites from the Erzgebirge by different methods – A comparison

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Granites from the Erzgebirge mark the final stage of the Variscan Orogeny. Therefore, they are important time marks to unravel the evolution of late and post-orogenic processes. Until now, there is still a large scatter of ages obtained at different laboratories and by different methods for these igneous rocks. The granites display very distinct geochemical and petrological patterns. ‘Early’ granites were almost undifferentiated and consist mainly of biotite granites. ‘Later’ granites were strongly differentiated and appear as two-mica granites or Li-mica granites. Some of the ‘latter’ granites belong to fluorine-rich varieties. In addition to geochemical magmatic differentiation, many granites were severely overprinted by hydrothermal activity which was often related to ore-forming processes. Multiple overprint processes may hamper precise and accurate dating of such granites because of the possible disturbance of dating systems.

Recently, an age difference of about 9 (±3) Ma was established between two granite suites belonging to the ‘early’ and ‘late’ stage by the single zircon evaporation method [1]. We present new age data (Pb/Pb on zircon, U/Pb SHRIMP on zircon, U/Pb conventional dating, Rb/Sr on mineral separates, Ar/Ar on mica) for these and further granite suites from the Erzgebirge (Eibenstock, Aue-Schwarzenberg, Kirchberg, Bergen, Frauenstein). The data will be discussed in light on duration of igneous processes as well as on precision of dating methods.

[1] Tichomirowa & Leonhardt (2010) *Z. Geol. Wiss.* **38**, 99–123.