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## The Slab-Mantle Interaction in Continental Subduction Channels

ZHENG Yongfei

*CAS Key Laboratory of Crust-Mantle Materials and Environments, School of Earth and Space Sciences, University of Science and Technology of China, Hefei 230026, China*

The subduction channel is the dynamic site of mass and energy exchange between the slab and mantle. It is evolved into the subduction factory by processing raw materials into different products. The raw materials are sedimentary crust, igneous crust, and lithospheric mantle (juvenile or ancient). They are carried with the subducting slab and undergo physicochemical modification by metamorphic dehydration and partial melting, producing metasomatic agents in the forms of aqueous solutions, hydrous melts and even supercritical fluids. Then these metasomatic agents would chemically react with the overlying mantle wedge peridotite, generating ultramafic to mafic metasomatites that are further processed into various output products. Typically, the metasomatites undergo partial melting to produce mafic to felsic melts, which evolve in petrology and eventually give rise to volcanic and plutonic rocks, aqueous solutions and gaseous volatiles, and metalliferous deposits that consequently emerge on the upper plate. In addition, the mantle wedge would also undergo the subduction erosion, offscraping the peridotite fragments into the subduction channel. This leads to the physical and chemical mixing between these mantle and crustal rocks, resulting in tectonic mélanges that are termed as cold plumes in numerical models.

Orogenic peridotites are common in many UHP terranes of continental collision orogens, providing us with an excellent target to directly study the slab-mantle interaction in continental subduction channels. According to the occurrence of crustal derivatives in the orogenic peridotites, two types of crustal metasomatism may take place beneath the mantle wedge. One is modal metasomatism that is indicated by the presence of new mineral phases such as serpentine, chlorite, amphibole,

phlogopite, apatite, carbonate, sulfide, titanite, ilmenite and zircon, which are absent in primitive and depleted mantle sources. The metasomatic products may occur in serpentinitized to chloritized peridotites or in pyroxenites and hornblendites. The new mineral phases are mineralogically and geochemically distinguishable from primary peridotite minerals. The other is cryptic metasomatism that is indicated by the absence of such new mineral phases but the enrichment of fluid-mobile incompatible trace elements such as LILE and LREE relative to HFSE and HREE. In the extreme case, only enrichment of highly incompatible water-soluble trace elements (e.g., LILE) occurs in orogenic peridotites, similar to the product of fluid metasomatism in forearc settings above oceanic subduction zones.

In association with variable occurrences of new mineral phases, variable enrichment of LILE and LREE in orogenic peridotites is prominent due to the crustal metasomatism. Both newly grown and relict zircon domains have been observed in orogenic peridotites. This indicates that both the chemical transport of dissolved Zr and the physical transport of crustal zircon xenocrysts by either metamorphic fluids or anatectic melts have taken place at the slab-mantle interface in subduction channels. While U-Pb ages for the newly grown zircon directly date the metasomatic event, its Lu-Hf isotope composition is primarily inherited from the metasomatic agent and thus has little to do with the composition of the overlying lithosphere. The survival of protolith zircon in the orogenic peridotites suggests that the crustal metasomatism beneath the mantle wedge would have proceeded at kinetically limited conditions, and thus it did not achieve the thermodynamic equilibrium between crustal and mantle components.

\* Corresponding author. E-mail: [yfzheng@ustc.edu.cn](mailto:yfzheng@ustc.edu.cn)