

From Land to Sea: Tracing continental LIP activity in marine sediments using Osmium isotopes.

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The geochemical proxy of osmium isotope composition, expressed as $^{187}\text{Os}/^{188}\text{Os}$, has widely been used to trace Large Igneous Province (LIP) emplacement in sedimentary records. Variations in osmium isotopes provide direct evidence of increased volcanic activity as volcanic emissions introduce unradiogenic Os into seawater, leading to measurable shifts in the global marine osmium isotope record. Consequently, the $^{187}\text{Os}/^{188}\text{Os}$ ratio in seawater acts as a crucial tracer of the relative contributions of mantle-derived inputs versus continental weathering. However, the majority of existing studies on osmium isotopes in sedimentary records to trace LIP activity involved LIPs that were emplaced in oceanic setting, since the Os signal is rapidly incorporated into the marine sediments. In contrast, if a continental LIP is involved, the signal in sedimentary rocks is expected to exhibit a lag due to delayed weathering, transport and biogeochemical cycling of the isotopic signature into the ocean. In this study, we are measuring the Os signal imparted by the Columbia River Basalt Group (CRBG) - Earth's youngest and among the smallest continental flood basalts - in distal Miocene marine sediments, and assess how that signal may align with the climatic perturbations of the Miocene Climate Optimum (MCO). Here, we present new Osmium isotope data from MCO-aged sediments sampled at ODP Site 1000 (Nicaragua Rise), which benefits from a well-resolved Bayesian age model derived from high-precision U-Pb zircon geochronology, to assess the temporal relationship between CRBG emplacement and its corresponding marine geochemical signatures. Specifically, we aim to determine the lead and lag time of continental LIP activity as recorded by Os in marine sediments. Results show a decrease in $^{187}\text{Os}/^{188}\text{Os}$ at the onset of the Miocene Climatic Optimum (MCO), suggesting an increase in unradiogenic Os input, potentially linked to CRBG emplacement. This study further evaluates the impact of the CRBG on the MCO, providing new insights into the role of large-scale continental volcanism in driving past climate change.