In situ diamonds and moissanite in podiform chromitites of the Luobusa and Ray-Iz ophiolites, Tibet and Russia

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Podiform chromitites and peridotites of several ophiolites, including the Luobusa and Donqiao bodies of Tibet, the Semail ophiolite of Oman and the Ray-iz ophiolite of Russia, contain various combinations of deep mantle minerals, such as diamond, coesite, moissanite, base-metal and PGE alloys and native elements. These are associated with a range of crustal minerals, including zircon, corundum, kyanite, sillimanite, almandine garnet and rutile. Most of these minerals have been recovered from heavy mineral separates but in-situ grains of diamond, moissanite and corundum occur in podiform chromitites of the Luobusa and Ray-Iz ophiolites. Coesite, possibly after stishovite, from the Luobusa ophiolite is intergrown with kyanite on the rim of an Fe-Ti alloy grain recovered from chromitite. The in-situ diamonds, moissanite and corundum consist of euhedral to subhedral grains about 200-500 μm across, enclosed in small, irregular to spherical patches of carbon hosted in chromite grains. Both the diamonds and moissanite are characterized by having exceedingly low C isotopic values (mean $\delta^{13}C = -28$), much lower than typical kimberlite diamonds. The in-situ UHP minerals in chromite grains suggest that at least some of the chromite crystallized at depth. Based on the occurrence of these minerals in widely separated ophiolites of variable age, we suggest that diamonds and associated minerals may be common in the upper oceanic mantle.

Gabbroic xenoliths in Pleisto-Holocene alkali basalts from Jeju Island, South Korea

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Gabbroic xenoliths occur in Pleisto-Holocene alkali basalts from Jeju Island, Korea, consisting of plagioclase + clinopyroxene + orthopyroxene. The coarse grain size (up to 3 mm), moderate mg# of pyroxenes (70-77) and textural features (e.g., poikilitic) indicate that gabbroic xenoliths are cumulates of igneous origin. Clinopyroxene from these xenoliths is constantly enriched in REEs with smooth convex-upward patterns, as expected for cumulus minerals formed from a melt enriched in incompatible-trace elements. Strikingly similar major and trace element variations and patterns of constituent minerals between gabbroic xenoliths and the host basalt indicate that cumulates are genetically related to the host basalt, but more evolved. The xenoliths crystallized at the margins in a volatile-rich roof environment of magma reservoirs, which had emplaced above the present Moho estimates beneath Jeju Island, suggesting the presence of ancient high-level magma storage reservoir beneath hotspot or plume-impacted areas. Following consolidation of the xenolith lithologies, volatile- and incompatible-elements enriched melt infiltrated through grain boundaries, and metasomatized the anhydrous cumulate phases, producing amphiboles. This volatile-enriched melt, as metasomatic agents, could have resulted from initially anhydrous to volatile-saturated compositions, being evolved by fractional crystallization. The studied xenoliths appear to represent cumulus remnants of melt compositions leading to more evolved rocks which related with the prior volcanism in the southern part of Jeju Island. It is noteworthy that this metasomatism is a relatively young event at the continental margin near the back arc basin (East Sea) in the Western Pacific.