

Geochemical features of dolerites as indicator of distance to center of mantle plume (a test of Proterozoic LIPs of the Siberian craton)

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Most Proterozoic dyke swarms of the Siberian craton belongs to several Large Igneous Provinces (LIPs) including the 1.75 Ga Timpton, 1.50 Ga Kuonamka, 1.35 Ga Listvyanka, and 0.72 Ga Irkutsk LIPs. Each of these events has been linked to the arrival of a mantle plume at the base of the lithosphere. However, only some of the dolerite swarms have geochemical and isotopic affinities indicating their enrichment by mantle plume-related sources. We propose that these dolerites are located just above or near the center of the mantle plume head. These dolerites are geochemically similar to OIB, and are characterized by near zero or slightly positive $\epsilon\text{Nd}(t)$ values. Such geochemical and isotopic compositions are observed in the dolerites of Olenek Complex (Kuonamka LIP) and Listvyanka and Goloustnaya dolerites of Listvyanka LIP.

Dolerites of other Proterozoic LIPs (Timpton LIP in Baikal uplift, Aldan and Anabar shields as well as Neoproterozoic dolerites of the Irkutsk LIP) were generated and emplaced far from mantle plume centers. On normalized multi-element diagrams, these dolerites demonstrate negative Nb-Ta and Ti anomalies. Moreover, all of them have negative $\epsilon\text{Nd}(t)$ values. These dolerites were produced from lithospheric mantle sources or crustal contaminated mantle sources. In this case mantle plume(s) supplied extra (additional) temperature and fluids to lithospheric mantle sources. Moreover, uplifts in the crust, caused by rising of mantle plume led to extension, faulting and provided favorable conditions for emplacement of dyke swarms.

Thus, based on the example of Siberia, we can clearly observe how the geochemical characteristics of mafic dyke swarms dolerites of LIPs are related to the distance from the place of their formation to the center of the mantle plume.

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