НАУКИ О ЗЕМЛЕ

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AGE AND COMPOSITION OF GRANITOIDS FROM THE BASEMENT OF KRASNOLENINSKY OIL AND GAS REGION (WESTERN SIBERIA)

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The relevance of the study consists in the insufficient level of scrutiny of the crystalline basement of the West Siberian megabasin. The purpose of this research is to study the material composition and age of granitoids from the pre-Jurassic basement of Krasnoleninsky oil and gas region in the Ural part of the West Siberian megabasin.

Research methodology: a detailed study of mineralogy, petrochemistry, geochemistry and age (different isotope systems using K–Ar, Rb–Sr and U–Pb methods of dating) of the granites in the Krasnoleninsky area.

Results. The mineralogy and petrogeochemical of the Krasnoleninsky region granites are studied in detail. It was found that rocks are composed of quartz, plagioclase (albite and oligoclase), potassic feldspar (microcline and orthoclase) and mica (annite). The accessory mineralization in the form of rutile, apatite, magnetite, titanite, monazite, zircon and cassiterite is added. Granites are subject to propylitization, which is expressed in the development of secondary carbonate, chlorite, sericite and albite. The sulfide (chalcopyrite, galena) and native (gold, silver) mineralization is also added to it. On petrogeochemical characteristics of rocks belong to granitoids of S-type, the source of substance for them was mainly sedimentary rocks. Granites are of early Permian age, which, apparently, reflects the process of raising granites to the level of the upper crust during riftogenesis and stretching of the entire region.

Summary. The granites of the Kamennaya petroleum exploration area are an integral part of the regional Shaimsky-Kuznetsovsky anticlinorium. The time of magmatic introduction and crystallization of granites of the Krasnoleninsky area is estimated at 300 million years, as well as of the granitoids of the nearby Shaimsky oil and gas area. The difference between U–Pb (297.9 ± 3.8 million years) and Rb–Sr (291.8 ± 2.1 million years) granite ages is likely to result from the gradual cooling of the granite massif. This happened because the uranium-lead isotope system closes at a higher temperature than the rubidium-strontium one. We interpret the "Mesozoic" numerals obtained by the K–Ar method as the time of the last tectonic-thermal events, most likely expressed in the form of granites propylitization.

Keywords: mineralogy; age; granites; pre-Jurassic basement; Kamennaya area; Krasnoleninsky region; Western Siberia.

Introduction

World experience shows that granitoids are the most promising for searching hydrocarbon deposits out of all the complexes of sedimentary basins basements, and only then – limestone or other rocks [1 and others]. Western Siberia in this sense is no exception. Apparently, this is primarily due to the low specific gravity of granites. It is due to this, that granite batolites, together with the surrounding sialic slates, often form large (usually up to several hundred meters) ledges on the basement surface. When the crimp of these ledges with clay packs of the lower horizons of the sedimentary cover takes place (these packs are impermeable beds), the industrially significant tanks are often obtained with oil and/or gas condensate. This happens due to the cracks and secondary changes in granitoids. This especially happens in the event of the joining of lower oil-saturated horizons of the sedimentary cover to the traps of this type.

We have studied the deep core of granitoids from a large massif within a Kamennaya oil exploration area located within the Krasnoleninsky oil and gas region. This area is located directly northeast of Shaimsky area. Its foundation is the major regional late Paleozoic "granite-schist axis", also known as the Shaim-Kuznetsovsky meganticlinorium of the Trans-Uralian uplift (the central axial part). The Northern part of the late Paleozoic "granite-schist axis" can be traced, according to the geological and geophysical mapping [2], in the form of several granite plutons in the pre-Jurassic basement of the Krasnoleninsky uplift.

Mineralogy and geochemistry of granites

The Kamennaya area granitoids have a massive texture, medium-grained to fine-grained, weakly porphyritic structure (Fig. 1). The main rock-forming minerals are: plagioclase (≈ 40 %), potassic feldspar (≈ 25 %), quartz (≈ 25 %), biotite (8–10 %), accessory minerals – apatite, zircon, rutile, titanomagnetite, and monazite.

The plagioclase forms tabular or slightly idiomorphic grains with a size of 0.4–5 mm in diameter. It is presented with a zonal (number of zones from 2 to 4), double-ended grains. Rims have different widths – from whisker to 1/3 of the width of the grain, they often developed myrmekite. Cores are heterogeneous ("spots" of the oscillating basicity), sericitized and carbonatized (more basic parts). Some parts are saussuritized. The smallest grains are only sericitized or almost not changed. According to the microprobe analysis, the composition of plagioclase varies from oligoclase in the central part to pure albite in the rim zones (Table 1, analyses 1–2).

The potassic feldspar forms a shapeless mass between the grains of plagioclase. It is predominantly represented by the lattice type, i. e., microcline, but there are and orthoclase. The transitions occur within a single grain (among lattice plots are monotonous "spots"). The perthite occur in the form of spindles or small, idiomorphic weak spots. The poikilitic structure manifested rarely,

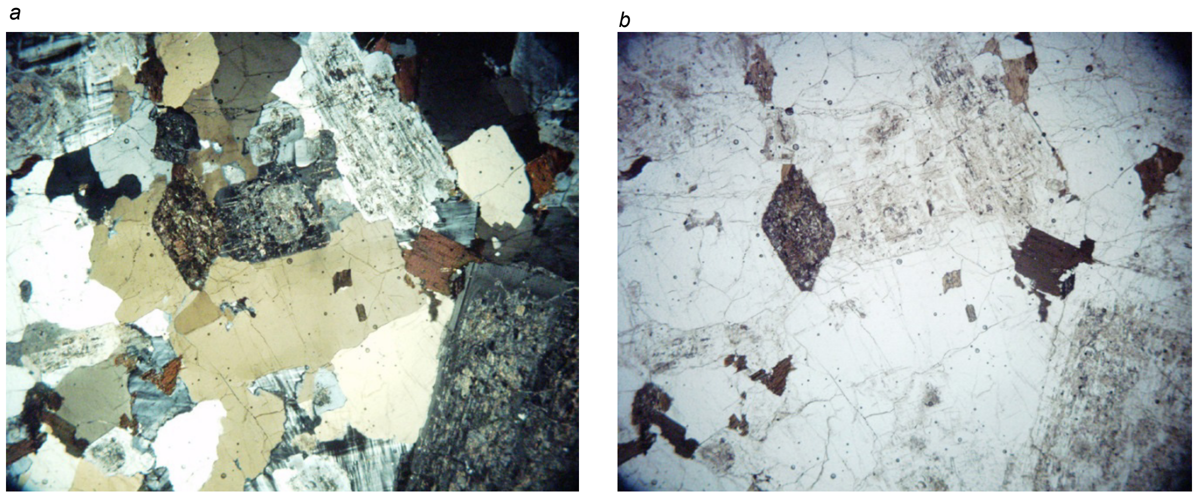

Figure 1. Granite from the pre-Jurassic basement Krasnoleninsky region. Kamennaya area. Kam P68/2555 m, well P–68, depth 2555 m. *a* – analyzer; *b* – without analyzer. The field length is 2.5 mm.
Рисунок 1. Гранит из доюрского фундамента Красноленинского района. Каменная площадь, обр. Кам P68/2555 м, скв. Р-68, гл. 2555 м: *а* – с анализатором, *б* – без анализатора. Длина поля 2,5 мм.

Table 1. The chemical composition (in wt. %) of minerals of granite Kamennaya area (Kam P68/2555).
Таблица 1. Химический состав минералов из гранита Каменной площади (Кам P68/2555).

№	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	F	Total
						Plagioclase						
1c	65.39	–	22.19	–	0.10	–	–	3.26	9.61	0.08	–	100.65
1r	66.00	0.02	21.83	–	0.06	0.01	–	2.49	9.47	0.07	–	99.96
2c	63.35	0.02	23.06	0.01	0.12	–	–	4.78	9.11	0.20	–	100.64
2r	65.38	0.04	21.74	–	0.15	–	–	2.84	10.12	0.20	–	100.47
						Potassium feldspar						
3	64.60	–	18.52	0.02	0.09	–	–	–	0.35	16.19	–	99.76
4	64.19	–	18.73	–	0.06	0.01	–	–	0.46	15.93	–	99.40
5	64.99	0.04	17.86	0.01	0.10	–	–	–	0.45	15.95	–	99.40
6	65.18	–	18.39	0.01	0.15	–	0.01	0.02	0.45	16.00	–	100.22
						Mica						
7	36.21	3.37	13.96	0.05	20.68	0.30	11.42	0.02	0.06	8.06	0.68	94.80
8	36.46	3.45	13.46	0.12	20.50	0.19	11.21	0.09	0.12	7.10	0.94	93.65
9	36.39	3.48	13.71	0.08	20.45	0.27	11.42	0.13	0.10	7.04	0.71	93.78
10	35.45	3.37	14.47	0.03	21.60	0.32	11.47	0.04	0.04	7.61	0.30	94.70
						Chlorite						
11	27.36	0,04	18.82	0.06	23.14	0.54	17.38	0.01	0.03	0.03	–	87.39
12	27.42	0,06	18.50	0.03	23.00	0.55	17.53	0.02	0.03	0.02	–	87.15
13	27.93	0,02	18.32	0.03	22.68	0.51	17.75	0.03	0.05	0.04	–	87.35
						Carbonate						
14	–	–	–	–	0.71	0.56	–	49.67	–	–	–	50.94

Note: the analyses have been done in the Zavaritsky Institute of Geology and Geochemistry of the Ural Branch of RAS on the CAMECA SX 100, analyst V. V. Khiller, c – center of the grain, r – rim of the grain.

sometimes small tables plagioclase or biotites are enclosed in pure potassic feldspar. According to the microprobe studies the potash feldspar has zoning; the central parts of the grains contain higher values of Na_2O of 0.5 wt. % (Table 1, analyses 3–6).

Quartz forms segregation of panidiomorphic grains of different sizes, the grains sometimes have mosaic fading. It contains the "bays" of the substance of potassic feldspar.

Biotite forms scales and blades, often corroded in the rims, which pleochroic from gray-yellow to dark brown. It sometimes contains sagenite lattice, ilmenite spindles, and inclusions of ore mineral, apatite and sphene. According to the microprobe analysis biotite relates to magnesian annite (Table 1, analyses 7–10). Some small scales of mica are replaced by very light green chlorite. The composition of the chlorite aggregates are defined as ferrous clinochlore (Table 1, analyses 11–13).

In the rock there sometimes happen former envelopes of titanite replaced by an aggregate of carbonate and rutile, as well as separate clusters (0.5 mm) of carbonate (calcite, see Table 1, analysis 14). Granites are subject to secondary changes, first of all

Table 2. Chemical composition of gold and silver from granite of the Kamennaya area, wt. %.
Таблица 2. Химический состав (в мас.%) золота и серебра из гранитов Каменной площади.

Element	Cu	As	Ag	Hg	Au	Total
			Native gold			
1	0.17	–	–	2.82	97.48	100.47
2	0.16	–	–	2.64	96.28	99.09
3	0.14	0.27	0.10	4.39	96.90	101.81
4	0.16	0.46	0.02	1.54	95.91	98.09
5	0.15	0.43	–	2.17	97.76	100.51
			Native silver			
6	0.05	–	100.10	–	0.01	100.16
7	0.06	0.23	99.96	0.04	0.05	100.34
8	–	–	99.67	–	0.02	99.69
9	0.13	0.07	99.30	–	0.04	99.54
10	0.01	–	99.54	–	–	99.55

Note: microanalyzer CAMECA SX 100 Zavaritsky Institute of Geology and Geochemistry of the Ural Branch of RAS, analyst V. V. Khiller.

Table 3. Chemical (in weight %) and trace element (in ppm) composition of granites in the Kamennaya area.
Таблица 3. Химический (в вес.%) и микроэлементный (в г/т) состав гранитов Каменной площади.

Depth meters	2553	2555	2556	2564	Depth meters	2553	2555	2556	2564
SiO_2	69.14	69.21	68.70	68.00	Ce	60.19	37.74	52.07	57.13
TiO_2	0.47	0.45	0.49	0.55	La	35.39	17.08	29.03	31.95
Al_2O_3	14.71	14.80	17.73	14.56	Pr	6.70	4.11	6.15	6.68
FeO	2.20	1.51	2.00	2.80	Nd	23.94	15.61	22.38	24.75
Fe_2O_3	0.68	1.20	1.00	0.91	Sm	3.84	2.85	3.72	4.22
MnO	0.05	0.06	0.05	0.06	Eu	0.88	0.76	0.88	0.98
CaO	0.88	1.25	1.11	1.29	Gd	2.89	2.23	2.84	3.37
MgO	1.38	1.32	1.34	1.54	Tb	0.39	0.33	0.38	0.48
K_2O	3.55	3.46	3.35	3.39	Dy	1.69	1.61	1.66	2.17
Na_2O	4.05	4.20	4.20	4.20	Er	0.83	0.85	0.79	1.04
P_2O_5	0.14	0.15	0.15	0.16	Tm	0.12	0.12	0.10	0.14
L.O.I.	1.98	1.86	1.97	2.62	Hf	0.89	1.39	0.93	0.99
Sr	346.61	402.73	403.25	399.24	Ta	3.49	1.15	1.26	1.77
Rb	134.17	140.67	125.96	146.10	Pb	24.36	22.02	21.70	21.83
Zr	54.84	89.38	62.81	68.04	Th	13.87	17.56	14.84	24.23
Yb	0.74	0.75	0.67	0.86	U	2.72	2.58	2.50	3.82
Y	9.72	9.34	9.38	13.78	W	0.71	0.54	0.69	0.65
Sc	7.27	6.68	7.39	10.61	Ga	36.70	37.68	39.73	42.01
V	48.55	49.43	51.88	65.68	Ge	1.50	1.42	1.54	1.64
Co	8.23	8.21	9.54	10.35	Mo	0.39	0.39	0.80	0.45
Ni	17.96	18.60	19.41	22.70	Tl	0.67	0.74	0.62	0.62
Ba	616.73	637.84	642.14	689.98	Bi	0.27	0.20	0.21	0.37
Nb	12.21	13.16	13.65	15.20	Be	2.47	2.61	2.67	2.54
Cr	32.88	34.71	36.88	67.11	Cs	7.08	9.90	8.06	8.57
Cu	47.71	30.88	63.00	37.51	Li	28.98	26.22	28.03	32.37
Zn	106.43	88.23	94.88	113.06	Cd	0.08	0.08	0.05	0.09

Note: the analyses of rocks have been made in an analytical laboratory, Zavaritsky Institute of Geology and Geochemistry of the Ural Branch of RAS.

propylitization which is expressed in the development of carbonate, chlorite, sericite and albite. Accessory mineralization: rutile, apatite, magnetite, monazite, zircon and cassiterite. In addition, the granite has sulfides – chalcopyrite and galena, as well as scattered impregnation of native gold and silver (see Table 2). The latter consist of inclusions, up to 10 microns in size, in rock-forming minerals affected by secondary processes of change. Any gravitation of metals to accumulations of accessory minerals and sulfides is not marked [3].

Chemical and microelement composition of the granites in the Kamennaya area is given in Table 3. In the classification diagram $K_2O + Na_2O - SiO_2$ they fall into the field of normal granites, near the lower boundary of the subalkaline granites.

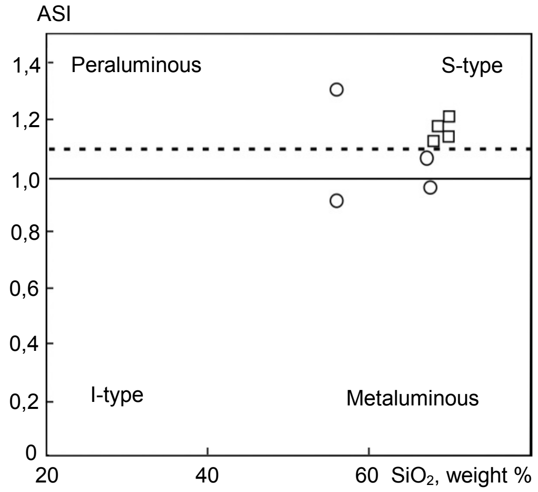

Figure 2. The distribution of the ASI–SiO_2 in granite. Circles are used to denote granitoids of the Shaim region; squares are used to denote granites from the Kamennaya area of the Krasnoleninsky region.
Рисунок 2. Распределение ASI–SiO_2 в гранитах. Кружки – гранитоиды из Шаимского района, квадраты – граниты из Каменной площади Красноленинского района.

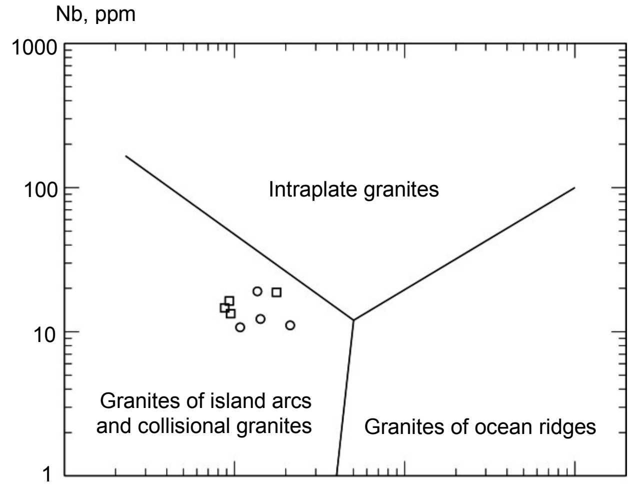

Figure 3. The diagram Nb–Y for the granites. Circles are used to denote granitoids of the Shaim region; squares are used to denote granites from the Kamennaya area of the Krasnoleninsky region.
Рисунок 3. Диаграмма Nb–Y для гранитов. Кружки – гранитоиды из Шаимского района, квадраты – граниты из Каменной площади Красноленинского района.

Table 4. Isotope Rb–Sr data for minerals and granite Kamennaya area.
Таблица 4. Изотопные Rb–Sr данные для минералов и гранита Каменной площади.

Sample	Rb, ppm	Sr, ppm	$^{85}Rb/^{86}Sr$	±2σ	$^{86}Sr/^{87}Sr$	± 2σ
Plagioclase (ρ = 2.61 – 2.64)	86.95	438	0.57460	0.00575	0.707167	0.000035
Potassic feldspar (ρ = 2.54 – 2.59)	211	422	1.4480	0.0145	0.710823	0.000036
Potassic feldspar (ρ < 2.54)	255	411	1.7979	0.0180	0.712287	0.000036
Granite (gross sample)	118	281	1.2160	0.0122	0.709804	0.000035
Biotite (ρ = 3.24 – 3.3)	389	134	8.2710	0.0827	0.739005	0.000037
Biotite (ρ = 3.15 – 3.24)	420	147	8.3774	0.0838	0.739582	0.000037

According to the content of potassium, the rocks are high potassium. According to the index of saturation with aluminum ASI = Al_2O_3/(CaO + Na_2O + K_2O) (at. number) [4], the studied rocks fall into the field of peraluminous granitoids (ASI = 1.13 – 1.22; see Fig. 2). This is typical for S-type granitoids, the source of the substance for them was mainly sedimentary rocks [5]. In the discriminatory diagram Nb–Y [6] these granites fall into the field of granites of island arcs and collision granites (Fig. 3).

The distribution of rare earth elements, normalized to chondrite, shows a strong predominance of light lanthanides over heavy ones and the absence of europium anomaly. A similar distribution is seen in nearby granitoids of the Shaim-Kuznetsov anticlinorium [2]. In general, granitoids of the Krasnoleninsky oil and gas area just like those of the Shaim oil and gas area compose the plutons the Shaim-Kuznetsov anticlinorium. They are characterized by a large similarity to the monzodiorite-granite complexes of the Urals, such as subalkaline composition of the medium and acidic rocks and mezoabyssal facies of the depth. They are also characterized by a zonal structure of massif. There, the central part is composed of quartz monzodiorites, and the edge part is composed of the more acidic granitoids (granosyenites). The granitoids are also characterized by geochemical peculiarities not only by rare earth elements, but also by other rare and scattered elements.

The results of the K–Ar granitoids dating of the Krasnoleninsky oil and gas region were obtained in the Zavaritsky Institute of Geology and Geochemistry (analyst B. A. Kaleganov). Kamennaya area granites have the following ages – 253 ± 10, 238 ± 7, 236 ± 7 million years. The obtained Mesozoic ages, obviously, do not date the stage of magmatic introduction of granites, but show the age of superimposed secondary changes (for example, propylitization).

To check the obtained “Mesozoic” K–Ar dates, additional study was undertaken to determine whether these figures reflect the time of magmatic introduction and crystallzation of rocks. The separation of mineral fractions was carried out in a mixture of iodide methylene (ρ = 3.3 g/cm^3) with acetone. The sample decomposition and chromatographic separation of Rb and Sr were performed according to the standard procedure in the IMGRE laboratory [7]. Isotopic analysis was conducted on a multicollector mass spectrometer Finnigan TRITON at the Vernadsky Institute of Geochemistry and Analytical Chemistry of Russian Academy of Sciences (see Table 4, analyst A. Yu. Petrova). The magnitude of the blank contamination in the laboratory was: [Rb] = 0.02 ng, [Sr] = 0.1 ng. When calculating the isochrones parameters, the measurement errors of $^{87}Sr/^{86}Sr$ isotope ratio in the samples at the significance level of 2σ were used. Calculation of isochrones was carried out by the York method [8]. We used the accepted decay constant of rubidium – 1.42 × 10^{-11} years^{-1} [9]. The obtained Rb–Sr isochrone determines the age of these granites as 291.8 ± 2.1 million years (Fig. 4). Subsequent studies showed (see below) that the rubidium-strontium system gives, perhaps, a little understated, “rejuvenated” age.

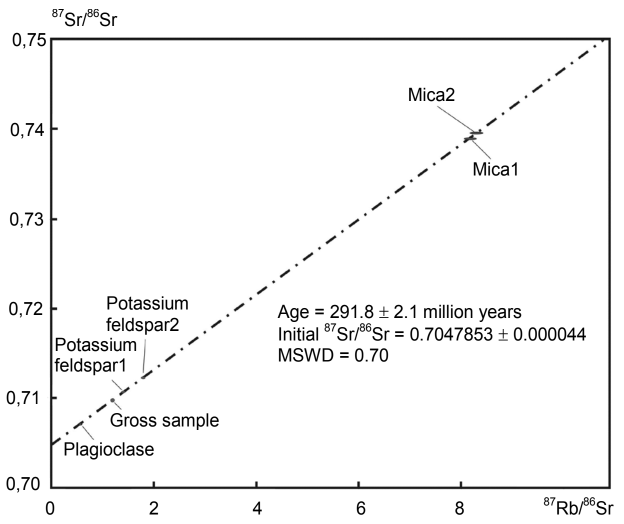

Figure 4. Rb–Sr isochrones for granite Kamennaya area. Sample Kam P68/2555 m.
Рисунок 4. Rb–Sr изохрона для гранита Каменной площади. Обр. Кам P68/2555 м.

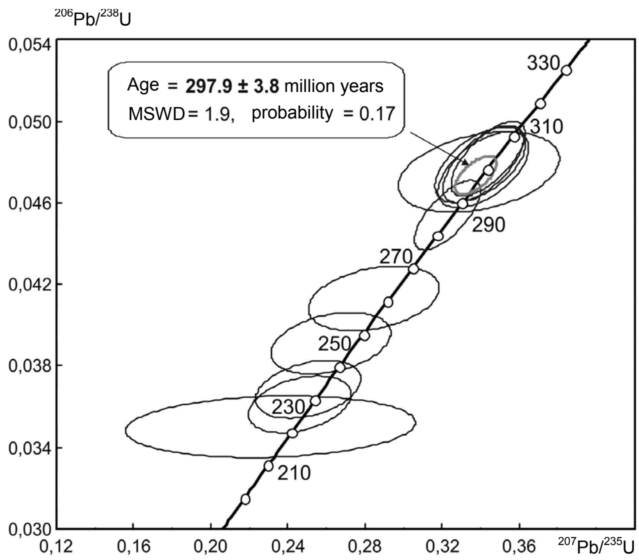

Figure 6. Isotope U–Pb diagram with concordia, built on the results of the study of zircons from granite of the Kamennaya area (Krasnoleninsky uplift).
Рисунок. 6. Изотопная U–Pb диаграмма с конкордией, построенная по результатам изучения цирконов из гранита Каменной площади (Красноленинский свод).

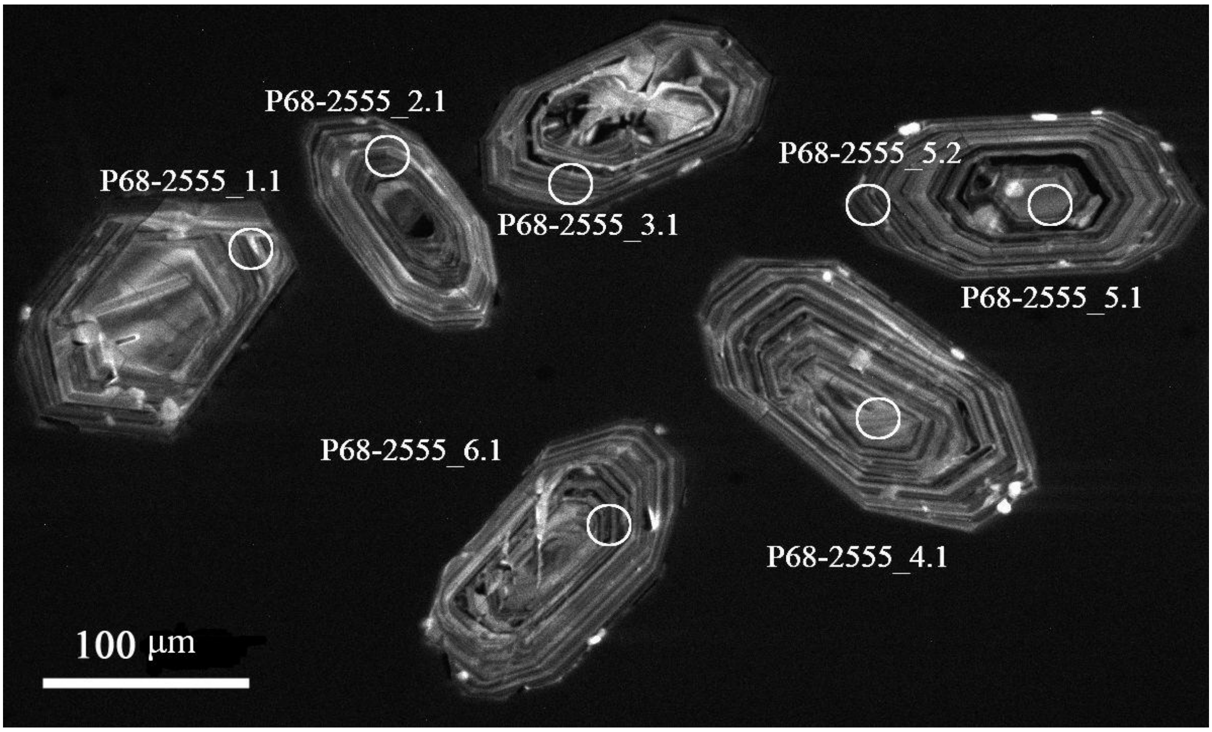

Figure 5. Photo of zircons from granites of the Kamennaya area in the rays of the cathodoluminescence.
Рисунок 5. Фото цирконов из гранитов Каменной площади в катодолюминесцентных лучах.

To obtain reliable age of the rock (igneous time of the introduction and crystallzation of the granites), we have conducted an isotopic study of accessory zircon (U–Pb method, the ion microprobe SHRIMP-II, A. P. Karpinsky Russian Geological Research Institute, analyst N. V. Rodionov). The mineral was highlight in the form of a monofraction from the granite of the Kamennaya area (sample Kam P68/2555 m). It was analyzed according to standard methods. Processing of the results and calculation of U–Pb ages was carried out using the program ISOPLOT/EX ver.3.66 [10]. Zircons are represented by well-formed prismatic crystals up to 150 microns in lengthening. In the rays of the cathodoluminescence crystals have zoning, often with a very distinct core (Fig. 5). According to the microprobe analysis, zircon is characterized by small impurities of hafnium (HfO_2 to 1.3 wt. %), yttrium (Y_2O_3 to 0.4 wt. %), thorium (ThO_2 up to 0.3 wt. %) and (UO_2 up to 0.3 wt. %). The mineral is non-metamict and is quite suitable for U–Pb-dating.

Most of the examined zircons (5 of 11 local analyses, see Table 5) mainly from the central part of crystals give concordant age 297.9 ± 3.8 million years (Fig. 6). Therefore, they correspond to the border of Permian and Carboniferous according to an

Table 5. U–Pb isotope data for zircons from granites of the Kamennaya area.
Таблица 5. U–Pb изотопные данные для цирконов из гранитов Каменной площади.

Points	Content				Age, million years	Isotopic ratio (1), ±%		
	%	ppm						
	$^{206}Pb_c$	$^{206}Pb^*$	U	Th	$^{206}Pb/^{238}U$	$^{207}Pb^*/^{235}U$	$^{206}Pb^*/^{238}U$	$^{207}Pb/^{206}Pb^*$
1.1	–	42.3	1029	445	301.6 ± 4.8	0.341 ± 2.5	0.0479 ± 1.6	0.0517 ± 1.9
2.1	1.06	43.9	1400	846	228.7 ± 3.5	0.246 ± 4.4	0.0361 ± 1.6	0.0495 ± 4.1
3.1	1.56	49.4	1371	731	260.9 ± 4.0	0.285 ± 4.9	0.0413 ± 1.6	0.0500 ± 4.6
4.1	0.10	34.3	838	592	299.9 ± 4.7	0.341 ± 2.8	0.0476 ± 1.6	0.0520 ± 2.3
5.1	0.08	37.6	913	537	301.4 ± 4.7	0.339 ± 2.8	0.0479 ± 1.6	0.0515 ± 2.3
5.2	–	53.9	1303	512	303.1 ± 4.6	0.344 ± 2.3	0.0482 ± 1.6	0.0518 ± 1.7
6.1	0.98	45.0	1325	1096	247.3 ± 3.8	0.262 ± 4.8	0.0391 ± 1.6	0.0487 ± 4.6
7.1	0.93	27.5	669	237	299.1 ± 4.9	0.339 ± 5.0	0.0475 ± 1.7	0.0518 ± 4.8
8.1	–	61.3	1573	642	286.2 ± 4.3	0.323 ± 2.2	0.0454 ± 1.5	0.0516 ± 1.5
9.1	3.94	41.5	1325	898	221.8 ± 3.8	0.231 ± 13	0.0350 ± 1.8	0.0479 ± 13
10.1	1.68	61.5	1911	1797	233.3 ± 3.6	0.251 ± 4.5	0.0369 ± 1.6	0.0493 ± 4.2

Note: Pb_c, Pb* are common and radiogenic lead, respectively; calibration errors are relative to standards 0.29 %; (1) – correction using ^{204}Pb.

international scale. Similar age (about 300 MA) is typical for the granitoids of the Shaim oil and gas area [11, 12]. The rims of zircon crystals of the Kamennaya area are characterized by the "rejuvenated" dating– 286, 261, 247, 233, 229 and 222 million years. Obviously they are similar to the aforementioned K–Ar and Rb–Sr dates and they are quite likely to reflect the late stages of tectonic activation of the West Siberian platform [13].

Conclusion

Thus, we have studied the material composition and age of granitoids in the basement of the Krasnoleninsky oil and gas region of Western Siberia. It is demonstrated that granites of the Kamennaya petroleum exploration area are an integral part of the regional Shaim-Kuznetsovsky anticlinorium. The time of the magmatic introduction and crystallization of granites of the Krasnoleninsky oil and gas area according to U–Pb dating of zircon is estimated at ≈300 million years. This is just like in the granitoids located near Shaim oil and gas area. The difference between U–Pb (297.9 ± 3.8 million years) and Rb–Sr (291.8 ± 2.1 million years) granite ages is likely to result from the gradual cooling of the granite massif. This happens because the uranium–lead isotope system closes at a higher temperature than the rubidium–strontium one. This phenomenon ("cooling") has been identified in many well–studied intrusive massifs [14 and others]. We have interpreted the "Mesozoic" numerals obtained by the K–Ar method as the time of the last tectonic–thermal events, most likely expressed in the form of granites propylitization.

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Возраст и состав гранитоидов из фундамента Красноленинского нефтегазоносного района (Западная Сибирь)

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Актуальность исследования заключается в слабой изученности кристаллического фундамента Западно-Сибирского мегабассейна.
Цель работы заключается в изучении вещественного состава и возраста гранитоидов из доюрского фундамента Красноленинского нефтегазового района Приуральской части Западно-Сибирского мегабассейна.
Методология исследования: детальное изучение минералогии, петрохимии, геохимии и возраста (разными изотопными системами с использованием K–Ar, Rb–Sr и U–Pb методов датирования) гранитов Красноленинского района.
Результаты. Детально изучена минералогия и петрогеохимия гранитов Красноленинского района. Установлено, что породы сложены кварцем, плагиоклазом (альбит и олигоклаз), калишпатом (микроклин и ортоклаз) и слюдой (аннит) с акцессорной минерализацией в виде рутила, апатита, магнетита, титанита, монацита, циркона и касситерита. Граниты подвержены пропилитизации, которая выражается в развитии вторичного карбоната, хлорита, серицита и альбита, а также сульфидной (халькопирит, галенит) и самородной (золото, серебро) минерализации. По петрогеохимическим характеристикам породы относятся к гранитоидам S-типа, источником вещества для них служили преимущественно осадочные горные породы. Граниты имеют раннепермские возраста, которые, по всей видимости, отражают процесс подъема гранитов на уровень верхней коры при рифтогенезе и растяжении всего региона.
Выводы. Граниты Каменной нефтеразведочной площади являются составной частью регионального Шаимско-Кузнецовского мегантиклинория. Время магматического внедрения и кристаллизации гранитов Красноленинского района оценивается в 300 млн лет, как и у гранитоидов рядом расположенного Шаимского НГР. Разница между U-Pb (297,9 ± 3,8 млн лет) и Rb-Sr (291,8 ± 2,1 млн лет) возрастами гранитов по всей видимости есть следствие постепенного остывания гранитного массива, т. к. уран-свинцовая изотопная система закрывается при более высокой температуре, чем рубидий-стронциевая. Полученные K-Ar методом «мезозойские» цифры трактуются нами как время последних тектоно-термальных событий, вероятнее всего, выразившегося в виде пропилитизации гранитов.

Ключевые слова: минералогия; возраст; граниты; доюрский фундамент; Каменная площадь; Красноленинский район; Западная Сибирь.

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