Origin of Diamondites

Ekaterina V. Rubanova, William L. Griffin, Suzanne Y. O'Reilly
GEMOC, ARC National Key Centre, Department of Earth and Planetary Sciences, Macquarie University, NSW 2109, Australia
ekaterina.rubanova@gmail.com

Diamondites are fine (<100 mm) to coarse grained (>1 mm) rocks consisting dominantly of polycrystalline diamonds with abundant pores and cavities (Kurat and Dobosi, 2000; Dobosi and Kurat, 2002; Rege et al, 2008). Kurat and Dobosi (2000) showed that diamonds and silicates were formed from the same fluid/melt system. They also suggested that these "polycrystalline diamonds" should be regarded as diamond rock – diamondite. Diamond crystals/grains are intergrown mainly with garnet (fig.1) and clinopyroxene and with other minor minerals including chromite, ilmenite, dolomite, rutile. Jacob et al. (2004) reported spherules of cohenite (Fe_3C), native Fe-Ni and FeS in syngenetic garnets. We have found coesite as an inclusion in intergrown garnet (fig.2) in samples previously studied by Dobosi and Kurat (2002), Kurat and Dobosi (2000) and Rege et al (2008). Olivine, orthopyroxene and omphacite are not present in diamondites (Dobosi and Kurat, 2002). Rege et al (2008) reported the presence of solid micro-phases inferred from the diamondite trace-element data: a Y-Yb rich (fluoride?) phase, a Cu-Pb-Zn-Co-Ni sulfide phase, LIMA-type phase, a carbonate, an ilmenite-like phase, chromite and mica. They suggested that these phases may have controlled the trace-element composition of the fluid during diamondite formation.

Diamondite colour varies from grey to almost black due to wide-spread graphitisation of diamond crystals. The walls of open cavities are lined with garnet and clinopyroxene and euhedral transparent diamond crystals: the diamonds are commonly simple octahedra or stepped octahedra (fig.3). Silicates often contain inclusions of euhedral diamonds (Rege et al. 2008), indicating a cogenetic origin of them. Diamondites are classed as peridotitic or eclogitic depending on major-element composition (mainly Cr) of garnets, although both types have similar trace-element compositions. Dobosi and Kurat (2002) suggested that the trace-element similarity of these "peridotitic" and "eclogite" garnets reflects they precipitatedtheir precipitation from similar melts and/or fluids. The Cr, Ca, Ti, Mg contents can vary slightly in garnets from the same sample (fig.4), but do not correlate with trace-element variation. Dobosi and Kurat (2002) suggested that fluid evolved from "peridotitic" to "eclogitic" due to chromite precipitation. Rege et al (2008) reported lower abundances of Cr, Mn, Co, Ni in "eclogitic" relative to "peridotitic" as well as higher Nb/Ta (average Nb/Ta ranges from 0.70 to 2.47 for E-type and 0.22 to 0.99 for P-type). Rege et al (2008) observed that small differences between the "eclogitic" and "peridotitic" diamondites are reflected in the similarity of the calculated fluids/melts: the main difference is in lower LREE/HREE of the eclogitic fluids, which might reflect the crystallisaion of clinopyroxene.

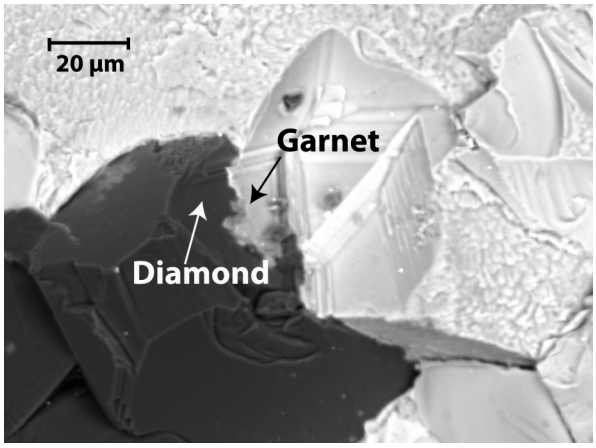

Fig.1. Intergrowth of diamond and garnet in diamondite

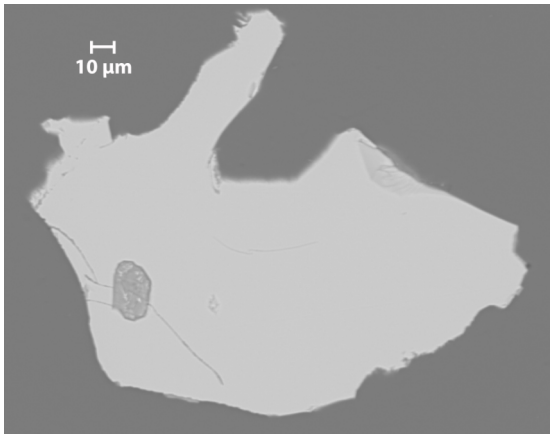

Fig.2. Coesite inclusion in garnet from diamondite

Our work confirms previous observations (Dobosi and Kurat, 2002; Rege et al 2008) that the parental fluid/melt for diamondites had trace element patterns similar to those for average carbonatites and kimberlites, and for some fibrous diamonds (Rege et al, 2008). The fluid/melt is inferred to be silico-carbonatitic (fig.5) and lie on a kimberlite-carbonatite trend. This fluid may evolve from "peridotitic" to

"eclogitic" one with subtraction of some minerals, such as chromite, clinopyroxene and the micro-inclusion phases reported by Rege et al (2008).

This work is a part of PhD project and was supported by an ARC Discovery Project grant (to SYO'R, WLG, NJP) and a Macquarie University postgraduate scholarship and used instrumentation funded by ARC LIEF and DEST Systemic Infrastructure Grants, Macquarie University and Industry.

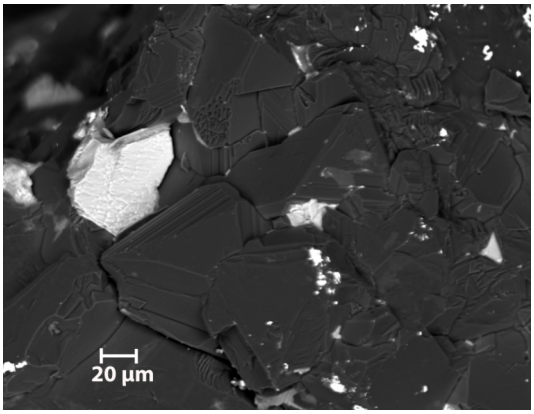

Fig.3. Surface image: intergrowth of octahedral diamonds (grey) and garnets (white)

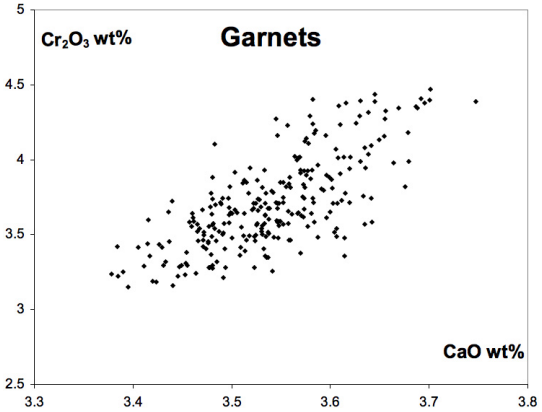

Fig. 4. Variation in composition of garnet from peridotitic diamondite

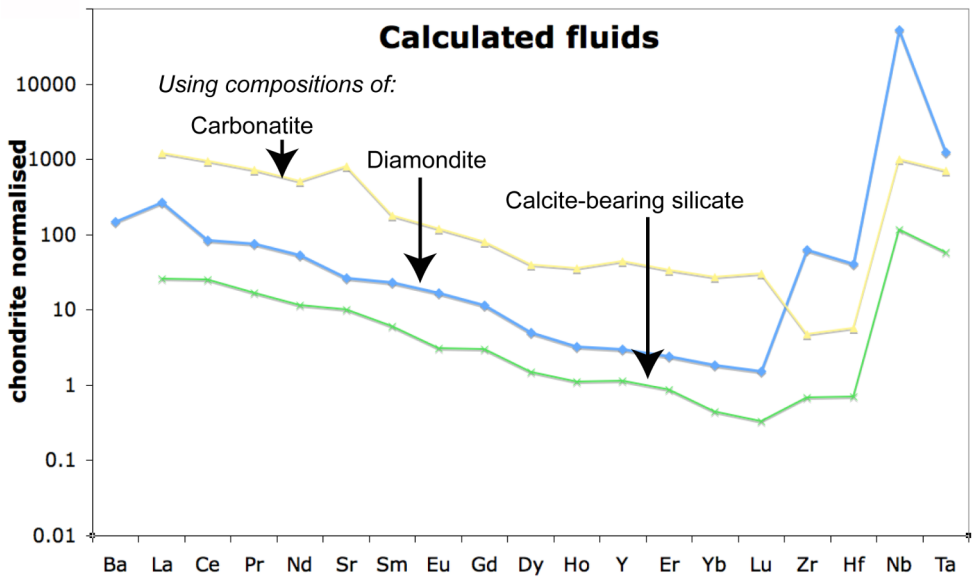

Fig. 5. Comparison of fluid calculated from average diamondite trace-element composition (this study) with fluids calculated from carbonatitic and calcite-bearing silicate matrices (Araujo et al, 2009)

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