Factors for the long-term climatic trends in the early Eocene hothouse world: Implications from the seawater osmium isotope record of the Indian Ocean sediments

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It is widely accepted that the early Paleogene (late Paleocene–middle Eocene) is characterized as a “hothouse” environment in the long-term (~10^6 yr) climatic trend during the Cenozoic era [1]. The long-term warming initiated at the late Paleocene and culminated during the early Eocene, as the Early Eocene Climatic Optimum (EECO). After the EECO, the global climate turned to a long-term cooling. Although many hypotheses have been proposed, the fundamental factors accounting for the long-term warming and cooling trends during the Paleogene are still in debate.
Here we employed the Os isotopic ratio ($^{187}Os/^{188}Os$) of seawater as a proxy for the solid Earth activity (e.g., silicate chemical weathering, magmatism), and discuss its relationship with the early Paleogene climate trend. The marine Os isotopic ratio reflects the relative strength of two dominant influxes to the ocean: radiogenic Os flux through the weathering of continental crust ($^{187}Os/^{188}Os > 1.0$) and unradiogenic Os flux through the inputs of hydrothermal, mafic materials, and extraterrestrial inputs ($^{187}Os/^{188}Os = 0.12–0.13$) [2]. Owing to the contrasting $^{187}Os/^{188}Os$ values between these two influxes, the variability in $^{187}Os/^{188}Os$ of seawater constitutes a sensitive tracer for the continental, mantle, and extraterrestrial inputs into the marine environment.
We report the long-term early Paleogene marine Os isotopic record from the pelagic carbonate sediment in the Exmouth Plateau (ODP Site 762C) and Kerguelen Plateau (ODP Site 738C) in the Indian Ocean. In addition, we will quantitatively discuss the relative contribution between continental and mantle-like materials into the ocean by using a simple 1-box isotopic mass-balance modeling based on the marine $^{187}Os/^{188}Os$ record. In the presentation, we will provide new constraints for the long-term climatic trend during the Early Eocene.

[1] Westerhold et al. (2020) *Science* **369**, 1383–1387. [2] Peucker-Ehrenbrink & Ravizza (2000) Terra Nova **12**, 205-219.

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