Multiphase inclusions associated with residual carbonate shed new light on the origin of super-deep diamonds from Juina (Brazil)

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Super-deep diamonds and their mineral inclusions preserve very precious information about Earth's deep mantle. In this study, we examined multiphase inclusions entrapped within a Vinte e um de Abril, São Luiz area(Juina, Brazil), using a combination of non-destructive methods: micro-Computed X-ray Tomography (μ-CXRT) to investigate the size, shape, d absorption of inclusions and mapping by micro X-ray Fluorescence (μ-XRF), μ-Raman Spectroscopy and micro-Fourier Transform Infrared Spectroscopy (μ-FTIR) to determine the chem composition of the inclusions. Previous studies revealed that the diamond has nitrogen occurring in clusters of three atoms and a vacancy (Type IaB), has a N-enriched core, is plas contains several syngenetic, Fe-rich ferropericlase–magnesiowüstite inclusions in its N-rich core (Agrosì et al., 2017; Nimis et al., 2019). In this work we found that four large inclusion rich core, consist of complex assemblages dominated by ferropericlase/magnesiowüstite with locally exolved magnesioferrite and carbonates. Compared with other similar diamonds f was remarkable because it encased an atypical inclusion, which showed a very unusual flask shape resembling a large (ca 100 μm) fluid/melt inclusion. Based on μCXRT tomo mapping, the inclusion is polyphase and consists of magnetite and hematite partly replacing a magnesiowüstite core. μ-Raman spectra reveal local features that could be ascribed to chromite, stable for P ≥ 18 GPa. Some spectra show also the presence of huntite, a carbonate with formula CaMg3(CO3)4 that represents the first known occurrence in diamond.
We interpret the composition of the inclusions as further evidence of ferropericlase-bearing diamond formation in a carbonate-rich environment, probably under evolving redox conditi that a full picture of the significance of diamond inclusions cannot be determined without an accompanying multidisciplinary study that allows a full description of the growth history of

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