Abstract: The SE Ladakh (India) area displays one of the best-preserved ophiolite sections in this planet, in places up to 10 km thick, along the southern bank of the Indus River. Recently, in situ ultra-high pressure (UHP) microstructural evidences from mantle transition zone (MTZ ~ 410–660 km) with diamond and reduced fluids were discovered from two peridotite bodies in the basal mantle part of this Indus ophiolite (Das et al., 2015; 2017). Ultrahigh-pressure phases were also found by early workers from podiform chromitites of another equivalent Neo-Tethyan ophiolite in southern Tibet (e.g., Yang et al., 2007; Yamamoto et al., 2009).

However, the MTZ phases in the Indus ophiolite are found in silicate peridotites not metallic chromitites and the peridotitic UHP phases show systematic and contiguous phase transitions from the MTZ to shallower depth, unlike the discrete ultrahigh-pressure inclusions, all in Tibetan chromitites. The gradual change in oxygen fugacity ($f_{O_2}$) and fluid composition from (C-H + H$_2$) to (CO$_2$ + H$_2$O) in the upwelling peridotitic mantle causing melting to produce MORB. At shallow depths (< 100 km) the free water stabilizes into hydrous phases, such as amphiboles and serpentines, capable of storing water and prevent melting (Fig. 1). The results from Indus ophiolite provide unique insights into deep sub-oceanic mantle processes, and link deep mantle upwelling and MORB genesis (Fig. 1).

The tectonic setting of Neo-Tethyan ophiolites has been a difficult problem since the birth of plate tectonics concept. This problem for the origin of ophiolites in mid-ocean ridge versus supra-subduction-zone settings clearly confused the Geoscience community. However, Indian Ocean–type isotopic characteristics are present in Neo-Tethyan ophiolites (Zhang et al., 2005). Recently, continental materials (quartz, k-feldspar etc.) bearing old zircons (up to 2700 Ma) are also recovered from UHP chromitite of Tibetan ophiolite (Yamamoto et al., 2013). Eventually, the presence of older continental material can produce non-MORB like basalts in Neo-Tethyan ophiolites in mid-oceanic-ridge following the “historical contingency” model (Moore et al., 2000).

Key words: mantle transition zone, Neo-Tethyan ophiolites, diamond, oxygen fugacity, historical contingency

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References


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