Not deep-mantle origin of unusual minerals in the Moho Transition Zone of eastern Cuba ophiolites

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Minerals indicative of super-reducing (SuR) and ultra-high pressure (UHP) conditions have been reported in many ophiolitic peridotites and associated chromitites, along with minerals that typically form in the continental crust. There are currently multiple scenarios proposed in order to explain these unusual findings.

In chromitite samples from the Moho Transition Zone of Eastern Cuba ophiolites, we have identified oriented clinopyroxene and rutile lamellae in chromite, moissanite hosted both in chromite and in the altered matrix of the chromitite, secondary healed fractures in chromite grains including graphite-like amorphous carbon, serpentine, magnetite, methane, corundum, carbonates and quartz, and native Cu and Fe-Mn alloy. Similar mineral phases have been also identified in olivine from associated gabbro sills and dikes and dunites that show no evidence of UHP metamorphism. In addition, olivine from these gabbros include ilmenite and Cr-spinel needle-shaped inclusions.

In the studied area there is evidence of a genetic relation between unmetamorphosed gabbro dikes and sills and chromitites. The geological and petrological relations rule out a (ultra)high pressure origin for these “unusual” minerals and textures. A simpler explanation for these unusual phases includes formation of exsolution lamellae (clinopyroxene and rutile) during cooling of chromite, while SuR phases (moissanite, graphite-like amorphous carbon, native Cu, Fe-Mn alloy) formed in super-reduced microenvironments during serpentinization at low pressure and low temperature, when serpentine-magnetite-methane inclusions also formed. Finally, continental crust phases (corundum?, quartz, zircon) may represent sediment-derived xenocrystic grains emplaced in the suprasubduction mantle via cold plumes.