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Origin of the Dongbo Peridotite Massif from the Western Part of the Yarlung Zangbo Suture Zone, Tibet: Evidence from Petrological and Os Isotopic Geochemical Data

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The early Cretaceous Yarlung Zangbo Suture Zone (YZSZ) ophiolites form a nearly continuous E-W-trending belt in southern Tibet, marking the suture between the Indian and Eurasian plates. The Dongbo peridotite massif, located at the western part of the YZSZ, is a mantle thrust sheet of more than 400 km^2 tectonically overlying the Cretaceous tectonic mélange. Spinel-harzburgites with porphyroclastic texture are the main rocks type, with subordinate dunites. Olivines (Fo = 90.3-91.3), orthopyroxenes (En = 87-90; Mg# (molar Mg/(Mg+Fe^{2+}) = 90.3-92.0), clinopyroxenes ($En_{49-51}Wo_{46-51}Fs_{0-4}$; Mg# = 92.7-99.4) and spinels (Mg# = 41.1 to 73.1; Cr# (molar Cr/(Cr+Al) = 23.6-87.3) are the major minerals. The peridotites are characterized by LREE-depleted REE patterns with $(La/Yb)_{CN}$ = 0.09-0.40, and $(Gd/Yb)_{CN}$ = 0.23-0.95; however, a slightly enriched trend from Nd to La are observed. Mineralogy, petrology and geochemical data demonstrate that the peridotites were residues of mantle rocks after variable degrees of basaltic magma extraction at mid-ocean-ridge environment, and then were involved in an arc environment and modified by percolating subduction-ralted melts. The Dongbo peridotites have variable, unradiogenic Os isotopic compositions with $^{187}Os/^{188}Os$ = 0.1161 to 0.1282 (Fig. 1) and rhenium-depletion ages (T_{RD}) = 0.22 – 2.00 Ga, implying the heterogeneity of Os isotopes in mantle beneath the New-tethys Ocean, and establishing the the consensus that the convecting upper mantle is heterogeneous in Os isotope.One harzburgite sample (11Y-71-1) exhibits extremely unradiogenic $^{187}Os/^{188}Os$ ratio (0.1161) and ancient T_{RD} age (to 2.00 Ga old), indicating the preservation of ancient, depleted mantle fragments beneath the New-Tethys Ocean. We infer that such ancient, depleted mantle fragments may be pieces of

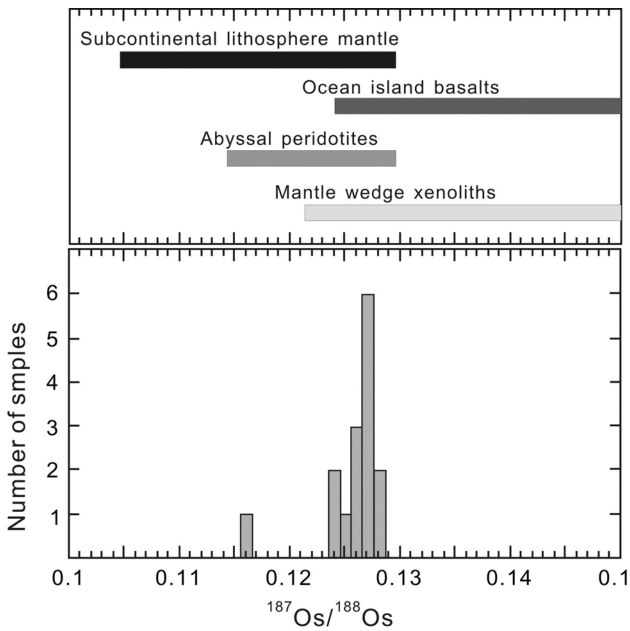

Fig. 1 Histogram of the Os isotopic compositions of the Dongbo peridotites.
Also shown for comparison is the range of Os isotopic compositions of other rock types of different origin from around the world. The range of subcontinental lithosphere mantle is defined by data from Walker et al. (1989), Reisberg and Lorand (1995), Meisel et al. (2001), Gao et al. (2002), Chesley et al. (2004), Wu et al.(2003, 2006), Xu et al. (2008) and Zhang et al. (2008, 2009). The range of ocean island basalts is defined by data from Reisberg et al., (1993), Hauri (1996) and Kogiso et al. (2004), and of abyssal peridotites is defined by data from Snow and Reisberg (1995), Parkinson et al. (1998), Brandon et al. (2000), Harvey et al. (2006) and Liu et al. (2008), and of mantle wedge xenoliths is defined by data from Brandon et al. (1996, 1999), Widom et al. (2003) and Saha et al. (2005).

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the Gondwanaland subcontinental lithosphere that incorporated into the New-tethys Ocean lithosphere.

Key words: Re-Os isotopes; residual mantle rocks; Dongbo peridotite massif; Yarlung Zangbo Suture Zone; New-tethys Ocean

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