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Petrogenesis of Peridotites from the Purang Ophiolite in Western Part of Yarlung-Zangbo Suture Zone, Southern Tibet

ZHOU Wenda[1, 2, 3], YANG Jingsui[2, 3, *], ZHAO Junhong[3], MA Changqian[3], XIONG Fahui[2], XU Xiangzhen[2], CHEN Yanhong[2] and TIAN Yazhou[4]

1 Institute of Geology and Mining , China Nonferrous Metals (Guilin) Geology and Mining Co., Ltd, Guilin 541004
2 CARMA,State Key Laboratory of Continental Tectonics and Dynamics, Institute of Geology, Chinese Academy of Geological Sciences, Beijing 100037
3 Faculty of Earth Sciences, China University of Geosciences, Wuhan 430074
4 College of Resource and Environmental Engineering, Guizhou University, Guiyang 550025

Peridotites are an important part of ophiolites: they not only record plate tectonic settings and events, but also offer help to interpret the composition of the mantle and the effect of the deep mantle. The Yarlung-Zangbo suture zone extends more than 2000 km along southern Tibet, which is the biggest suture zone in China. The western segment includes the Dajiweng-Saga ophiolite sub-belt in the north and the Daba-Xiugugabu ophiolite sub-belt in the south. There are manly large scale and planar mantle peridotite massifs in the southern sub-belt. However, the mantle peridotite massifs in the northern sub-belt and the other segments of the Yarlung-Zangbo suture zone appear as a narrow sheet. In order to discuss the petrogenesis and tectonic significance of the peridotite massif, this work is based on the Purang ophiolite, which contains a large mantle peridotite massif c.600km^2 in area in the southern sub-belt.

Here, a section of about 10 km across the massif is sampled in the eastern part of the Purang mantle peridotite massif. Based on a detailed field survey and mineralogical and geochemical analysis of systematically selected mantle peridotite samples, a number of observations can eb made:

(1) The lithofacies distribution of the Purang ophiolite peridotites has been determined. The profile across the massif shows that harzburgites form the main part of the Purang peridotite massif, the harzburgites are mainly located within the peridotite massif, the banded lherzolites mainly distribute at the edge of the peridotite massif, and the ratio of the exposure area of harzburgites and lherzolites is about 4:1.

(2) The degree of partial melting of the Purang ophiolite peridotites has been analyzed and estimated. On the basis of the mineral chemistry (e.g., Cr$^{\#}$-TiO_2 in spinel, Cr$^{\#}$s of spinel-Ol of olivine diagram) and geochemistry (e.g., MgO-Al_2O_3, V-Yb diagram and HREE contents) characteristics, we calculate that the lherzolites are the residues of 9-15% partial melting of the mantle source, whereas the harzburgites formed by 15–25% partial melting.

(3) The oxygen fugacity of the Purang ophiolite peridotites has been calculated. On the V–Yb oxygen fugacity diagram of the mantle peridotites, all of the peridotite samples plot between the FMQ and FMQ-1 trends. Basing on olivine–spinel associations and the formulae that are based on the reaction of $6Fe_2SiO_4+O_2=3Fe_2Si_2O_6+2Fe_3O_4$, the oxygen fugacity values have been calculated ($\Delta\log(fO_2)^{FMQ}$ range from − 1.11 to + 0.45), which are significantly higher than the fO_2 value obtained using the V content, indicating a reducing tectonic setting (Fig. 1).

(4) The Purang peridotites are not simple residues of partial melting and maybe experienced later melts metasomatism. The mineral chemistry of the Purang peridotites shows refactory signatures. The olivine ranges from 89.5 to 92.8% Fo, the Mg$^{\#}$s of orthopyroxene range from 87.6 to 92.0, the Mg$^{\#}$s of clinopyroxene range from 89.5 to 94.5, the Cr$^{\#}$s of spinel range from 18.5 to 71.7. The mineralogy and geochemistry of the Purang peridotites indicate that they may have experienced melt metasomatism. Furthermore, mineralogical and textural characteristics indicative of melt-rock interactions have been identified within our samples, such as: 1) high-temperature recrystallization of olivine neoblasts; 2) olivine embayments partly corroding the orthopyroxene

* Corresponding author. E-mail: mahuif@126.com

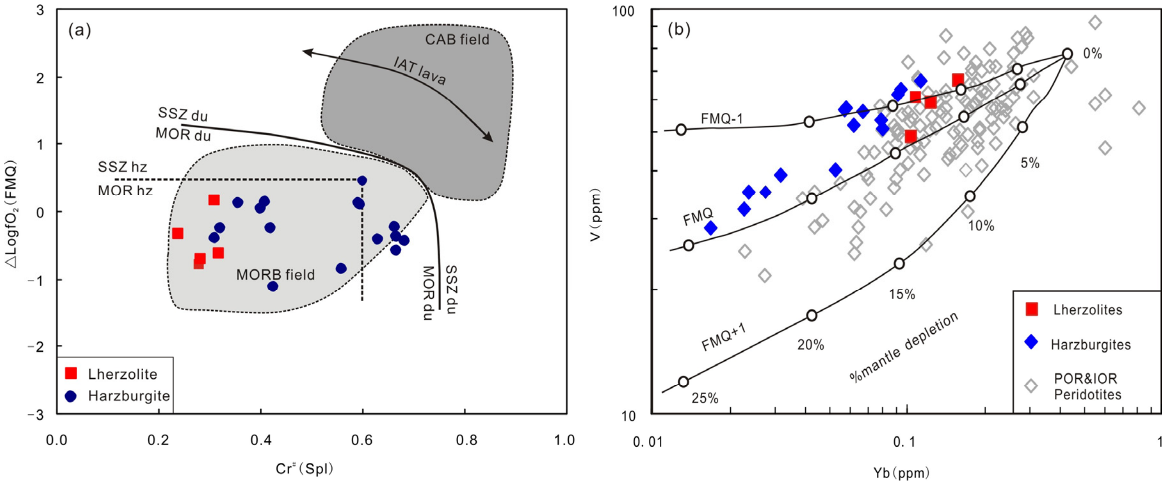

Fig. 1. (a) Plot of ΔlogfO$_2$(FMQ) against Cr$^{\#}$ of spinel for peridotite samples of the Purang ophiolite (after Dare et al., 2009).The field of MORB (Parkinson and Pearce, 1998) and CAB(Pearce et al., 2000) are also shown for comparison. (b) Melting degrees and oxygen fugacities modeling of peridotite samples of the Purang ophiolite using V–Yb covariations (after Pearce and Parkinson, 1993). Data for pacific ocean ridge and Indian ocean ridge peridotites (Niu et al., 2004) are shown for comparison.

porphyroclasts; 3) orthoproxene and spinel symplectite; and 4) olivine as inclusions in the spinels. The whole rock REE contents of the peridotites show that some peridotites exhibit LREE enrichment relative to MREE, demonstrating that the Purang peridotites may have experienced later melt metasomatism. According to the whole rock geochemistry and oxygen fugacity values, this argues that the later metasomatic melts maybe come from the magma which formed by low degrees of partial melting in a mid-ocean ridge setting.

(5) The Purang ophiolite peridotites show similar bulk geochemistry and oxygen fugacity characteristics with the modern mid-ocean ridge abyssal peridotites. Therefore, we argue that the Purang ophiolite peridotites formed in a mid-ocean ridge tectonic setting, without imprints of supra-subduction zone setting. The two stage evolution modal (MOR→SSZ) of the peridotites from the Yarlung-Zangbo suture zone needs to be reexamined.

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