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## Origin of natural polycrystalline diamond, carbonado, inferred from the discovery of primary fluid inclusions

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Carbonado is a natural polycrystalline diamond whose origin is still in enigma. Carbonado consists of small diamond crystals ranging from submicron to several micrometers in size. No mantle-originated minerals have been reported as inclusions of carbonado. Several assumptions on the genesis of carbonado have been proposed e.g. shock metamorphism caused by a large impact on the Earth's crust, transformation of organic sedimentary carbon into diamond at high pressure, and radiation-induced diamond formation from organic carbon. Recently, a couple of studies on infrared (IR) absorption spectra of carbonado reported that carbonado contains carbonate and fluid inclusions (Garai et al., 2006, Kagi and Fukura, 2008). However, it is not clear that the fluid inclusions exist inside of diamond grain or boundaries between grains. In this study, we measured infrared (IR) absorption spectra of diamond after heating at several temperature steps.

Furthermore, TEM images were obtained for thin sections prepared using a focused ion beam equipment.

Liquid water was detected from the carbonado specimens and the fluid inclusions remained after heating at 950 C until the diamond transformed to graphite under vacuum. The experimental results strongly suggest that the detected fluid inclusions were trapped inside of diamond crystal and the fluids are primary inclusions syngenetic to the host diamond.

TEM observations also revealed the presence of voids inside of diamond grain and the shape of the void was equivalent to the negative crystal of diamond. The observation implies the fluid was trapped inside of diamond and equilibrated with surrounding diamond by dissolution and crystal growth in the thermodynamical stability field of diamond.

The present results suggested that mantle fluid played an important role on the formation environment of carbonado diamonds and the mantle-origin of carbonado.

Keywords: carbonado, diamond, fluid inclusion, infrared absorption spectra, TEM, mantle fluid