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Unusual 8.5 Ma andesites from the Barguzin basin of the Baikal Rift Zone, Southern Siberia: melting of peraluminous source rocks for subsequent xenocrystic sapphires in basalts

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Pliocene-Quaternary mantle-derived basanites and related alkaline volcanic rocks from Southern Siberia include sapphires of jeweler quality, origin of which is disputable. In the Barguzin basin, we have found unusual Late Miocene crust-derived pyroclastic andesitic material that might exhibit magmatic liquids from a peraluminous source region of the jeweler sapphires.

Peraluminous character of the andesites is demonstrated by mutually consistent increasing ACNK from 1.79 to 3.19, ANK from 2.59 to 4.15, $Al2O_3$ content from 20.4 to 26.5 wt.%, and CIPW-normative corundum from 9.7 to 18.6 %. Crustal origin of the andesites is inferred from low Nb/U, Ce/Pb, high Rb/Sr, and strongly enriched signatures of initial 87Sr/86Sr (0.710162-0.712082) and epsilon Nd (-13.4-14.7). In Rb-Sr isochron diagram, the upper limit of andesitic data points correspond to the reference line of ca. 440 Ma with initial 87Sr/86Sr at 0.705 that assumes the early Silurian isotopic closure of the source region.

As a rule, deep-seated mineral inclusions do not occur in early lavas of a volcanic area and appear in those of later eruptive stages. This indicates their origin through interaction between the earlier magmatic liquids and wall-rocks. In the $Al2O_3$ versus total $Fe2O_3$ diagram, the unusual andesites are comparable to silica-rich corundum-bearing rocks from metamorphic terranes. We suggest that the andesite eruption in the Barguzin basin was provided by selective melting of the Al-Si-rich source during structural reorganization that occurred in the Baikal Rift Zone between 9 and 5 Ma, when rifting began propagating from the Southern Baikal basin to the Northern Baikal one. The high-temperature processes in a weakened layer favored to growing corundum crystals. Afterwards, the jeweler sapphires were extracted from the reactivated crust of the Baikal Rift Zone by ascending Pliocene-Quaternary mantle-derived liquids.

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