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New volcanogenic-eruptive genetic type of diamond occurrence (based on studying the 2012-2013 Fissure Tolbachik Eruption in Kamchatka)

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During the 2012-2013 Fissure Tolbachik eruption, diamonds were found both in fresh pyroclastics and in the effusive lava pores. Lavas are aphyric and subaphyric porous aluminous basaltic trachyandesites with rare megacrysts and subphenocrysts of plagioclase, olivine and pyroxene. Groundmass is hyalopilitic, pilotaxitic, occasionally hyaline, with abundant plagioclase microlites. So far, over 750 diamond grains have been found sized mostly 100-500 mkm. Generally, grains are well formed isometric, plane-faced and sharp-edged monocrystals of cubic-octahedral habit and green color, rarer colorless. Faces of rhombic-dodecahedron, tetragonal-trisoctahedron and trigonal-trisoctahedron also occur. Crystal cubic faces host pits of diffusive depletion, and pits with induction surfaces formed after the breakoff of syngenetic inclusions. Octahedral faces often show pyramidal etching pits formed at the dislocation outcrops. Pits contain coatings whose composition includes Fe, Mg, Ca, Si, and Cu-Sn (Zn) alloy films. Diamond X-ray diffraction data (Bruker APEX DUO, STOE IPDS II, MoKα-radiation, 788 reflections) show space group Fd-3m, cubic unit cell parameter a = 3.574(3) A and major reflections (111), (220), (311) etc. at Gandolfi pattern. Raman spectra with red beam reveal only one strong line at 1332 cm-1 typical for diamonds. Spectra excited by the 785 nm beam reveal a wide line with the peak at 1370 cm-1, whose intensity oscillates from 1% to 70% of the diamond line intensity at 1332 cm-1. Infrared absorption spectra reflect two lines with peaks at 1345 and 1130 cm-1, corresponding to structural C-defects (isolated N atoms). Partially, these defects occur in the positive charge state - N+. Structural nitrogen concentration in the form of C-defects varies from 150 to 500 ppm, while that in the form of N+ - from 10 to 30 ppm. Lines of infrared absorption on A and B1 nitrogen defects, as well as those on hydrogen defects typical for most natural diamonds, are not detected for the instance considered. The above can indicate that Tolbachik diamonds were never affected by mantle anneal. Generally, by their spectroscopic properties, Kamchatka diamonds correspond to the Ib-type whose occurrence among natural diamonds does not exceed 2%. Reported are isolated twinned crystals. Tiny grains of blue moissanite, single grains of pink garnet and pink and blue corundum were found within the association accompanying diamonds (commonly in basalt pores). Often found are thin laminae and filaments of native elements (Fe, Al, Cu), blades or lumpy grains of Cu-Sn (Zn) alloy. Tolbachik diamonds bear no evidence of magmatic corrosion. Data obtained allow us to state the discovery of a new genetic type of diamond occurrence that we suggest to call “volcanogenic-eruptive”, or Tolbachik type.