

# **Lithium isotope evidence for weathering feedbacks linked to volcanism in the Southeast Indian Ocean during the Middle Eocene**

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A series of transient global warming events, such as the Middle Eocene Climatic Optimum (MECO) and the Late Lutetian Thermal Maximum (LLTM), interrupted the long-term cooling trend of the Middle to Late Eocene. These hyperthermals are primarily attributed to episodic volcanism associated with tectonic plate reorganization. Continental silicate weathering plays a critical role in atmospheric CO<sub>2</sub> consuming and climate regulation. However, the relationships between volcanism, the carbon cycle, and continental weathering during the middle Eocene remains poorly understood. Here, we conducted a multiproxy analysis, including lithium and mercury isotopes, clay minerals, and organic geochemical components, on a continuous Eocene sedimentary sequence from International Ocean Discovery Program (IODP) Site U1514 in the Mentelle Basin off southwestern Australia. We find a negative Li isotope excursion of ~3‰ in local weathering inputs (detrital clays) and gradual drop of marine  $\delta^{18}\text{O}$  at the onset of an intense volcanic episode (~42 Ma). This is consistent with an increasing terrigenous input, which altogether point towards an intensification of the regional hydrological cycle. The synchronous variations observed between carbon and oxygen stable isotope ratios and chemical weathering intensity indicate a strong coupling among the carbon cycle, climate, and chemical weathering during the widespread volcanism. These findings significantly enhance our understanding of the Eocene climate dynamics and Earth system regulatory feedbacks.