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Geochemistry of Dominant Low-Ti Basalts of the Siberian Traps and Subduction-Related Model of Their Origin

A.V. Ivanov (1)

(1) Institute of the Earth's Crust SB RAS, Irkutsk, Russia (aivanov@crust.irk.ru)

Siberian Traps is one of the most voluminous volcanic provinces on Earth (~4*10^6 km^3, covering ~7*10^6 km^2). It was formed between the Late Permian and the Late Triassic, at a time when the Pangea supercontinent was surrounded by subduction zones. The dominant erupted rocks are low-Ti basalts, which make up to 80 % by volume of the classical Noril'sk lava sequence. In the Angara-Taseevskaya Syncline, West Siberian Basin and Maymecha-Kotuy area the low-Ti basalts make up to about 100 %, 99 % and 50 % by volume, respectively. The low-Ti basalts despite their wide spatial distribution and temporal variations within Late Permian - Late Triassic are characterized by uniform geochemical features similar to that of island-arc basalts. In conventional plume model, this is explained by high-degree lithospheric (either mantle or lower crust) contamination of primary plume melts. However, taking into account the size of the Siberian Traps and heterogeneous nature of underlying lithosphere, the contamination is unlikely to yield uniform composition of erupted magma. Thus, sublithospheric origin of the low-Ti magmas is suggested. The sublithospheric upper mantle attained 'subduction-like' trace element features shortly before the Siberian Traps volcanism because of Permian subduction. New model includes water recycling through fast subduction, slab stagnation in transition zone of mantle, water-saturation of the bottom-part upper mantle peridotite and its upwelling to sublithospheric depth and, finally, voluminous melting. The model is supported by (1) tectonic position of the Siberian Traps in a back-arc setting of Permian subduction systems, (2) island-arc-basalt-like trace element patterns for the majority of the erupted basalts, (3) experimental data on the high water capacity of the mantle transition zone, its recharging via the subduction process and (4) significant volume expansion of olivine as a result of water saturation. (Study is supported by RFBR 05-05-64477)