Using synchrotron-based FT-IR microspectroscopy to study the spatial distribution of volatile components in natural diamonds

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It has been supposed that diamond genesis was associated with the presence of fluids or volatile-rich melt, but direct evidence for deep-mantle fluids has not been obtained. Thus, it is necessary to investigate the volatile components in natural diamonds not only for considering genesis of diamonds but also for deciphering the behavior of volatiles in mantle. In this study, we observed infrared absorption spectra of volatile components in cuboid diamonds. Cuboid diamonds usually contain numerous tiny inclusions with a size less than several micorometers. It is worthwhile to note that inclusions in cuboid diamonds are known to preserve high pressure in the order of gigapascals and part of fluid was observed as high pressure form of ice (Kagi et al., 2000). We aimed to obtain chemical compositions of the fine inclusions and information on residual pressures in volatile components.

A thin section of cuboid diamond from Zaire was prepared with a thickness of approximately 400 µm. In this sample the tiny inclusions form zoned fine structure of several micrometers. Infrared absorption spectra of this sample were obtained at the beamline 43IR at SPring-8, one of the third generation synchrotron radiation facilities (Kimura et al., 2001). At the infrared microspectroscopy station in BL43IR, small beam with a diameter less than 10 µm is available in using this facility. Kawamoto et al. (2003) confirmed that OH stretch mode of hydrous glass can be observed using microbeam with diameter of 5 µm at the 43IR beamline. We will show the 2D mapping images obtained from absorbance of OH stretch region and carbonate region, and demonstrate the spatial resolution of the present facility is good enough to observe chemical heterogeneity of the zoned structure of cuboid diamonds. Furthermore, a comparison with measurements using a conventional light source will be shown.

References

Kagi et al. (2000) *Mineral. Magazine* **64,** 1057-1065.
Kawamoto et al. (2003) *Geochemical Journal,* **37,** 253-259.
Kimura et al. (2001) *Nucl. Instrum. Meth.,* **A467-468,** 893-896.

Anaerobic oxidation of methane in the water column of the Black Sea

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Measurements of anaerobic microbial oxidation rates reveal that not only in marine sediments but also in the water column bacterial oxidation is the major process removing methane and converting it to carbon dioxide. Radiotracer (C^3H_4) incubations reveal that anaerobic bacterial oxidation consumes maximal 600 nmol CH_4 l^{-1} day^{-1}, which equals a removal of 5% of the total CH_4 pool present in the anoxic water column of the Black Sea. Besides radiotracer experiments, stable carbon isotopic ($^{13}CH_4$) analyses provide strong evidence for anaerobic microbial oxidation. Interestingly, the values show an enrichment of $^{13}CH_4$ within the chemocline. Furthermore, bacterial community structure analyses using FISH and T-RFLP reveal that dominantly archaea mediate the anaerobic oxidation of methane. We find that the abundance of archaea correlates well with the presence of methane, showing high abundances below, reduced numbers of cells throughout and almost negligible numbers above the chemocline.