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GEOLOGY

Age of Zircons from Diamond-Bearing Lamproites of the East Sayan as an Indicator of Known and Unknown Endogenous Events in the South Siberian Craton

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Diamond-bearing lamproites are reported in the limits of the Urik-Iya graben (southwestern flank of the Siberian Craton) (Fig. 1a), where they compose a series of steeply dipping veins hosted in schists and sandstones of the Paleoproterozoic Urik and Ingashi formations [1] (Fig. 1b). All these bodies on aggregate are considered as the Ingashi field. The thickness of veins is 0.1 to 1.0 m, with the average value 15–20 cm. The length of veins is several hundreds of meters, and their general strike is 280°–300°. The maximal length (850 m) was discovered for vein no. 1 Iskra.

The age of lamproite veins was initially determined by the Rb–Sr method on the whole rock as the Mesoproterozoic (1268 ± 30 Ma) [2]. The relatively small error of the obtained value suggested its validity, despite the fact that the study was carried out for a significantly carbonized variety of lamproites, where preservation of the initial Rb–Sr system was questionable. Thus, the age of diamond-bearing lamproites of East Sayan was assumed as the Precambrian for more than 20 years. This dating gained special importance in the late 20th century, with respect to intensive international studies of the formation and breakup of the supercontinent Rodinia. The available dating of lamproites (1268 Ma) agreed well with the age of the big McKenzie dike swarm in North Canada. This point suggested that both complexes belong to a common endogenous event and allowed researchers to interpret this combination as a reflection of the mantle plume effect that touched marginal areas of two ancient cratons, the Siberain and North American (Laurentia), joined in the structure of the supercontinent Rodinia [3]. However, the validity of the dating mentioned above based on lamproites of East Sayan was questionable for both Russian and international researchers, so geochronological study of these rocks using modern methods was started. In the framework of the present study, samples of diamond-bearing lamproites (ING-1 and ING-2) were collected in the Ingash field, from vein no. 1 Iskra and then zircons from these samples were studied to define their U–Pb age. The U–Pb age was determined at Curtin University of Technology (Perth, Australia) on a SHRIMP II instrument with a BR266 standard by the standard technique [4]. Data processing was carried out using the SQUID software [5]; for plotting the concordia diagrams, the ISOPLOT software was used.

The contents of the main petrogenic oxides in the studies were as follows (ING-1/ING-2, mass %): SiO_2 = 42.93/43.64; TiO_2 = 3.70/3.60; Al_2O_3 = 4.66/4.69; $Fe_2O_3^*$ = 12.62/12.22; MnO = 0.44/0.39; MgO = 19.98 / 20.36; CaO = 3.87 / 3.27; Na_2O = 0.18/0.19; K_2O = 1.60/1.69; P_2O_5 = 2.25/1.93. The Zr contents in the studied samples are 1187 and 1140 g/t, respectively, while the REE contents are 2018 and 1897 g/t, respectively.

Among the zircons extracted from both samples, there are colorless and colored varieties. The sizes of the grains varies from 50 to 10 μm. In terms of size and morphology, crystals differ from each other, and their elongation ranges from 1:1 to 4:1. In the cathode luminescence images, we can see various patterns of the internal structures for zircon grains. U–Pb isotopic studies were carried out for 30 zircon grains (39 measurements) from ING-1 sample and for three grains from ING-2 sample. Since both samples were collected from the same dike, we can consider them jointly. On the basis of isotopic ratios, and with the peculiarities of the internal structure of the zircon grains taken into account, several age groups were distinguished.

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