

Ultra-High Pressure Minerals in the Luobusa Ophiolite, Tibet: Implications for Tethyan Mantle Dynamics

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A wide variety of ultra-high pressure(UHP) minerals occur in podiform chromitites in the Luobusa ophiolite, Tibet. UHP minerals include diamond, moissanite, coesite, Fe-silicides, wüstite, Ni-Fe-Cr-C alloys, PGE alloys, silicon spinel, silicon rutile, and octahedral Mg-Fe silicates. Associated with these minerals is a variety of native elements including Si, Fe, Ti, Ni, Cr and graphite, alloys, silicates, sulfides, and carbonates. Many of the minerals are either enclosed in PGE minerals or chromite grains leaving no doubt as to their provenance. Diamonds typically occur as euhedral octahedra, generally 0.1-0.2 mm across but irregular grains up to 1 mm are also present. Some diamonds contain inclusions of Mg-Fe silicate. Silicon carbide(moissanite) forms euhedral, hexagonal crystals, up to 1 mm across and ranges in color from pale yellowish-green to dark green, to bluish green to dark blue. Coesite occurs as lath-like crystals intergrown with kyanite rimming a grain of Ti alloy. Fe-silicides form irregular to rounded grains, 0.1-0.3 mm across, many of which contain inclusions of pure Si. Wüstite forms irregular to subrounded grains up to 0.1 mm, which typically contain perfectly spherical inclusions of native iron. Some of the native iron grains, in turn, contain spherical inclusions of Mn-Fe silicates. Cr(Ni, Fe)C alloys range from nearly pure(Fe, Ni)C to nearly pure CrC. Grains of Os-Ir, Ru-Os-Ir and Pt-Fe commonly host inclusions of UHP minerals, such as diamond and silicon spinel. The Luobusa ophiolite is believed to have formed originally at a Tethyan mid-ocean ridge at about 177 ± 33 Ma and was then modified by suprasubduction zone magmatism at about 126 Ma. Based on their textures and compositions, the chromitites are believed to have precipitated from boninitic melts reacting with the host peridotites. We suggest that the UHP minerals were transported from the deep mantle either by the rising limb of a convection cell or by a plume and incorporated in the ophiolite during seafloor spreading at about 176 Ma. Blocks of the mantle containing the UHP minerals were presumably picked up by the later boninitic melts, transported to shallow depth and incorporated in the chromitites during crystallization.