Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.11999

Microdiamond in orogenic peridotite: Implications for carbon cycling into mantle depths

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Microdiamond as a classic ultrahigh pressure (UHP) metamorphism indicator in subduction-zone related rocks, can provide key insights to understanding deep carbon cycling. Here for the first time we report the occurrence of diamond as inclusion in olivine and zircon of Mantle wedge type (M-type) peridotite from the Dabie UHP metamorphic belt in East China. Raman data revealed that the microdiamond is composed of sp^2 disordered carbon and sp^3 ordered carbon. Importantly, three-dimensional Raman tomographic microspectroscopy results show that microdiamond, methane and magnesite are coexisting within the same inclusion (Fig. 1). A crystallization from carbon saturated supercritical fluids that derived from the subducting slab is indicated. Thus, during continental subduction, carbon can be transported to depths of the diamond stability field, i.e. of >120km, by such supercritical fluids. In addition, the presence of the studied inclusions in olivine and zircon of the M-type peridotite indicates that slab-derived carbon can be transported supercritical fluids and infiltrate the overlying mantle wedge, where it can be stored as diamond, methane and magnesite which thus have a significant influence on the global deep carbon cycling.