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To the problem of rhenium extraction in the areas of modern volcanism

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Rocks of the areas of modern volcanism, fumarole gas of volcanoes, rhenium bearing waters of thermal springs can become a likely source of rhenium. At present in the Kuril Islands, about 20 manifestations were revealed of rhenium mineralization of various types of the age from the Late Miocene to Holocene. Detection of rheniite, rhenium-bearing molybdenite, cadmoindite, kudriavite, indium-bearing minerals of the system ZnS-CdS and other minerals of rare and trace elements in fumarole products allowed distinguishing a new type of rare-metal sulfide ore formed in the conditions of high temperature and low pressure.

Systematic and detailed studies of fumaroles gas of Kudriavyi started in 1993. It was established that beside rhenium, fumaroles gas contains a number of other valuable elements: In 45 %, Ge – 34 %, Re – 16 %, Au – 4 %, Bi – 1 %. Rhenium mineralization is centered in fumaroles fields. In the manifestation area five ore zones were distinguished. To assess the possibility of commercial extraction of rhenium in volcano Kudryavyi, a new technology of rhenium extraction from fumarole gas was tested.

In 2012 – 2013, works were conducted in volcano Kudriavyi that were aimed at the search for rhenium mineralization in volcanogenic formations. Sampling was made in the vent and flanks of the volcano Menshoi Brat, outer fumarole fields of volcano Kudriavyi, low-temperature fields of the eastern flank of volcano Sredniy Brat, the saddles of volcanoes Sredniy Brat and Medvezhiy. The results of work showed contamination of the territory with rhenium.

To find processing solutions, research was conducted into metal-bearing sublimates of hot fumarole fields with rock temperatures in the range from 600 to 650°C. Laboratory research showed that Re content varies from 15 g/t to 287 g/t and on the average makes 108 g/t. The ores under investigation are more likely grouped with refractory ores, which can be accounted for by both a considerable admixture of iron in volcanic glass of andesite composition and micro concretions of rhenium-bearing molybdenite and cellular glass. The ground mass is saturated with inclusions of small crystals of various minerals: magnetite, pyrrhotine, hematite, molybdenite, rheniite, sulfides of copper, zinc, lead and iron as well as oxides of molybdenum, iron, magnesium and aluminum. Rheniite in the free form is not noted in the sample, but it occurs in the form of thin dispersed particles in the ground mass in notable amount. All these features complicate rhenium production with the use of conventional methods. In this case, the extraction into total collective concentrate amounts to: Mo – 20.9-25.2 (with content of 13.4-19.1%) and Re – 43.7-48.2% (with content 0.43-0.55%).

Further research showed that extraction of metals can be accomplished by direct leaching. Thus experimentally it was established that with acid leaching the extraction of rhenium from rocks reaches 60% and with alkaline leaching it is lower (40 – 45%), but the equilibrium rhenium-molybdenum shifts to rhenium and provides its greater yield.

Thus volcanogenic formations of fumarole fields of volcano Kudriavyi are considered to be a possible source of rhenium.