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No volcanic trigger for late Cambrian carbon cycle perturbations?

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The Early Paleozoic was marked by several carbon cycle perturbations and associated carbon-isotope excursions (CIEs). Whether these CIEs were connected to significant (external) triggers, as is generally the case for CIEs in the Mesozoic and Cenozoic, or resulted from reduced Early Paleozoic carbon cycle resilience, remains unclear. We present sedimentary mercury (Hg) concentration and Hg- and osmium- (Os) isotope data from the upper Cambrian – Lower Ordovician Alum Shale Formation (Sweden) to resolve the potential impacts of volcanism and weathering. The ~16 million-year-long record from the Albjära-1 core covers, amongst others, the Steptoean Positive Carbon Isotope Excursion (SPICE; *ca.* 497 – 494 million years ago): a period marked by a rise in atmospheric oxygen and biotic overturning.

The Hg record shows relatively high but also approximately stable average Hg concentrations and low Hg accumulation rates. A few minor Hg peaks are recorded coeval with the Top of the Cambrian Excursion (TOCE) but none coincide with other previously recognized carbon cycle perturbations. Moreover, neither Hg- nor Os-isotope data show clear impact of volcanism, basalt-seawater interaction or enhanced continental weathering on the SPICE event, the largest CIE in the 16-Myr time-interval. Instead, Hg concentration data show astronomical pacing, likely driven by organic- matter and sulfide burial. We conclude that the late Cambrian – Early Ordovician CIEs cannot easily be connected to processes linked to volcanic activity or weathering, external triggers that have been linked with events in the Mesozoic and Cenozoic Eras. The apparent absence of large triggers suggests that amplification of small carbon cycle instabilities may have resulted in large carbon cycle perturbations in the Paleozoic, whereas the superficially similar Mesozoic and Cenozoic events seem to have required strong external forcing.