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Geology

Zircons U-Pb Geochronology of the Ore-Bearing Plutons of Adjara-Trialeti Folded Zone, Lesser Caucasus and Analysis of the Magmatic Processes

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ABSTRACT. Zircons of the major ore-bearing plutons (Merisi, Namonastrali, Vakijvari, Zoti, Okros-Ghele and Rkviana) of the Adjara-Trialeti Paleogene folded zone of the Lesser Caucasus were dated by the U-Pb method using the Laser Ablation ICP-MS tool at the isotope laboratory of the Department of Earth Sciences at the National Taiwan University. The results are almost identical and are as follows: Merisi (diorite), sm. #12Ge-03=43.42±0.61 Ma; Merisi (syenite) sm.#12Ge-04=42.78±0.65 Ma; Namonastrali (diorite) sm. #12Ge-05=42.42±0.5 Ma; Namonastrevi (diorite) sm.#12Ge-06=42.03±0.83 Ma; Vakijvari (syenite) sm.#12Ge-13=43.26±0.74 Ma; Zoti (syenite) sm. #12Ge-15 =43.86±0.43 Ma; Zoti (gabbro) sm.#12Ge-16=46.77±0.81 Ma; Okros-Ghele (syenite) sm. #12Ge=19-44.34±0.55 Ma; Rkviana (gabbro) sm. #12Ge-21=44.85±0.59 Ma. Based on the analysis of the results, it is obvious that the ore bearing plutons of the Adjara-Trialeti zone were intruded through the volcanic-sedimentary rocks within a short time interval, between 46-42 Ma. It should be noted that according to paleontological data, the peak of volcanic activity in the Ajara-Trialeti folded zone was similarly dated as the Middle Eocene. If we rely on these data and accept the results of the plutons zircons dating by U-Pb method above, we should assume that the volcanic activities in the region were shortly followed by plutonic injections. Proceeding from the above and the petrological-geochemical analysis of the rocks, we assert, that volcanic and plutonic formations of the Adjara-Trialeti zone are the products of the same magmatic source activity and their formation was not significantly separated in time. *© 2018 Bull. Georg. Natl. Acad. Sci.*

Key words: Zircon, U-Pb geochronology, Adjara-Trialeti folded zone, plutons

Adjara-Trialeti was formed as a rift zone by the end of the Cretaceous, developed during the Paleogene, by the end of which it underwent folding [1, 2]. It is mainly constructed by trachytic and trachytic-andesitic volcanogenic-sedimentary rocks, though plutonic rocks also play an important role in the structure, which are mainly represented by syenite, montzonite and gabbro. Based on modern research data, syenite-trachytic magmatic activity can develop at subduction zones [3], mantle plume activity regions [4], post-collisional tectonic areas [5] and aslo continental rifting environments [6]. In all cases, formation of this type of magmatism is determined by the influence of the mantle magma on the lithosphere and the subsequent processes of hybridism, assimilation and metasomatism.

Plutons of Adjara-Trialeti folded zone form different types and scale bodies that cut igneous sedimentary rocks. There is no information on isotopic age of these bodies in the scientific literature, though some opinions are expressed based on the type of the contact the bodies make with the hosting igneous sedimentary formations. According to paleontological data, the volcanic-sedimentary formations are dated by middle Eocene [7]. Some researchers think that Adjara-Trialeti zone plutonic bodies are synchronous with volcanic activity, and therefore consider them as middle Eocene [8], while others distinguish several phases of intrusion [9].

It is noteworthy that intensive processes of hydrothermal ore mineralization are often developed in the contact zones of igneous sedimentary rocks with plutonic bodies, resulting in formation of the most important orefields like Merisi, Vakijvari, Zoti etc. [10]. According to the general opinion of the researchers, all of the above-mentioned ore occurrences are genetically related to plutonic injections, which is why determination of real, isotopic age is very important from both scientific and the practical point of view. In order to fill this gap, zircons from volcanic and plutonic rocks of Adjara-Trialeti zone were dated by U-Pb method. In total, 21 samples were dated, including 10 samples from ore-bearing pluton: Merisi, Namonastrali, Vakijvari, Zoti, Okros-Ghele and Rkviana. The results and the analysis of the magmatic processes of Adjara-Trialeti zone, are reviewed in the paper.

Materials and Methods

The geological field works were based on the classical principles of geology, during which, 6-7 kg relatively fresh rock samples were taken from each pluton, with almost two hundred zircon crystals separated and dated.

The zircon U-Pb dating was conducted at National Taiwan University, Taipei, Taiwan. After moaning the zircons on epoxy resin, cathodoluminescence (CL) images were taken for checking the internal textures of the zircon grains and selecting the suitable positions for in-situ U-Pb analyses. Measurement of zircon U-Pb isotopic analysis was performed by using Agilent 7500s ICP-MS coupled with a New Wave UP213 laser ablation system equipped at the Department of Geosciences, National Taiwan University following the analytical procedures by Chiu et al. [11].

Brief geological description of Adjara-Trialeti folded zone

Within the present structure of the Lesser Caucasus, the Adjara-Trialeti represents a rift-folded zone that is distinctly expressed in space and time, spread sub-meridionally from the east of Tbilisi (v. Azamburi) to the west as far as the Black Sea. The length of the zone is over 350 km, gradually expanding from East to West in width, reaching more than 50 km at the Black Sea. The northern border of Adjara-Trialeti zone is well expressed in modern terrain and represents a tectonic suture with the Trans-Caucasian massif, along which rocks of the zone form over-trusting structures towards the north. The southern border that passes at the Artvin-Bolnisi massif, is covered by Late Cenozoic, thick, sub-aerial pyroclastic material and lava flows, what makes its detailed research almost impossible. Additionally, along the border, Late Cenozoic magmatic melts are intruded within the Adjara-Trialeti folded zone.

Currently, the Ajara-Trialeti zone is considered as continental rift structure [1, 2], formed in the Late Cretaceous by stretching the pre-Mesozoic crystalline basement, which is proved by immediate occurrence of Late Cretaceous rocks on the basement at some areas of the Trialeti ridge central part [7]. This is also confirmed by geophysical data of the central and eastern part of Adjara-Trialeti zone. It should be noted that the formation of the Ajara-Trialeti rift structure caused separation of the Artvin-Bolnisi block from the south-western part of the Trans-Caucasus massif.

Analysis of geological development of the region shows that an intensive transgression starts within the Adjara-Trialeti zone in the beginning of Paleogene, resulting in deposition predominantly of terrigenic Borjomi flysch [7]. The transgression proceeded continuously and reached its maximum in the Middle Eocene, with the activation of igneous sedimentary process.

In the eastern part of the Adjara-Trialeti region, middle Eocene igneous sedimentary formation is divided into two parts almost everywhere: the lower - stratified, tuffogenic and upper - massive tuff-breccias. Within the limits of the Trialeti ridge maximum thickness of the Middle Eocene igneous sedimentary formation does not exceed 2000 m [7]. To the west, thickness of the middle Eocene igneous formation increases and reaches 2.5 - 3 km in Borjomi district. The middle Eocene volcanogenic formation of the Ajara-Trialeti zone has its maximum thickness (up to 5000 m) in the extreme western part of the zone, in Adjara and south Guria. Here, two series of middle Eocene volcanic rocks are spread: calc-alkaline - (lower) and sub-alcaline - (upper). The latter, with mostly basic composition, is more widely spread [8].

Brief description of ore-bearing plutons

Plutonic formations play an important role in the construction of Adjara-Trialeti folded zone (Fig. 1). The role is especially large in post-magmatic hydrothermal alteration of volcagenogenic-sedimentary rocks and formation of ore mineralized areas. They are represented by cutting bodies of different size and shape, with the composition varying from gabbro to syenite. These petrographic varietes do not form independent cutting phases, replacing each other gradually. The chemical composition of plutons is relatively more acidic than that of the igneous sedimentary rocks, and the origin is complex as far as they are the products of both assimilation of roofing rocks and mantle injections, and the crystalline fractionation at the magmatic chamber. Contacts of plutons with the host tuffogenic rocks are active everywhere and characterized by endocontact alteration and post-magmatic intensive hydrothermal processes. It should be noted that numerous ore mineralization zones of the region are related exactly to such alteration areas [10].

Merisi pluton outcrops in Adjara, in the r. Akavreta gorge, left tributary of the r. Adjaris-Tskali. It has ellipsoidal form of latitudinal stretching, and its outcropped area amounts 10.8 km^2. The pluton is mainly constructed of gabbro, diorite, monzonite and syenite. Formation of Merisi ore-field genetically is related to this pluton injection.

Namonastrevi pluton outcrops in the r. Tiknara basin, at village Namonastrevi. The area of pluton amounts 5.2 km^2 and is constructed by the same rocks as Merisi pluton.

Vakijvari pluton is located in Guria region and outcrops in the rr. Natanebi and Bzhuzha gorges. There are 8 outcrops at modern erosion level and relatively big outcrops are Bzhuzha (15 km^2), Vakijvari (3 km^2) and Korisbude (1.5 km^2). Most of the Vakijvari pluton is represented by pyroxene-biotitic and biotitic syenites, and relatively small amount of gabbro-monzonites. Formation of the Vakijvari ore-field is genetically related to this pluton.

Zoti pluton outcrops in the r. Tetri-Ghele basin - right tributary of the r. Gubazeuli, and occupies about 4.5 km^2 area. It is constructed by gabbro-diorite-monzonites, and formation of Zoti orefield is related to this pluton injection.

Okros-Ghele pluton outcrops in the r. Okros-Ghele gorge - left tributary of the r. Gubazeuli. The

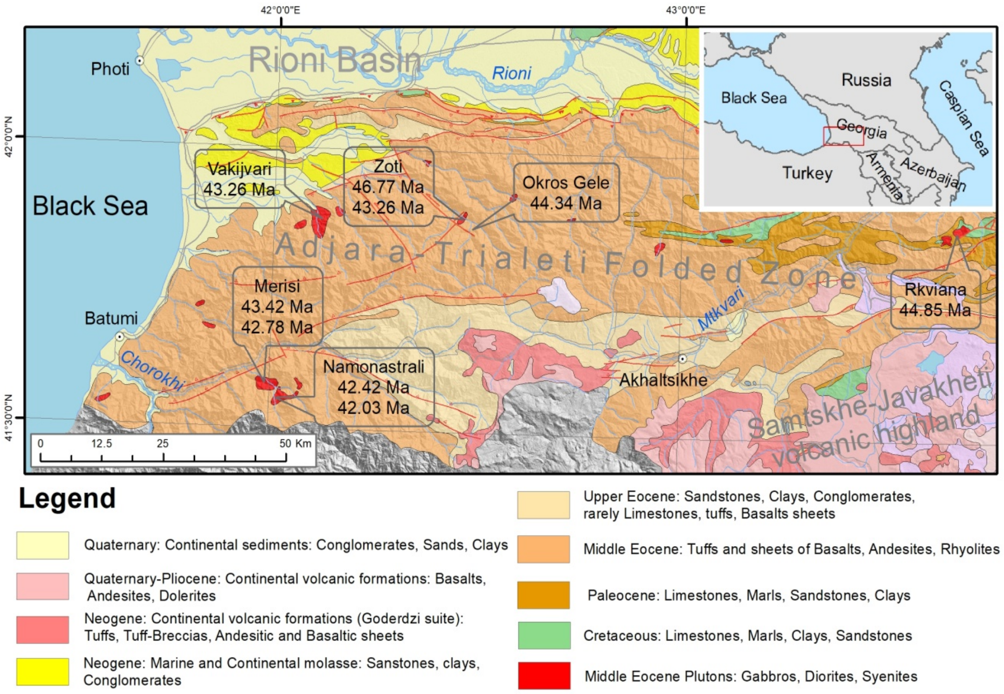

Fig. 1. Schematic-geological map of the Adjara-Trialeti Paleogene folded zone (adapted according to I. Gamkrelidze) [13] and zircons U-Pb dating results.

outcropped area of the pluton is small - 200m^2. It is represented by massive, medium-grained biotitic syenites.

Rkviana pluton outcrops in the r. Saterdze sources, left tributary of the r. Dzama, in Inner Kartli, and constructs most areas of the Rkviana and Shuano mounts. The pluton is represented mostly by gabbro, and rarely by diorite and syenite. The Dzama iron scarn deposit and Garta polymetallic occurences are genetically related to this pluton injection.

Results of zircons U-Pb Geochronology

Ten samples of the above described plutons were taken (Fig. 1), with 200 zircon grains separated. Zircon grains being almost identical, with mostly prismatic forms and simple zoning. The grains are similar in chemical composition and many other isotopic parameters. U concentrations are high, and the parameter Th/U is always greater than 0.4 (Tables 1- 4), which is characteristic of a zircon of magmatic origin [12]. The U-Pb geochronology of these zircons showed a very small time interval (46-42 Ma) of the plutons' formation. Below the results of the conducted research are shown, but due to the limited space of the paper, we present here only a small part of the whole material. We show here only 4 tables, with only eight grains of the zircons chemical and isotope analysis.

Merisi Pluton. Two samples are dated from Merisi pluton. The first one - #12Ge-03 (coordinates: N-41.58341667; E-41.96616667; asl - 352 m) represents relatively fresh diorite (SiO_2=60.00%) and is taken from the western perifery of the intrusive, in the r. Akavreta valley. 20 zircon grains were dated (Table 1), and according to the data the age corresponds to 43.42.00.61 Ma, MSWD=1.6 (Fig. 2). The second sample - #12Ge-04 is taken in 120 m east from the first one (N-41.58356667 m; E-41.96818333 asl-358 m) and represents an older syenite (SiO_2=58.90%). 22 Zircon grains were dated from this sample, and the age was determined at 42.78±0.65 Ma, MSWD=1.6.

Table 1. Chemical analyses, U-Pb ratios and ages of the Merisi pluton zircons #12Ge-03 sample

Sample Spot#	U (ppm)	Th/U	U-Pb ratios						Ages	
			$^{207}Pb/^{206}Pb$	±σ	$^{207}Pb/^{235}U$	±σ	$^{206}Pb/^{238}U$	±σ	$^{206}Pb/^{238}U$	±σ
1	1166.1	0.6090	0.06429	0.0011	0.06054	0.00217	0.00683	0.00017	44	1
2	5915.9	0.6090	0.06128	0.0038	0.05656	0.00452	0.00669	0.00017	43	1
3	3344.3	0.2999	0.06852	0.0011	0.06524	0.00311	0.00691	0.00017	44	1
4	3532.6	0.7817	0.0649	0.0001	0.05829	0.00188	0.00651	0.00017	42	1
5	1101.8	0.9025	0.04933	0.0007	0.04696	0.00135	0.0069	0.00016	44	1
6	5749.9	0.8006	0.05286	0.0035	0.0491	0.0041	0.00674	0.00016	43	1
7	9300.7	0.8863	0.05756	0.0006	0.07322	0.00182	0.00923	0.00021	59	1
8	8892.5	1.1679	0.10717	0.0016	0.12966	0.0043	0.00877	0.00023	56	1

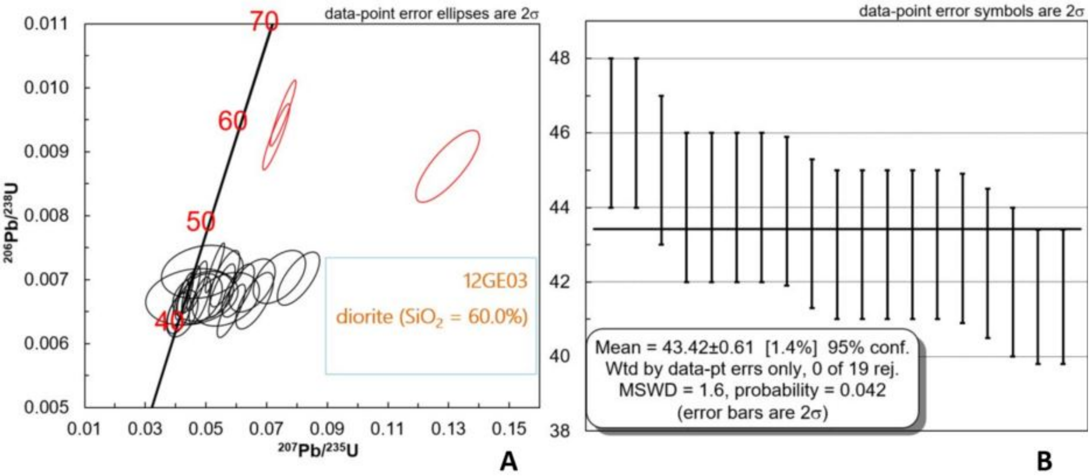

Fig. 2. Concordia plot (A) and weight mean U-Pb age (B) of Merisi pluton #12Ge-03 sample zircons.

Table 2. Chemical analyses, U-Pb ratios and ages of the Vakijvari pluton zircons #12Ge-13 sm.

Sample Spot#	U (ppm)	Th/U	U-Pb ratios						Ages	
			$^{207}Pb/^{206}Pb$	±σ	$^{207}Pb/^{235}U$	±σ	$^{206}Pb/^{238}U$	±σ	$^{206}Pb/^{238}U$	±σ
1	517.4	0.4085	0.00689	0.00013	0.06115	0.0016	0.00689	0.00013	44.3	0.8
2	700.4	1.2566	0.00747	0.00017	0.04746	0.0042	0.00747	0.00017	48	1
3	552.3	0.1209	0.00867	0.00016	0.05986	0.0023	0.00867	0.00016	56	1
4	2449.6	3.4231	0.00632	0.00012	0.04017	0.0023	0.00632	0.00012	40.6	0.8
5	804.4	2.0681	0.00854	0.00017	0.16592	0.0034	0.00854	0.00017	55	1
6	528.1	1.1960	0.0076	0.00014	0.11394	0.0024	0.0076	0.00014	48.8	0.9
7	957.7	11.0300	0.00898	0.00096	0.05714	0.1065	0.00898	0.00096	58	6
8	394.7	2.4212	0.01042	0.0002	0.47178	0.0095	0.01042	0.0002	67	1

Namonastrevi pluton. Two samples are dated from Namonastrali pluton. The first sample - #12Ge-05 (N-41.57688333; E-42.01933333; asl-659 m) is relatively fresh massive diorite (SiO_2=60.80%), and 22 zircons were dated from this one, age of which is 42.42±0.52 Ma, MSWD=1.6. The second sample - #12Ge-06 is taken to the east, in 200 m from the previous one, and is a diorite (SiO_2=56.70%). 11 zircon grains are dated from this sample, and their age corresponds to 42.03±0.83 Ma, MSWD=1.3.

Vakijvari pluton. Two samples are dated from Vakijvari pluton, but according to the data one of them is older than the intrusive. Directly, from the intrusive phase, we took a sample along the Shemokmedi-Gomi road, in the r. Bjuja valley (#12Ge-13; N-41.85338; E-42.11592; asl-953 m), which is a massive syenite (SiO_2=59.70%). From

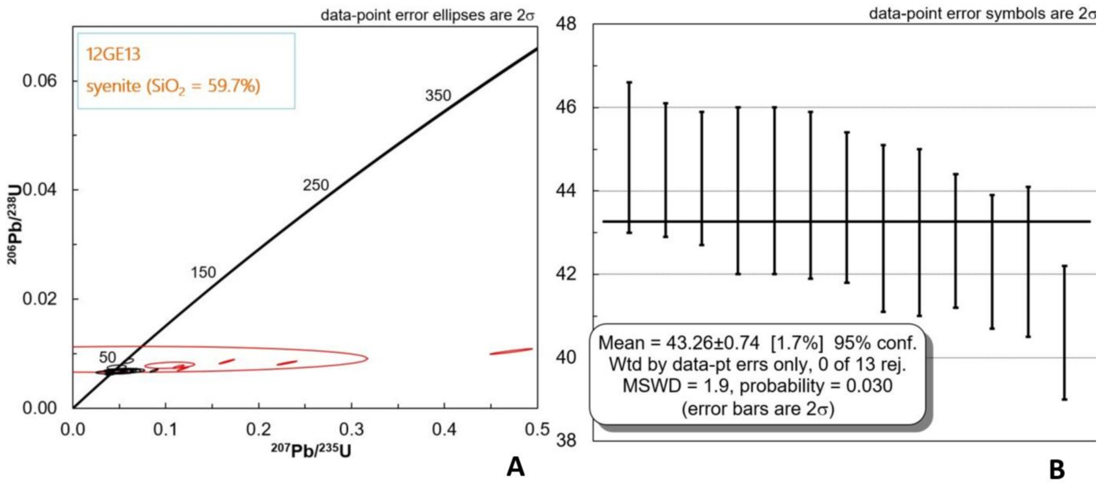

Fig. 3. Concordia plot (A) and weight mean U-Pb age (B) of Vakijvari pluton #12Ge-13 sample zircons.

Table 3. Chemical analyses, U-Pb ratios and ages of the Zoti pluton zircons #12Ge-16 sample

Sam. Spot #	U (ppm)	Th/U	U-Pb ratios						Ages	
			$^{206}Pb/^{238}U$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{206}Pb/^{238}U$	1σ
1	1087.0	0.6488	0.00714	0.0002	0.04746	0.0028	0.00714	0.00015	45.9	1
2	199.2	0.6531	0.00729	0.0002	0.04633	0.0028	0.00729	0.00017	47	1
3	110.0	0.3677	0.00701	0.0002	0.04951	0.0048	0.00701	0.00018	45	1
4	459.5	0.8708	0.0073	0.0002	0.0467	0.0032	0.0073	0.00016	47	1
5	156.9	0.4890	0.00723	0.0002	0.0542	0.0041	0.00723	0.00018	46	1
6	548.1	0.9365	0.0073	0.0002	0.04969	0.0031	0.0073	0.00015	46.9	1
7	666.6	0.4842	0.00707	0.0002	0.04536	0.0023	0.00707	0.00015	45.4	1
8	427.9	0.6846	0.00733	0.0002	0.04693	0.0021	0.00733	0.00016	47	1
9	373.7	0.6446	0.00731	0.0002	0.05068	0.0018	0.00731	0.00015	47	1
10	350.7	0.8413	0.00711	0.0002	0.05174	0.0049	0.00711	0.00017	46	1

this sample 22 zircon grains are dated (Table 2), whose age (mean weight) corresponds to 43.26±0.74 Ma, MSWD=1.9 (Fig. 3).

Zoti pluton. Two samples - one syenite (SiO_2=64.40%) (#12Ge-14; N=41.8919; E=42.46631; asl - 981m) and one slightly silicified gabbro (SiO2=53.60%) (#12Ge-16), were dated from Zoti pluton (Table. 3). Both samples are taken in the r. Tetri-Ghele valley, where gabbroic body as a restite is located in syenitic intrusive rocks. According to U-Pb dating the age of zircon grains (n=20) age, of the silicified gabbro, corresponds to 46.77±0.81 Ma, MSWD=2.9, and the age of zircon grains (n=24) from syenites - 43.26±0.74 Ma, MSWD=1.01 (Fig. 4).

Okros-Ghele pluton. From Okros-Ghele pluton one sample (#12Ge-19) of medium-grained massive biotitic syenite is taken (SiO_2=60.60%). 22 Grains of zircon were separated and dated from this sample; their age is 44.34±0.55 Ma, MSWD=2.1.

Rkviana pluton. One sample (#12Ge-21) is dated from Rkviana gabbro-dioritic intrusive, which represents a gabbro (SiO_2=48.60%). Sample is taken from the r. Saterdze sources, from the outcrop along the road, north-eastern part of the intrusive. 22 Zircon grains were separated from the sample, age of which is 44.85±0. 59 Ma, MSWD=1.7 (Fig. 7).

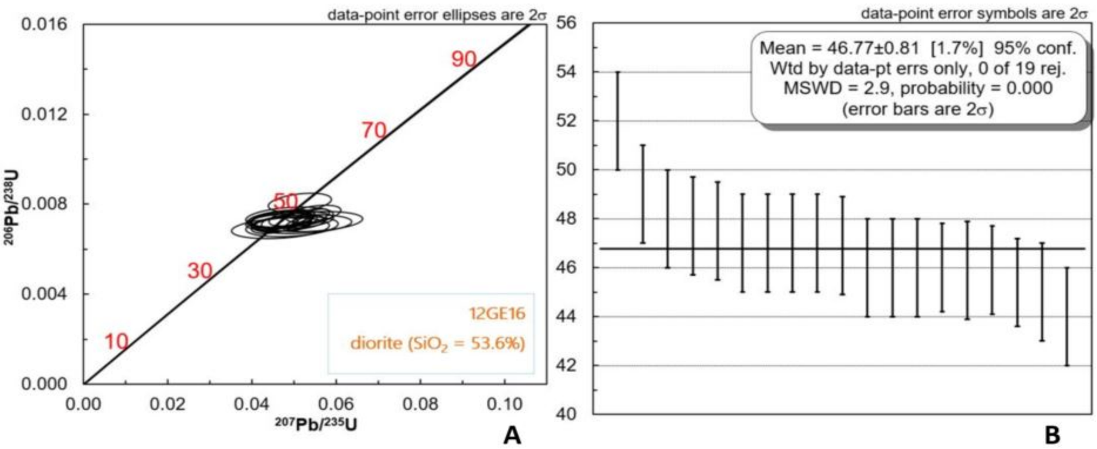

Fig. 4. Concordia plot (A) and weight mean U-Pb age (B) of the Zoti pluton #12Ge-16 sample zircons.

Table 4. Chemical analyses, U-Pb ratios and ages of the Okros-Ghele pluton zircons #12Ge-19 sm.

Sample Spot #	U (ppm)	Th/U	U-Pb ratios						Ages	
			$^{206}Pb/^{238}U$	±σ	$^{207}Pb/^{235}U$	±σ	$^{206}Pb/^{238}U$	±σ	$^{206}Pb/^{238}U$	±σ
1	517.4	0.8785	0.00661	0.0002	0.04891	0.0068	0.00661	0.00017	42	1
2	700.4	1.0790	0.00748	0.0002	0.04752	0.0020	0.00748	0.00015	48	1
3	552.3	0.6846	0.0068	0.0001	0.04407	0.0013	0.0068	0.00013	43.7	0.8
4	2449.6	1.8730	0.00675	0.0001	0.04448	0.0001	0.00675	0.00013	43.4	0.8
5	804.4	1.0674	0.00723	0.0002	0.05053	0.0015	0.00723	0.00015	46.4	1
6	528.1	0.6531	0.00686	0.0001	0.04664	0.0014	0.00686	0.00014	44.1	0.9
7	957.7	0.7879	0.00695	0.0001	0.04557	0.0011	0.00695	0.00014	44.6	0.9
8	394.7	0.7755	0.00681	0.0001	0.04579	0.0015	0.00681	0.00014	43.8	0.9

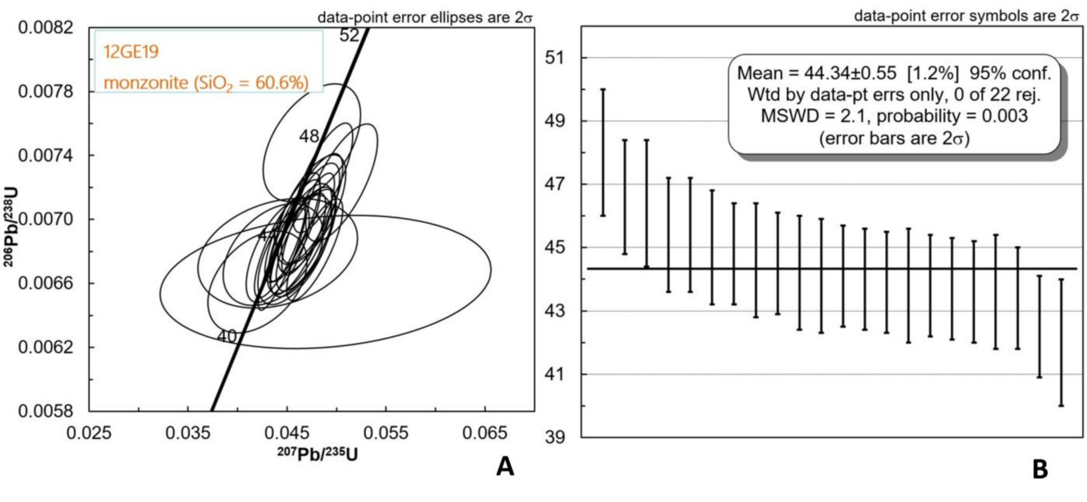

Fig.5. Concordia plot (A) and weight mean U-Pb age (B) of the Okros-Ghele pluton #12Ge-19 sample zircons.

Discussion

The study shows that the ore-bearing plutons intruded the igneous sedimentary rocks in Adjara-Trialeti rift-folded zone in the middle Eocene, which proveds the opinion that the volcanic and plutonic actions were not sharply disconnected in time in this zone [8]. In addition, the study clearly showed that these plutons intruded within a short period of time (46-42 Ma) and crystallized in hosting igneous sedimentary rocks. At the same time, the dating results showed that the melts of base composition of these plutons crystallized earlier than the dioritic-syenitic ones. In particular, zircon grains' U-Pb age of the gabbro sample

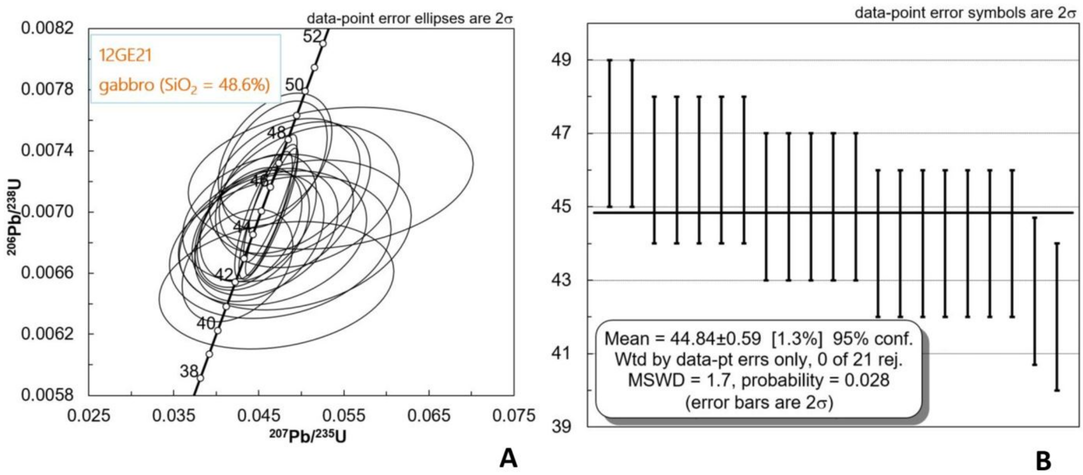

Fig. 6. Concordia plot (A) and weight mean U-Pb age (B) of the Rkviana pluton zircons #12Ge-21 sample.

(SiO_2=53.60%) from Zoti pluton is 46.77±0.81 Ma, while the U-Pb age of the syenite from the same pluton (SiO2 = 64.40%) is 43.26±0.74 Ma. The similar, relatively high numbers showed dating of zircons from the Rkviana pluton gabbro (44.85.0±0.59 Ma). At the same time, these data need to be interpreted, as it can be considered either the first phase of magmatic chamber fractionation, or the time of mantle injections. In order to resolve the issue, future petro-geochemical studies of these rocks are required.

As for the reliability of the carried out analytical works, we dated two similar samples of diorite from Namonastrevi pluton, sample #12Ge-05 (SiO_2= 60.80%) and sample #12Ge-06 (SiO2=56.70%). The obtained results are almost identical within the margin of error of the method, and are as follows: sample #12Ge-05 zircons U-Pb age is 42.42±0.52 Ma and sample #12Ge-06 - 42.03±0.83 Ma. These data undoubtedly show the most accurate analysis.

Conclusion

Thus, from the obtained results it is clear that Adjara-Trialeti rift-folded zone plutons (Merisi, Namonastrevi, Vakijvari, Zoti, Okros-Ghele, Rkviana) are the products of the same tectonic-magmatic activity that took place within a short time interval between 46.77±0.81 - 42.03±0.83 Ma, when they intruded into hosting igneous sedimentary rocks. It should be noted that according to the paleontological data, the peak of volcanic activity in the Adjara-Trialeti rift zone is dated as middle Eocene. If we rely on these data, we should assume that the volcanic activity in the region was soon followed by the plutonic magmatism. Proceeding from the above and the petro-geochemical characteristics, we can conclude that volcanogenic-plutonic rocks of the Adjara-Trialeti rift-folded zone represent identical genetic formations and are associated with one and the same magmatic activity that reached its peak by the middle Eocene.

From the conducted survey, we can conclude that within the Adjara-Trialeti zone, the middle Eocene magmatic activity (46-42 Ma) is most interesting from the point of view of ore bearing capacity. So, it is clear that new ore occurrences in the zone should be explored in the contact zone of the plutonic injections of this age.

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გეოლოგია

მცირე კავკასიონის აჭარა-თრიალეთის ნაოჭა ზონის მადანმატარებელი პლუტონების ცირკონების U-Pb გეოქრონოლოგია და მაგმური პროცესების ანალიზი

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(წარმოდგენილია აკადემიის წევრის ე. გამყრელიძის მიერ)

ტაივანის ნაციონალური უნივერსიტეტის გეომეცნიერებათა დეპარტამენტის იზოტოპურ ლაბორატორიაში, **ICP–MS** დანადგარზე განვახორციელეთ მცირე კავკასიონის აჭარა-თრიალეთის პალეოგენური რიფტულ-ნაოჭა ზონის ძირითადი მადანმატარებელი პლუტონების (მერისის, ნამონასტრევის, ვაკიჯვრის, ზოტის, ოქროს ღელეს და რკვიანას) ცირკონების **U-Pb** მეთოდით დათარიღება. მიღებული შედეგები თითქმის იდენტურია და არის შემდეგი: მერისი (დიორიტი) ნიმ. **#12Ge-03=43, 42±0,61** მლნ. წ.; მერისი (სიენიტი), ნიმ. **#12Ge-04=42, 78±0,65** მლნ. წ.; ნამონასტრევი (დიორიტი) ნიმ. **#12Ge-05=42, 42±0,52** მლნ. წ.; ნამონასტრევი (დიორიტი) ნიმ.**#12Ge-06=42, 03±0,83** მლნ. წ.; ვაკიჯვარი (სიენიტი) ნიმ. **#12Ge-13=43, 26±0,74** მლნ. წ.; ზოტი (სიენიტი) ნიმ. **#12Ge-06=43, 86±0.43** მლნ. წ.; ზოტი (გაბრო) ნიმ. **#12Ge-16=46, 77±0,81** მლნ. წ.; ოქროს ღელე (სიენიტი) ნიმ. **#12Ge-19 = 44, 34±0,55** მლნ. წ.; რკვიანა (გაბრო) ნიმ. **#12Ge-21=44, 85±0,59** მლნ. წ. მოცემული შედეგების ანალიზიდან აშკარაა, რომ აჭარა-თრიალეთის მადანმატარებელი პლუტონები დროის მცირე, კერძოდ, 46-42 მილიონი წლების მონაკვეთში (შუა ეოცენი) შემოჭრილან ვულკანოგენურ-დანალექ ქანებში. აღსანიშნავია, რომ პალეონტოლოგიური მონაცემების მიხედვით, აჭარა-თრიალეთის რიფტულ-ნაოჭა ზონის ვულკანური აქტივობის პიკიც აგრეთვე შუა ეოცენურად თარიღდება. თუ ამ მონაცემებს დავეყრდნობით და გავითვალისწინებთ პლუტონების ცირკონების **U-Pb** მეთოდით დათარიღების შედეგებს, მაშინ უნდა დავუშვათ, რომ რეგიონში ვულკანურ მოქმედებებს მალევე მოჰყოლია პლუტონური ინექციები. აღნიშნულიდან და აგრეთვე ამ ქანების პეტროლოგიურ-გეოქიმიურ მახასიათებლების ანალიზიდან გამომდინარე მიგვაჩნია, რომ აჭარა-თრიალეთის რიფტულ-ნაოჭა ზონის ვულკანიტები და პლუტონები ერთიანი მაგმური კერის აქტივობის პროდუქტებს წარმოადგენდნენ და მათი ფორმირება დროში მკვეთრად არ იყო გათიშული.

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