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Geology

Some Questions on Structure, Variscan Regional Metamorphism and Granitoid Magmatism of the Caucasian Terrane Crystallinicum

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ABSTRACT. Variscan regional metamorphism and granitoid magmatism of the Elbrus and Pass subzones of the Main Range structural zone of the Greater Caucasus considerably differ from each other. In particular, Bretonian granitoid magmatism is not manifested in the Pass subzone in contrast to the Elbrus one; composition and conditions of geodynamic formation of Sudetic granitoids of these zones considerably differ from each other; Sudetic regional metamorphism took place only in the Elbrus subzone; in the Pass subzone the intensive influence of Sudetic granitoids on enclosing rocks is fixed; Sudetic granitoids of the Elbrus subzone are by ~15 Ma younger, than granitoids of the Pass subzone, connected with the same orogeny. Taking into consideration that these subzones are different by types of fold structures, lithologic-formational content and conditions of their formation and by types of magmatism etc, the authors of paper think that structural-geological units of the Main Range zone of the Greater Caucasus - the Elbrus and Pass subzones can be to regarded as subterranes constituting the Greater Caucasian terrane. *© 2014 Bull. Georg. Natl. Acad. Sci.*

Key words: *the Greater Caucasus, regional metamorphism, granitoid magmatism, subterrane, zircon age.*

The Elbrus, Pass, Huko and Bambak subzones are identified within the Main Range zone of the Greater Caucasus (Fig. 1) [1]. Despite the similarity, in general, they differ from each other by a number of geological characteristics. In particular, they have different types of fold structures, lithologic-formational content and PT conditions of their formation and different types of magmatism etc. The subzones are separated from each other by the system of deep faults between which graben type narrow tectonic depressions built up of the Lower Jurassic sediments are developed.

Some researchers consider the tectonic division of the Caucasus on the basis of terrane analysis [2-5]. As it is known, the terrane is a large body of regional spreading, delimited by deep faults, and by geological structure and development history differs from other terranes of the same scale. It usually undergoes significant horizontal displacement in different directions within the oceanic area and as a result

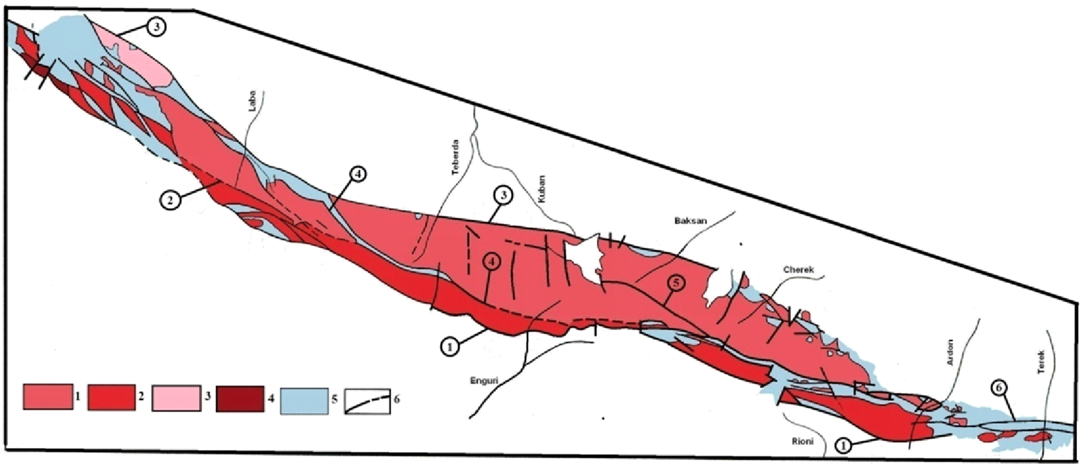

Fig. 1. Simplified scheme of tectonic zoning of the crystalline basement of the Main Range zone of the Greater Caucasus (after M.L. Somin [1]). The Main Range zone of the Greater Caucasus (1-4): 1 – the Elbrus, 2 – the Pass, 3 – the Huko and 4 – Bambak; 5 – tectonic depressions built up of the Lower-Middle Jurassic sediments, 6 – faults (figures in circles): 1 –the Main Range, 2 – Sanchar-Dzichec, 3 – Pshekish-Tirniauz, 4 – Alibek, 5 – Adil-Su and 6 – Buron-Lars.

ultimately joins the continent and turns into accretionary terrane [6]. Issuing from the explanation it is clear that the main range zone of the Greater Caucasus represents the Greater Caucasian terrane [3]. However, there is not any consideration about the main range zone composing subzones in the existing terrane division. According to the explanation [3, 7], the subterranes are bodies, which by analogy with terranes are delimited by faults, but do not undergo significant horizontal displacement and have similar, but not identical history of geological development. They join each other as a result of amalgamation or vertical accretion before accretion to the continental margin. Based on all the above mentioned and taking into consideration that structural-geological units (subzones) presented within the Greater Caucasian terrane completely correspond to the explanation of the term “subterrane”, it is correct to consider the Elbrus, Pass, Huko and Bambak subzones as subterranes.

Despite rather high level of knowledge in geology of the Greater Caucasian terrane, the correlative characterization of subterranes from this point of view is not carried out. The aim of the present paper is to make correlation between the Pass and Elbrus subzones according to the peculiarities of Variscan regional metamorphism and granitoid magmatism and to show more distinctly difference and similarity between them.

The Elbrus subzone. Variscan regional metamorphism of the Elbrus subzone rocks is connected with the Bretonian and Sudetic orogenies.

Both infrastructure (autochthon) and suprastructure (allochthon) pre-Late Variscan formations of the Elbrus subzone underwent Bretonian regional metamorphism.

Bretonian regional metamorphism of infrastructure corresponds to the P-T conditions of facies of biotite-muscovite gneisses (low- and moderate temperature amphibolites facies) –T - 500-620°C, depth 9-11 km [8], but its K-Ar age is determined as 350-360 Ma [9].

As to formations of suprastructure of the Elbrus subzone, it should be mentioned that all its exposures represent separate fragments of indivisible in the past meganappe (so-called Macera nappe). All the fragments are overthrust from the Pass subzone to the Elbrus subzone after undergoing the Bretonian regional metamorphism in situ [10].

Sudetic regional metamorphism of the Elbrus subzone, being synchronous with granite formation, corresponds to retrograde type of metamorphism and temperature conditions of its green schist facies. With Sudetic metamorphism microclinization processes

Table 1. U-Pb and Lu-H fisotopic data of zircons from the Late Variscan granitoids of the Greater Caucasian terrane

Spot	Th/U	^{207}Pb/^{206}Pb	±1σ	^{206}Pb/^{238}U	±1σ	^{207}Pb/^{235}U	±1σ	error corr.	^{206}Pb/^{238}U (Ma±1σ)	age	^{176}Hf/^{177}Hf	±1σ	^{176}Lu/^{177}Hf	±1σ	εHf(T)	±1σ	T_{DM}	T_{DM}^{C}
								The Pass sub-zone										
57-A	**wt. mean = 325.3 ± 2.5 Ma (2σ)**																	
57-A-01	0.645	0.05426	0.00059	0.05201	0.00095	0.38911	0.00925	0.768	327.0	6.0	0.282363	11	0.001860	18	-7.7	0.4	1285	1823
57-A-02	0.076	0.05469	0.00051	0.05141	0.00093	0.38761	0.00830	0.845	323.0	6.0	0.282354	7	0.000629	5	-7.8	0.3	1255	1826
57-A-03	0.211	0.05423	0.00058	0.05194	0.00094	0.38831	0.00908	0.774	326.0	6.0	0.282341	9	0.000549	9	-8.2	0.3	1272	1856
57-A-04	0.204	0.05351	0.00049	0.05173	0.00093	0.38167	0.00804	0.853	325.0	6.0	-	-	-	-	-	-	-	-
57-A-05	0.476	0.05371	0.00049	0.05185	0.00092	0.38394	0.00802	0.849	326.0	6.0	0.282369	8	0.001175	2	-7.4	0.3	1253	1802
57-A-06	0.541	0.05243	0.00049	0.05191	0.00093	0.37523	0.00804	0.836	326.0	6.0	0.282344	9	0.001891	14	-8.4	0.3	1314	1867
57-A-07	0.275	0.05252	0.00049	0.05112	0.00091	0.37019	0.00785	0.839	321.0	6.0	0.282374	9	0.000745	2	-7.1	0.3	1231	1783
57-A-08	0.162	0.05279	0.00067	0.05093	0.00078	0.37070	0.00905	0.627	320.0	5.0	0.282248	8	0.000527	1	-11.5	0.3	1399	2062
57-A-09	0.308	0.05438	0.00051	0.05208	0.00092	0.39044	0.00833	0.828	327.0	6.0	0.282350	9	0.000517	4	-7.9	0.3	1258	1835
57-A-10	0.235	0.05385	0.00051	0.05113	0.00090	0.37961	0.00815	0.820	321.0	6.0	0.282325	9	0.000587	0	-8.8	03	1294	1891
57-A-11	0.143	0.13232	0.00103	0.39794	0.00689	7.25944	0.12743	0.986	2160.0	32.0	0.281229	9	0.000684	1	-8.0	0.3	2795	3203
57-A-12	0.277	0.05476	0.00050	0.05190	0.00091	0.39179	0.00815	0.843	326.0	6.0	0.282314	9	0.000995	3	-9.2	0.2	1323	1920
57-A-13	0.200	0.05762	0.00055	0.06555	0.00116	0.52068	0.01123	0.820	409.0	7.0	0.282277	7	0.000699	3	-8.7	0.2	1365	1949
57-A-14	0.059	0.05307	0.00063	0.05174	0.00094	0.37854	0.00949	0.725	325.0	6.0	0.282329	9	0.000926	7	-8.7	0.2	1300	1887
57-A-15	0.240	0.05534	0.00054	0.05346	0.00095	0.40783	0.00889	0.815	336.0	6.0	–	–	–	–	–	–	–	–
57-A-16	0.152	0.05317	0.00092	0.05188	0.00096	0.38034	0.01227	0.574	326.0	6.0	0.282342	10	0.000431	5	-8.2	0.4	1266	1852
57-A-17	0.106	0.05260	0.00083	0.05111	0.00096	0.37063	0.01128	0.617	321.0	6.0	0.282310	9	0.000473	3	-9.3	0.3	1311	1923
57-A-18	0.283	0.05252	0.00095	0.05118	0.00097	0.37051	0.01226	0.573	322.0	6.0	0.282371	10	0.001328	14	-7.3	0.3	1255	1798
57-A-19	0.588	0.05318	0.00045	0.05164	0.00091	0.37858	0.00739	0.903	325.0	6.0	0.282255	11	0.003309	50	-11.9	0.4	1498	2084
57-A-20	0.365	0.05220	0.00065	0.05277	0.00095	0.37974	0.00986	0.693	332.0	6.0	0.282310	11	0.001210	4	-9.4	0.4	1336	1932
57-A-21	0.314	0.06224	0.00056	0.10633	0.00190	0.91232	0.01868	0.873	651.0	11.0	0.282035	8	0.000516	1	-11.9	0.3	1691	2334
57-A-22	1.111	0.11227	0.00094	0.32498	0.00585	5.03025	0.09682	0.935	1814.0	28.0	0.281608	8	0.000905	5	-1.3	0.3	2295	2572
57-A-23	0.463	0.06847	0.00058	0.13704	0.00245	1.29368	0.02507	0.923	828.0	14.0	0.282234	8	0.000778	1	-1.2	0.3	1427	1792
57-A-24	0.662	0.05463	0.00098	0.05198	0.00097	0.39157	0.01282	0.570	327.0	6.0	0.282438	10	0.001457	10	-5.0	0.3	1164	1650
57-A-25	1.111	0.06274	0.00054	0.10567	0.00189	0.91407	0.01816	0.900	648.0	11.0	0.282022	8	0.000763	3	-12.6	0.3	1719	2371
57-A-26	1.613	0.05915	0.00091	0.09904	0.00185	0.80768	0.02407	0.627	609.0	11.0	0.281888	9	0.000931	4	-18.2	0.3	1912	2696
57-A-27	1.961	0.05750	0.00197	0.08302	0.00165	0.65807	0.03361	0.389	514.0	10.0	0.282245	8	0.000344	4	-7.5	0.3	1397	1950
57-A-28	0.319	0.06283	0.00057	0.10738	0.00193	0.93023	0.01922	0.870	658.0	11.0	0.282306	8	0.000691	3	-2.3	0.3	1325	1733
57-A-29	1.075	0.06583	0.00172	0.10470	0.00207	0.95021	0.04034	0.466	642.0	12.0	0.282137	9	0.000909	3	-8.7	0.3	1567	2124
57-A-30	1.136	0.05337	0.00050	0.05195	0.00094	0.38229	0.00811	0.853	326.0	6.0	0.282335	8	0.002097	83	-8.8	0.3	1333	1889
57-A-31	0.671	0.05348	0.00062	0.05163	0.00094	0.38065	0.00946	0.733	325.0	6.0	0.282403	10	0.002335	34	6.4	0.4	1244	1741
57-A-32	0.465	0.06240	0.00058	0.08502	0.00155	0.73137	0.01546	0.862	526.0	9.0	0.282278	8	0.001126	9	-6.3	0.3	1379	11885
57-A-33	1.000	0.06141	0.00097	0.09797	0.00186	0.82952	0.02537	0.621	603.0	11.0	0.282305	10	0.001104	6	-3.7	0.4	1341	1779
57-A-34	0.362	0.06166	0.00051	0.10721	0.00192	0.91143	0.01714	0.952	657.0	11.0	0.282323	8	0.000482	4	-1.6	0.3	1294	1689
57-A-35	1.010	0.07333	0.00062	0.16937	0.00306	1.71232	0.03321	0.932	1009.0	17.0	0.282031	8	0.001038	0	-4.3	0.3	1720	2135

continued

The Elbrus sub-zone

GK15GR	**wt. mean = 309.1 ± 2.5 Ma (2σ)**																		
GK15GR-01	0.268	0.05380	0.00047	0.04874	0.00090	0.36155	0.00723	0.923	307.0	6.0	0.282405	12	0.001002	3	-6.4	0.4	1196	1727
GK15GR-02	0.272	0.05293	0.00045	0.04837	0.00089	0.35296	0.00675	0.962	305.0	5.0	0.282493	11	0.001143	17	-3.3	0.4	1077	1532
GK15GR-03	0.275	0.05369	0.00048	0.04844	0.00090	0.35855	0.00735	0.906	305.0	6.0	0.282479	12	0.001214	6	-3.8	0.4	1099	1565
GK15GR-04	0.239	0.05283	0.00045	0.04927	0.00091	0.35887	0.00696	0.952	310.0	6.0	0.282472	10	0.001064	2	-4.0	0.4	1105	1579
Spot	**Th/U**	**$^{207}Pb/^{206}Pb$**	**±1σ**	**$^{206}Pb/^{238}U$**	**±1σ**	**$^{207}Pb/^{235}U$**	**±1σ**	**error corr.**	**$^{206}Pb/^{238}U$ (Ma±1σ)**	**age**	**$^{176}Hf/^{177}Hf$**	**±1σ**	**$^{176}Lu/^{177}Hf$**	**±1σ**	**εHf(T)**	**±1σ**	**T_{DM}**	**T_{DM}^{C}**
GK15GR-05	0.474	0.05198	0.00047	0.04865	0.00090	0.34869	0.00726	0.889	306.0	6.0	0.282526	13	0.000966	6	-2.1	0.5	1026	1456
GK15GR-06	0.298	0.05343	0.00047	0.04909	0.00091	0.36164	0.00734	0.913	309.0	6.0	0.282466	14	0.001052	6	-4.2	0.5	1113	1592
GK15GR-07	0.309	0.05203	0.00052	0.04910	0.00092	0.35219	0.00800	0.825	309.0	6.0	0.282530	13	0.000921	9	-1.9	0.5	1019	1445
GK15GR-08	0.289	0.05334	0.00045	0.04931	0.00091	0.36265	0.00703	0.925	310.0	6.0	0.282423	10	0.001142	4	-5.8	0.4	1177	1690
GK15GR-09	0.337	0.05208	0.00045	0.04969	0.00092	0.35680	0.00701	0.942	313.0	6.0	0.282497	14	0.001095	2	-3.2	0.5	1071	1523
GK15GR-10	0.282	0.05212	0.00110	0.04929	0.00095	0.35422	0.01281	0.533	310.0	6.0	0.282431	14	0.001367	11	-5.5	0.5	1171	1673
GK15GR-11	0.221	0.05352	0.00048	0.04929	0.00092	0.36366	0.00741	0.916	310.0	6.0	0.282494	14	0.001245	8	-3.3	0.5	1079	1532
GK15GR-core	0.758	0.06224	0.00058	0.10270	0.00191	0.88117	0.01891	0.867	630.0	11.0	0.282408	12	0.000668	1	0.7	0.4	1183	1521
GK15GR-12	0.352	0.05344	0.00047	0.04904	0.00091	0.36134	0.00728	0.921	309.0	6.0	0.282427	13	0.001255	10	-5.7	0.4	1174	1682
GK15GR-13	0.292	0.05284	0.00045	0.04944	0.00095	0.36018	0.00706	0.949	311.0	6.0	0.282451	11	0.001532	2	-4.9	0.4	1148	1631
GK15GR-14	0.362	0.05277	0.00047	0.05028	0.00094	0.36573	0.00745	0.918	316.0	6.0	0.282428	13	0.001150	7	-5.6	0.5	1169	1678
GK15GR-15	0.299	0.05224	0.00045	0.04857	0.00090	0.34979	0.00683	0.949	306.0	6.0	0.282445	12	0.001412	6	-5.1	0.4	1153	1643
GK15GR-16	0.292	0.05236	0.00046	0.04950	0.00092	0.35730	0.00716	0.927	311.0	6.0	0.282479	14	0.001217	7	-3.8	0.5	1099	1565
GK15GR-17	0.342	0.05442	0.00053	0.04872	0.00092	0.36551	0.00815	0.847	307.0	6.0	0.282421	15	0.001059	3	-5.8	0.5	1176	1692
GK15GR-18	0.331	0.05371	0.00046	0.04968	0.00093	0.36788	0.00726	0.949	313.0	6.0	0.282473	11	0.001582	8	-4.1	0.4	1118	1582
GK15GR-19	0.324	0.05210	0.00121	0.04845	0.00094	0.34804	0.01356	0.498	305.0	6.0	0.282480	13	0.001070	4	-3.8	0.5	1094	1561
GK15GR-20	0.2.04	0.05328	0.00049	0.04939	0.00093	0.36274	0.00763	0.895	311.0	6.0	0.282448	12	0.000782	6	-4.8	0.4	1130	1629
GK15GR-21	0.120	0.06328	0.00069	0.10241	0.00193	0.89343	0.02159	0.780	629.0	11.0	0.282491	12	0.000293	6	3.8	0.4	1056	1325
GK15GR-22	0.746	0.05360	0.00054	0.04831	0.00090	0.35700	0.00817	0.814	304.0	6.0	0.282400	15	0.001136	10	-6.6	0.5	1208	1741
GK15GR-23	0.410	0.06479	0.00067	0.11300	0.00213	1.00935	0.02344	0.812	690.0	12.0	0.282295	13	0.000908	4	-2.1	0.4	1347	1743
GK15GR-24	0.794	0.05447	0.00081	0.05028	0.00096	0.37753	0.01111	0.649	316.0	6.0	0.282413	12	0.000780	2	-6.1	0.4	1178	1707

regional scale are associated. This process affected both rocks of infrastructure and suprastructure [11].

In the Elbrus subzone granitoids connected with Bretonian and Sudetic orogenies are spread [2].

Bretonian granitoids are spread only within the infrastructure and are represented by two varieties [2]: 1- biotite and bimica bearing plagiogranites, plagiogneisses and granitic gneisses and 2 – biotite-hornblende and hornblende bearing plagiogranites, plagiogneisses and quartz-diorites, granodiorites and granitic gneisses.Biotite and bimica bearing plagiogranites and plagiogneisses belong to I type granites, but granitic gneisses to S type, occupying intermediate position between the MPG and KCG groups [2, 12]. The heat sources of formation of these anatectic granitoids are: radioactive decay, dissipative heat generated during the subduction and the heat delivered from fluid streams. Hornblende bearing granitoids belong to I group and ACG type granitoids [2, 12]. The heat source of their formation is mainly subductive dissipative heat. K-Ar age dating of the Elbrus subzone Bretonian granitoids shows 355-365 Ma [9].

Sudetic granitoids of the Elbrus subzone are represented by two varieties: 1- porphyroblastic (microcline porphyroblasts) biotite and bimica bearing granitoids (Kassar or Dariali type) and 2 – equigranular bimica bearing granitoids (Ulukam type).

Porphyroblastic granitoids are subductional, island arc and also mantle-island arc formations, 60% of which corresponds to S type of granites, but other 40% to I type. They show signs of MPG and CPG, as well as KCG groups of granitiods [2, 13]. The heat sources of formation of these granitoids are:the heat supplied from fluid streams, subduction heat, radioactive decay and heat generated from basic magma intrusion. As it was mentioned earlier, microclinization was a regional scale process, which underwent infrastructure rocks of different composition and age. As a result, there is widespread microcline porphyroblasts bearing migmatites, quartz-diorites and gabbros. The age of microclinized granitoids is fully corroborated by the authors with the help of LA-ICP-MSU-Pb (^{206}Pb/^{238}U) (Lazer ablation inductively coupled plasma mass-spectrometry) zircon dating. The result of age dating of 22 grains of zircons is mean 309.1±2.5 Ma (Table 1 and Fig. 2). According to other authors [14], K-Armuscovite age of pegmatites from the same granitois is 321±6 Ma.

Sudetic equigranular granitoids (granodiorites and granites) of the Elbrus subzone are postmetamorphic formations. After their petrochemical and geochemical parameters they belong to I and S types and MPG and T groups of subductional, island arc and crustal-anatectic granitoids [2, 13 and 15]. The heat sources of formation of the granitoids are: subductiondissipative heat, radioactive decay and heat generated during the Macera nappe displacement, as well as rising of geothermal gradient provoked by thickening of the Earth's crust as a result of nappe formation [2]. The age of equigranular granitoids according to A. Dolya [16] (K-Ar, Ar-Ar, U-Pb) varies within the limits of 301-308 Ma.

The Pass subzone. In the Pass subzone Variscan regional metamorphism is conditioned by Bretonian orogeny only. The lower part of metamorphic complex (autochthone) is metamorphosed in P-T conditions of facies of biotite-muscovite gneisses (low- and moderate temperature amphibolite facies), corresponding to T – 530-630°C and depth <12 km. P-T conditions (T–350-530°C, depth – <5.5km) of regional metamorphism of the upper part of the complex occupies rather wide interval: from garnet subfacies of greenschist facies to andalusite-biotite-muscovite facies inclusive (from moderate temperature green schists facies to epidote-amphibolite facies) [8]. K-Ar age dating shows 350-360 Ma [9]. In the Late Variscan formations of the Pass subzone (the Gvandra unit, Klich tectonic plate, gabbro-diorite intrusions) strong influence of Sudetic alaskaites and aplites is fixed accompanied by appearance of cummingtonite, garnet, quartz and sphene.

In the Pass subzone Variscan granitoid magmatism is represented by postmetamorphic Sudetian

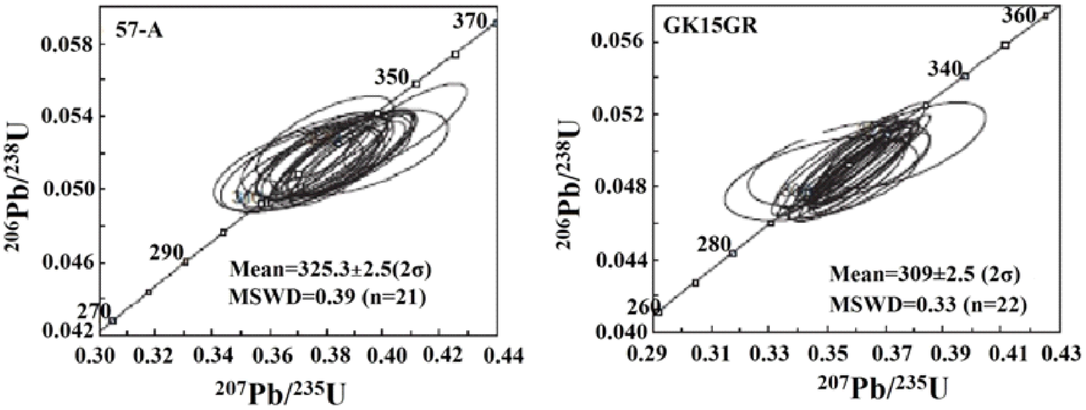

Fig. 2. Concordia diagrams of zircon U-Pb LA-ICP-MS dating results for the Late Variscan granitoids of the Greater Caucasus. Samples: GK15GR-Daryali massif, 57-A Sakeni intrusive.

granitoids: biotite and biotite-hornblende bearing quarz-diorites, plagiogranites and granodiorites and alaskites and aplites as well. After I. Gamkrelidze and D. Shengelia [2], initial magma of these granitoids is generated in the thinned crust of the Pass subzone – in the lower part of the metamorphic complex during the Sudetic orogeny. By A. Okrostsvaridze [17], the basement, where granite formation took place, was located directly over the subduction plate, representing an ensimatic zone transitional between the oceanic and continental crusts. Variscan granitoids of the Pass subzone are subduction mantle-crustal formations of I and ACG type granitoids, but by conditions of geodynamic formation they belong to U group of granitoids [2, 13, 15]. The heat sources of formation of the granitoids are: subduction dissipative heat, fluid streams and the heat generated from basic magma while cooling. The age of the granitoids is corroborated by the authors with the help of LA-ICP-MSU-Pb zircon dating in 21grains of zircons and shows mean 325.1±2.5 Ma (see Table 1 and Fig. 2).

Results of U-PbLA- ICP-MS zircon dating (see Table 1) of Late Variscan granitoids of the Elbrus and Pass subzones show that the rocks of the first subzone are by ~15 Ma younger than the rocks of the second one. In the granitoids of the Elbrus subzone the inherited age of zircons is fixed only in 3 crystals and occupies small interval – 630-690 Ma, but in the same rocks of the Pass subzone the inherited age of zircons is determined in 14 crystals covering the interval – 400-1800 Ma. The other main isotope parameters of zircons from these granitoids are different as well. In particular, Th/U ratio in zircons from granitoids of the Elbrus subzone covers smaller interval (0.221-0.794), than in zircons from granitoids of the Pass subzone (0.076-1.136); although in zircons from the granitoids of both subzones the negative value of $\varepsilon_{Hf}(T)$: -50 – -11.0 is fixed, but this value is considerably lower in the zircons from the granitoids of the Elbrus subzone; the value $T_{DM}{}^{C}$ in zircons from granitoids of the Pass subzoneis higher (1650-2084), than in zircons from granitoids of the Elbruss subzone (1445-1741).

Thus, the correlation of Variscan regional metamorphism and granitoid magmatism of the Elbrus and Pass subzones shows that:

- Bretonian granitoid magmatism is not manifested in the Pass subzone in contrast to the Elbrus one;
- Composition and conditions of geodynamic formation of Sudeticgranitoids of these zones considerably differ from each other;
- Sudetic regional metamorphism took place only in the Elbrus subzone;
- In the Pass subzone the intensive influence of Sudeticgranitoids on enclosing rocks is fixed;
- Sudetic granitoids of the Elbrus subzone are by ~15 Ma younger thangranitoids of the Pass subzone connected with the same orogeny.

In addition, it should be mentioned that the main part of rocks building the infrastructure of the Elbrus subzone are sialic rocks represented by crystalline schists, migmatites and gneisses, but rocks of basic composition are less spread. The majority of rocks of the Pass subzone metamorphic complex (the Klich, Damkhurts and Mamkhurts units) is of the basic composition and is represented by amphibolites, amphibole bearing schists and sometimes by gneisses.

Based on all the above mentioned, the authors of the present paper think that structural-geological units - the Elbrus and Pass subzones distinguished within the Main Range zone of the Greater Caucasus could be considered as subterranes constituting the Caucasian terrane.

გეოლოგია

ზოგიერთი საკითხი კავკასიონის კრისტალინიკუმის აგებულების, ვარისკული რეგიონული მეტამორფიზმისა და გრანიტოიდული მაგმატიზმის შესახებ

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სტატიაში მოცემულია კავკასიონის მთავარი ქედის სტრუქტურული ზონის იალბუზისა და საუღელტეხილო ქვეზონების შედარება ვარისკული რეგიონული მეტამორფიზმისა და გრანიტოიდული მაგმატიზმის მიხედვით. ნაჩვენებია, რომ კავკასიონის მთავარი ქედის სტრუქტურული ზონის იალბუზისა და საუღელტეხილო ქვეზონების ვარისკული რეგიონული მეტამორფიზმი და გრანიტოიდული მაგმატიზმი მკვეთრად განსხვავებულია. კერძოდ, ბრეტონული გრანიტოიდული მაგმატიზმი, იალბუზის ქვეზონისგან განსხვავებით, საუღელტეხილო ქვეზონაში გამოვლენილი არ არის; მნიშვნელოვნად განსხვავებულია ამ ქვეზონების სუდეტური გრანიტოიდების შედგენილობა და ფორმირების გეოდინამიკური პირობები; სუდეტური რეგიონული მეტამორფიზმი მხოლოდ იალბუზის ქვეზონაშია განვითარებული; საუღელტეხილო ქვეზონაში აღინიშნება სუდეტური გრანიტოიდების ძლიერი ზეგავლენა შემცველ ქანებზე; ორივე ქვეზონის სუდეტური გრანიტოიდების ცირკონების U-Pb LA ICP MS მეთოდით დათარიღება გვიჩვენებს, რომ იალბუზის ქვეზონის სუდეტური გრანიტოიდები უფრო ახალგაზრდაა (~15 მლნ. წელი) საუღელტეხილო ქვეზონის ამავე ოროფაზისთან დაკავშირებულ გრანიტოიდებთან შედარებით. აღსანიშნავია აგრეთვე, რომ იალბუზის ქვეზონის ინფრასტრუქტურის ამგები ქანების უდიდესი ნაწილი სიალური ქანებია და წარმოდგენილია კრისტალური ფიქლებით, მიგმატიტებით და გნეისებით, ხოლო ფუძე შედგენილობის მეტამორფიტები დამორჩილებულ როლს თამაშობს. საუღელტეხილო ქვეზონის შემადგენელი

მეტამორფული კომპლექსის ქანების ძირითადი ნაწილი კი ფუძე შედგენილობისაა და წარმოდგენილია ამფიბოლიტებით, ამფიბოლიანი ფიქლებით, და ზოგჯერ გნეისებით. იმის გათვალისწინებით, რომ ეს ორი ქვეზონა მნიშვნელოვნად განსხვავდება ერთმანეთისაგან ნაოჭა სტრუქტურების ფორმებით, ლითოლოგიურ-ფორმაციული შედგენილობით და მათი ფორმირების პირობებით, ფუძე მაგმატიზმის ხასიათით და სხვ., მართებულად ვთვლით, რომ კავკასიონის მთავარი ქედის ზონის ფარგლებში გამოყოფილი სტრუქტურულ-გეოლოგიური დანაყოფები - იალბუზის და საუღელტეხილო ქვეზონები განვიხილოთ როგორც კავკასიონის ტერეინის შემადგენელი სუბტერეინები.

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