EVOLUTION OF MAGMATIC COMPLEXES OF THE KULDZHUKTAU MOUNTAINS AND THEIR ORE CONTENT

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Abstract: The evolution of magmatism is the most important pattern manifested in all periods of the Earth's geological history. At the same time, two sides of the evolution of magmatism are noted: on the one hand, cyclicity, on the other, irreversibility and directionality, the petrochemical data of the Kuldzhuktau complex show a regular homodromic change in the composition of the subdivisions of the complex from early ultrabasic to late acidic. First of all, this is a consistent increase in the total content of silica, potassium, sodium and total ferruginousness in the rock.

Keywords: Magmatism, Granitoid, complex, formation, andesits

The Kuldzhuktau Mountains are located in the southern part of Central Kyzylkum. Within the Kuldzhuktau mountains, magmatic formations comprise ~ 15% of the exposed area, with batholith-like bodies and granitoid rods predominating [1], intrusions of the main composition and rod-like bodies of alkaline rocks are less developed, volcanogenic formations belonging mainly to effusions of basic, medium and acid compositions are slightly widespread.

The host rocks are sediments of the Ordovician, Silurian, Devonian and Carboniferous with a characteristic set of formations and a folding plan. Several deposits are known on the territory, as well as a significant number of ore occurrences and mineralization points, the distribution of which is controlled by the tectonomagmatic structure formed by tectonomagmatic processes [3].

Research methods

The magmatic formations of the district were studied at different times and with varying degrees of detail by H.M. Abdullaev, I.H. Khamrabaev, A.F. Sviridenko, Yu.G. Likhoydov, A. Kayumov, Ya.B. Aisanov, A.I. Egorov, Z.A.

Yudalevich. F.K.Divaev, U.D. Mamarazikov and many other researchers. The first scheme of magmatic formations of the Kuldzhuktau district was developed by Ya.B.Asanov and A.I.Egorov in 1973 [1,2,8].

In the course of our research, five plutogenic and three volcanogenic complexes were studied with sampling for various analyses: description of the grinds, anshlifs. Based on the results obtained, classification and discriminant diagrams were compiled [3].

Discussion of the results

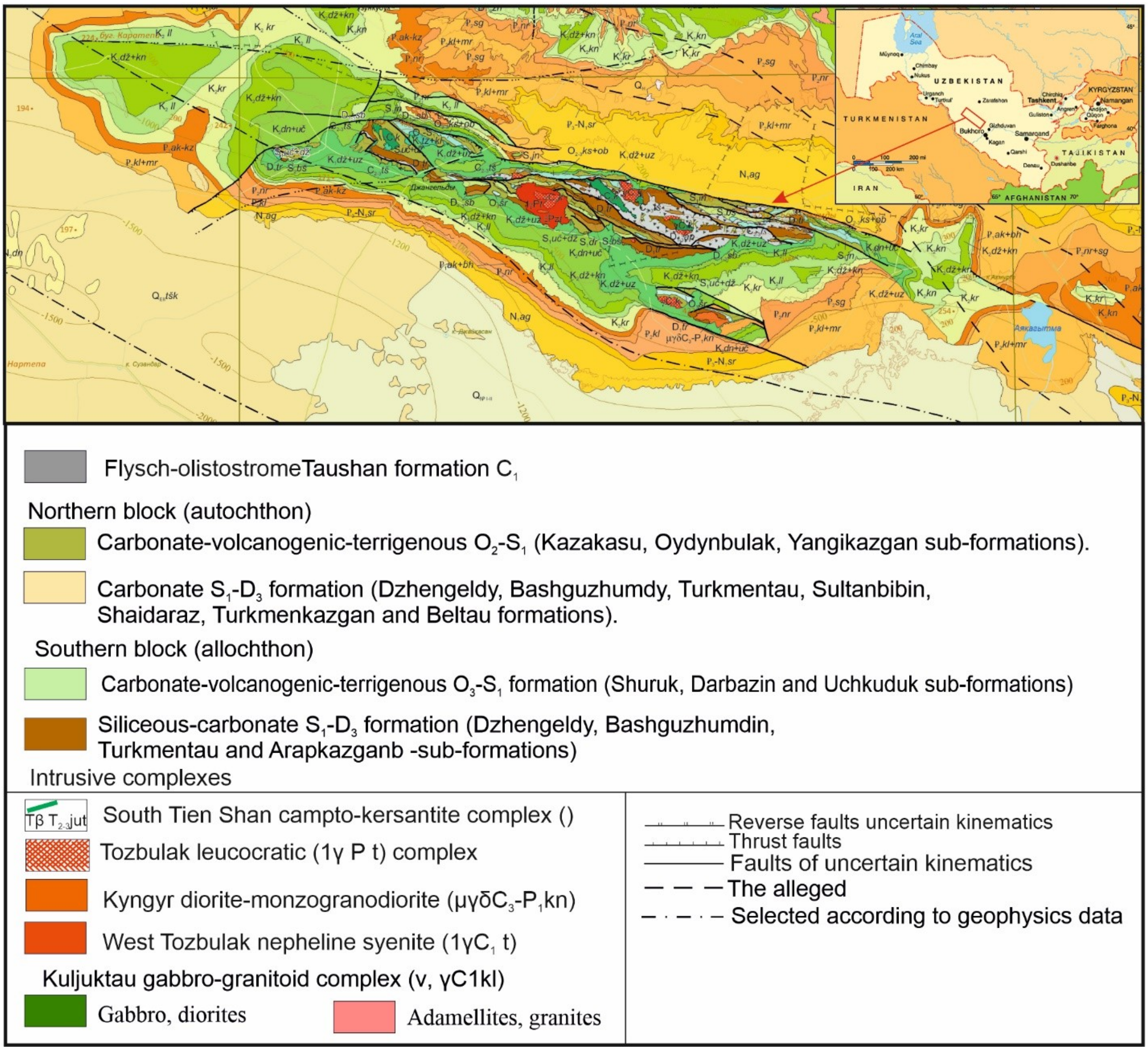

Fig. 1. Overview geological map of the Kuldzhuktau mountains.

The evolution of magmatism is the most important pattern manifested in all periods of the Earth's geological history. At the same time, two sides of the evolution of magmatism are noted: on the one hand, cyclicity, on the other, irreversibility and directionality [4]. The stages of magmatism evolution include a number of successive tectonomagmatic cycles, the beginning of each of which is generally fixed by the broader development of basal magmatism, and the end by the predominance of acidic, subalkaline and alkaline magmatism [5].

In the structure of the Western part of the Tien Shan, on the territory of Uzbekistan, it is customary to distinguish three segments that differ in geological structure and history of development: These are the Middle, Southern and Southwestern Tien Shan, which are bounded from the east by the Ustyurt block [7].

The folded system of the Southwestern Tien Shan is separated from the Southern one by the Zeravshan fault and stretches from the Kuldzhuktau mountains in the west through the Zirabulak-Ziaetdin hills to the Zeravshan and Hissar ranges, covering the Baisun-Kugitang zone [5].

The study of igneous rocks and magmatic processes (as one of the most important factors of ore formation) in Uzbekistan has always been given significant influence, which is reflected in numerous publications of Uzbek geologists [2,9].

There are three volcanogenic-sedimentary complexes, four plutonic, and two complexes of small intrusions in the Kuldzhuktau mountains (Table 1).

Table 1

Magmatic complexes of the Kuljuktauk mountains

Type	Complex / suite	Formation type	age	Geodynamic regime
dyke	South Tianshan	alkaline-basaltoid	$T_{2\text{-}3}$jut	Diffuse rifting
small intrusions	Central Kuldzhuktau	odinite - diorite-granitoid	Pck	Intraplate A-type
intrusive	Zapadno-tozbulaksky	syenite-granosienite	P1zt	Intraplate A-type
intrusive	Tozbulaksky	leukogranite	P t	Intraplate A-type
intrusive	Kuldzhuktausky	gabbro-granitoid	C_3kl	Intraplate A-type

intrusive	Kingirsky	monzonite-syenodiorite-syenite	C_2k	Intraplate A-type
volcanogenic	Darbaza	Dacite-rhyolite	S_1dr	Encymatic arcs
volcanogenic	Shuruk	basalt-andesite	O_3sr	Encymatic arcs
volcanogenic	Kazakasu	basalt-rhyolite	$O_{2\text{-}3}$ kz	Encymatic arcs

In the course of our research, five plutogenic and three volcanogenic complexes were studied using various classification and discriminant diagrams.

Volcanogenic complexes. In the classification diagram (Na_2O+K_2O)-SiO_2, (Fig. 2.a) propylitized trachybasalts of the Kazakasui formation are in the field of subalkaline rocks, and andesites and rhyolites are in the field of calcareous-alkaline. The volcanites of the Shuruk and Darbaza formations also fall into the field of calcareous-alkaline rocks. In the Rb-Sr diagram, (Fig. 2.b) andesites and rhyolites of the Kazakasui formation fall into the field of oceanic tholeites, and propylitized basalts fall into the field of island-arc tholeites. Volcanites of the Shuruk and Darbaza formations are also recorded in the field of island-arc toleites.

In the Mg-FeO-Al_2O_3 diagram (Fig. 2.c), all analyses of volcanites are concentrated in the basalt fields of oceanic ridges. In the AFM diagram (Fig.2.d), all volcanites coincide with the Tholeiitic trend. In the diagram Zr-Ti/100-3Y, all analyses of volcanites are concentrated in the basalt field of the oceanic bed (Fig. 2. e). In the Miyashiro diagram (FeO*/MgO)/SiO2 (Fig. 2.f), the basalts of the Kazakasui formation fall into the field of the tholeiitic series, and all other volcanites fall into the field of the calcareous-alkaline series.

The distribution of impurity elements in the volcanic rocks of Kuldzhuktau is characterized by the following features.

The basalts and andesites of the Kazakasui formation are characterized by increased relative to Clark contents of V, Ti, Li, Sr, Mo, Re, Be, Au, Ag, B, As, Bi, Te, Sb, Nb, Ta, Zr, Hf, elements of the light rare earths group (especially Ce (33 Clark)).

A different spectrum is observed for basalts and andesites of the Shuruk formation - they are characterized by elevated concentrations of Ni, Cr, B, As, Bi, Sc, Ag, Mo, W, Be relative to Clark.

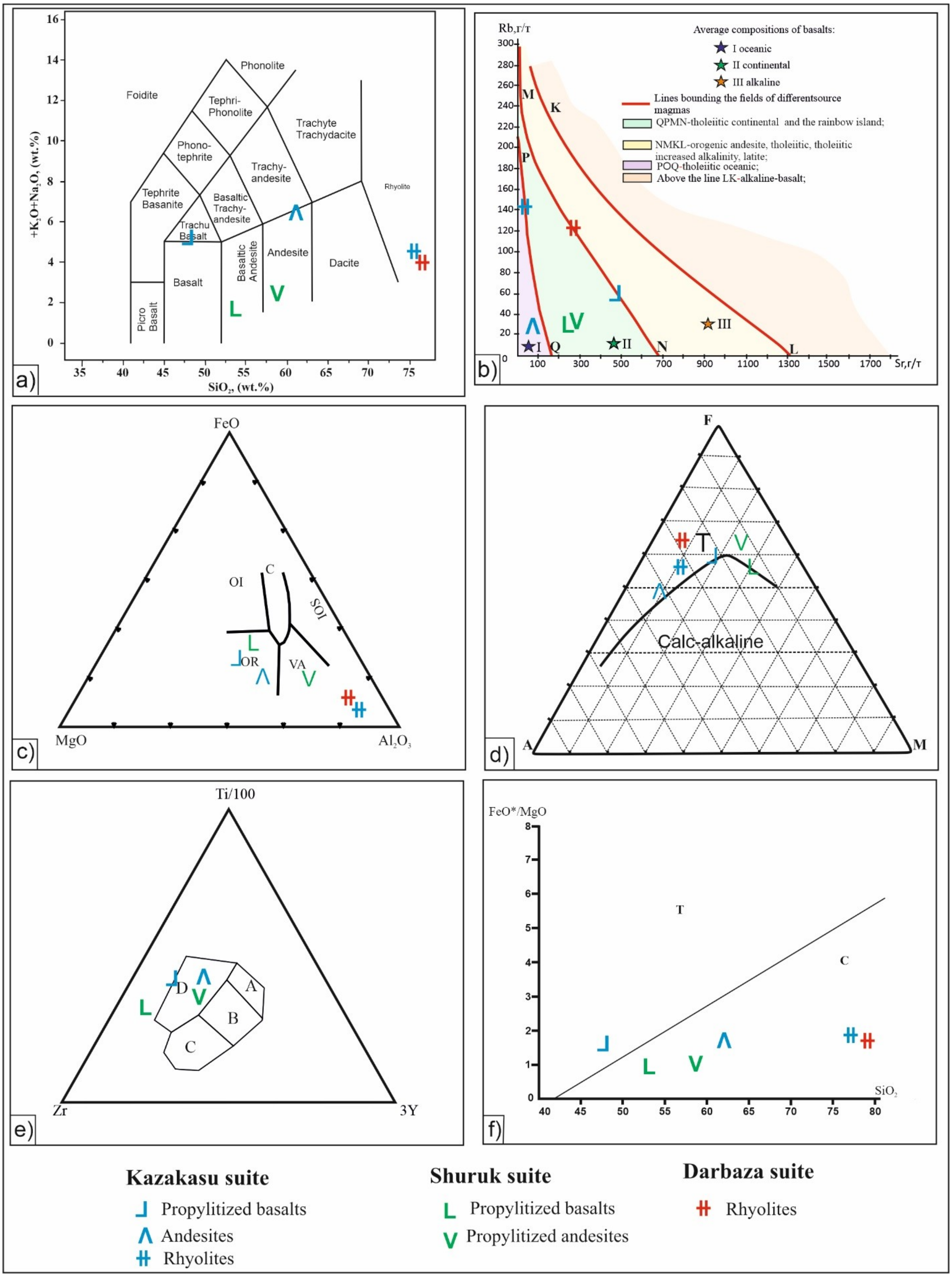

Figure 2. Diagrams of (a) (Na2O + K2O) vs. SiO2 [10], (B) Rb-Sr , (C) Mg-FeO-Al2O3, (D)AlkaliFeOT-MgO (AFM) [11], (e) Zr-Ti/100-3Y and (f) FeO*/MgO)/SiO2.

The rhyolites of the Kazakasui and Darbaza formations differ quite significantly in terms of the content of impurity elements. In the first, the Si content is higher, and the Pb content, on the contrary, is lower than, secondly. The content of such elements as B, As, Sc, Zr, La, Ce, Pr, Sm in Darbaza rhyolites is also noticeably higher.

Intrusive complexes of Kuldzhuktau. The petrochemical data of the Kuldzhuktau complex show a regular homodromic change in the composition of the complex units from early ultrabasic to late acidic. First of all, this is a consistent increase in the total content of silica, potassium, sodium and total ferruginousness in the rock.

Granitoids of the complex are calinatric in type of alkalinity (the subtype is mainly sodium-potassium). They are supersaturated with alumina and steadily contain corundum in the normative composition, which differs from the granites of the younger Tozbulak complex that look similar to them. Granites of the Tazbulak complex differ from granitoids of the Kuljuktau complex by their higher silicicity and ferruginousness. The granitoids of these two complexes also differ significantly in the content of trace elements. The granitoids of the Kuljuktau complex contain higher concentrations of Ni (46 and 7 g/t), Sr (71 and 54), Va (201 and 153), Sr (39 and 18). Au (0.04 and 0.01), B (41 and 19), As (42 and 7), Bi (1.25 and 0.33), Zr (72 and 57), Th (23 and 9).

In turn, the leucocratic granites of the Tozbulak complex have higher contents of Li (39 and 13 g/t), Mo (3.10 and 1.07), Re (0.013 and 0.004), Be (2.73 and 1.59), Ag (0.26 and 0.15), Tl (0.91 and 0.53), Se (4.28 and 1.56).

Rocks of the Kungur complex in the classification diagram (Na2O + K2O) - SiO2 (Fig. 3.) fall into the field of calcareous-alkaline rocks, and rocks of the West Tozbulaksky - into the subalkaline field.

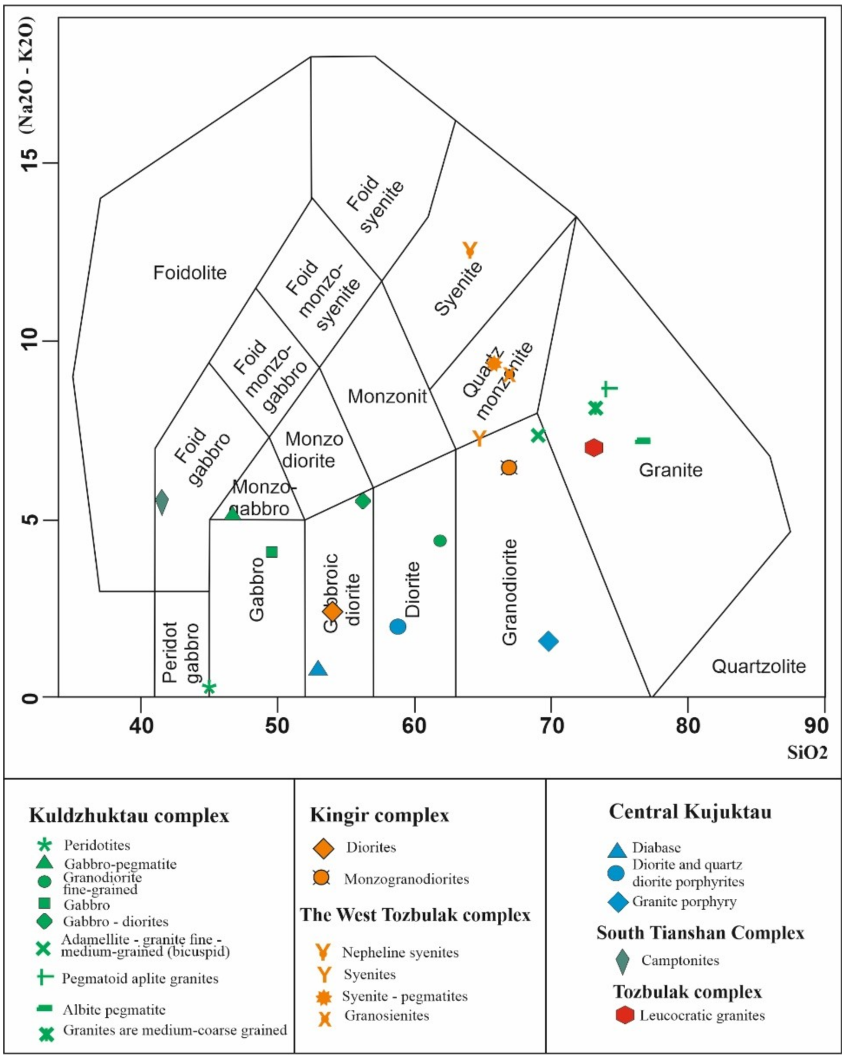

Figure 3. Classification of Granitoid Rocks (Middlemost, 1994)

In the Rb-Sr diagram (Fig. 3.2.7.), part of the samples of the West Tazbulak complex falls into the field of derivatives of oceanic tholeites, and the other part falls into the field of derivatives of tholeites of increased alkalinity. The rocks of the Ingyr complex fall into the field of derivatives of continental and island-arc tholeites.

In the FeO*/MgO diagram (Fig.4a), the rocks of the Kyngyr complex fall into the field of the lime-alkaline series, and the rocks of the Zapadno-Tozbulaksky into the toleite.

In the K2O-SiO2 diagram (Fig.4b), the diorites of the Kungur complex fall into the calcareous-alkaline field, and the monzogranodiorites fall on the boundary of the calcareous-alkaline and subalkaline fields. All rocks of the West Tozbulak complex fall into the field of subalkaline and alkaline rocks.

In the rocks of the Kingir diorite-Monze granodiorite complex, attention is drawn to the increased content of iron group elements relative to Clark -Ni (53-80 г/т), Co (11-27 g/т), Cr (96-160 g/т), V (77-126 g/т), а также Mo (1,07-1,83 g/т), Re (0,001-0,017 g/т), Sn (2,06-3,67 g/т), Ag (0,11-0,21 g/т), B (24-25 g/т), Bi (0,09-,23 g/т), Sb (0,2-0,46g/т), Yb (1,50-2,15g/т), U (2,96-4,91 g/т), Th (6,18-25,00 g/т).

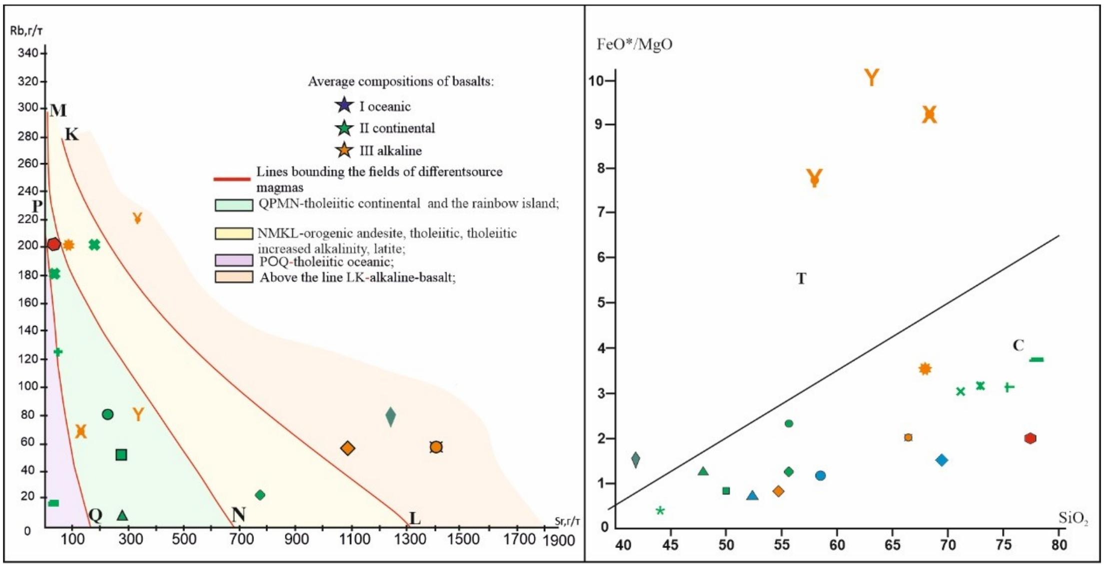

Fig. 4. a) The Rb-Sr diagram for the volcanic complexes of the Kuldzhuktau mountains (according to Fershtater, 1987). b) FeO*/MgO-SiO_2 diagram (according to A. Miyashiro, 1974) for granitoids of the Kuljuktau mountains.Fields of the series: T - tholeiitic, And lime-alkaline.

The syenites of the West Tozbulak complex are characterized by high concentrations Li (15-40 g/т), Rb (82-283 g/т), Mo (2,61-5,90 g/т), Re (0,010-0,012 г/т), Su (3,41-4-79 g/т), Ag (0,20-0,39 g/т), B (19-26 g/т), Te (0,001-0,110 g/т), Sb (0,43-0,70 g/т), Yb (1,63-2,87 g/т).

The chemical composition of the dykes of the central Kuljuktau complex largely inherits the features of the composition of the rocks of the Kuljuktau complex. In the classification diagrams, they also fall into the field of calcareous-alkaline rocks.

The rocks are low-titanium (0.63-1.03%), low-potassium (0.22-2.0%). The identification of petrochemical signs include increased levels of normative magnetite (1.19-5.03%) and ilmenite (0.44-2.11%). Of the impurity elements in the above clarke contents Ni (21-209 г/т), Cr (76-324 г/т), V (80-154 г/т), Mo (0,78-2,46 г/т), W (0,607-9,74 г/т), Ag (0,10-0,21 г/т), Zn (69-76 г/т), As (52-70 г/т), Sb (1,19-5,11 г/т), Zr (61-152 г/т), Y (8,81-17,0 г/т).

The dikes of the camptonites of the South Tien Shan complex are characterized by chemical composition features inherent in the formation of alkaline basaltoids. On the classification and discriminant diagrams, the rocks of the complex fall mostly into the fields of subalkaline and alkaline rocks of the potassium-sodium subtype, containing ~ 10% of normative quartz and orthoclase, and on geodynamic diagrams in the field of intraplate magmatic formations.

Of the impurity elements present in the above Clark concentrations, it should be noted Ni (110 г/т), Co (44 г/т), Cr (157 г/т), V (147 г/т), Ba (577 г/т), Sr (470 г/т), Mo (2,83 г/т), Ag (0,47 г/т), As (7,5 г/т), Nb (88 г/т), Ta (4,73 г/т), Zr (143 г/т), Hf (3,43 г/т), La (46 г/т), Ce (84 г/т), Nd (35 г/т), U (5,90 г/т).

Discussion

According to the theory of tectonics of lithospheric plates, the manifestations of magmatism They are divided into two large groups: 1) confined to the boundaries of lithospheric plates; 2) intraplate. Magmatism of plate boundaries prevails in terms of volume and intensity. It is mainly divided into magmatism of constructive or divergent boundaries (plate extension) and destructive or convergent boundaries (plate displacement), although sometimes plate sliding magmatism (transform) is also distinguished. In turn, oceanic and continental rift magmatism are distinguished among the geodynamic settings of the constructive plate boundaries. Among the geodynamic settings of destructive plate boundaries, magmatism of intraoceanic island arcs is distinguished. active continental margins (Andean and Californian types), collisions or collisions of continents, as well as continents and island arcs. At the same time, each geodynamic environment has magmatic formations characteristic of it, and, conversely, each magmatic formation is formed in a strictly defined geodynamic environment. The evolution of the magmatic complexes of Kuldzhuktau obeys all the above-described patterns of the evolution of magmatic processes, therefore, the authors tried to consider the evolution of volcanogenic formations in conjunction with the geodynamic evolution of the Tien Shan folded belt.

Conclusion

Summarizing all the above-mentioned features of the chemical composition of the Kuljuktau volcanics, the following conclusions can be drawn. The formation of the volcanites of the Kazakasui formation occurred under oceanic conditions, while the chemistry of andesites and rhyolites corresponds to the differentiates of oceanic tholeites, and high-titanic basalts most correspond to the formation of alkaline olivine basalts characteristic of intraplate oceanic islands (simounts).

The geodynamic regime of the formation of the basalt-andesite formation of the Shuruk formation corresponds to the regime of young island arcs, and the andesite-dacite-rhyolite formation of the Darbaza formation corresponds to the regime of the mature island arc.

The obtained conclusions allow us to identify the development areas of the Kazakasui formation as promising for the detection of ore mineralization of Au, Ag, Fe, Mp, Si, as well as rare and rare earth elements.

The rock development sites of the Shuruk and Darbaza formations can be considered promising for gold, silver and rare metal mineralization.

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