

On ecological-geochemical monitoring in Kamchatka (the Mutnovsky-Asachinsky ore region)

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The Kamchatka Peninsula with its beautiful scenery, fauna and flora is one of the last Russian regions which has not yet suffered from the monstrously destructive forces of exploration and exploitation for economic minerals. Many economically important materials, solid, liquid and gaseous occur at depth in Kamchatka. Geothermal heat (hot water, water-steam mixtures and hot dry rocks) and precious metals (Au, Ag and Pt Group metals) are of great importance there. With its significant reserves of these precious metals, Kamchatka has become of great importance after the disintegration of the USSR and the loss of traditional regions of gold mining such as Uzbekistan (Muruntau etc.) and Kazakhstan.

Geothermal energy is becoming important, and will help to solve some of Kamchatka's economic problems, since these geothermal waters amount to about 75% of the country's available total.

Commercial reserves of Au have been established in the Mutnovsky, Rodnikov, Asachinsky and Ametistovy deposits which contain solid auriferous ores, but only those of Ozernovsky and Zolotoy are exploited at present. More than a hundred Au occurrences are known and no doubt several of these will be commercially exploitable. Placer deposits of gold and the platinum group metals are of especial importance and are particularly significant.

There is intense economic activity in South Kamchatka, with the greatest in the Mutnovsky-Asachinsky ore region. This is not only a very beautiful part of Kamchatka, it is also one of the world's most beautiful areas as well. Here there are two active volcanoes, Mutnovsky and Gorely, and three great active geothermal systems, Mutnovsky, Vilucha and Karymshino-Bolshebanny with their associated hot springs. There are splendid views from the crater of

Mutnovsky Volcano available for both scientists and tourists. Intensive mineral formation takes place at depth as well as at the surface associated with this geothermal activity. The connected processes of ore formation and volcanicity can be studied together in this natural laboratory in a National Park.

Mutnovsky Volcano is at present the construction site for the building of the largest geothermal power station in Russia (about 100MW), but in this area auriferous solid ores with reserves of up to 100 tons Au and 1000 tons Ag are to be found. During the exploration and exploitation of these deposits several adits have been driven and trenches dug. Hundreds of thousands of tons of spoil from these works have been brought to the surface and deposited on the surface soils which have now been contaminated. This debris now lies in stream catchment areas that feed the main spawning rivers of the region - the Paratunka, Vilucha, Asacha and Jirovay etc. Weathering of the rocks comprising this spoil results in mobilisation of many contained elements, both precious like Au and Ag, as well as others such as Cu, Pb, Zn, Cd, Ge, Se, Te, Hg, As, etc which then appear in the groundwater.

Preservation of this outstanding area of natural beauty as well as the natural laboratory which exists in the face of this intense economic activity requires ecological-geochemical monitoring and needs help from scientists world-wide and maybe also from UNESCO. The objectives of this monitoring would be: 1) Investigation of the natural geochemical background, 2) Monitoring compositional variations in natural stream waters and in geothermal systems, 3) Measure concentrations and determine species of toxic components of ores, hydrothermally altered rocks, and those present in hydrothermal systems of South Kamchatka.