

Antipodean records show Deccan Traps volcanism drove environmental change prior to the K/Pg boundary

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Large igneous provinces (LIPs) are recognised as drivers of rapid environmental change and are linked with major mass extinction events. The role of the Deccan Traps LIP in the Cretaceous/Palaeogene (K/Pg) mass extinction has remained ambiguous, however, and is often overshadowed by the impact of the Chicxulub asteroid. Trace element chemostratigraphy offers the opportunity to investigate the relative timing of LIP volcanism, asteroid impact and environmental change and thus elucidate potential drivers of mass extinction. While this approach has been applied to K/Pg boundary sequences before, current data is biased towards northern hemisphere sites mostly representing continental or shallow marine environments and thus a global perspective is lacking. To address this, we present new trace element and isotope data on three pelagic sedimentary sequences from the southern hemisphere: Mead Stream and Flaxbourne River in Marlborough, New Zealand, and IODP hole U1514 drilled off the SW coast of Australia. At all three sites positive Hg anomalies (up to 500 ng/g above background levels) occur at the K/Pg boundary, with both sites from New Zealand recording the highest Hg concentrations analysed in any K/Pg boundary sequence. Comparison with Hg data from northern hemisphere boundary sequences demonstrates the global impact of volcanic emissions from the Deccan Traps. Hg concentrations begin to increase below the K/Pg boundary, suggesting growing volcanic effects over >10 kyr prior to the end of the Cretaceous. Rare Earth elements and highly siderophile elements do not mirror this pattern, however some redox-sensitive elements (e.g., Mo) do. At Mead Stream, significant changes in Mo/U in the uppermost ~10 cm of Cretaceous sediments imply growing euxinia associated with LIP emissions at the end of the Cretaceous. This suggests that emissions from the Deccan Traps began to drive environmental change prior to asteroid impact.