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SMALL INTRUSIONS AND DIKES ASSOCIATED WITH ORE FORMATION (ALMALYK-ANGREN MINING DISTRICT)

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Abstract. *The thesis provides generalized brief materials for the study of small intrusions, about their role in ore formation. Their formations, their independence and others are given. The metallogenic specificity of this area is also given. New factual materials of our research.*

Keywords: *independent small intrusions, dike belts, pluto, gabbro-diorite, essexite, syenodiorite (quartz monzonite), granodiorite, dolerite, gabbro, diabase, granite porphyry.*

The category of "independent small intrusions" in the Middle Tien Shan includes intrusions following orogenic plutons. The time of their manifestation in the geotectonic development of the region was highlyghted by H.M. Abdullaev [1] as a stage of small porphyry intrusions. The solution of the issues of the relationship of small intrusions, dike belts and metal concentrations with the deep structure of the lithosphere is currently one of the most urgent. Several special works have been devoted to small intrusions and dyke formations of the Chatkalo-Kuramin region (O.P. Gorkova, V.I. Eisenstat, J. Matchanov, E.V. Poyarkova, V.Ya. Klipenstein, G.T. Tajibaev). As a result, general information was obtained on the geology and prevalence, petrographic and partially chemical composition of certain types of rocks of small intrusions of Almalyk, the right bank of the Angren River and dikes of the northern and southern slopes of the Kuramin ridge.

Based on the generalization of literary data, personal research materials and formation analysis, I.H. Khamrabaev and co-authors proposed a number of criteria for the identification of small intrusions. The most important of them are: confined to the late stages of the development of folded zones and activation stages; autonomy from large granitoid intrusions and volcanic manifestations; homodromity, increased alkalinity, mottled but related material composition, fine-grained, often porphyry rock structure, predominant rare metal and copper-polymetallic specialization. The correspondence of small intrusions to two series of formations was determined: early – gabbro-diorite (essexite)-syenodiorite (quartz monzonite)-granodiorite-granite (P_1-P_2) and late – dolerite-gabbro-diabase-granite-porphyry (P_2-T_1). They are mainly confined to the regional Kyzylkum-Kuramin and Baisun volcanic belts. Within the Chatkalo-Kuramin region, the small intrusions include the Chorukh-Dayron interformational laccolith with an outlet area of 25 km^2 (305-270 million years), the Babayob lolite – 50 km^2 (273 million years), a number of other small bodies and dike belts. The rocks of the Chorukh-Dayron intrusive are combined into the monzonite-granodiorite-granite formation, and the Babayob formation into the gabbro-monzonite-syenite formation. Previously, these massifs were included in the Permian gabbro-syenite formation of postrogenic independent small intrusions, completing the subsequent magmatism of the Middle Tien Shan. By the beginning of it, that is, Permian volcanites (rhyolites, trachyriolites, granophyres) and comagmatic to them, the so-called interstitial leucogranites, alaskites of the Shaidan and Arashan complexes, were also attributed to the formations preceding small intrusions.

H.M. Abdullaev [1], J. Matchanov [5] and others proposed to call small dike intrusions plutonic dikes. They are characterized by the formation of folded regions in the final stages of development; multiphase and phase affinity; small body sizes or more often their dyke shape; hypabyssal appearance, porphyry structure of rocks, their formation from a multiphase melt (crystal + liquid); predominantly acidic composition of

rocks, i.e. relative saturation with silica and alkalis; frequent association with previous effusions and younger dikes of the main composition; mainly the paragenetic connection of gold and polymetallic mineralization with them.

V.A. Zharikov, V.L. Rusinov [6] small intrusions of granodiorite porphyries of the skarnovo-polymetallic and gold-silver deposits of the Kuramin Mountains were considered a vein series of hidden granitoid plutons. The independence of dikes of diorite porphyrites, granodiorite porphyries and adamellite porphyries and the paragenetic relationship with them of polymetallic deposits of the Almalyk ore region is shown by special studies by J. Matchanova [5]. Simple and complex dikes of Permian age, composed of diabases, dolerites, diorite porphyrites, syenite porphyries, quartz syenite porphyries, rhyolite porphyries, are combined into the Chilten series or a complex of dykes of the "Kyzylnurinsky type" and belong to independent porphyry small intrusions of the gabbro-syenite series. The Chorukh-Dayronsky, Babayobsky, Shavazsky, Kassansky belts (arcs) of the development of these dikes are distinguished. In the southwestern spurs of the Chatkal ridge (right bank of the Angren River) they are developed only in the form of separate dikes of the north-eastern, west-north-western and latitudinal directions. The metallogenic specificity of this area (gold, uranium, copper, lead, zinc, tin, lithium, fluorite) is close to that of the Karamazar and Mogoltau mountains, where petrotypes of ore-bearing small intrusions are located. Therefore, the assumed dyke form of expression of small intrusions does not exclude a possible genetic connection of mineralization with them. Previous studies have made it possible to carry out the first genetic classifications of small intrusions and dikes [1], to suggest their possible connection with large plutons, volcanic eruptions and ore manifestations. This limited our knowledge of small intrusions and dikes. The conditions for the generation of foci of their melts, the mechanism of penetration (penetration) and penetration into the upper layers of the Earth's crust, the place of small intrusions and dikes in the general process of petrogenesis and metallogeny, in the evolution of magmatism and the development of the Earth's crust remain unknown.

The increased copper content in small intrusions of the Almalyk mining district is highlighted as a special feature of their metallogeny. The high ore saturation of this area may be related to its position at the intersection of deep-seated tectonic structures [7].

Studies of the deposits of the Almalyk ore region (Sarychek, Kalmakir, Yeshlik, etc.) have shown the commonality of their geological structure, tectonics, magmatism, material composition and the genesis of industrial mineralization. The ores of the Kalmakyr, Yeshlik, Karabulak deposits, Northwestern interspersed, veined and vein-type Balykles contain Si (0.4%), Mo (0.005%), Au (0.59 g/t), Ag (2.6 g/t), which are concentrated in chalcopyrites, molybdenum, pyrites. Almalyk deposits are supergiant and unique in terms of reserves.

Along with iron, copper, and molybdenum, the Kalmakyr, Sarychek, and Yeshlik deposits contain a valuable complex of elements – gold, silver, rhenium, selenium, tellurium, bismuth, indium, cadmium, cobalt, antimony, palladium, platinum, as well as lead and zinc (Table 1).

Table 1. The ratio of impurity elements in rocks of copper-porphyry deposits of the Almalyk ore region to clarks in the Earth's crust (Cc)

№	Element	Sarychek	Kalmakyr	Yeshlik
1	copper	1,9-62,3	15,7-85,1	2,1-8,5
2	molybdenum	1,9-44,9	11,8-79,1	1,9-7,3
3	tungsten	1,6-5,8	2,3-26,9	1,6-4,5
4	tin	до 2,3	1,6-6,8	1,9
5	lead	1,5-9,3	1,6-9,4	1,8-2,3
6	rhenium	14,3	7,1-457,1	14,3-20,0
7	ytterbium	2,3-8,4	1,6-3,9	2,5-10,9
8	gold	11,6	17,2-311,7	2,2-46,2

9	silver	6,0-35,9	8,6-85,7	3,7-91,4
10	arsenic	5,3-57,9	1,8-18,8 до 47,0	2,4-15,9
11	antimony	1,7-6,1	1,8-15,0	2,0-20,0
12	bismuth	20,1-465,6	31,1-211,1	17,3-189
13	selenium	10	38,0-280,0	4,0-56,0
14	tellurium	300	300	300
15	platinum	10	5	10
16	boron	2-3	2-4	1,9-3,9
17	phosphorus	at clark's level	at clark's level	1,3-2,7
18	barium	1,6-6,7	-	-
19	chromium	-	1,5-3,1	-

Note. Compiled according to the results of 65 analyses on the ISP-MS 7500 Series Angilent Technologies mass spectrometer (Japan). According to Sarychek – 25 samples, Kalmakyr – 29 samples, Eshlik (Far) – 11 samples.

Most of these elements, along with copper and molybdenum, are oreogenic and are the main ones in the gold and silver deposits of the Almalyk-Angren metallogenic zone. The formation of Au, Ag, Te, Se, As, and U ores is associated with the most recent lamprophyre dikes [3] widely represented in the Kyzylalma and Kochbulak deposits.

Their formation is associated with small intrusions of diorites and mainly monzodiorites and monzonites. There is a possible connection between the mineralization of gold, silver and platinoids with plutonic dyke formations [3]. These manifestations of multi-temporal and heterogeneous ore-magmatic systems within the Chatkalo-Kuramin hotspot are explained by the authors of the spatial combination of ores of copper, rare, precious metals and the formation of the so-called "Big Almalyk" [4].

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