Characteristics of nitrogen impurity in octahedral diamonds from Snap Lake (Slave craton, Canada)

O.A. IVANOVA[1]*, A.M. LOGVINOVA[2], N.P. POKHILENKO[3]

[1] V.S. Sobolev Institute of Geology and Mineralogy SB RAS, Novosibirsk 630090, Russia (*ivanova@igm.nsc.ru)
[2] Novosibirsk State University, Novosibirsk 630090, Russia

The nitrogen concentration and aggregation form reflect the conditions of diamond formation and diamond evolution in primary source [1].

FTIR measurements were made on 40 colorless or slightly greenish octahedral diamonds from Snap Lake kimberlite dyke system. Studied diamonds differ in nitrogen content, distribution and aggregation degree. The total nitrogen content in different diamond zones is up to 1600 ppm.

Diamonds have been classified into two groups on the basis of nitrogen aggregation degree in them. Group 1 includes poorly-aggregated-nitrogen diamonds. We suggest that such diamonds belong to the same generation such as cubic diamonds from Snap Lake [2]. The low degree of nitrogen aggregation in diamonds is indicative of short mantle residence and suggests that they crystallized shortly before kimberlite eruption.

Diamonds of Group 2 are characterized by high nitrogen aggregation degree (up to 98.6%). Group 2 includes diamonds either with uniform nitrogen distribution throughout the crystal volume or with a predominance of B-defect in the center. Inhomogeneity in nitrogen distribution from the center to the edge of the octahedral crystals indicates, at least, about the two, or even more growth stages of a part of the studied diamonds. High nitrogen aggregation degree according to “annealing” model is evidence of diamond staying in the high temperature region or of their residence in the mantle conditions. Results obtained support that significant part of octahedral diamonds from Snap Lake may have formed at the base of a thick lithospheric mantle at depth below 300 km [3].

[1] Evans et al. (1981) J. Phys. C. 14, 379-384. [2] Zedgenizov et al. (2015) Dokl. Earth Sci. 461, 297-300. [3] Pokhilenko et al. (2008) Lith. 77(1), 57-67.