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Magmatic complexes of the Urals that may belong to Large Igneous Provinces.

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Petrogenetic, geochemical studies and isotope age determinations of flood basalts, dolerites, trachybasalts, picrite-basalts, rapakiwi granites, layered mafic-ultramafic intrusions and also alkaline and carbonatite magmatic complexes of the western zones of the Urals, along with coeval magmatic complexes of adjacent and faraway territories permits to put forward a preliminary list of objects – “candidates” at attribution to Large Igneous Provinces (LIPs). Their petro-geochemical properties distinguish them from MOR and subduction types; they are characterized by wide areas of development, very short periods of activity and independence of their areas from earlier geological structures.

In the Southern Urals near the base of the Lower Riphean (Uppermost Paleoproterozoic and Lower Mesoproterozoic), covering crystalline Taratash complex dated as Archean and Lower Paleoproterozoic, there are volcanic deposits of the Navysh Subformation, represented mostly by trachybasalts. The age of the unit was determined as 1752 ± 11 Ma (SHRIMP, zircons) [1]. It turns out that volcanic rocks of the age level of 1750–1780 Ma are developed not only in some other places of Baltica, but also in the Northern Africa, Siberia, Laurentia and North China [2,3]. Therefore they may belong to a LIP.

Higher up the section of the Riphean, at the base of the Middle Riphean (Mid-Mesoproterozoic), rhyolites of the Mashak Formation were dated by SHRIMP and CA-IDTIMS U-Pb methods in three isotopic laboratories as 1380–1385 Ma. The same ages have also rapakiwi granites, layered gabbro, carbonatites and dolerite dykes widely developed in the Southern Urals and encountered in boreholes of East European platform; magmatic rocks of the same age are traced to Greenland, Laurentia and Siberian cratons and date the beginning of Nuna supercontinent break-up [2]. Less confidently we may speak of the younger Neoproterozoic magmatic complexes of the Southern Urals as LIPs, dated as ca. 720 Ma and 680 Ma (Arshinian and Kiryabinka complexes); they need a further study.

The study of dykes in the western slope of the Urals has revealed three main Paleozoic volcanic events. The first one, represented by subalkaline volcanics is connected with rift process started at ca. 490 Ma, the beginning of the Ordovician, that has led to oceanic spreading and formation of the Paleouralian ocean. The second episode was marked by an eruption of trachytes, and was dated (SHRIMP, zircons)

between 435 and 455 Ma. It can be correlated with the early stage of development of Vishnevogorsk plume-related carbonatite complex [4,5].

The younger complex is Devonian in age and is traced along the western slope of the Urals to Pay-Khoy. They match excellently with the Mid-Upper Devonian volcano-intrusive complexes of the East European platform including traps, dolerite dykes, alkaline and carbonatite intrusions and kimberlites, and belong to the marginal part of the LIP called Kola-Dnieper [7]. The late, reliably dated stage of the Devonian magmatism of the East European platform and Urals–Novozemelian belt is Frasnian in age [6]

The last but not the least are the Lower Triassic flood basalts and dykes traced from the easternmost parts of the Southern and Middle Urals to the western margin of the Polar Urals. It became evident that they belong to the Uralo-Siberian LIP and “African” superswell [4].

References:

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