

LOCALIZATION CONDITIONS AND ALLOCATION PATTERNS OF MINERALIZATION AT THE SHAKARDARA DEPOSIT

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Received 15may 2024; accepted 25june 2024

Abstract

The article discusses the localization conditions of the Shakardara gold-sulfide-quartz deposit. It is noted that ore bodies of two morphological types are distinguished at the deposit: vein zones of hydrothermally altered andesitic porphyrites and their tuffs (secondary quartzites) and a band of gold-bearing metasomatites. The vein zones are represented by intensely silicified and kaolinized rocks with separate quartz veins and veinlets bearing pyrite-chalcopyrite mineralization. Gold mineralization is most common in quartz-rich metasomatites.

Keywords: gold-sulfide-quartz deposit, vein zones, gold-bearing metasomatites, pyrite-chalcopyrite mineralization

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The Shakardara gold-sulfide-quartz field is located in the southwestern part of the Pyazbashi ore field (Fig.1). The field has been known since ancient times and was exploited in an artisanal method. The old workings have been preserved here to this day. The geological and structural position of the field is determined by its location at the junction of the Zangezur horst uplift with the Ordubad trough, in the exocontact strip (5-6km) of the Mehri-Ordubad batholith [4].

The geological structure of the field involves effusive-pyroclastic formations of the Lower Eocene (andesites and their tuffs), which form the northwestern continuation of the Ketam-Kalaki anticline with gentle dip angles (10-25°). The crest of the fold is broken by subparallel and small differently oriented faults of predominantly northwestern (310-340°) strike, dipping to the NE and SW at an angle of 60-70°.

Intrusion of diorite-porphyrines, derivatives of the adamellitic phase of the Mehri-Ordubad batholith, is confined to the Kalaki fault in the southeast.

The Shakardara field is confined to the fault zone located in the near-axial part of the NE wing of the Ketam-Kalaki anticline and can be observed from the Pyazchai River to the village of Kalaki in the southeast. The zone has a NW strike of 320-340° with a dip to the SW towards the Kalaki fault and is observed for 3.5 km with a thickness from 1 to 40 m. It is most intensely occurred in deeply incised gorges of the valleys of individual rivers, and it often completely disappears in elevated areas. Judging by the difference in elevations on the modern zone erosion, the depth of mineralization reaches 300-400 m [1,3].

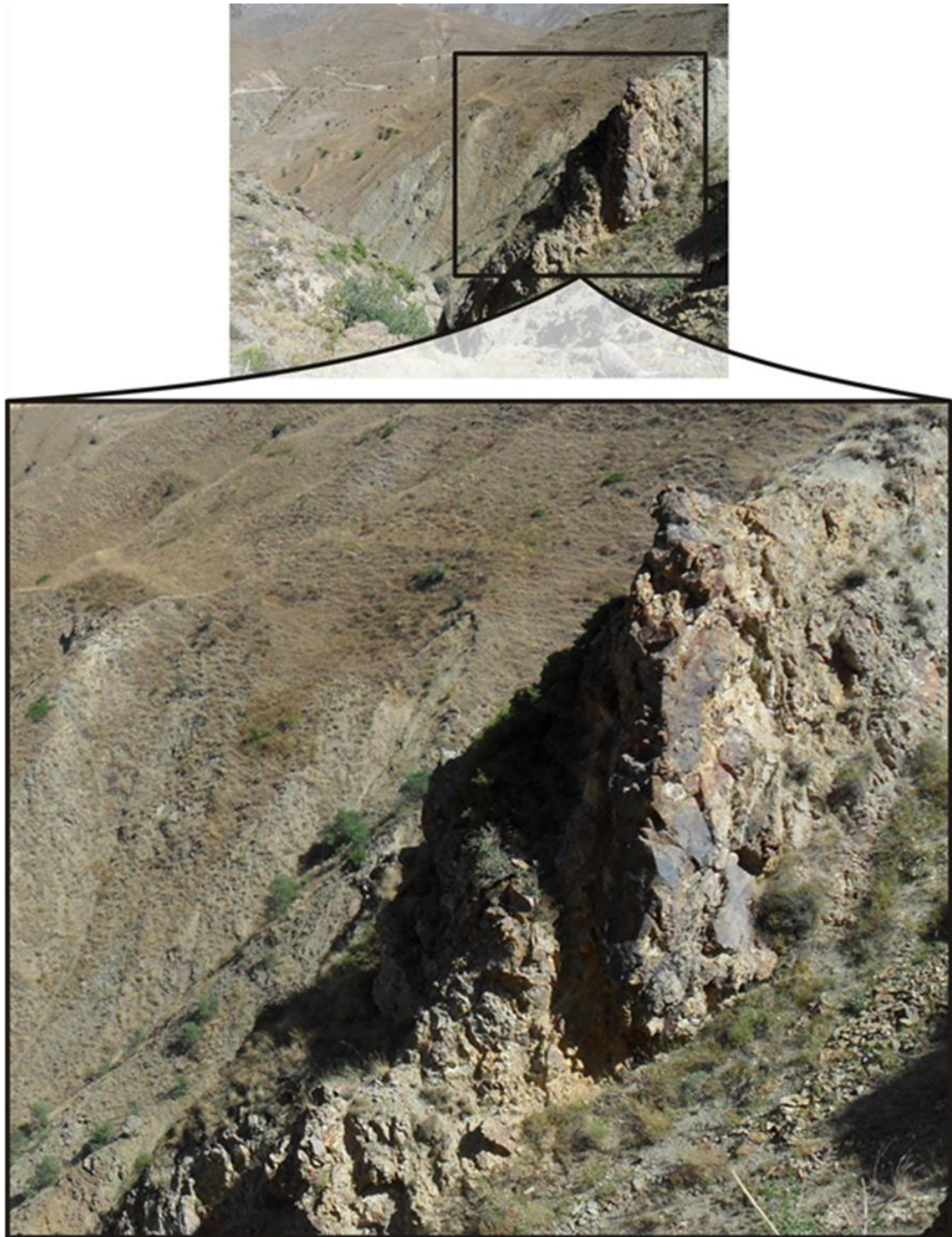


Fig. 1. Northwestern flank of the Shakardara field. Andesite-dacite dyke with northeast strike

Ore bodies of two morphological types are distinguished at the Shakardara field: vein zones of hydrothermally altered andesite porphyrites and their tuffs (secondary quartzites) and a band of gold-bearing metasomatites [2,3]. The main volume of prospecting was associated with the study of three subparallel ore zones with a NW strike, at a distance of 20-40 m from each other. Ditches, individual pits and clearings were observed along the entire length of the zone, which ran through 60-80 m across the strike of the ore zones. Two of them were opened to a depth in one section by short adit No. 1 (hor. 1754.7 m), which in some narrow intervals turned out to be productive for gold mineralization.

To date, the field has been opened to a depth by adits No. 10 and 12 at horizons of 1725-1734 m (60-100m below the day surface), owing to which it was possible to reveal a completely new type of gold mineralization at the field and within the Ordubad ore district.

The vein zones are represented by intensely silicified and kaolinized rocks with individual quartz veins and veinlets bearing pyrite-chalcopyrite mineralization. They have a northwest (320-340°) strike with a dip at an angle of 60-80° to the southwest. The thickness of individual zones varies between 2.0-13.5 m, merging in places to form a single zone with a thickness of up to 20 m.

Morphologically, the vein zones are complex, forming frequent puff up, contractions and junctions, which are controlled mainly by supported fractures. Increased concentrations of gold are associated with quartz veins and veinlets, the most highly fractured and pyritized varieties of quartzous rocks.

The distribution of commercial components in them is extremely uneven. The gold content ranges from "traces" to 24 g/t, silver – from 0.2 to 50 g/t, copper – up to 0.3%. According to the content of components, two zones on the surface are relatively gold-bearing, the total length of which is 1200 m. The average gold and silver grades are 2.12 and 1.8 g/t, respectively in the southeastern segment (between ditches No. 33 and 101), with a zone length of 450 m and an average thickness of 2.6 m; the length is 700 m, the average thickness is 7.9 m, the average gold content is 1.34 g/t, silver is 1.99 g/t in the northwestern segment (between ditches No. 123 and 32°).

Single wells were drilled at depth to study ore zones, and adits were passed in a northeastern (60-80°) direction. They have been more completely studied at the horizon of adit No. 10 (1724.75m), which were opened as a single zone in the interval 230-239.6 of the straight shaft. A single ore zone is represented here by a mass of highly crushed metasomatites with dense impregnations of pyrite and less commonly chalcopyrite, with a small amount of sphalerite. The gold content is low – 0.3-1.3 g/t, silver – 5.2-13.2 g/t, copper – 0.41-2.96%.

The ore zone along the strike is observed in the northwestern and southeastern directions [3] by drifts 1 and 2 at 380 and 360 m, respectively. Gold-bearing is the north-western segment of the zone with the length of 284.5m, where the average thickness of 1.6 m accounts for the average gold content of 2.13 g/t, silver - 4.5 g/t, copper - 1.96%. The northwestern part of the zone was also uncovered by drift 1 from adit No. 12 (hor. 1734m), but there are no sample data.

Zone No. 1 on the surface was studied at a distance of 200 m and at depth - with a short adit No. 2. The strike of the zone is NW 320-340°, the dip is south-west at an angle of 60-80°, with a thickness of 2 to 8 m. 2 subzones, separated from each other by 9m, were uncovered here. The first, dipping to the southwest and with a thickness of 2 m, is represented by an intensely silicified, kaolinized zone with a thin but dense impregnation of pyrite, with a gold content of 15.2 g/t, silver 24.7 g/t (Fig. 2). There is an intensely limonitized part with a thickness of 0.5 m and a gold content of 9 g/t in the footwall of this subzone. The second subzone, dipping to the SE at an angle of 60°, with a thickness of 1.2 m, is represented by intensely silicified, kaolinized rocks with separate quartz veinlets. The gold content in the subzone is 10.4 g/t. Pyritized, limonitized secondary quartzites are exposed in the side wall of the zone. Thickness is 5m, with average gold content of 15g/t and silver content of 36g/t.(Fig.2).

The average gold content in zone No. 1 is 7g/t with an average thickness of 4m from the surface over the tracked length of 200m.

The described zone was partially studied by short (25 m) adit No. 2, set transverse to its strike. The adit uncovered by silicified, fractured, chloritized, pyritized andesites in the interval of 8-15 m among intensely fractured rocks; chalcopyrite mineralization is observed in some places. The gold

content is 5.2-8.6 g/t, silver sometimes up to 85 g/t, copper – basis point in this interval. The gold content does not exceed traces, silver - on average 4 g/t in the host rocks of this interval.

Zone No. 2 is located 200m east of zone No. 1 and, unlike the latter, is located outside the secondary quartzites – among effusive-pyroclastic formations. The zone is oriented with a strike to the NW of 330-340°, dipping to the SW at an angle of 70-85°, observed sporadically for 700m with an average thickness of 1 to 10m.

The surface zone has been studied on the NW and SE flanks. The zone on the northwestern flank is represented by fractured, silicified, limonitized rocks with a thickness of 1.5-2.5 m and with a gold content of 3.6 to 8 g/t, silver 50.7-101.4 g/t, copper 0.01-0.25%. The average gold content is 6.2 g/t, silver 50 g/t, copper 0.02% with an average zone thickness of 2.0 m at length of 250 m.

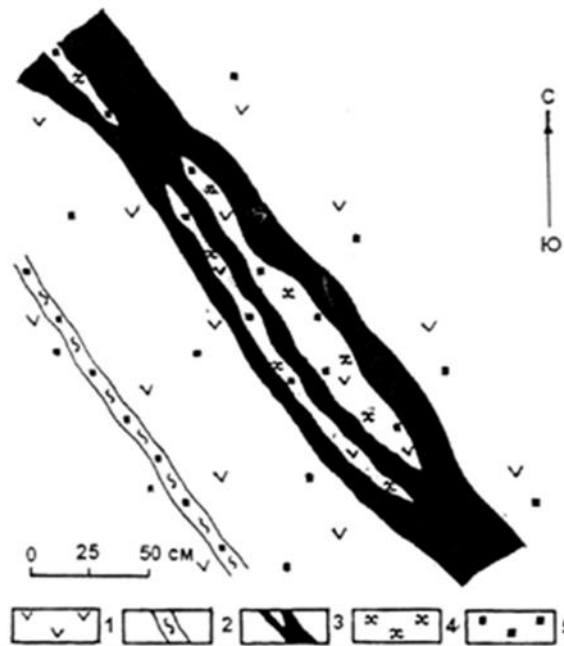


Fig. 2. Details of the structure and distribution of mineralization in quartz-sulfide vein No. 1 on the roof of adit No. 31 (Shakardara field): 1-andesites; 2-zone of hydrothermally altered rocks; 3-quartz-sulfide vein; 4-chloritization; 5-pyrite impregnations

On the southeastern flank on the surface, the gold content in hydrothermally altered rocks “traces” to 2 g/t, silver 1 – 72 g/t, copper – basis point. The average thickness of the zone is 7m.

The zone No. 2 was explored by short adit No. 1 at depth, passed along strike to a depth of 18 m. The gold content in the zone ranges from 1.2 to 12.8 g/t, on average 4.7 g/t, silver from “trace” to 28.2 g/t, copper from 0.21 to 0.5%. The full thickness of the zone, equal to 13m, was penetrated by cross adit No.1, which was passed from the end of adit No. 1 (from a depth of 18m). The gold content in cross aditranges from “trace” to 9 g/t (average – 3.2g/t), silver from “trace” to 16.2 g/t (average – 6.5g/t), copper from 0.03 to 1.46% (average – 0.2%).

Zone No. 3 is located between zones No. 1 and 2. The strike of the zone is NW 330-340°, the dip is southwest at an angle of 60-70°. The thickness of the zone is 4-6 m on the surface (ditch No. 15), it is represented by intensely silicified, limonitized rocks with a thickness of 1.5 m with quartz veinlets with a gold content of 6.4 g/t, silver - 8.2 g/t in the footwall. The average content per the zone for the total thickness is: gold – 4.9 g/t, silver – 10.6 g/t.

The average gold content per total length (150m) is 4.7 g/t, silver – 7.5 g/t, copper – 0.05% with an average zone thickness of 5 m.

A strip of gold-bearing metasomatites with veinlet-impregnated mineralization of pyrite and chalcopyrite, characterized by gold content ranging from 0.4-1.0 to 2.5-3.6 g/t, was identified based on sampling data from the horizons of adits No. 10 and No. 12 among hydrothermal-altered rocks with background gold content from 0.05 to 0.1-0.2 g/t, in some places up to 0.4 g/t.

It is distinguished along the lead shaft in the intervals of 154-340 m (average gold content - 1.03 g/t, silver 9.74 - g/t, copper - 1.12%) and 334-349 m (average gold content - 0.93 g/t, silver - 7.16 g/t, copper - 0.83%) on the horizon of adit No. 10, as well as along cross adit No. 7 of adit 1 in the interval of 33.5-54.0 m (downhole part) and with an average gold content of 0.95 g/ t, silver –1.57 g/t, copper – 0.53% and cross adit No. 11 in the range of 39.0-44.0 m (downhole part) with a gold content of 0.8-1.8 g/t [5].

A strip of gold-bearing metasomatites at the horizon of adit No. 12 is detected according to the available results of sample analyzes along the lead shaft in the range of 4.0-390 m, where the distribution of gold is very uneven – from 0.4-0.8 to 3.0-3.6 g/t. As a result, the following intervals with different average gold contents can be conditionally distinguished: 4-76m (1.43 g/t), 76-172m (0.68 g/t), 172-276 m (1.6 g/t), 276-316 m (0.96 g/t), 316-348 m (0.32 g/t), 348-390 m (0.78 g/t). Overall, the average gold content is 1.08g/t in the 4-390m interval; the silver and copper contents are 2.4 g/t and 0.22%, respectively.

So, the thickness of the strip of gold-bearing metasomatites from the southeast to the northwest increases sharply from 90-100m (along adit No. 10) to 390m (along adit No. 12). At the same time, the average gold content remains constant at 1.0 g/t, while the content of silver and copper decreases significantly.

Judging by the nature of quartz-sulfide mineralization and the distribution of gold mineralization on separate intersections at the horizon of 1725-1734 m, the described strip of gold-bearing metasomatites is a single ore zone with a length of about 900 m, stretched in the northwest direction, according to the general direction of the Kalaki fault.

The ores of the Shakardara field are characterized by a simple mineral composition. Quartz, carbonates, micaceous minerals, sulfides, mainly pyrite, in small quantities chalcopyrite, less often sphalerite [1,5], etc. are present. Quartz usually forms veinlets and veins of different directions with a thickness of 1.5-2.0 mm and 1.0-2.0 m, respectively. Gold mineralization is most common in quartz-rich metasomatites. Local undulated and isolated areas are observed on the horizon of adit No. 10 with a gold content of 2-6 g/t within a thick strip of metasomatites against the background of poor, more or less even gold mineralization (intervals 170-178 and 199-201 m along the main shaft, 50.5-53 m along cross adit No. 7 and 10-20 m at horizon of adit No. 12 with a gold content of 2-3.6 g/t (interval 56-76 m and other straight shaft). Such isolations are typical, as a rule, for areas with increased rock fracturing and saturation of quartz-sulfide veinlets.

A complex zone with a thickness of 8 m, consisting of three subzones, was uncovered in the Pyazchai section of the Shakardara field, which represented by pyritized porphyrites, intensely silicified, pyritized rocks, as well as fractured secondary quartzites with dense thin impregnation of pyrite. The average gold content is 2 g/t, silver – 13.6 g/t, copper – 0.02% for the total thickness of the zone.

The described zone on the slopes cannot be observed due to the occurrence of sediment and turf cover of the area. The area appears to be worth exploring on the flanks.

Another zone of intensely kaolinized, silicified, sericitized, pyritized rocks with a thickness of 20 m, extending NW - 320°, with a north-eastern dip at an angle of 70-80° and with three subzones

containing gold from “traces” up to 4 g/t, silver up to 6.2 g/t, copper 0.01-0.05% was uncovered in a dry beam on the right slope of the Pyazchai River valley. Increased concentrations of gold, silver and copper are identified in the footwall of the zone, where intense pyritization is observed. The zone on the surface can be observed at a distance of 100m.

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