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## Geochronologic constraints on the Shuram excursion in Oman

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The rise of animals occurred during an interval of Earth history that witnessed highly dynamic atmosphere-ocean redox conditions; regional, transient glaciations; extraordinarily low magnetic field intensities potentially related to inner core formation; and perturbations to the global carbon cycle of a size not seen before or since. The largest of these, the Shuram carbon isotope excursion, has been invoked as a driving mechanism for, or consequence of, various biological and geological events during the Ediacaran Period. However, there are a number of major controversies regarding the Shuram, including its timing. Without age constraints on its onset or duration, it is impossible to confidently connect the Shuram Event with any biological or geological upheavals.

Here, we apply multiple methods, including Re-Os on black shales and U-Pb LA-ICP-MS dating on carbonates, to well-preserved Ediacaran stratigraphy from Oman, deriving new age controls in previously undated parts of the stratigraphy. Our new data show that paired Re-Os shale and U-Pb carbonate analyses constrain the onset and duration of the Shuram excursion in Oman. The results—which are consistent with recent age constraints on Shuram-bearing stratigraphy from Northwest Canada (Rooney et al. 2019, Goldschmidt)—demonstrate the utility of leveraging multiple geochronological techniques within a single basin to constrain deposition in deep to shallow depositional environments. The results also provide key absolute age constraints on the onset of the Shuram excursion in the stratigraphy where it was first defined, critical for testing global correlation schemes, constructing a temporal framework for the Ediacaran period, and identifying causal mechanisms during this interval of geobiological and geodynamic dynamism.