MINERAL INCLUSIONS IN BORT FROM THE MIR PIPE, YAKUTIA.

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This paper presents the results of studying mineral and chemical compositions of crystal inclusions in bort.

The inclusions were studied in a sample that measured 7x5x3 mm and consisted of two varieties of bort: fine- and coarse-grained. The fine-grained aggregate makes up the central part of the sample and consists of opaque, up to 0.2 mm sized individuals lacking well-defined crystallographic form. The coarse-grained bort grows over the fine-grained one as a porous crust with cavities and consists of large (up to 1 mm), transparent individuals which also lack well-defined crystallographic form. In one of the cavities there is a druse of well-shaped octahedral diamonds measuring 0.8 - 1 mm.

The sample was cut in two across the druse. Under a microscope, the two polished surfaces of the cut showed numerous transparent and opaque inclusions. The latter are mostly concentrated in the central, fine-grained part of the sample and are 5x15 μ or less in size. In the outer, coarse-grained part, inclusions are fewer but larger (up to 45x135 μ). The compositions of the inclusions were determined using a "Camebax-Micro" microanalyzer.

Only opaque inclusions were found in fine-grained bort. Of them, magnetite (*Mt*) and sulphide (M_{ss}) inclusions are considered to be syngenetic. They have no accompanying cracks and have a hexagonal shape in cross-section. There are also two-phase inclusions which represent *Mt - sulphide* intergrowths. They also have a hexagonal shape but cannot be considered as syngenetic because they are accompanied by cracks that extend to the surfaces of diamond grains

M_{ss} inclusions contain (in wt.%) 28.15-30.05 - Ni, 28 21-30.69 - **Fe**, 0.18-6.82 - Cu, 0.09-0.36 - Co, and 34.44- 38.04 - S. Syngenetic *Mt* inclusions are practically free of **TiO_2** (0-0.71 wt. %) and rich in NiO (up to 3.39 wt.%). In the two-phase inclusions, *Mt* is similar in composition to syngenetic *Mt*, whereas sulphide has the composition 8.54 -

Fe, 55.46-Ni, 0.28-Co, 1.19-Cu 31.65-S (in wt.%) and corresponds in stoichiometry to NiS (probably millerite).

Coarse-grained bort contains syngenetic garnet, pyroxene and magnesite inclusions in addition to M_{SS} and two-phase inclusions that are much fewer than in the fine-grained variety of bort

Elongated inclusions of garnet correspond in Cr_2O_3 and CaO contents (3.33-3.64, 3.45-5.69 wt.% respectively) to pyrope of the lherzolitic paragenesis. A pyroxene inclusion, in the form of a parallelogram in cross-section, corresponds in composition to chrome-diopside (1.93 wt. Cr_2O_3).

Magnesite inclusions which are found in the coarse-grained bort (six inclusions) and the druse (one inclusion) measure 5x10 µ and have a hexagonal form in cross-section. Magnesite from the druse is higher in Fe (9.24 wt.%. FeO) than that from the coarse-grained bort (4.06 - 4.79 wt.% FeO).

The results lead to the following conclusions:

(1). Based on the chemistry of garnets (Sobolev, 1974) and M_{SS} inclusions (Yefimova et al., 1983), the studied inclusion suite belongs to the lherzolitic paragenesis of the ultrabasic association. The crystallization temperature is about 1150°C at 45 Kbar using the Ellis-Green's geothermometer (1979).

(2). Magnetite is similar in composition to that crystallized from sulphide melt (Skinner, Peck, 1979; Al'mukhammedov, 1982). This suggests that during the early stage of the formation of bort an unmixable sulphide melt existed from which magnetite, M_{SS} and probably magnetite-sulphide intergrowths were crystallized. In the latter, the sulphide was represented by pentlandite or M_{SS} later replaced by millerite.

(3). The presence of magnesite and magnetite indicates more oxidized conditions (consistent with QFM buffer) for the formation of bort compared to diamond monocrystals.

(4). A lesser number of magnetite inclusions in coarse-grained bort compared to fine-grained bort indicates a higher oxyden fugacity during the formation of the fine-grained variety of bort.