

Geology

The Sakeni Ore Field (Greater Caucasus) – Geological Evidence and Prospects

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ABSTRACT. In the crystalline basement of the Greater Caucasus, in the contact zone between the Upper Variscan Sakeni intrusive of dioritic-granodioritic composition of the mantle-crust generation and the Pre-Alpine anatectic granite-migmatitic complex, the authors have discovered the Sakeni ore field. Here, four isolated ore-manifestations of quartz-gold-lowsulfide hydrothermal genetic type have been established, formed at a medium depth (2-3km), that are entirely controlled by the Alibek regional overthrust and a system of young cross faults. Recent erosion strips mainly the frontal part of low temperature quartz-gold-antimonite mineralization. Due to it, in the deeper horizons, more important gold stockwork type mineralization is expected. © 2009 Bull. Georg. Natl. Acad. Sci.

Key words: ore-field, intrusive, gold, ore-mineralization, quartz, antimonite.

At the end of the past century, the pre-Alpine crystalline basement of the Greater Caucasus was considered as poor in mineral resources, but the researches of the latter years have shown the incorrectness of this statement [1-5]. From this point of view the most noteworthy is the contact zone between the Sakeni granitoid intrusive of the Hercynian generation mantle-crust genesis and Pre-Alpine anatectic granite-migmatitic complex [6-9]. It follows along the Alibek regional fault; within the limits of this fault several promising ore-manifestations are observed. We have established spatial and presumably paragenetic correlation of ore-manifestations with the Sakeni intrusive (Fig.).

The Alibek regional fault (SW-NW, $60-70^{\circ}$) is the main tectonic unit of the region; along the fault the rocks of granite-migmatitic complex thrust over the Sakeni granodioritic intrusive. The fault zone is well expressed in the relief in the form of steep slopes and scarps. In some places its thickness reaches 500m and within the zone of its activity the rocks are subject to

fissuring, brecciation and greisenization. The Alibek fault is intersected by comparatively short submeridional faults, supposedly of Alpine generation, along them the rocks are dislocated and have undergone tectonization and greisenization. It is remarkable that high concentrations of Au, Sb and As often are connected with the areas of fault system activity, in particular with the points of coupling with the Alibek fault system.

Tectonic, lithological, structural, petrological and geochemical peculiarities [2-9] of the region and localization of mineralization zones in space testify the existence of the Sakeni ore field. At the present stage of study the following ore-manifestations are revealed (from east to west) in the Sakeni ore-field: 1 – Kakrinachkuri, 2 – Hokrila, 3 – Memuli, 4 – Achapara (Fig.). All these ore manifestations are localized in the north contact of the Sakeni diorite-granodioritic intrusion; they belong to quartz-gold-low sulfide hydrothermal genetic type and are controlled by Alibek regional fault and its intersecting by young fault systems.

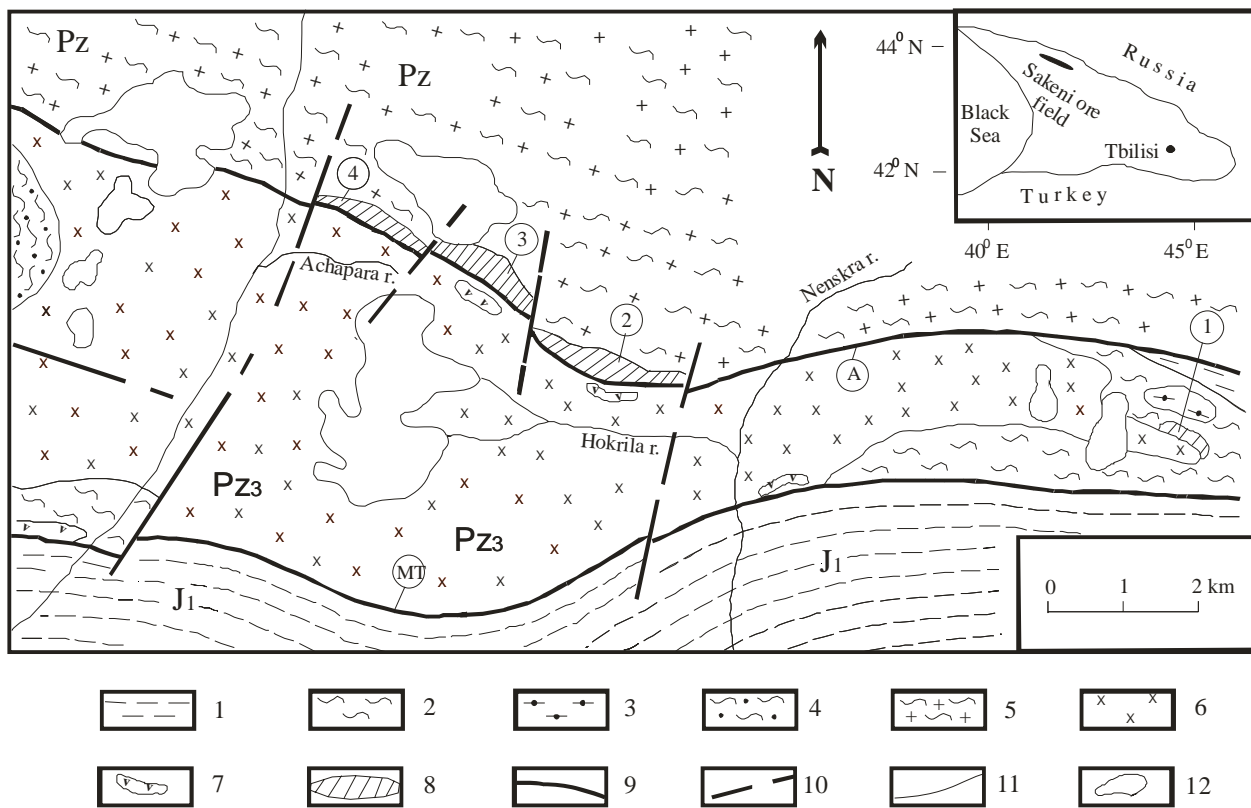


Fig. Schematic geological map of the Sakeni ore field and its geographical position.

1. Lower Jurassic clay-schist; 2. Middle Paleozoic Sisina suite – epidote-amphibolite facies metaterrigenous schist; 3. Lower-Middle Paleozoic Klichy suite – amphibolite and metaterrigenous schist; 4. Lower-Middle Paleozoic Gvandra suite – metaterrigenous gneisses, amphibolites and migmatites; 5. Pre-Alpine granite-migmatite complex; 6. Upper Hercynian Sakeni intrusive; 7. Middle Jurassic gabbro-diabase; 8. Ore-bearing zones (1 - Kakrinachkuri, 2 - Hokrila, 3 - Memuli, 4 - Achapara); 9. Regional overthrust (MT – main thrust, A - Alibek thrust); 10. Local faults; 11. Geological boundaries; 12. Glaciers.

The Hokrila ore manifestation is the best studied area of the Sakeni ore field. It is exposed on the left slope of the river Hokrila and is developed in the rocks of tectonized, fissured and greisenized granite-migmatitic complex. The ore-bearing zone is traced over 2.5km, its maximum thickness amounting to 400-500m in the central part (section of the river Qvani) and westwards and eastwards its thickness decreases to 150-200m. The ore-bearing bodies are observed throughout the ore-bearing zone and are represented by veins (with thickness from single centimeters to one meter) and nests, where five ore-bearing associations are distinguished: quartz-scheelitic, quartz-pyritic, quartz-polysulfide, quartz-antimonitic and quartz-gold. Gold is observed in all of them, but its highest concentration is evidenced in quartz-gold association; its maximum content corresponds to 20 g/t. [5].

Along with gold, the Hokrila ore manifestation deserves attention for high concentrations of stibium and its widespread occurrence. The main mineral of this element is antimonite that constitutes more than 50% of the ore-bearing band.

The Achapara ore manifestation zone genetically, structurally and by coverage is similar to the Hokrila ore manifestation (see Fig.). This 200-300m thick ore manifestation is formed in granite-migmatitic complex and extends over 2km along the right bank of the river Achapara. In this zone are distinguished such ore-bearing associations as in the Hokrila ore manifestation. Here also the highest concentrations of gold are evidenced in the quartz-gold association. Its maximum content reaches 17 g/t. [5].

The Memuli ore manifestation crops out between the Hokrila and Achapara ore-bearing areas, to the north of the Sakeni ore field. This zone as well as the above-described zones is localized in the rocks of granite-migmatitic complex. It is traced over 1.8 km and attains 600-700m in thickness. In the Memuli ore manifestation the average gold content reaches 2.5 g/t, tungsten – 0.23%, stibium – 1% and arsenic – 0.1% [2].

The Kakrinachkuri ore manifestation is exposed on the eastern margin of the Sakeni granitoid intrusive. Here, in the crystalline schists and migmatites enclosing the intrusion a brecciated and greisenized ore-bearing

zone has been formed that is several tens of meters thick; it follows along the intrusive over a distance of 400m. The type of mineralization is similar to the above-described. The average gold (Au) content reaches 2.0 g/t, tungsten (W) – 0.03% and that of arsenic (As) – 0.1% [2].

The investigations have shown [1-3] that the contemporary erosion exposes the frontal, most low-temperature, mainly quartz-gold-antimonitic associations of the Sakeni ore field. Temperature of their formation falls within 210-230⁰C, whereas more rich quartz-gold association is formed at the temperature 230-250⁰C and quartz-pyrite-arsenopyritic association - in the interval of 290-320⁰C [2]. Moreover, in the central part (section of the river Kvani) of the Hokrila ore manifestation, in ascending section a decrease of Au concentration and increase of Sb is quite obvious.

Comparison of our data with the classical analogous ore manifestations has indicated that the Sakeni ore field genetically belongs to the rank of deposits of quartz-gold-low-sulfide hydrothermal genetic type, formed at a medium depth (2-3km) in metamorphic and ultra-metamorphic complexes; these deposits - spatially and genetically - are connected to convergent bound-

aries of diorite-granodioritic intrusives of mantle-crust origin. The necessary condition for their formation is a strong regional fault – an ore bearing that causes fissuring, breaking up, brecciation and prepares space for localization of ore-bearing mineralization.

The mentioned types of gold deposits are widespread in collision orogenic systems and are found in many regions of the world. The Sakeni ore field shows close affinity with the Sechi-Jirma [10] and Koktapani [11] ore fields.

Thus, from the investigations carried out it follows that in the crystalline basement of the Greater Caucasus, in the contact zone between the Upper Variscan Sakeni diorite-granodioritic intrusive of mantle-crust generation and the Pre-Alpine granite-migmatitic complex the Sakeni ore field (mineralization) of quartz-gold-low sulfide hydrothermal genetic type has been formed. It is entirely controlled by the Alibek regional overthrust, crossed by a system of young faults. Recent erosion strips mainly the frontal part of low temperature quartz-gold-antimonite mineralization area. It makes possible to propose the presence of stockwork type gold mineralization in the deeper horizons of ore-bearing area.

გეოლოგია

საკენის მადნიანი ველის (კავკასიონი) გეოლოგიური დასაბუთება და პერსპექტივები

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კავკასიონის კრისტალურ ფუნდამენტში საკენის მანტიურ-ქერქული გენერაციის დიორიტ-გრანო-დიორიტული შედგენილობის ზედა ვარისციული საკენის ინტრუზივის და ალპურისწინა ანატექტური გრანიტ-მიგმატიტური კომპლექსის კონტაქტის ზონაში ავტორების მიერ გამოყოფილია საკენის მადნიანი ველი. მასში ლოკალიზებულია კვარც-ოქრო-მცირესულფიდური ჰიდროთერმული გენეტური ტიპის ოთხი იზოლირებული მადანგამოვლინება, რომელთაც მთლიანად აკონტროლებს ალიბეკის რეგიონალური შეცოცება და მისი გამკვეთი ახალგაზრდა რღვევათა სისტემა. თანამედროვე ეროზია ძირითადად აშიშველებს საკენის

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