Seawater Chemistry Across Cretaceous-Tertiary Boundary

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Continental weathering is recognized as one of the primary mechanisms moderating the concentration of CO_2 in the atmosphere. Past carbon cycle perturbations, often associated with mass extinction events, recovered on a timescale of hundreds of thousands of years, broadly consistent with enhanced chemical weathering being the key moderating process. Since chemical weathering of continental rocks controls the delivery of cations to the oceans, records of seawater cation chemistry provide a powerful archive of this interplay and feedback between climate and weathering.

The Cretaceous-Paleogene (K-Pg) boundary at ~65.6 Ma is the last major mass extinction event. The two accepted drivers of this mass extinction were the geologically coeval eruption of Deccan Trap continental flood basalts and the meteorite impact at Chicxulub. The Chicxulub impact, on a bed of marine carbonate sedimentary deposits, happened during a second pulse of Deccan traps volcanism. Thus teasing apart the timing and dominant driver of the mass extinction and the recovery remains enigmatic. A key feature of the K-Pg event is the transient acidification of the global surface ocean that drove the collapse of the oceanic ecosystem. This surface ocean acidification was caused by 'geologically instantaneous' influx of large quantities of acidic gases (viz. CO_2, SO_2) to the ocean-atmosphere system.

We have utilised benthic foraminifera, a faithful recorder of the seawater composition and pH of their growth habitat, from the same genus for the K-Pg seawater chemistry reconstruction. A continuous array of chemically cleaned benthic foraminifera (*Nuttallides sp.* and *Stensioina sp.*) across the K-Pg section from deep-sea sites (DSDP 490; IODP 1210, 1262, & 1267) were analysed.

We have created high-resolution records of Li, B, Mg, and Ca isotope (δ^7Li, $\delta^{11}B$, $\delta^{26}Mg$, and $\delta^{44}Ca$, respectively), across the K-Pg boundary to assess the carbon cycle perturbation and its recovery through continental weathering feedback. This unique record allows for the first direct reconstruction of seawater isotopic composition of elements intimately linked to the continental weathering cycle (Li, Mg, and Ca), and the carbon budget of the ocean-atmosphere system (boron) across an event of rapid climate transition and recovery. Additionally, the isotopic excursion in boron isotopes allows us to fingerprint the timing of the acidic gas input to the atmosphere and to test the 'impact hypothesis'.

Utilizing the calcium and magnesium isotope excursions we put a revised constrian on the volume of Deccan Trap erruption at ≤ 0.7 million km^3. Whereas, boron isotope based pH reconstruction demonstrates that there were no long-term ocean acidification associated with K-Pg events.