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Review Article

PLATINUM GROUP METALS IN GOLD DEPOSITS OF UZBEKISTAN

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ABSTRACT
Uzbekistan has potential for PGM deposits. Currently, these metals, as minor components, subject to improvements in processing technology, may be of practical use for their recovery from ores of large- and medium-scale gold and gold-silver deposits containing low-level concentration. The article presents data on the re-evaluation of platinum group metal prospects in the gold deposits of the Central Kyzylkum.

Keywords: *Platinum, Gold, Ore, Muruntau, Kokpatas, Pyrite, Kyzylkum*

INTRODUCTION
Platinum Group Metals are contained in sulfide platinum-copper-nickel, low-sulfide platinum-ore, platinum-chromite, gold (silver)-platinum (black-shale type) formations - derivatives of polygonal ore-magmatic and ore-metasomatic systems of long-term (tens to hundreds of millions of years) multistage development.
The potential to discover black shale strata deposits is relevant for Uzbekistan, given the growing demand for them. The current data on the quantities of platinoids both in gold, gold-silver targets of Central Kyzylkum and in their host black-shale strata are quite ambiguous (Nekrasov and Stavsky, 1999).
The concentration of Palladium in the ore at Muruntau is below the detection threshold of existing analytical methods. However, it accumulates on resins and is extracted during processing. Annual production of palladium amounts is to the first kg per year.

DISCUSSION
The long Tien-Shan gold belt stretches, in accordance with paleotectonic reconstructions, from the Central Kyzylkum, Fergana Ridge and on to the Kelpincheltag Ridge (PRC), and is formed by black shale strata, gneisses, granitoids, gabbro, picrites. During the sedimentation period the areas of carbonaceous shales were characterized by active tectonic movements. In Western Uzbekistan, terrigenous carbonaceous shales rich in gold and platinoids (Muruntau, Kokpatas, Daugyztau deposits, etc.) are regressively deposited on Vendian carbonaceous-siliceous shales and, in turn, are overlain by even coarser-terrigenous sand-slate deposits of Ordovician-Silurian.
The co-precipitation of lithophile and siderophile elements in carbonaceous sediments is determined by a number of factors. Among them the primary role is played by easy hydrolysable metals and their ability to form complex compounds with organics. Such metal-organic and chemical compounds enrich the biogenic sludge. Subsequent lithification, catagenesis, and regional metamorphism lead to the formation of metalliferous cherts. Joint accumulation of lithophile and siderophile ore components in shales may also occur during epigenetic processes.
The flanks of the Muruntau ore bodies have belts of syenite-porphyry and plagiogranite-porphyry dikes. Precontact changes in siltstones and mica schists near the dikes (hornification, phenitization) are insignificant in thickness, not more than 3-5 m. Direct connection of the Late Hercynian- Early Triassic dike process with gold mineralization has not been traced. In the field of Kosmanachi deposit, 250 m to the north of the ore zones, single dikes of kersantites and less frequently of plagiogranite-porphyries are detected.
Consumption of PGM is extremely growing, far outstripping the growing rates of ferrous and nonferrous

metals and energy carrier's consumption. At the same time, there is a tendency of palladium gradually replacing platinum. The occurred dynamics of demand on platinoids and rather high price conjuncture for the platinum group metals, including palladium, make it possible to reevaluate the economic value of PGM-containing gold (especially sulfide) deposits and gold-silver deposits of Central Kyzylkum.

To estimate the scale of palladium quantities in the deposit, 26 bulk samples and 53 samples of sulfide concentrates and monominerals were taken. Palladium concentrations in these samples according to the results of the GI- REDMET laboratory turned out to be 0.1-13 g/t, platinum - 0.01-0.05 g/t, ruthenium 0.002-0.05 g/t.

According to the results of these analyses, palladium content in near-ore space fluctuated within 0.05-0.15 g/t, reaching 0.4-0.9 g/t in some samples. In ore bodies, the average content of palladium was about 0.3 g/t, and platinum - at the clark level (Yuldashev, 2001).

Palladium content in some bulk samples of primary ores of this deposit according to mass-spectrometric analysis (the same source) varies from 0.11 to 0.41 g/t.

There are almost no direct determinations of platinum group elements content in vein-disseminated gold-sulfide ore of Auminza-Beltau ore district. However, neutron-activation analysis revealed platinum content of main sulfides (pyrite and arsenopyrite) in ores of the Adzhibugut deposit localized in silicified, sericitized and in some places albitized metasediments and shales of Besapan formation

Assuming that all quantities of platinoids in ores are conditioned by their content in the main sulfides, the bulk concentrations of platinum could be from 0.04 to 0.1 g/t, of palladium from 8 to 15 g/t (at the sulfide content in commercial ores of 5 %). Platinum and palladium quantities in the host rock (estimation according to the same principle with pyrite content averaging approximately 1%) may be in the range of 0.001-0.005 and 0.002-0.006 g/t, respectively.

All stages of degeneration of sedimentary-diagenetic pyrite into metacrystalline crystalline and vein pyrite were traced at Daugyztau deposit. It was shown that as the metamorphic and hydrothermal transformations of the host rocks increase in metacrystalline and vein mineral formations, the quantitative ratios of pyrite and arsenopyrite substantially shift in favor of the second of them.

In light of this, one may expect a notable increase in platinum contents in rocks and ores of deposits of Kokpatas ore field where volcanogenic derivatives of diorite magmas are widely spread in the host rocks and quantitative parity of pyrite and arsenopyrite is observed in a number of ore bodies.

The resulted review of study of platinoids of some gold and gold-silver objects, first, allows to refer them to potential PGM-containing, opening the basic possibility of revaluation of ores, and second, testifies to ambiguity and some inconsistency of available analytical data on PGM content level in ores. Hence, these result in the necessity to continue further researches taking into account the creation of reliable laboratory base.

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