

Vaterite in a decrepitated diamond-bearing inclusion in zircon from a stromatic migmatite in the Chinese Sulu ultrahigh-pressure metamorphic belt

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ABSTRACT

Vaterite was identified in a decrepitated carbonaceous material (CM) bearing inclusion in zircon from a stromatic migmatite in the Chinese Sulu ultrahigh-pressure (UHP) metamorphic terrane. It is associated with nanometer to micrometer anhedral diamonds, aragonite, calcite, amorphous C-Si-O, and amorphous Zr-Si-O materials. The inclusion developed offshoots and abundant indigenous holes. The C-Si-O material is carbon-rich and porous and shows diagnostic Raman bands of highly disordered CM, whereas the Zr-Si-O material is spherulitic or banded with little or no carbon. The observations from focused ion beam–scanning electron microscope (FIB-SEM) and transmission electron microscope (TEM) verify that both diamond and highly disordered CM are of indigenous origin. The formation pathway of vaterite means that an amorphous calcium carbonate (ACC) phase occurred as the precursor of vaterite. The highly disordered CM contains the subsidiary bands at 1150 and 1250 cm^{-1} on the low-frequency side of the D1 band, suggesting that there exist aliphatic hydrocarbon chains. Thus, the highly disordered CM was derived from carbonization of some kind of organic species in the fluid inclusion. Decrepitation of inclusion resulted in an extremely high supersaturation state of the fluid that induced the precipitation of amorphous materials and released residual fluid out of the inclusion, which became dry and preserved vaterite and amorphous materials.

Keywords: Ultrahigh-pressure metamorphism, vaterite, diamond, fluid inclusion, migmatite, Dabie-Sulu orogenic belt