Extending the seawater Os isotope curve through the lower Paleozoic

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Climatic variations that significantly impact weathering rates are directly reflected in the Os isotopic composition of seawater, either locally or globally. Thus, $^{187}Os/^{188}Os$ ratios preserved in organic-rich sedimentary rocks archive climatic variations in the geologic record. The lower Paleozoic has relatively few constraints, despite the importance of the explosion of life in the Cambrian, biodiversity in the Ordovician, and a glacial epoch and mass extinction at the close of the Ordovician. Major variations in $^{187}Os/^{188}Os$ (0.3 to 1.1) during the last two stages of the Ordovician (Katian and Hirnantian) are reported by Finlay et al. (2010) based on age-corrected measurements from shales at the Ordovician/Silurian boundary GSSP at Dob's Linn, Scotland. Ideally, however, evidence that initial Os isotopic ratios are preserved should underpin these numbers. A selective subset of the data by Finlay et al. yields an approximately correct age for the section, but the poor precision is unsatisfying.

Re-Os isochrons for Katian (Upper Ordovician) and Telychian (Llandovery, lower Silurian) shale sections from the Siljan region in central Sweden provide two reliable points for the Os seawater curve. Both sections were sampled from drill core, eliminating the potential for oxidation and mobilization of Re or Os by weathering. The first, the Fjäcka Shale from the Stumsnås 1 core, yields an age = 454.0 ± 6.1 Ma, initial $^{187}Os/^{188}Os$ = 0.563 ± 0.036, MSWD = 1.08, n = 5. The second, an unnamed Llandovery shale from the Mora 001 core, yields an age = 435.1 ± 1.5 Ma, initial $^{187}Os/^{188}Os$ = 0.553 ± 0.007, MSWD = 1.3, n = 10. These data are combined with existing data from the lower Cambrian and two new isochrons from the latest Stage 10 Cambrian and Lower-Middle Ordovician (Goswami et al., this meeting) to document a steady decrease in $^{187}Os/^{188}Os$ from near 1.0 at the end Ediacaran to 0.55 by early Silurian. While rapid swings within this time frame are possible – especially associated with Hirnantian glaciation – we are working toward confirmation through precise isochrons based on drill core.

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