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Chemical composition of nano-inclusions in supe-deep diamonds and implications to the growth condition

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Superdeep diamonds originating from the mantle transition zone and the lower mantle were found from alluvial deposits of Sao-Luis river (Juina, Brazil). We investigated carbon isotopic variations and chemical compositions of nano-inclusions in the superdeep diamonds which can give a clue for the growth condition.

We found syngenetic inclusions of superdeep paragenesis from 59 diamond samples from Sao-Luis. The dominant inclusions in diamonds from studied here are CaSi-perovskite and AlSi-phases. MgSi- and CaTi-perovskites, ferropericlase, native iron, coesite and zircon have also been found. Our SIMS analysis showed the wide variations of carbon isotopic compositions ranging from 2.7 to -25.3 ‰ in δ^{13}C. The details on the carbon isotopic analysis will be reported by Zefgenizov et al. in this session.

Some samples contained microinclusions and FTIR analyses showed that water and carbonates were not major components of these tiny inclusions. To identify the microinclusions, TEM observations were carried out on a foil of carbonado (0.1 micron thick) made from a polished diamond specimen after Au-coating. The foil was fabricated with a Ga ion beam using a focused ion beam (FIB) instrument (JEOL JEM-9310FIB). The foil was observed with a TEM (JEOL JEM-2010) under an accelerating voltage of 200 kV. We found that the microinclusions were euhedral inclusions of several tens nanometers in size. The TEM observations revealed that the nano-inclusions have a negative cystal shape suggesting the syngenetic origin directly related to the diamond growth. In this study, chemical composition of the nano-inclusions were conducted by synchrotron X-ray fluorescence analysis using X-ray micro-beam as an incident light at BL-4A, Photon Factory, KEK. The obtained results clarified that the nano-inclusions contain S, Cr, Mn, Fe, Co, Ni, Cu Zn, and so on. The present study suggests that the growth media of the superdeep diamonds are composed of sufilde melt.

Keywords: diamond, nano inclusion, X-ray fluorescence analysis, super deep diamonds