Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.30778

Triple oxygen isotope evidence for the widespread distribution of recycled sediments in the deep mantle

DR. GUANGHUI WU, PHD[1], XU LI[1], LIHUI CHEN[2], TAKESHI HANYU[3] AND XIAOBIN CAO[1]

[1]Nanjing University
[2]Northwest University
[3]JAMSTEC

Extensive geochemical studies have revealed significant heterogeneity in Earth's deep mantle, characterized by five end-members: DMM (depleted mid-ocean ridge basalt mantle), EM1 and EM2 (enriched mantle types), HIMU (high μ, μ = $^{238}U/^{204}Pb$), and FOZO (Focal Zone). While the origins of EM1 and EM2 are linked to recycled marine and terrigenous sediments, respectively, the sources of HIMU and FOZO remain debated due to ambiguous radiogenic isotope signatures. This study aims to constrain the nature of these end-members using triple oxygen isotopes ($\Delta^{17}O$). Ocean island basalt (OIB) samples representing different mantle end-members were reacted with BrF_5 under CO_2 laser heating to generate O_2 gas, which was then analyzed for high−precision $\delta^{17}O$ and $\delta^{18}O$ using an isotope ratio mass spectrometer (MAT 253 plus).

The $\Delta^{17}O$ values for EM1 and EM2 OIBs range from −70 ppm to −49 ppm, lower than the mantle average (~ −50 ppm), confirming the incorporation of recycled sediments in their magma sources. Compared to other proxies, $\Delta^{17}O$ proves to be a robust indicator of recycled sediments. HIMU and FOZO OIBs exhibit $\Delta^{17}O$ values ranging from −73 to −52 ppm, indicating a contribution from recycled sediments. These results suggest a broader distribution of recycled sediments and highlight a potential genetic link between HIMU and FOZO.