

Sedimentary PGE anomalies at Snowball Earth terminations

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Bodiselitsch et al. [1] reported iridium anomalies in sediments at the termination of the Sturtian (~710 Ma) and Marinoan (~635 Ma) Snowball Earth glaciations from the Lufilian tectonic arc of the Eastern Congo craton. Iridium concentrations reach 1.9 ng/g over background values of <0.2 ng/g. The authors interpreted these anomalies as reflecting long-term (3-12 Myr) storage of PGE-rich extraterrestrial particles on ice followed by instantaneous delivery to sediments upon deglaciation.

We have initiated a research project investigating these claims. Our goal is to 1) confirm the Ir anomalies, 2) investigate the use Os and He isotopes to confirm the extraterrestrial nature of the PGE-rich particles, 3) use PGE concentration pattern to distinguish upper crustal, mantle, and extraterrestrial contributions to the sedimentary PGE budgets, and 4) evaluate the global significance of these anomalies. We report on two continuously sampled profiles of the 635-Ma glacial termination in Namibia (Otavi Platform) and the northern Canadian Cordillera (Mackenzie Mtns), where glacial diamictite is separated from post-glacial cap dolomite by a clay layer 2-12 cm thick.

Osmium concentrations across the glacial termination in Canada increase from background values of ~20 pg/g to 1.2 ng/g in the boundary clay, thus confirming the existence of PGE anomalies at Snowball Earth terminations. ¹⁸⁷Os/¹⁸⁸Os values decrease from ~0.8 in the diamictite to 0.56 in the boundary clay, then increase in the overlying cap dolomite from 0.7 to 1.0 four meters above the boundary. Rhenium analyses are in progress to correct these values for radiogenic ingrowth.

Platinum group element concentrations in the overlying Ravensthoat cap dolomite are non-chondritic, with low Os (15-35 pg/g), very low Ir (2-5 pg/g), and higher Pt (90-280 pg/g) and Pd (175-440 pg/g) concentrations. These pattern are very similar to rapidly accumulating modern marine carbonates. The low Ir concentrations set an upper limit of 10 ppm on the abundance of undifferentiated extraterrestrial matter in these sediments, close to the detection limit of our analytical method. If the elevated Os/Ir coincide with high Re concentrations and Re/Os, deposition of the cap carbonates may point to reducing conditions immediately after the termination of Snowball Earth glaciations.

References

[1] Bodiselitsch B., Koeberl C., Master S., and Reimold W.U. (2005) *Science* **308**, 239-242.