Zircon in orogenic peridotite records the crust-mantle interaction in continental subduction zone

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Zircon is theoretically unable to crystallize from the primary peridotite due to its low Zr content and Si activity. However, zircon has indeed been found in orogenic peridotites from several ultrahigh-pressure (UHP) metamorphic terranes in the world. The mechanism of zircon occurrences, especially for relict zircon cores in the orogenic peridotites, and the interpretation of geochemical information contained in zircon are intriguing. Zircons are common in orogenic peridotites from the Dabie-Sulu and North Qaidam orogenic belt in China. A number of petrological and geochemical studies have been devoted to the host UHP metamorphic rocks, allowing us distinction between different origins of zircons in the orogenic peridotites. As such, this study provides a comprehensive study of zirconology in the orogenic peridotites from these orogenic belts.

The occurrence of zircons in thin sections and olivine inclusions in zircons for some peridotites explicitly indicate that zircons were indeed crystallized inside the peridotites. The newly grown zircons in the orogenic peridotites show U-Pb ages similar to the metamorphic ages of UHP rocks. They have crustal Hf-O isotope compositions similar to those for UHP metamorphic rocks in the same orogenic belt, suggesting that the orogenic peridotite underwent multiple episodes of metasomatism by fluids originated from the deeply subducted continental crust. There are large variations in zircon Hf isotope composition, indicating that the fluids would originate from different parts of the subducted continental crust. Relict magmatic zircons have also been found in the Sulu orogenic peridotites. Their U-Pb ages, trace element and Hf-O isotope compositions are similar to those for protolith zircons from UHP metamorphic rocks in the Dabie-Sulu orogenic belt. Thus, these relict magmatic zircons would be physically transported into the peridotite by metasomatic fluids originated from the deeply subducted continental crust. Therefore, the orogenic peridotites underwent metasomatism by the fluids derived from the deeply subducted continental crust. These crustally derived fluids would have brought not only such chemical components as Zr and Si but also tiny zircon grains from the deeply subducted crustal rocks into the peridotite at the slab-mantle interface in continental subduction channel.