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GEOLOGY

Degree of Thermal Impact on the Periphery of the Siberian Craton in the Phanerozoic

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The crystalline basement of the Siberian Craton is exposed as fragments in the Sharyzhalgai inlier, which is separated by the Main Sayan fault from Paleozoic rocks of the Slyudyanka crystalline complex and is bounded by the ~70-km-long Baikal coastline from the Settlement of Kultuk to port of Lake Baikal (Fig. 1). The geological boundary between Sharyzhalgai and surrounding Caledonides is at the Lake Baikal floor. The spatial association of Archean and Proterozoic rocks with Paleozoides has repeatedly inspired researchers to search for traces of endogenous influence of the Paleozoic framing on the rocks and basement of the platform. However, all datings of rocks, including the youngest granites of the Shumikha Complex, yielded ages older than 1.6 Ga. The most recent reliable U–Pb datings of the Sharyzhalgai rocks are within 2.6–2.5 Ga [1], while the later Proterozoic dates are ~1.8 Ga [2].

The coastal section of Archean–Lower Proterozoic rocks exposed along the Krugobaikal railroad are cut by numerous granite pegmatites and quartz–feldspar veins with biotite. It was supposed that the veins formed in the Paleozoic, because the Paleozoic Slyudyanka phlogopite deposit incorporates numerous similar veins that have crosscutting relations with the Slyudyanka metamorphic complex.

To solve this question, we sampled the most representative pegmatite bodies unaffected by silicification and deformations over a distance of more than 30 km eastward from Kultuk along the Krugobaikal railroad (the distance marks are given in parentheses): sample 26 (118.2 km), sample 28 (118.7 km), sample 32 (120.9 km), sample 46A (130.5 km), sample 46B (130.8 km), sample 54 (140.35 km), sample 58 (145.75 km), and sample 64 (150.7 km) (table).

A detailed mineralogical study demonstrated that, in addition to rock-forming minerals, pegmatites and veins contain zircon, allanite, titanite, apatite, and garnet. Silicate and quantitative emission–spectral analyses of whole-rock samples for Pb, Sn, Zn, Ba, Sr, Be, Co, Ni, Sc, V, and Cr showed no differences between sampled veins. Gas chromatographic analysis conducted on a LKhM-8D gas chromatograph [3] also revealed no significant differences in H_2O, CO_2, CO, CH_4, H_2, and N_2 contents in quartz and feldspar from sampled bodies. In other words, detailed research highlighted a genetic relation of pegmatites and quartz–feldspar veins expressed in similar mineralogical and geochemical characteristics.

Then, averaged bulk samples were taken from the most representative veins. The samples were decomposed to extract feldspar aggregate and fresh biotite unaffected by later muscovitization. The Rb–Sr isotope system was studied in whole-rock samples, feldspars, and micas by Yu.A. Kostitsyn (table). The Rb and Sr concentrations were determined by isotope dissolution using a mixed (^{85}Rb + ^{84}Sr) tracer. Samples were decomposed in a ($HF + HNO_3$) mixture at atmospheric pressure. Rb and Sr were separated by column chroma-

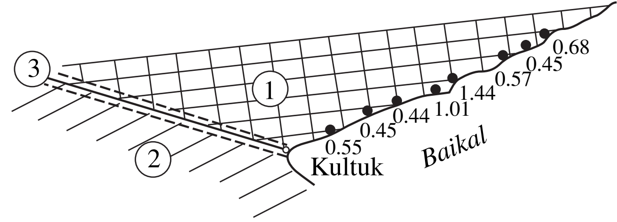

Fig. 1. Sampling sites of pegmatites from the Sharyzhalgai block along the coastline of Lake Baikal. (1) Sharyzhalgai block (Archean–Proterozoic), (2) Slyudyanka block (Paleozoic), (3) zone of the Main Sayan fault. Filled circles show sampling sites and value of the Rb–Sr mica age (Ga).

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Results of Rb–Sr isotope study of whole-rock samples, feldspars, and micas from the Sharyzhalgai pegmatites

Sample no.	Rb, μg/g	Sr, μg/g	$^{87}Rb/^{86}Sr$	$^{87}Sr/^{86}Sr$	±2σ	*T*, Ga
26	178	137	3.817	0.825176	0.000010	
26 Fsp	201	197	2.987	0.808497	0.000042	
26 M	921	26.5	111.8	1.866363	0.000053	0.68
28	243	140	5.096	0.842395	0.000018	
28 Fsp	314	184	5.003	0.840739	0.000012	
28 M	852	21.5	125.0	1.612138	0.000032	0.45
32	321	119	7.941	0.910464	0.000010	
32 Fsp	374	144	7.657	0.908453	0.000011	
32 M	907	27.2	105.7	1.700684	0.000020	0.57
46A	254	162	4.588	0.831608	0.000008	
46A Fsp	352	236	4.365	0.826926	0.000009	
46A M	952	17.8	225.9	5.419428	0.000252	1.44
46B	244	187	3.829	0.814407	0.000007	
46B Fsp	350	261	3.930	0.815820	0.000013	
46B M	1072	18.0	227.9	4.037170	0.000064	1.01
54	66.8	500	0.3871	0.738316	0.000008	
54 Fsp	44.0	531	0.2405	0.737749	0.000012	
54 M	813	112	21.24	0.869580	0.000012	0.44
58	45.6	148	0.8975	0.760451	0.000011	
58 Fsp	27.6	211	0.3799	0.758385	0.000014	
58 M	755	7.98	332.5	2.893760	0.000083	0.45
64	33.2	50.9	1.9211	0.901993	0.000013	
64 Fsp	44.0	105	1.2333	0.882686	0.000019	
64 M	431	18.6	71.67	1.446443	0.000017	0.55

Note: (WR) Whole-rock, (Fsp) feldspar, (M) mica. The measurement error of $^{87}Rb/^{86}Sr$ is 1% (2σ). The Sr isotope ratios were normalized to $^{86}Sr/^{88}Sr = 0.1194$. The measured isotopic composition of SRM-987 standard was 0.710256 ± 18 (2σ). The Rb–Sr model age based on the mica–rock pair is shown in the last column.

tography using the standard technique. Isotope analysis was conducted on a Triton spectrometer.

The results of isotope analysis of the whole-rock samples and feldspar fractions from the Sharyzhalgai pegmatites are shown in Fig. 2. A line with the slope corresponding to 1.6 Ga is shown for comparison. Data points demonstrate a large scatter and yield no isochron, but they are distinctly confined to the 1.6-Ga line. Obtained results suggest that the studied pegmatites are derivatives of the Shumikha granitoid massif localized within the Sharyzhalgai inlier (Fig. 1). Data points of Sample 46 (both the whole-rock sample and feldspar) are plotted much above and to the left of the 1.6-Ga line (Fig. 2). This pegmatite sample was taken at the 130.5-km mark of the Krugobaikal railroad, and the micas from adjacent pegmatites define age values closest to the 1.6-Ga line (Fig. 3).

The results of Rb–Sr isotope analysis of the micas and whole-rock samples and their positions relative to the 1.6-Ga reference line (Figs. 2, 3) indicate that the Rb–Sr isotope system of micas was rejuvenated to a variable extent ~0.45 Ga ago.

These facts suggest the following unambiguous conclusion. The Sharyzhalgai rocks were subject to thermal influences simultaneously with the formation of the Slyudyanka Complex. This impact is recorded in the micas of coarse-grained pegmatites over a distance of 30 km (Fig. 1). All samples define comparatively similar mica ages (0.68–0.45 Ma). However, samples 46A (130.5-km mark) and 46B (130.8 km) have an age of 1.44 and 1.01 Ga, respectively, while comparison of these samples with feldspar fractions indicate ages older than 1.6 Ga. This can be explained by a high SiO_2 content (>81% SiO_2) in the rock or an uneven thermal impact on the Archean basement rocks at the interval of 130.5–130.8 km, where rocks and host pegmatites were less affected by thermal metamorphism relative to other parts of the studied section.

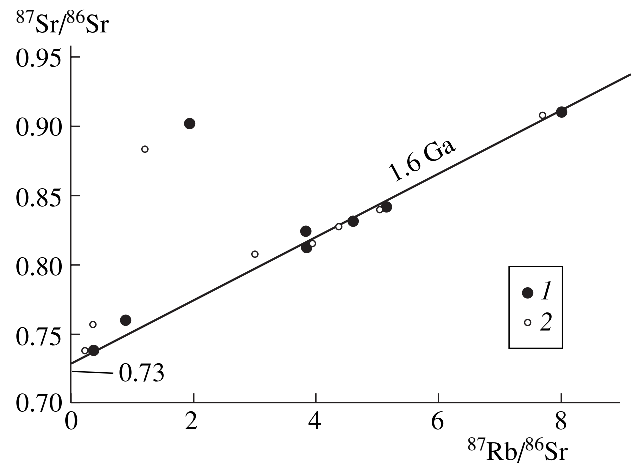

Fig. 2. Results of isotope dating of whole-rock samples and feldspars from the Sharyzhalgai pegmatites. (*1*) Rock; (*2*) feldspar fraction.

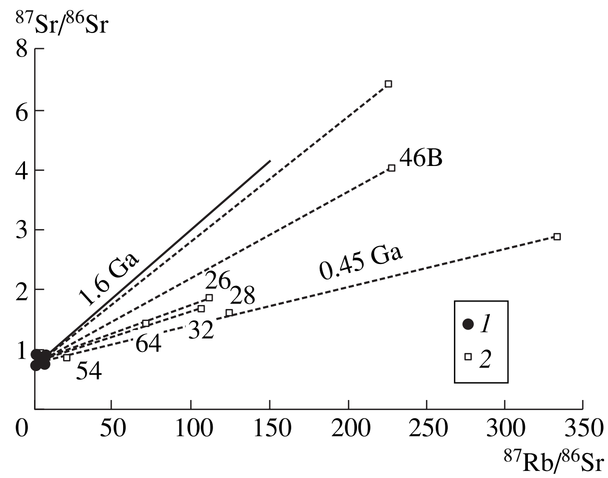

Fig. 3. Results of isotope dating of micas and whole-rock samples. The 1.6-Ga line is given for comparison. (*1*) Rock, (*2*) mica.

Thus, we established that Paleozoic thermal impact rejuvenated the Rb–Sr system of micas in Proterozoic pegmatites (1.6 Ga) within the Sharyzhalgai block. The age of this event is similar to the timing of the Slyudyanka Complex (~0.45 Ga). Further investigations are required to assess the degree of thermal influence on disturbance of the Rb–Sr system of micas in other rocks of the Sharyzhalgai crystalline complex.

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