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GEOLOGY

Paleoproterozoic Gabbroanorthosites of the Selenga–Stanovoi Superterrane, Southern Framing of the Siberian Craton

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The Selenga–Stanovoi Superterrane of the southern framing of the Siberian Craton includes numerous layered different (in genesis and composition) ultramafic–mafic and gabbroanorthosite massifs (Kengurak–Sergachi, Lukinda, Nyukzhin, Veselki, and others) (Fig. 1). Their place in the geological evolution of the region is

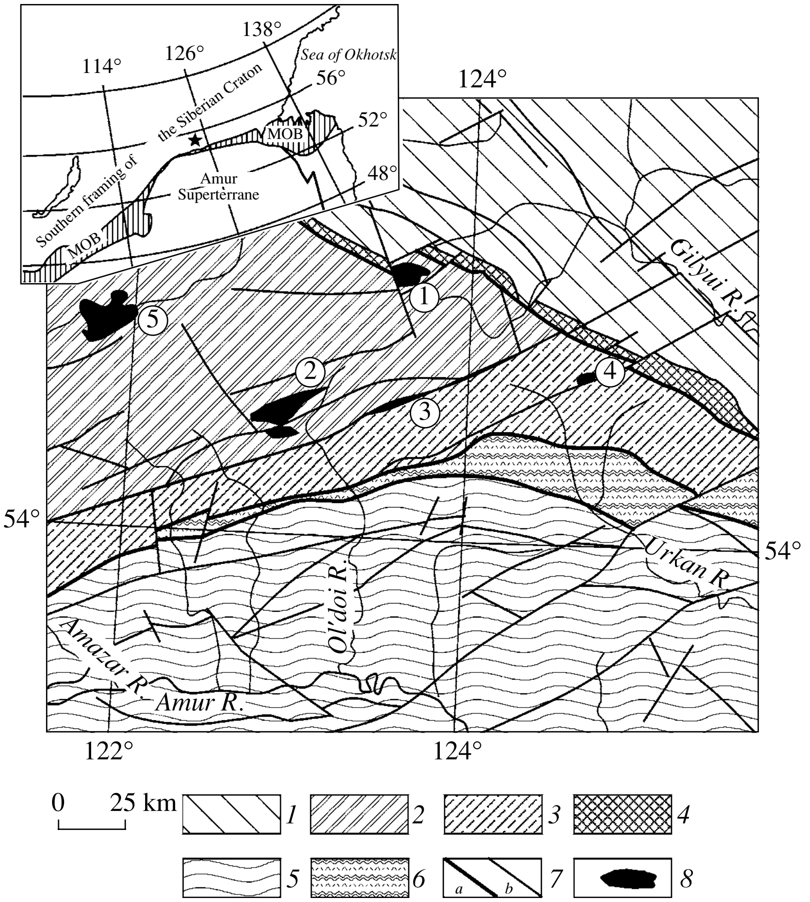

Fig. 1. Location scheme of mafic and ultramafic–mafic massifs within the Selenga–Stanovoi Superterrane (after [4]). (*1*) Eastern Stanovoi (Dzhugdzhur–Stanovoi Superterrane); (*2, 3*) Selenga–Stanovoi Superterrane: (*2*) Mogocha terrane, (*3*) Urkan terrane; (*4*) Dzheltulak suture; (*5*) Amur Superterrane; (*6*) Mongol–Okhotsk foldbelt; (*7*) faults: (*a*) main, (*b*) secondary; (*8*) Layered massifs. Massifs (encircled numbers): (1) Lukinda, (2) Kengurak, (3) Mongoli, (4) Veselki, (5) Nyukzha. Shaded area in the inset is the Mongol–Okhotsk Belt.

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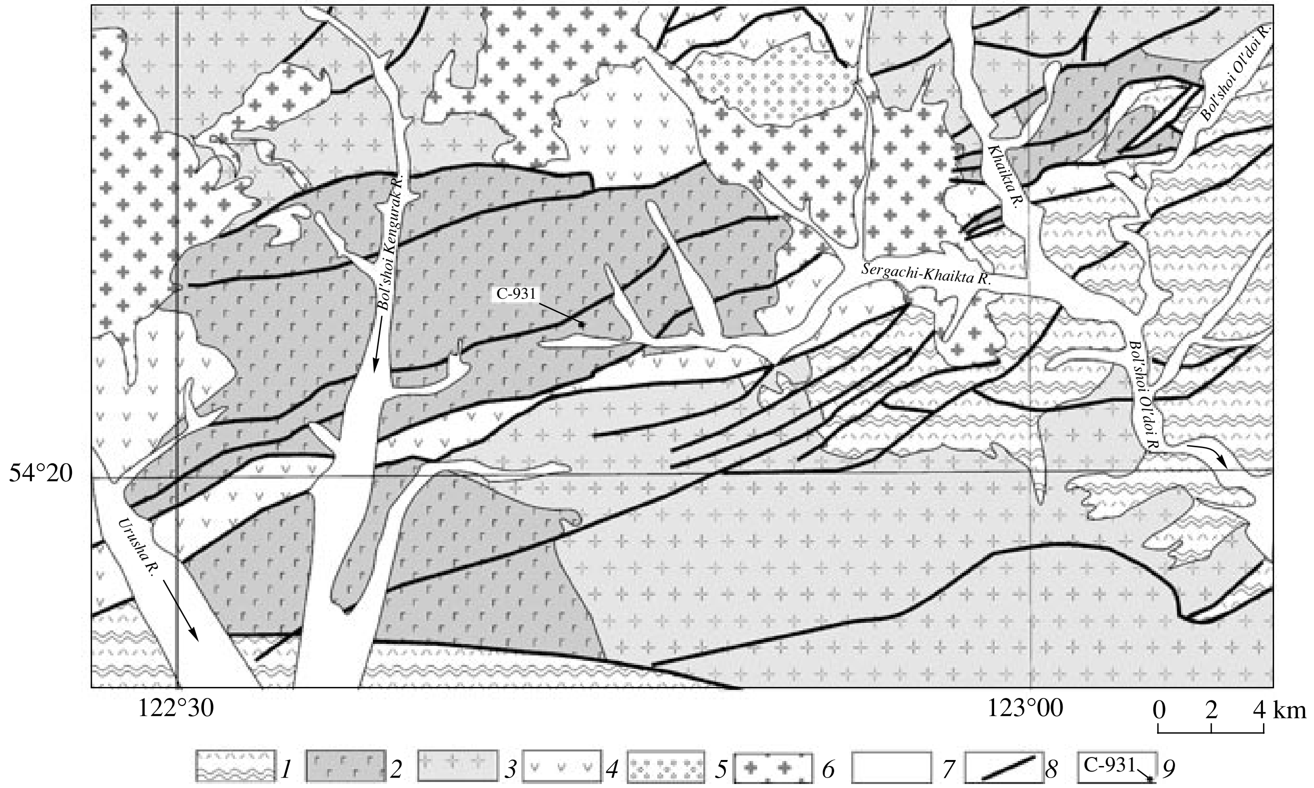

Fig. 2. Schematic geological map of the Kengurak–Sergachi gabbroanorthosite massif (after [2, 4, 5]). (*1*) Early Precambrian (?) crystal schists and gneisses; (*2*) pyroxenites, gabbros, gabbroanorthosites, and anorthosites of the Kengurak–Sergachi Massif; (*3*) Early Proterozoic (?) plagiogranites and quartz syenites; (*4*) Late Permian volcanogenic rocks: trachyandesites, andesites, and rhyolites; (*5*) Middle–Late Jurassic sandstones and siltstones; (*6*) Late Jurassic quartz diorites, granites, and granosyenites; (*7*) Quaternary loose sediments; (*8*) faults; (*9*) geochronological sampling locality.

a much-debated problem. Previously, these massifs together with host granitoids and metamorphic rocks were ascribed to the Early or Late Precambrian [2, 4, 5, 9]. Recent isotope data indicate a younger age of many magmatic complexes in the southern framing of the Siberian Craton, including some ultramafic–mafic massifs, which were previously considered Precambrian structures [1, 6, 7]. For example, it was established that the Veselki layered massif of the Selenga–Stanovoi Superterrane has a Mesozoic age [1], while at least part of the Luchin gabbro massif of the Dzhugdzhur–Stanovoi Superterrane has a Late Paleozoic age [7]. These data require significant corrections of the traditional understanding of the structure and evolution of the southern framing of the Siberian Craton.

This work reports the results of U–Pb geochronological investigations of the Kengurak–Sergachi gabbroanorthosite massif located in the Urushi–Bol'shoi Ol'doi interfluve within the Mogochin terrane of the Selenga–Stanovoi Superterrane (Fig. 2). On different geological maps, this massif is arbitrarily ascribed to either the Early Proterozoic Lukinda complex [2] or Early Archean complex [5].

The massif is dominated by gabbroanorthosites metamorphosed under amphibolite facies. Primary textural–structural features, such as variations in grain size, content of leucocratic minerals, and banding, indicate the primary layering of the intrusion. The host rocks are metamorphic rocks of the Mogochin Group of an arbitrarily Early Archean age [4, 9]. They have tectonic contact with gabbroids.

Gabbros are composed of labrador ($An_{55–60}$), uralitic and blue-green hornblende, and actinolite. Ti-magnetite, apatite, and titanite are accessory minerals. Gabbroanorthosites and gabbros show mutual transitions. Relative to gabbros, gabbroanorthosites are characterized by a more leucocratic appearance and absence of massive structures. The anorthosites are mainly composed of labrador ($An_{50–60}$). The rarer amphibolized pyroxenite only occasionally retains relicts of primary pyroxene, which is indicated by the short-tabular habit of actinolite–tremolite pseudomorphs. Apatite and magnetite are accessory minerals.

An anorthosite sample (C-931) for geochronological investigations was taken at upper reaches of Sergachi Creek in the central part of the Kengurak–Sergachi Massif (Fig. 1). Accessory zircon extracted from this sample is represented by transparent (more rarely, translucent) fragments of crystals of unknown habit. The color varies from violet to dark violet and brown-

Results of U–Pb isotopic investigations of zircon from anorthosites of the Kengurak–Sergachi Massif (Sample C-931)

Ordinal no.	Size (μm) and characteristics of fraction	Weight, mg	Content, μg/g		Isotope ratios		
			Pb	U	^{206}Pb/^{204}Pb	^{207}Pb/^{206}Pb(a)	^{208}Pb/^{206}Pb(a)
1	>100, 13 grains, brown, A 50%	–	U/Pb = 2.9		3831	0.1123 ± 1	0.2435 ± 1
2	<100, 50 grains, violet, A 50%	0.41	64.2	174	9939	0.1135 ± 1	0.2307 ± 2
3	>100, 6 grains, brown, A 20%	–	U/Pb = 2.7		4330	0.1133 ± 2	0.2241 ± 1
4	>100, 9 grains, violet, A 40%	–	U/Pb = 2.3		357	0.1143 ± 8	0.2419 ± 6

Ordinal no.	Size (μm) and characteristics of fraction	Isotope ratios		*Rho*	Age, Ma		
		^{207}Pb/^{235}U	^{206}Pb/^{238}U		^{207}Pb/^{235}U	^{206}Pb/^{238}U	^{207}Pb/^{206}Pb
1	>100, 13 grains, brown, A 50%	4.480 ± 14	0.2893 ± 9	0.92	1727 ± 5	1638 ± 5	1837 ± 2
2	<100, 50 grains, violet, A 50%	4.947 ± 15	0.3162 ± 9	0.91	1810 ± 5	1771 ± 5	1855 ± 2
3	>100, 6 grains, brown A 20%	5.034 ± 12	0.3222 ± 6	0.66	1825 ± 4	1800 ± 4	1853 ± 3
4	>100, 9 grains, violet, A 40%	5.168 ± 38	0.3280 ± 13	0.38	1847 ± 14	1829 ± 7	1868 ± 12

Note: (a) Isotope ratios were corrected for procedure blank and common lead according to [14]; (–) zircon sample was not analyzed; (brown, violet) zircon color; (A 40%) the amount of zircon removed by air abrasion. All errors are given at 2σ level. The accuracy corresponds to two significant decimal digits. The chemical decomposition of zircons, extraction of U and Pb, and air abrasion were performed following the technique described in [10, 11]. Isotope analysis was conducted on a Finnigan MAT-261 mass spectrometer. The measurement accuracy of the U/Pb ratio was 0.5%. Procedure blanks were <50 pg for Pb and 5 pg for U. Experimental data were processed with the programs PbDAT [13] and ISOPLOT [12]. Generally accepted U decay constants were used for age calculations [15].

ish. The crystals are characterized by lowered luminescence, coarse-zonal internal structure, and sectorial pattern.

U–Pb isotope investigations were performed for four microsamples of the most transparent zircon fragments (table), which were preliminarily air-abraded following technique described in [11]. Figure 3 shows that data points of the studied zircon form a regression line with an upper intercept at 1866 ± 6 Ma and lower intercept at 329 ± 78 Ma (MSWD = 1.5). The internal structure of zircon from anorthosites suggests its magmatic origin. Hence, the upper intercept age of 1866 ± 6 Ma can be taken as the most exact timing of the Kengurak–Sergachi Massif.

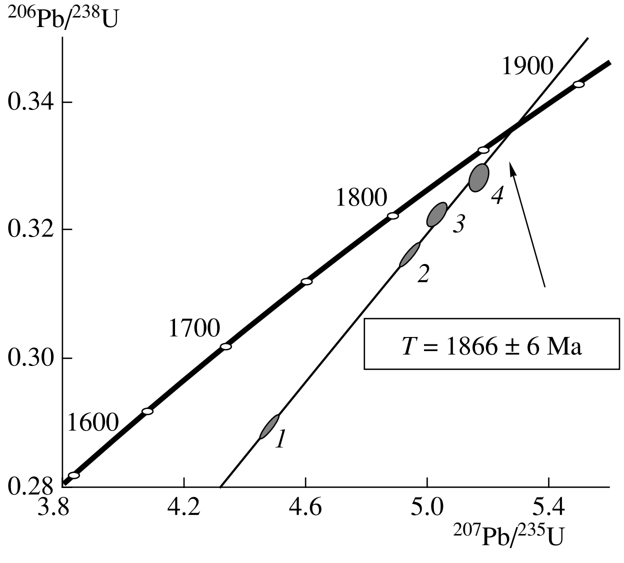

Fig. 3. Concordia diagram for zircons from anorthosites of the Kengurak–Sergachi Massif (sample C-931). Data point numbers correspond to numbers in the table.

The obtained data are the first evidence for Early Proterozoic gabbroanorthosite magmatism within the eastern part of the Selenga–Stanovoi Superterrane. An insignificant gap between granulite metamorphism of rocks of the Mogochin block (1873 ± 8 Ma) [3] and emplacement of the unaltered massif (1866 ± 6 Ma) suggests a postcollisional nature of the Kengurak–Sergachi Massif. This is also supported by the fact that the age of the massif corresponds to that of the eastern segment of the giant South Siberian postcollisional magmatic belt [8].

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