

# **Oxygen isotope heterogeneity of olivine crystals in orogenic peridotites from Songshugou, North Qinling Orogen: Petrogenesis and geodynamic implications**

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## **ABSTRACT**

Olivine grains from Songshugou mylonitized peridotite massif record  $\delta^{18}\text{O}$  both lower and higher than in pristine mantle samples in North Qinling Orogen, Central China. Olivines from dunites exhibit large variations in  $\delta^{18}\text{O}$  (4.03–7.07‰), and some porphyroclasts display negative correlations between  $\delta^{18}\text{O}$  and forsterite content {Fo;  $[100 \times \text{Mg}/(\text{Mg} + \text{Fe}^{2+})]$ }. The porphyroclast cores have low- $\delta^{18}\text{O}$  values, indicating that they formed in the oceanic lithospheric mantle prior to subduction. We attribute low- $\delta^{18}\text{O}$  values to seawater-peridotite interaction under high-temperature conditions. The porphyroclast rims and small olivines exhibit high- $\delta^{18}\text{O}$  values. These features suggest that high- $\delta^{18}\text{O}$  olivines formed during mylonitization in the exhumation process. Olivines reacted with  $^{18}\text{O}$ -rich melt/fluids released from subducted altered oceanic basalts and continental sediments at low temperature (<610–680 °C). The  $^{18}\text{O}$ -rich melt/fluids selectively affected porphyroclast rims and small olivine grains. Unlike the olivines in the dunites, the olivines and orthopyroxenes in the harzburgites show limited variations in  $\delta^{18}\text{O}$  (4.21–5.45‰ and 5.5–5.8‰, respectively), due to orthopyroxene exchange with melt/fluid at a slower rate than the coexisting olivine. The preservation of the low- $\delta^{18}\text{O}$  signature in olivines indicates a short residence time (<20 Ma) for subducting peridotites to mantle depths.

**Keywords:** Oxygen isotope heterogeneity, olivine, orthopyroxene, Songshugou peridotites, North Qinling Orogen