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Rodingite in the Purang Ophiolite and Its Geological Implication, Southwest Tibet

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The Yarlung Zangbo Suture Zone (YZSZ) separates the Lhasa block of the Eurasian plate to the north from the Indian plate to the south, along a ~2000km discontinuous E–W trending suture zone, several heterogeneous remnants of the Neo-Tethyan oceanic floor have been preserved from the subduction recycling. The Purang ophiolite massif is one of the most spectacular exposures of western extension along the Indus-Yarlung Zangbo Suture between the Himalayan passive margin and the Gangdise active margin, which is a mantle thrust sheet of more than 650 km^2, extending NWW in the western Tibet (Nicolas et al., 1981; Yang et al., 2011).

The Purang ophiolite consists mainly of spinel peridotites, including serpentinized harzburgite, minor lherzolite and chromite-bearing dunite associated with small amounts of olivine pyroxenite. Gabbro and diabase dike were observed intruding and cutting through spinel peridotites. Along the northern margin there is a mélange of serpentinized harzburgite, tectonically overlying upper Triassic-Cretaceous clastic rocks. Partly serpentinized harzburgite accounts for more than 80% of the ultramafic rocks. Lherzolite, dunite and olivine pyroxenite mostly occur as irregular blocks or bands within the harzburgite, some of which have clear boundaries with the host (Li et al., 2015).

Rodingites occur as lens, block or vein along the fracture in the south margin of the Purang ultramfic massif, and it is associated with relatively intense serpentinizated peridotite. Since the Purang ultramfic rocks suffered only weak to moderate serpentinization, rodingite only experienced early stage mineral assemblage of rodingitization (Li et al., 2007, 2008). Rodingite has intense crack texture and consists of amphibole, clinoziosite and chlorite. Accessory minerals are titanite and ilmenite. No relict primary minerals were found. Two generations of amphibole were found, the early one has edenitic composition, whiles the late amphiboles are Mg-hornblende, actinolite to tremolite, formed during rodingitization. Epidote-group minerals are clinozoisites and chlorite is clinochlore in composition.

Rodingites from the Purang area contain average SiO_2 ~48.65%, CaO ~ 9.89%, TFe_2O_3 ~4.34%, $Na_2O + K_2O$ < 2%. Additionally, they have extraordinarily high MgO ~23.92% and low TiO_2 < 0.02% in average. Bulk-rock recalculation indicates the protolith of rodingite is a dark olivine gabbro. Loss of ignition (LOI) varies from 1.83–3.23 wt%, reflecting weekly degrees of rodingitization.

The chondrite normalized composition of the rodingite generally displays a slightly depleted LREE pattern. The multi-element diagram normalized to primary mantle presents that all samples are enriched in U, Pb and Sr anomalies, but almost depleted in other trace elements with negative anomalies in part high-field strength elements (e.g. Nb, Ti, Y). The ∑REE of rodingite is much lower than that in the gabbroic diabase, but higher than that of spinel-bearing ultramafic rocks in the Pruang massif.

As conclusions, the Purang rodingite shows a mantle source protolith. Some rodingites are located in the IAT domain in the Th/Yb versus Nd/Yb diagram, whereas others are in between N-MMORB and E-MORB domain. Positive anomalies in U, Pb and Sr indicate a subduction-related affinity. REE and trace elements of rodingites are all indicative of fore-arc geochemical characteristics based on the diagrams of V-Ti, La/Nb-Y and Zr/Y-Zr (The current study was supported by the Chinese Geological Survey Project (12120114061801) and the SGSTSP of the Chinese Academy of Sciences XDB03010201).

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