

Inclusions of (Mg,Fe)SiO₃ in superdeep diamonds – former bridgmanite?

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Bridgmanite (Mg,Fe)SiO₃, a high pressure silicate with a perovskite structure, is dominant material in the Lower Mantle and therefore is probably the most abundant mineral in the Earth. One single-phase and two composite inclusions of (Mg,Fe)SiO₃ coexisting with jeffbenite ((Mg,Fe)₃Al₂Si₃O₁₂), and with jeffbenite and olivine ((Mg,Fe)₂SiO₄) have been analyzed to identify retrograde phases of former bridgmanite in diamonds from Juina (Brazil). XRD and Raman spectroscopy have revealed that (Mg,Fe)SiO₃ inclusions are orthopyroxene at ambient conditions. XRD patterns of these inclusions indicate that they consist of polycrystals. This polycrystalline textures together with high lattice strain of host diamond around these inclusions observed from EBSD may be an evidence for the retrograde phase transition of former bridgmanite.

Single-phase inclusions of (Mg,Fe)SiO₃ in superdeep diamonds are suggested to represent a retrograde phase of bridgmanite and fully inherit its initial chemical composition, including a high Al and low Ni contents [1,2]. The composite inclusions of (Mg,Fe)SiO₃ with jeffbenite and other silicate and oxide phases may be interpreted as exsolution products from originally homogeneous bridgmanite [3]. The bulk compositions of these inclusions are rich in Al, Ti, and Fe which are similar to bridgmanite produced in experiments on the MORB composition. However, the retrograde origin of composite inclusions due to decomposition of Al-rich bridgmanite may be doubtful because each of observed phases may represent single-phase inclusions, i.e. bridgmanite and high pressure garnet (majoritic garnet), with similar compositional features.

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[1] Harte & Hudson (2013), Proc. of 10th IKC, 1, 235-253. [2] Kaminsky F.V. (2017) The Earth's Lower Mantle. [3] Walter et al. (2011), Science, 334, 54-57.