# POSTCOLLISION LAMPROITOIDES OF EAST-MAGNITOGORSK PALEOVOLCANIC BELT (THE SOUTHERN URALS).

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The East-Magnitogorsk paleovolcanic belt is one of the largest submeridional belts of Southern Urals. It's an eastern branch of the Magnitogorsk-Mugojar ancient Island Arc system and is identified with East-Magnitogorsk Island Arc. This arc got through a long complicated history of development. Three distinctly expressed stages of its evolution may be described. The first stage is suboceanic (margin sea), it was displayed in Ordovician-Silurian. The second is the island arc stage, it took place in the mid Devonian and early Carboniferous. The third stage (collision and accretion) finishes the tectonic development of its region in the mid Carboniferous - Permian. The stabilization in subplatforms regime has taken place later on.

Lamproitoides were not known in the Urals until recently. For the first time they were found out in 1990 in the career of the Maleye Kuibas iron ore deposit during detailed geological maping of the Magnitogorsk ore area and later was defined as lamproites (Lukianova et al.,1992). At present inside the limits of the East-Magnitogorsk paleovolcanic belt about three tens of manifestations of lamproitoidic magmatism has already been revealed. They are introduced exclusively by subvertical dykes with visible thickness varying from 1 to 10 meters. According to the geochronologic data (K-Ar and Rb-Sr) its age is determined as mid Triassic - early Jurassic (197-240 millions years). Up to now the manifestations of Mezozoic magmatism in this section of the Urals were not known.

These rocks form the unified petrogenetic series, uniting the formations from an ultrabasic to a mediosilicic composition. Tthe dark-grey-brown-green colour, massive structure, the porphyritic texture and the microlites or glassy matrix are typical for them. The phenocrysts summary volume does not exceed 20 %, the size - from 0,3 to 2,5 mm. The phenocrysts are submitted olivine (1-10%), phlogopite (5-15%), clynopyroxene (1-10 %), less often leucite (to 5%). In the matrix the small-sized allocation phlogopite, diopside, enstatite, apatite, sanidine, richterite are defined. Olivine forms oval or wrong form of grains. The large phenocrysts contain the heaviest quantity MgO (Fo 95), in the small-sized crystalls MgO is less (Fo 88-89). Olivines do not contain CaO. Almost always olivine is superseded by serpentine and calspar. Phlogopite forms the plate-phenocrysts and small-sized scale and needle allocation in the matrix, making from 5 to 40 % the rocks volume. It is Ti-contains version (20-25% MgO, 0,7-4,0% $TiO_2$, 12-14,2% $Al_2O_3$, 6,6-10,5% $K_2O$). The Ratio of aluminium and iron of the phlogopites is close to

micas from lamproites of other regions. The tendency of reduction of $Al_2O_3$ content with growth of FeO, that is on the whole typically for lamproites, is observed. In phlogopite $Al_2O_3$ and $TiO_2$ are connected by distinct negative dependence, that is more characteristic for rich-istonite phlogopites from kimberlites (Mitchell, 1985). With increase of $TiO_2$ in micas MgO is lowered sharply, thus from internal to external zones of phenocrystalls the MgO content decreases and $TiO_2$ increases that is typically for lamproites (Mitchell, 1985 and Jaques et al., 1986). Phlogopite is frequently replaced by chlorite. Clynopyroxene forms the prismatic microphenocrysts of the size to 0,5 mm and the microlites in the matrix. It is poor aluminium diopside ($TiO_2$ 0,25-0,49%, $Al_2O_3$ 0,45-1,20%, FeOsum 3,20-4,20%, $Na_2O$ (0,36-1,25%) and considerably less often Ti-augite ($TiO_2$ 1,02-1,90%). In the endocontact zones of dykes the leucites phenocrysts (size to 0,5 mm) possessing characteristic eight-coal cuts, are revealed. Leucite is usually replaced by sanidine, which contains the increased quantity $Fe_2O_3$ (0,4-2,5%), that is typically just for lamproites (Mitchell, 1985). Enstatite is rare, it is comparable with olivine (MgO 36,91%, FeOsum 3,79%) on the contents of iron. Amphibole is colourless Ti-richterite ($TiO_2$ 2,60-5,30%, MgO 2,92-6,00%, CaO 2,62-15,01%, FeOsum 19,29-25,25%, $Na_2O$ 4,44-12,41%, $K_2O$ 0-0,15%).

According to mineralogical analysises the following accessory minerals were found: Cr-dyopside (0,9-1,56% $Cr_2O_3$), Cr-spinel (81-92 Cr/Cr+Al, 0,3-0,9% $TiO_2$, 0,1-0,6% MnO), garnets of pyrope-almandite-spessartite series, including very rare high-Cr pyrope (2,62-5,13% $Cr_2O_3$, 4,82-6,10% CaO), Ti-magnetite (5,6-6,6% $TiO_2$) and Cr-magnetite (to 0,5% $Cr_2O_3$), rutile (0,4-0,6% FeO, 0,4-0,6% MgO), ilmenite (0,5-1,1% MnO), free Pb, Fe, Au, natural alloys Fe and Te, Mo and Pb, Au and Ag, Au and Cu, as well as sulfides: pyrite, chalcopyrite and sphalerite. Besides, according to the termochemical analyses, the presence in them of garnets (including pyrope), zircon, graphite were found.

Thus, according to the mineralogical criteria (Mitchell, 1985) the investigated rocks may be corresponded to lamproites. The minerals, typical for the formations of other types of alcaline-ultrabasic magmatism: plagioclase, nephelite, melilite, monticellite etc. are absent in them.

The petrochemical peculirities of the rocks are typical for the lamproitic series. Their characteristic are: high summary alcaline at obvious prevalence K over Na ($K_2O/Na_2O$ 4-12), high MgO (10-20 % ) and $P_2O_5$ (0,8-2,0%) and low - $Al_2O_3$ (7-11%). On the distribution of the series of microelements they are close to lamproites of other regions. The high contents Li (35-56), Ba (800-1500), Rb (90-180), Sr (570-1600), Cr (300-1000), V (110-170), Ni (200-900), Sc (10-30), Th (10-23), U (2-9) (ppm). indicate it. However, low contens of $TiO_2$ (0,9-1,4%), Zr (150-350 ppm) and Nb (10-21 ppm) permit to

speak about essential differences between them and "platforms" lamproites of Australia, Southern Africa, the USA, Greenland, Antarctic Continent, Northern Karelija. The REE distribution (La 49-61 ppm, Ce 101-117 ppm at (La/Yb)N = 21,6-25,4) testifies to the benefit of it. The existence of small Eu-anomalies, probably, indicates to fractional differentiation processes. The adduced quantities are essentially below for the mentioned lamproitic provinces. Some mineralogical features of the rocks (low-Ti phlogopite, low-K richterite, absence of diamonds etc.) also are confirmed by these distinctions. The most close analogues of the East-Magnitogorsk belts rocks on the mineralogical and geochemical features are lamproitoides of Alger, Yugoslavia, Indonesia, Spain, Aldan, Kamchatka, regarded to "collision" type (Lamproites, 1991, Seliviorstov et al., 1994). The term "lamproitoides" was offerred for the similar rocks of Kamchatka, (Seliviorstov et al., 1994). It is interesting, that the increased contents of chalcophile elements are marked in Southern Urals lamproitoides: Cu 90-150, Zn 180-300, Co 34-42, Pb - to 66 (ppm), that, evidently, is a provincial feature of the Urals rocks. Possibly, it is explained by crusts contamination of the mantle magmas. The finds of garnets-pyralspites, typical for the formation of the "granulite-basite layer" earth crust and increased significance $(^{87}Sr/^{86}Sr)_o$ = 0,70524-0,70593. also indicate to the certain role of contamination. PT-parameters evolution of initial melts (calculated by Simakov,S.G.: P=30-15 kbars, T=1416-1445°C) were defined according to many known geotermometers and geobarometers of investigated mineral paragenesises. Certainly, this pressure is far below than diamond subfacies of depth.

In view of geological conditions of lamproitoides' manifestations (the Mezozoic activization of the Paleozoic fold belt with total cycle of development) is offerred to allocate the rocks in the "postcollision" subtype. The conducted researches do not permit to consider these rocks as the primary source of the Urals' diamonds. The mentioned problem waits for the decision up to now.

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