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E.V. Belogub, K.A. Novoselov, E.E. Palenova, M.V. Zabotina, P.V. Khvorov
Institute of Mineralogy UB RAS, Miass, bel@mineralogy.ru

MINERALOGY OF OXIDIZED ORE OF IKRYANSKOYE GOLD DEPOSIT (SVERDLOVSK DISTRICT, RUSSIA)

Икрянское месторождения золота приурочено к зоне Егоршинского глубинного разлома и локализовано в рассланцованных метавулканитах и метаосадочных породах – эпидот-актинолит-хлоритовых, хлоритовых, кремнистых, глинисто-кремнистых и углеродисто-глинисто-кремнистых сланцах. Руды вкрапленные, прожилково-вкрапленные. Золото связано с пиритизацией, находится преимущественно в самородной форме, обычно содержит примесь ртути. Окисленные руды глинистые, при этом метавулканиты характеризуются высокими содержаниями хлорит-смектита, в то время как метаосадки обогащены слюдой и каолинитом. Наличие глинистых мирнералов с высокой сорбционной емкостью ухудшает технологические свойства руд, предполагаемых для гидрометаллургической переработки.

Due to the depletion of gravel and large gold deposits in the Urals in the last decade a small objects that are available for open-pit mining are involved to exploitation. As a rule, these deposits of oxidized ore with low grade of gold. Gold from ore is extracted by heap leaching cyanidation. The efficiency of this process is largely determined by the mineral composition of the ore: size and morphology of gold, clay content, the presence of fresh sulphides and copper minerals. The study of the mineral composition of oxidized ore was held in conjunction with the planned mining of the deposit ZAO Aurum. Currently Ikryanskoye deposit is excavated by shallow pit.

Ikryanskoye deposit is a part of larger Fevralskoye deposit, which belongs to submeridional Reft schist band of Sillurian–Lower Devonian volcanic-sedimantary rocks. Deposit locates in Yegorshinskiy regional fault. Ore zone is located within tectonic wedge, which contacts with Lower Carbon carbon-bearing sedimentary rock and limestone in East. In West direction schist band boardered with Low Carbon Reft gabbro-granite complex. Vein bodies of granite in schist band connect with this complex. There is regional weathering crust above deposit. Its thickness at the plane area is about 25–30 m. Linear weathering crust above tectonic zone spread deeper more, then 60 m [Koshkin et al., 2009].

Host rocks because of tectonic influence are schistose. There are metavolcanites (basalt with rare dacite), their clastic varieties, metasediments, and rare vein plagiogranite. Metavolcanic rocks were metamorphosed under epidote-amphibolite subfacie of green-schist facie. In ore zone they al-

tered to chlorite, epidote-chlorite, gauffering schists. Chert, quartz-sericite, clayey shists and rare black shales are metasediments in ore zone. Gold concentration is connected with metasomatical processes as disseminated pyrite and some quartz-carbonate veinlets [Sazonov et al., 1999].

Pyrite is the main ore mineral of fresh ore. Chalcopyrite, sphalerite, pyrrhotite, pentlandite are secondary. Alloclasite, galena, altaite, cinnabar (?), and native gold are rare. Nickel and cobalt enrichment of iron sulfides is typical for deposit. Main matrix minerals of metavolcanites are epidote group, chlorite, actinolite, albite, quartz. In metasediments there are quartz, albite, sericite, carbon matter.

Clayey eluvial weathering crust after schist with steep bedding is outcropped in open pit. The separation of wheathered metasediments and metavolcanites in open pit is very difficult. But some small lenses of black shale among brownish clayey oxidized chert and schist can be allocated in the central part of open pit.

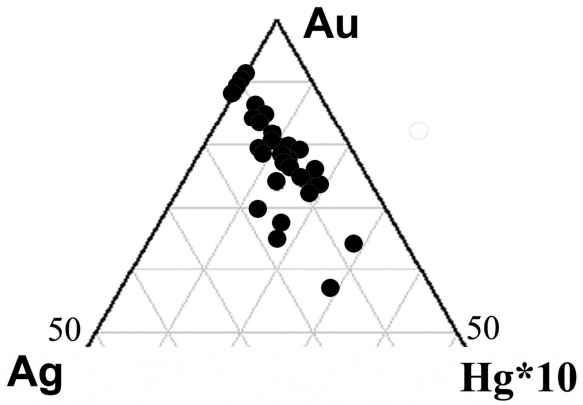

Fig. 1. Composition of gold (mas.%).

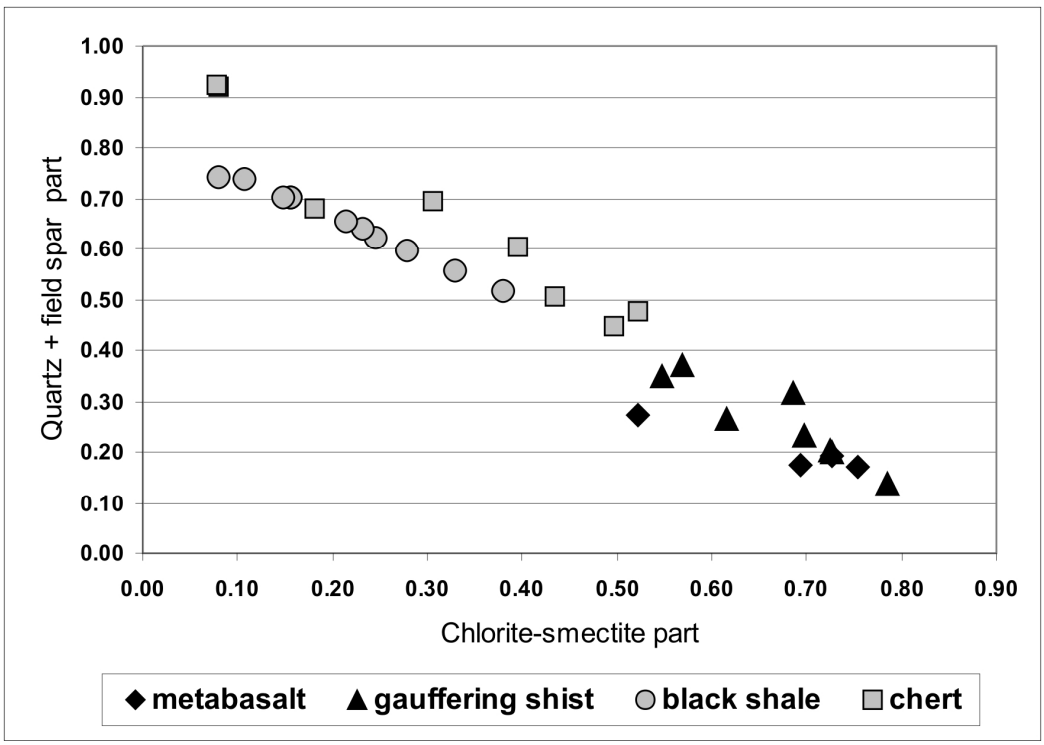

Fig 2. Quartz + field spar and smectite-chlorite + kaolinite in different weathered rock type plot.

Ore bodies can be isolated only by sampling. Oxidized ore is clayey, ocher-cleyey with relic schistosity. Gold content very varies, average 3.4 g/t with cut-off grade 1.4 g/t and reach more then 1 kg/t [Koshkin et al., 2009]. Au/Ag ratio also varies from 10 to 0.07, usually 1–3.

Goethite is prevailing ore mineral in heavy concentrate of ore independently of matrix. Rutile and semioxidized pyrite and chalcopyrite are occasional. Gold forms free particles with complex morphology up to 2 mm in size as well as micron-size inclusion in pyrite. Impurity of silver (10–20 mas. %) and mercury (up to 3.9 mas.%) is characterized for chemical composition of gold (fig.1). Impurity content is higher in free gold then inclusions.

Light fraction mineral composition depends of matrix. After XRD analysis (Shimadzu XRD-6000, Cu-Kα) it have been obtained that layer silicate part is higher in metavilcanites then metasediments. Oxidized and hydrated chlorite (chlorite-smectite) prevails in metavolcanites (fig. 2). Hydrated mica and kaolinite also presented in minor percentage. Layer silicates sum in this rock type is 60 % and more. Secondary minerals are quartz, albite, relics of actinolite and epidite. In general, metasediments consist of quartz and field spaar. The main layer silicate in chert is sericite and kaolinite. Carbon-bearing shale is enriched by sericite. But chlorite-smectite is in both rock type (fig. 2).

Degree of supergene change of chlorite depends after depth. At the 0–10(12) m chlorite is transformed into vermiculite-like mineral ("chlorite-smectite" with complete destroying of "brucite" layer and its replacing by smectite layer. These features are good identified using thermogravimetric analysis. After 10–12 m in depth the relics of chlorite structure became preserved. After 20 m chlorite are not changed practically.

These features of the mineral composition of oxidized ores are the base for planning of hydrometallurgical processing of Ikryanskoye deposit.

We are sincerely grateful to the ZAO Aurum administration for permission to work on deposit.

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I.A. Blinov
Institute of Mineralogy UB RAS, Miass, Russia, ivan_a_blinov@mail.ru

MINERALOGY OF THE OXIDIZED ORES FROM THE VERKHNYAYA ARSHA Pb-Zn DEPOSIT, SOUTH URALS

В работе представлены первые данные о минералах бурых железняков и полуокисленных руд стратиформного Верхне-Аршинского Pb-Zn месторождения. Набор минеральных видов схож с Амурским Zn-месторождением, представлен золотом, галогенидами серебра, галенитом, минералами семейства алунита и другими.

The Verkhnyaya Arsha deposit is located 1.5 km to north from the village of Verkhnyaya Arsha in the Republic of Bashkortostan. It belongs to the West Urals metallogenic zone and is hosted in the Riphean dolomites. The deposit was exploited before 1958. The ores include sulfide (Fe and Pb-Zn), semioxidized and oxidized types. The major minerals of the sulfide ores are pyrite, galena, and sphalerite [Rotar et al., 1976]. Anglesite, cerussite, jarosite, and Pb-jarosite were identified in the oxidized ores in addition to Fe-hydroxides [Shumikhin et al., 1956]. The technogene supergene mineralisation was previously described [Blinov et al., 2011].

The oxidized ores (or brown ore) are characterized by heterogeneous chemical composition and contain up to 0.7 % Zn and Pb and up to 0.3–1.5 % Ag in some samples. The brown ore with high amount of sulfides represent semioxidized ore with the higher Zn and Pb contents.