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Diamond-bearing Ophiolites and Their Geological Occurrence

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We document in this study the geological occurrence of diamonds and other ultrahigh-pressure (UHP) minerals in ophiolitic mantle peridotites and podiform chromitites from different orogenic belts. These minerals exist in both high-Cr and high-Al chromitites. Most ophiolite-hosted diamonds are small (~ 200-500μm across), and some contain distinctive inclusions (i.e., coesite, NiMnCo alloys, spessartite, tephroite). All of the analysed diamonds have extremely light carbon isotope compositions (δ13C = -28.7 to -18.3‰), and variable trace element contents. These diamonds can be distinguished from most kimberlitic and UHP metamorphic varieties on the basis of these characteristic. A wide range of highly reduced minerals, such as native elements, Ni-Mn-Co alloys, Fe-Si and Fe-C phases and moissanite (SiC) also occur as accompanying mineral separates confirming the super-reducing conditions of their environment of formation. The presence of exsolution lamellae of diopside and coesite in some chromite grains suggests chromite crystallization depths around >380 km, near the mantle transition zone. Carbon and other recycled crustal materials at these depths are considered to have been derived from previously subducted material. The peridotites encapsulating the podiform chromitites and diamonds were transported to shallow mantle by convection cells beneath oceanic spreading centers. The chromitites may have formed in the deep mantle or in shallow suprasubduction zone environments. On the basis of our findings, we suggest that diamonds, UHP minerals and recycled crustal material are likely ubiquitous in the oceanic mantle.