

Trace element composition of synthetic diamonds: Evidences for anthropogenic contamination of natural ophiolitic rocks

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Keywords: synthetic diamond, HPHT synthesis, metal catalyst, ophiolite, chromitite

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Recently several detailed studies on type Ib cuboctahedral diamonds with low nitrogen aggregation in ophiolitic peridotite and chromitite has been reported [1-2]. Diamonds were rarely observed *in situ* in the interstitial space between chromite and olivine grains, surrounded by amorphous carbon aggregates. The diamonds clearly show growth at high-*PT* conditions in the diamond stability field. In contrast, the host ophiolitic rocks do not show any deviation from normal ophiolitic sequences in sub-arc environment at pressures of the stability of spinel peridotite. Here we report trace element compositions of a set of synthetic diamonds and show their clear similarity with diamonds found in ophiolite. We also provide critical discussion on the possibility of natural origin of ophiolitic diamonds.

The data were obtained using Laser ablation inductively coupled plasma mass-spectrometry (LA-ICP-MS) at Geochemical Research Center, University of Tokyo (Tokyo). A single quadrupole mass spectrometer iCAP Qc (Thermo Scientific) was utilized. The element concentrations were calculated by comparison of element mass intensity from diamond sample and NIST-612 standard glass. The measured concentrations were recalculated to 100% of carbon, which was measured using ¹³C isotope.

The absolute concentrations of the trace elements in the studied diamonds have little meaning, because ablated spot covers an area with variable amount of metallic microinclusions. That is why the concentration range in diamonds studied by Howell et al. [3] is so huge. From our point of view, the most important information, which can be derived from these data, is elemental ratios. From 74 to 99% of measured amounts of the transition metals are presented by Ni-Mn-Co indicating that they are major compounds of the captured metallic alloy inclusions. An average ratio for 11 diamonds is Ni:Mn:Co = 66.6:28.6:4.8 in wt%. Two diamonds have different compositions corresponding to Ni-Fe-Co alloys.

The measured compositions resemble those of Ni-Mn-Co inclusions in diamonds from ophiolite [2-4] and HPHT catalyst Ni₇₀Mn₂₅Co₅ (wt.%), which is the most widely used to produce synthetic diamonds in China [5].

The Ni-Mn-Co environment is unknown and may be impossible for any reliable natural upper mantle conditions. Indeed, this cannot be a regional feature as diamonds with similar inclusions were reported from Luobusa (Tibet), Ray-Iz (Polar Ural), Hegenshan (Inner Mongolia) and Pozanti-Karsanti, (Turkey) ([2-4] and others).

Thus, we claim for thorough reconsideration of diamonds in ophiolitic rocks and emphasize that most of them appear by anthropogenic contamination. We have provided the strongest evidence that the compositions of metallic inclusions in type Ib cuboctahedral diamonds in ophiolitic chromitites and peridotite are equal to the compositions of metallic inclusions in synthetic diamonds produced from the most widely used catalyst for growth of synthetic HPHT diamonds in China, which is Ni:Mn:Co = 70:25:5 in wt.%.

However, in some papers strong arguments were provided for natural origin of diamonds from ophiolite. The most important of them are the mineral inclusions of moissanite, feldspar and chromite in some diamonds from Tibet and Ural ophiolites [6]. We believe that mentioned *pro et contra* should be considered as equally competitive. It is most likely that we may have several sources for diamonds from ophiolitic chromitite and peridotite.

Acknowledgments: This work was performed under the state assignment of IGM SB RAS.

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