

## SECTION 21. GEOLOGY, MINING AND PETROLEUM ENGINEERING (ENGLISH, GERMAN)

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than the one, which could be observed during optimal operation (Fig. 2). This conclusion can be proven by analyzing the output product. During the end of the work period, juddering changes was observed, and the output of the product is between 81 and 84.5 % mass.

Furthermore, computer model is able to take the reactivity of the individual components into account. This makes it possible to evaluate the performance of the industrial reformer adequately. The juddering changes of activity confirms changes in the composition of the feedstock in this work period, namely reduction of aromatic hydrocarbons for 19.12.12 and 09.01.13 (from 60.96 to 68.88).

Therefore, the calculations of the current and optimal activity of the catalysis were done, the degree of the composition feedstock influence was evaluated, and the impact of technological regimes was researched. Based on these calculations it is possible to conclude that:

1. The installation works relatively close to optimal. An insignificant deviation from the optimum current activity was observed at the end of the work period (0.4 points), which may be associated with a change in the feedstock composition.
2. The amount of coke used in the catalysis during the current activity is 34.92 % higher than the optimum value.
3. The output of product is in the range of from 81 to 84.5% mass.

### **PLATINUM–METAL MINERALIZATION OF THE WESTERN AND CENTRAL PARTS OF THE STANOVAYA METALLOGENIC ZONE (FAR EAST, RUSSIA)**

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The Stanovaya metallogenic zone occurs along the southeastern margin of the Northern Asian Craton with a length of 1300 km and a width of ~250–300 km. The metallogenic zone is located in the eastern part of the Stanovoi megablock limited by the Stanovoi deep fault from the north and by the Mongol–Okhotsk deep fault from the south. A megablock surrounds the Aldan protomassif, represented by a folded–block or granite–greenstone area that underwent Mesozoic tectonomagmatic activation. The structure of the territory includes a number of blocks composed of Early Archean (Zverevsko–Chogarskii and Zeiskii Complexes) and Late Archean (Stanovoi and Gilyuiskii Complexes) metamorphic rocks. Intercratonic troughs are filled by formations of the Early Proterozoic Dzheltulakskii Complex represented by phyllite like, biotite, and twomicaschists, quartzites, metaconglomerates, and metaeffusive rocks [1].

Platinum mineralization of the Stanovaya metallogenic zone mainly belongs to the sulfide Pt–Cu–Ni formation [5]. It is genetically related to three basic–ultrabasic complexes of different ages: Archean–Proterozoic anorthosite, gabbro–anorthosite, and dunite–troctolite–gabbro; Paleozoic ultrabasic; and Early Cretaceous cortlandite–pyroxenite–gabbro complexes. In our opinion, at the modern level of study, four potentially platiniferous ore regions may be distinguished on the territory of the Stanovaya metallogenic zone: Kalarskii, Luchanskii, KunMan'enskii, and Dambukinskii (Fig.).

The Kalarskii platiniferous massif composed of anorthosite, gabbro–anorthosite, gabbro–norite, and gabbro is distinguished in the Kalarskii region. Its isotope age is estimated as 2.62 Ga [2]. The massif contains deposits and ore occurrences of platinumbearing titanomagnetite (Bol'shoi Seim, Kuranakh) and copper–nickel (Bayukit and others) ores. Thus, the Kalarskii massif is promising not only for accompanying production of platinoids from titanomagnetite ores, but also for searching for PGE mineralization of the lowsulfide type similar to that discovered in the Chineiskii massif of Transbaikalia.

Two platiniferous intrusions of the dunite–troctolite–gabbro composition (the Luchanskii and Il'deusskii massifs) with small sizes (from tens to several hundred km<sup>2</sup>) occur in the Luchanskii region. The Luchanskii massif is composed of troctolite and olivine gabbro with stratalike segregations of melanocratic troctolite and plagioclase dunite intruded by dykes of gabbro–diabase, pegmatoid gabbro, pyroxenite, and peridotite. The Zeiskoe (Luchanskoe) copper–nickel ore occurrence is located in the northwestern part of the massif. It occurs in the apical part of the massif and is composed of olivine gabbro–norite with cortlandite and websterite layers. Seven sulfidebearing zones with a length up to 1 km and a thickness of 75–150 m are revealed there. Ore minerals are represented by pyrrhotite, pentlandite, chalcopyrite, violarite, and pyrite. Ores are epigenetic. The following PGE concentrations (ppm) were registered in bulk samples collected in 2012: Pt, 0.075–0.2; Pd, 0.069–0.1 (sulfidized pyroxenite); Pt, 0.006 (gabbro); Pt, 0.001–0.01; Pd, 0.05 (gabbro–norite); Pt, 0.001–0.01 (troctolite); Pt, up to 0.01 (sulfidized gabbro). The predicted resources of PGEs are 50 t by the P3 category.

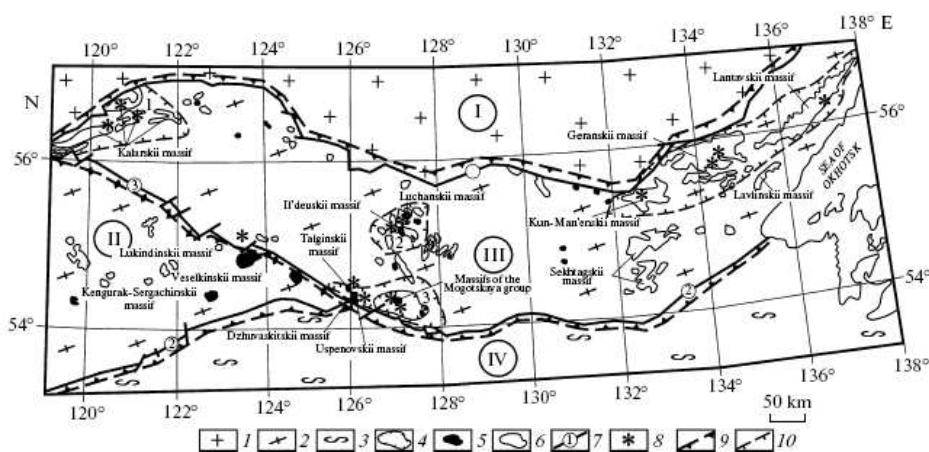


Fig. PGE ore occurrences in the Stanovaya metallogenic zone:

(1) Aldan Shield; (2) Stanovoi megablock; (3) Mongol-Okhotsk folded area; (4) area of abundance of Early Cretaceous cortlandite-pyroxenite-gabbro small intrusions and dykes; (5) Early Proterozoic dunite-troctolite-gabbro intrusions; (6) Late Archean anorthosite and gabbro-anorthosite intrusions; (7) deep faults, numerals in circles: (1) Northern Stanovoi, (2) Mongol-Okhotsk, (3) Dzhaltulakskii; (8) PGE-copper-nickel ore occurrences; (9) contours of metallogenic zones, Rome numerals in circles: (I) Southern Yakutia, (II) Northern Baikal, (III) Stanovaya, (IV) Mongol-Okhotsk; (10) contours of platiniferous ore regions: (1) Kalarskii, (2) Luchanskii, (3) Dambukinskii, (4) Kun-Man'enskii.

The Il'deusskii massif is composed of dunite, troctolite, and olivine gabbro of the Il'deusskii Complex intruded by dykes of plagioclase peridotite, pyroxenite, and gabbro-norite. Syngenetic and hydrothermal types of sulfide copper-nickel mineralization are observed. Ore minerals include pyrrhotite, pentlandite, chalcopyrite, and pyrite. Bulk samples of gabbro-norite collected in 2012 contain 0.127–0.355 ppm Pd and 0.054–0.073 ppm Pt. The predicted resources of PGEs are 50 t. The predicted resources of PGEs by the P3 category are 25 t.

Basic-ultrabasic complexes perspective for gold and PGE mineralization are distinguished on the territory of the Dambukinskii ore region: Khani-Maiskii Complex of metamorphosed basic and ultrabasic rocks; peridotite-gabbro Ul'degitskii Complex and gabbro-pyroxenite-peridotite Dzhaltinskii Complex [3, 6].

The Khani-Maiskii Complex of metamorphosed basic and ultrabasic rocks includes the Maristyi massif composed of olivinite, peridotite, gabbro, pyroxenite, anorthosite, garnet plagioclase, and hornblende. Impregnation of pyrrhotite, chalcopyrite, and pentlandite is abundant in rocks. Atomic-absorption analysis of bulk samples collected in 2012 provided the following element concentrations (ppm): Pt, 0.08–0.55; Pd, 0.01–0.2; Ir, 0.02–0.1; Rh, 0.001–0.03; Ru, 0.01–0.05; Os, 0.007–0.2; Au, 0.1–0.56.

The Ul'degitskii peridotite-gabbro complex includes two wellstudied massifs: Talginskii and Uspenovskii. The Talginskii massif is composed of pyroxenite, serpentinized peridotite, gabbro, and gabbro-diorite. Mineralized zones with a thickness of 1–7 m containing impregnated and vein-nest sulfide platinumbearing copper-nickel ores of the Stillwater (Fedorovo-Panskii) and Shanuchskii (Norilsk, Monchegorsk) geological types are observed in ultra basic rocks. Spectral analyses provided the following element concentrations in 16 trench samples: Pd, 0.1–1 ppm; Cu, 0.1–0.52%; Ni, 0.05–0.4%; Co, 0.02–0.1%; Ag, 0.1–2.5 ppm. The inversion volt-ampometric analysis provided the following concentrations: Pd, 0.55–2.22; Pt, 0.09–0.45; Au, 0.09–0.32 ppm. The Uspenovskii massif is composed of pyroxenite, minor gabbro, gabbro-diorite, diorite, and peridotite. According to the data of atomic-absorption analysis (33 bulk samples), rocks contain Pt, up to 0.21 ppm; Pd, 0.21–0.67 ppm; Os, up to 0.013 ppm; Ir, up to ppm; Au, 0.07–0.75 ppm (gabbro, gabbro-amphibolite, pyroxenite with sulfides); Pt, 0.16–ppm; Pd, 0.03–0.25 ppm; Os, 0.011–0.2 ppm; Ir, 0.016–0.111 ppm; Au, up to 0.44 ppm (peridotite replaced by serpentine and talc with sulfides).

The Dzhaltinskii Complex contains the Mogotskaya group of small intrusions composed of cortlandite, hornblende, pyroxenite, peridotite, and gabbro with a group of ore occurrences (Nikelevoe, Strelka, Taehzka, and Alaska) with PGE-copper-nickel mineralization.

The Nikelevoe ore occurrence contains harzburgite, olivine and garnetbearing pyroxenite, gabbro, and gabbro-amphibolite with fragments of copper-nickel ore. As is evident from the atomic-absorption analysis, sulfidized ultrabasic rocks contain (ppm): Pt, 0.01–0.015; Pd, 0.02–0.075; Ru, 0.02–0.025 and copper-nickel ores contain (ppm): Pt, 1.38–8.29; Pd, 2.25–4.52; Ir, 0.01; Rh, 0.2–2.9; Ru, 0.08–0.1; Os, 0.01. The spectral analysis provided the following concentrations (%): Ni, 2.95–6.55; Cu, 0.25–2.88; Co, 0.13–0.24; Cr, 0.41–0.56. Sulfide minerals are represented by pyrrhotite, chalcopyrite, pyrite, and pentlandite.

The Strelka ore occurrence is represented by small (up to 0.1–5 km<sup>2</sup>) stocks, dykes, and sills of cortlandite, pyroxenite, and gabbro containing impregnated, nestimpregnated, and veinimpregnated pyrrhotite-chalcopyrite ores. Scintillation analysis provided the Pd concentration of 0.008–0.05 ppm and the presence of Pd-Os particles. The atomic emission and ICP spectrometry provided the following concentrations: Cu, up to 0.76%; Ni, up to 0.13%; Co, up to 0.08%; Ag, up to 4.8 ppm; Au, up to 0.019 ppm; Pt, 0.005–0.014 ppm; Pd, 0.006–0.08 ppm. The predicted resources by the P3 category are 25 600 (Cu), 12.8 (Pt), and 64 (Pd) t. The copper-nickel mineralization may have commercial interest only in the case of complex extraction of copper, nickel, cobalt, and noble metals [4].

The Taezhka ore occurrence is represented by small intrusions of pyroxenite, cordierite, and dunite intruding the Archean metamorphic complex. Densely impregnated, impregnated, and nest-impregnated pyrrhotite–chalcopyrite ores are distinguished. Atomic emission and ICP spectrometry provided the following concentrations: Ni, 0.02–0.065%; Cu, 0.119–0.503%; Co, 0.004–0.035%; Au, 0.15–0.41 ppm; Ag, 0.5–1.3 ppm; Pt, 0.15–0.18 ppm; Pd, 0.08–0.1 ppm. Pyrrhotite prevails among sulfides (up to 95–99%); there are small contents of chalcopyrite, pentlandite, and pyrite. The revealed copper–nickel ore occurrence requires additional study by bulldozer trenches through the valley of the Taezhka Brook and deep holes.

The Alaska ore occurrence is composed of peridotite and pyroxenite intruding the Archean metamorphic complex. Impregnated and vein-impregnated pyrrhotite–chalcopyrite ores were revealed in ultrabasic rocks. The following concentrations were obtained by the atomic-absorption analysis (ppm): Pd, up to 0.72; Pt, up to 0.14; Ru, up to 0.1; Au, up to 0.1.

Thus, the Stanovaya metallogenic zone (its western and central parts) is promising for discovery of various geological types of PGE mineralization on its territory, especially those related to widely abundant basic–ultrabasic massifs with impregnated, vein-impregnated, and massive sulfide mineralization. It is necessary to perform detailed investigations of numerous gold placers as well, in which dredging and hydraulic working allowed researchers to discover commercial concentrations of PGEs (native platinum, sperrylite, polyxen, etc.).

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### ENVIRONMENTAL CONDITION OF THE MZYMTA RIVER AFTER CONSTRUCTION AND EXPLOITATION OF OLYMPIC VENUES

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Sochi 2014 Olympic and Paralympic Winter Games has gone and due to this event world society has started to discuss the Games organization level, Games, in general, winners and losers as well. Eleven Olympic venues were built for Sochi 2014 Winter Games which, surely, have impact on the environment. One of the main problems concerning Games organization is the effect of such construction on the environment as well as method of its protection from ecological disasters and their prevention.

In our research, we have decided to make analysis of the resultant Olympic venues impact and in accordance with this several goals were set:

- To consider and explore the Mzymta river water composition during construction
- To explore the measures on prevention of Olympic venues' negative environmental impact
- To analyze the legislation adopted prior to the Sochi 2014 Winter Games.

Olympic venues construction is sited on two clusters: Coastal Cluster and Mountain Cluster. Mountain venues group is situated in the borders of Sochi National Park which is of federal value. Some of Olympic venues are located on two ski regions which are intended for commercial use. Venues territories include the habitats of flora and fauna species listed in the RF Red Book, being also part of environmental accounts area for Olympic venues.

Besides, the area of not less importance for Games facility is located in the Mzymta valley predominantly on the left riverside. There is Adler – Alpika-Servis Combined Road and Railway. It should be taken into account that Mzymta refers to the highest fishery ponds category, which ensures reproduction, feeding and wintering salmonids and trout farm development in the floodplain [6].

Construction of Combined Road and Railway led to some ecosystem transformation, namely, riverbed changing, deforestation on the left riverside, reduction and loss of habitats of rare and endangered plant species listed in the Red Book of the Russian Federation and the Red Book of the Krasnodar Region [1].

According to results of hydrochemical observations made by Federal Water Agency chemical state of the Mzymta waters totally has changed within 2007-2013. For example, the turbidity of the Mzymta suspended solids have significantly changed, as well as Fe, phenols and oil sometimes exceeds the values of MPC<sub>px</sub> and SAE<sub>chem</sub> adopted for fishery in ponds and rivers of the Black Sea basin, respectively.

Climate particularity of Olympic venues location region and their territories imposes many obligations for the Olympic facilities design. Project includes negative impact minimization measures for the environment, environmental monitoring, conducted at all stages of the construction, reclamation of land, relocation of rare animal and plant species, as well as a set of measures to support the biodiversity of Games region [1].

In accordance with this the Environmental Program “Sochi 2014” was developed supported by the Supervisory Board of ANO “Organizing Committee” Sochi 2014 “June 2, 2009 Environmental Strategy “Sochi 2014”. Environmental