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The Significance of Zircon in Oceanic Mantle Rocks

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The presence of zircon in ultramafic bodies is commonly taken as evidence for intrusion into continental crust. However, this interpretation cannot explain the presence of zircon in depleted harzburgites and chromitites of many ophiolites, which represent fragments of oceanic lithosphere that have been emplaced tectonically, Our studies have shown that zircon and various combinations of other crustal minerals, such as corundum, feldspar, almandine garnet, kyanite, sillimanite, quartz, and rutile occur in podiform chromitites of the Luobusa and Dongqiao ophiolites of Tibet, the Semail ophiolite of Oman and the Ray-Iz ophiolite of the Polar Urals, Russia. In the Luobusa and Ray-Iz ophiolites, these minerals are associated with UHP minerals including in-situ diamonds, coesite and moissanite. Many of the crustal minerals occur in-situ or are attached to chromite grains, metallic alloys or rutile. Rounded grains of zircon, 50-300 microns across, with very complex internal textures, are common in all of the ophiolites. 206Pb/208U SIMS dates for the Luobusa zircons range from 549 to 1657 Ma, those from Dongqiao from 484 to 2515 Ma, and those from Semail from 84 to 1386 Ma, typically much older than the host ophiolites. Most of the zircons contain low-pressure mineral inclusions, including quartz, rutile, orthoclase, mica, ilmenite and apatite. All of the zircons have REE and trace element compositions compatible with a crustal origin. The crustal minerals, combined with the morphology and age of the zircon, indicate derivation from crustal rocks subducted into the mantle where they were mixed with UHP and highly reduced phases. Preservation of these minerals may be due to their encapsulation in chromite and possibly olivine grains. We suggest that subducted crustal material is widespread in the upper mantle and that it may account for some of the observed mantle heterogeneity.

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