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Petrological and Re-Os Isotopic Constraints on the Origin and Tectonic Setting of the Cuobuzha Peridotite, Yarlung Zangbo Suture Zone, SW Tibet, China

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1 Abstract

The Yarlung Zangbo Suture Zone (YZSZ) in southern Tibet includes the remnants of Neotethyan oceanic lithosphere and marks a major suture between the Indian Plate to the south and the Lhasa Terrane of Tibet to the north (Dupuis et al., 2005; Yang et al., 2011). In the western part of the YZSZ, the Northern and the Southern sub-belts form two sub-parallel zones of mafic – ultramafic rock assemblages with overlapping crystallization ages (Xiong et al., 2011; Hebért et al., 2012; Liu et al., 2015). The upper mantle section of the Cuobuzha ophiolite in the northern sub-belt of the Yarlung–Zangbo Suture Zone (YZSZ) in SW Tibet comprises mainly clinopyroxene (cpx)–rich and depleted harzburgites. Spinels in the cpx-harzburgites show lower Cr# values (12.6–15.1) than the spinels in the harzburgites (26.1–34.5), and the cpx-harzburgites display higher heavy rare earth element concentrations than the depleted harzburgites. The harzburgites have subchondritic Os isotopic compositions (0.11624–0.11699), whereas the cpx-harzburgites have suprachondritic 187Os/188Os ratios (0.12831–0.13125) with higher Re concentrations (0.380-0.575 ppb). The cpx-harzburgites plot in a Re vs. Al2O3 diagram as a result of subsequent addition of Re following the last partial melting event that occurred during mid-ocean ridge melt evolution processes (Uysal et al., 2015).

Although these geochemical and isotopic signatures suggest that both peridotite types in the ophiolite represent mid-ocean ridge type upper mantle units, their melt evolution trends reflect different mantle processes. The cpx-harzburgites formed from low-degree partial melting (~5%) of a primitive mantle source, and they were subsequently modified by melt–rock interactions in a mid-ocean ridge environment. The depleted harzburgites, on the other hand, were produced by re-melting of the cpx-harzburgites, which later interacted with MORB- or island arc tholeiite (IAT)-like melts (Fig. 1) possibly in a trench-distal backarc spreading center. Our new isotopic and geochemical data from the Cuobuzha peridotites confirm that the Neotethyan upper mantle had highly heterogeneous Os isotopic compositions as a result of multiple melt production and melt extraction events during its seafloor spreading evolution.

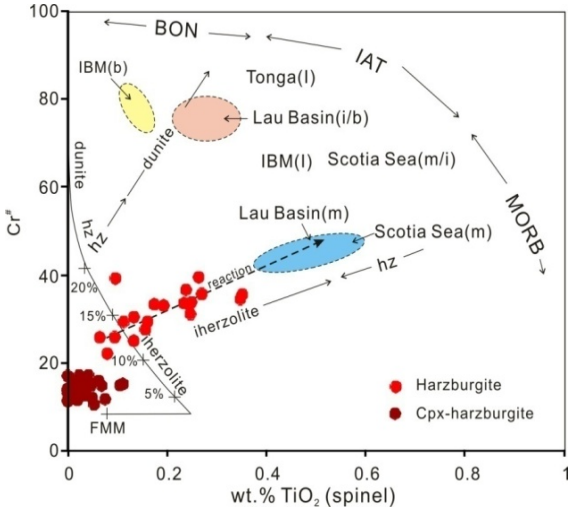


Fig. 1. Cr# vs. TiO_2 diagram for spinels within samples from the study area (modified from Pearce et al., 2000).

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