Fluid microinclusions in octahedral diamonds

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Microinclusions carrying high-density fluids (HDFs) with silicic, carbonatitic and saline compositions are common in fibrous diamonds and represent the medium in which their host diamond grew. Such inclusions have not been documented previously in monocrystaline octahedral diamonds or in the octahedral cores of coated diamonds, allowing a debate on whether such fluids are responsible for the formation of octahedral diamonds as well. The other notable difference is that all nitrogen in microinclusion-bearing zones resides in A-centers, whereas most octahedral diamonds carry both A and B centers. We report the first finding of HDF microinclusion in an octahedral diamond from Finsch, South Africa and in the core of a coted diamond from Kankan, Guinea.

The microinclusions in the Finsch diamond are restricted to two thin layers (~10 μm), parallel to the (111) face, ~20 and 200 μm from the rim. Cathodoluminescence (CL) reveals concentric zoning and octahedral growth throughout the diamond. The inclusion-rich layers are easily recognized by their weak fluresence. The diamonds carry ~800-1200 ppm nitrogen. Absorbance of B centers is observed in the inner part (A/B=5) and between the inclusion rich layers and the rim (A/B=16). Forty-five inclusions of carbonatitic HDF were analyzed along the inner layer. Their major and trace element compositions and FTIR analyses are highly similar to the ones observed in HDFs from fibrous diamonds.

In the octahedral core of the Kankan diamond we found six microinclusions with saline composition. Unlike the case of the Finsch diamond, these inclusions are sporadically scattered, up to ~100 μm away from a sulfide mineral inclusion and were hard to find.

Supporting evidence for the involvement of HDF, similar to the ones capsulate in fibrous diamonds, in the formation of monocrystaline diamonds comes from LA-ICP-MS analyses of trace element patterns in monocrystalline diamonds (McNeill *et al*. 2009) and the sinosuidal REE patterns of garnet inclusions in diamonds (Stachel and Harris, 2008; Weiss *et al*. 2009).

Based on the above observation we have good reasons to believe that microinclusions and HDFs may be found in other octahedral diamonds, extending the role of HDFs to the formation of most natural diamonds.

Seasonal and temporal variations of uranium isotope ratio in atmospheric deposits in Japan

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The uranium isotope ratios, especially $^{235}U/^{238}U$, do not change substantially in the natural environment. The $^{235}U/^{238}U$ ratio in environmental samples differing from the natural ratio thus resulted from anthropogenic nuclear activities. The Japan Meteorological Agency (JMA) and the Meteorological Research Institute (MRI) have been monitoring the deposition amounts of anthropogenic radioisotopes, mainly ^{90}Sr and ^{137}Cs, using the atmospheric deposits collected with open surface samplers installed throughout the Japanese Islands since the 1950s. In our previous work, we had reported that the $^{235}U/^{238}U$ ratios in the deposits collected at Fukuoka, Kyushu, the most southwesterly one of the four Japanese main islands, were slightly but obviously higher than the natural ratio since the 1960s until today [1]. This time, we have measured the uranium isotope ratios in the atmospheric deposits collected at Akita, which is located at the northeastern region of Japan and faces to the Sea of Japan, in the months of March between 1964 and 2000 and every month in 1977 and 1978. The results revealed that the $^{235}U/^{238}U$ ratios in the atmospheric deposits had varied seasonally and temporally. The fluctuation pattern of the $^{235}U/^{238}U$ ratio in the Akita deposits through the 24 months in 1977 and 1978 is in good accordance with that of the deposition amounts of plutonium at Tokyo [2]. Contrary to this, the deposition amounts of ^{90}Sr and ^{137}Cs are not always connected with the uranium isotope ratio in the deposits. Our results suggest that a certain amount of depleted uranium (DU) had been transported to Japan in the 1970s with plutonium ejected into the atmosphere by the thermo nuclear tests then conducted in the test sites in the Central Asia. DU and plutonium had probably been transported by the mechanism different from that of radioactive strontium and cesium, although they all had come from the same source, neuclear test explosions.

[1] Kikawada *et al*. (2009) *J. Nucl. Sci. Technol*. **46**, 1094–1098. [2] Hirose *et al*. (2001) *Plutonium in the environment* A. Kudo (Ed.) Elsevier Science, 251–266.