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## Gongzhucuo Massif: An Ever Slightly Depleted Peridotite in the Western Yarlung Zangbo Ophiolitic Belt of Southern Tibet

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The Gongzhucuo ophiolite, located near Lake Gongzhu in SW Tibet, occurs in the southern ophiolite sub-belt along the western Yarlung Zangbo suture zone. It is mainly composed of harzburgitic and lherzolitic upper mantle peridotites, intruded by mafic dikes. The mantle peridotites consist of olivine (Fo<sub>89-91</sub>) and orthopyroxene (En<sub>85-90</sub>) with minor clinopyroxene (En<sub>44-51</sub>) and spinel (spinel in harzburgites Cr<sup>#</sup>=17–20; spinel in lherzolites Cr<sup>#</sup>=13–20). Compared to primitive mantle, the Gongzhucuo peridotites have relatively high MgO (in harzburgites average: 43.13wt%; in lherzolites average: 41.40wt%), and relatively low Al<sub>2</sub>O<sub>3</sub> (in harzburgites average: 1.64 wt%; in lherzolites average: 2.16wt%), CaO (in harzburgites average: 1.60wt%; in lherzolites average: 2.29wt%), and TiO<sub>2</sub> (in harzburgites average: 0.03wt%; in lherzolites average: 0.04wt%). Their mineral chemistry and whole rock geochemistry show an affinity to abyssal peridotites, and their total rare-earth element (REE) contents (in harzburgites ΣREE=0.662–1.096 ppm, average: 0.923; in lherzolites ΣREE=0.904–3.784 ppm, average: 1.912) are significantly lower than those of the primitive and depleted mantles. Chondrite-normalized REE patterns of the Gongzhucuo mantle peridotites display a slight enrichment in LREE, suggesting late-stage modification. Primitive mantle-normalized spider diagrams exhibit large positive U anomalies, small positive Nd anomalies, large negative anomalies of Zr, and both positive and negative anomalies of Sr. Their platinum group element (PGE) contents (in harzburgites 15.26–25.23 ppb, average: 20.06; in lherzolites 18.81–26.86 ppb, average: 22.98) are homogeneous. Chondrite-normalized diagram shows a generally flat pattern with

narrow range of IPGE as compared to PPGE, characteristic of partial melting residues. However, most samples have Pd/Ir, Pd/Pt and Rh/Ir ratios that are higher than primitive mantle- and C1 chondrite, indicating that they may not simply represent partial melting residues. Results of our modeling of partial melting suggests that the Gongzhucuo peridotites represent the residues after 3–11% near-fractional partial melting (using the REE model after Krishnakanta, 2013 shown in Fig. 1) or 9%–16% batch partial melting (using the partial melting model based on the PGEs and Cu versus Al<sub>2</sub>O<sub>3</sub> after Marchesi, 2013 shown in Fig. 2) in the spinel stability field. Compared to the Purang and Xiugugabu ophiolites, the Gongzhucuo ophiolite probably formed in a different tectonic setting and underwent lower degrees of partial melting. The Gongzhucuo mantle peridotites represent the residues after low-degrees of partial melting in the spinel stability field beneath a mid-ocean ridge environment, however, the U-shaped chondrite-normalized REE patterns suggest some minor late-state modification.

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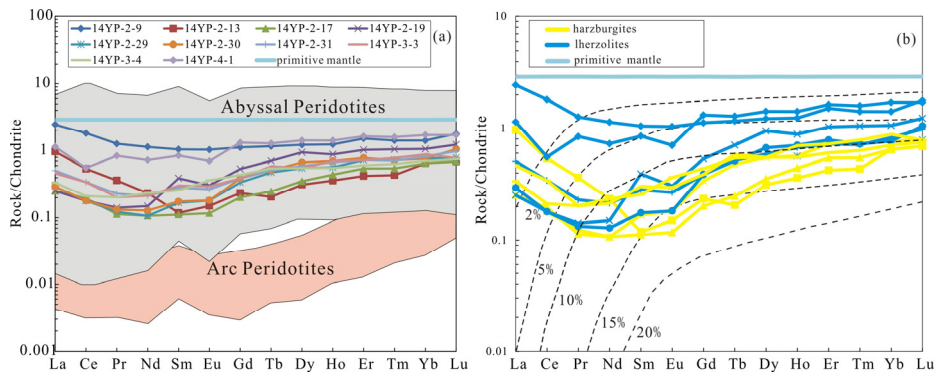


Fig. 1. Chondrite-normalized REE patterns for the mantle peridotites from Gongzhucuo ophiolite (chondrite value after Sun, 1989). (a), the gray region represents compositional variations of abyssal peridotites (after Niu (2004)); the pink region represents compositional variations for arc peridotites from Izu-Bonin-Mariana (after Parkinson and Pearce (1992)); (b), Dash lines are the range of model residual mantle compositions calculated using the modelling of near-fractional melting for different amounts of melt extraction (2%–20%)melting within the spinel stability field (after Krishnakanta , 2013).

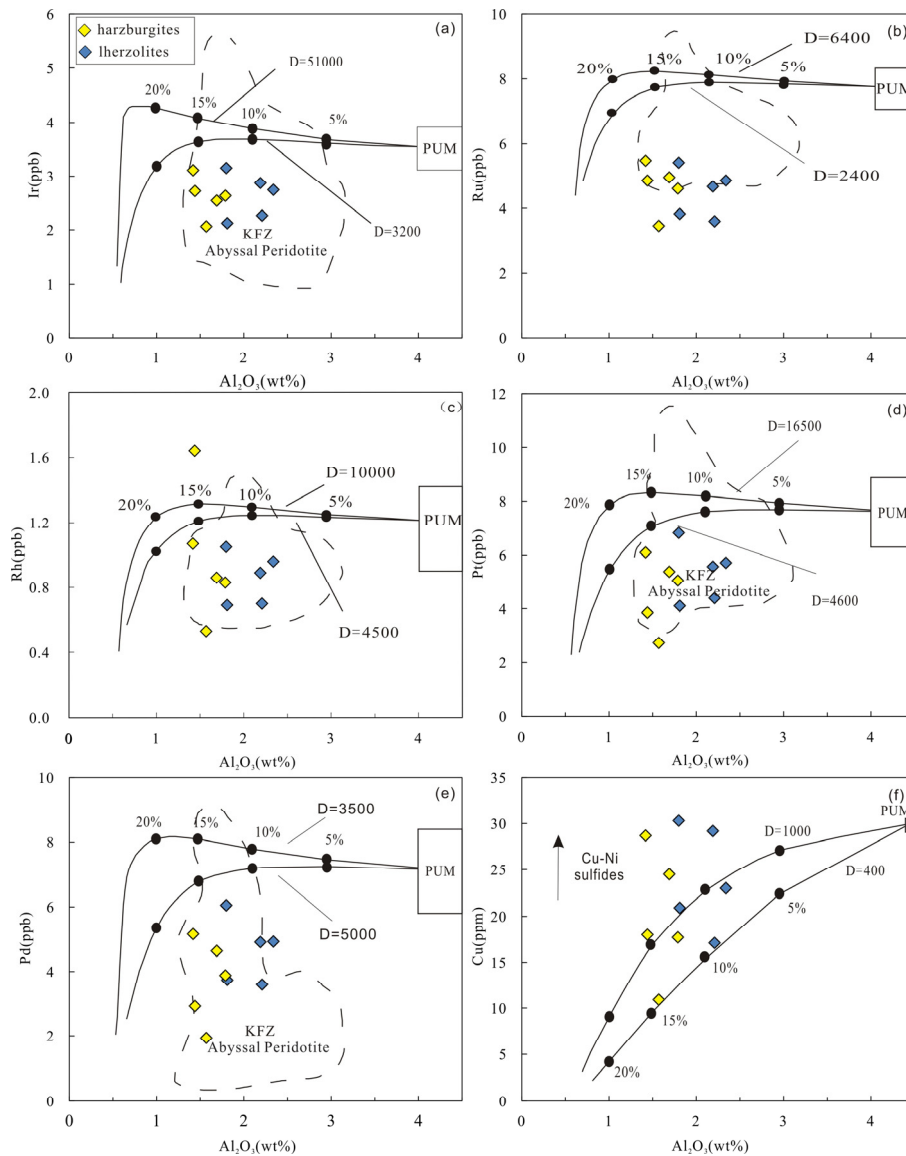


Fig. 2. Plots of PGEs and Cu versus  $Al_2O_3$  for mantle peridotites from Gongzhucuo ophiolite (after Marchesi, 2013). (a), Ir- $Al_2O_3$ ; (b), Ru- $Al_2O_3$ ; (c), Rh- $Al_2O_3$ ; (d), Pt- $Al_2O_3$ ; (e), Pd- $Al_2O_3$ ; (f),Cu- $Al_2O_3$ . KFZ abyssal peridotite, abyssal peridotite from the Kane Fracture Zone (after Luguét (2003)); PUM, primitive upper mantle (after McDonough, 1995).

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