Mineral forming processes in the modern volcanic areas (Kuril Islands) as the indicator of fluid flow conditions.

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Active fumarole fields of volcano Ebeko (Kurile Islands) were investigated during 2001 year to find-out the mineral formation sequence and regularities of crystal growth from gas-hydrothermal solutions. The places of fumarole activity are presented by hot acid sources of two types: fumaroles (gas) and solfataras (gas-liquid) ones. Physical and chemical parameters of solfataras vary essentially at the same fumarole field: __ are 0.78-4.16, t?_ - 96-41 and mineralization - 0.04-7g/l. Significant distinctions are established both for main and trace-elements (ppm): $Ca^{+}Mg$ 306 (1.5), Na 129 (1.7), K 31.3 (1.2), Cl 9510 (1.5), SO_4 9310 (9.6); Al 281 (0.4), Ba 0.13 (0.02), Cr 3.5 (0.01), Fe 104 (0.06), Mn 4.06 (0.5), Ni 1.9 (0.01), P 2.7 (0.2), Si 187 (0.6), Sr 1.5 (0.05), Ti 0.8 (0.0), V 1.05 (0.002), Zn 0.13 (0.0), Zr 0.08 (0.0).

Deposition of minerals occurs around coming out of solfataras and on hot (40-60°C) walls of drainage streams. Main minerals of surface association are: halotrichite - $Al_2Fe(SO_4)_4*22H_2O$, tamarugite - $NaAl(SO_4)_2*6H_2O$, gypsum - $CaSO_4*2H_2O$, jarosite - $KFe_3(SO_4)_2(OH)_6$, meta-alunogen - $Al_2(SO_4)_3*17H_2O$) and to a lesser degree silicates (revdite - $Na_2Si_2O_5*5H_2O$) and phosphates (sampleite - $NaCaCu_5(PO_4)_4Cl*5H_2O$). Saturation indexes calculated by means of WATEQ4F code (Ball and Nordstrom, 1987) revealed some phases that could present in the solution but not found in samples yet.

Variations of solutions composition and physical and chemical conditions, and also a mineralogical variety of formed phases indicate, probably, to a various degree of altering and chemical weathering of rocks through which there is a rise of a fluid and as a consequence, about age of the object (fumarole or solfatara). Thermodynamic calculations with use of multireservoir model (Karpov et al.,2000) have shown, that such variety in qualitative composition of solfataras could be connected with a degree of altering and chemical weathering of rocks and/or intensity of a fluid flow.

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Geochemical estimation of environment impact of Co-Ni-As tailings.

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Storage places of ore-recovering industry wastes are the source of trace elements to the environment. The object of this study are the tailings of the "TuvaCobalt" plant, processed nickel-cobaltic sulfoarsenide ores of the Khovu-Aksy deposit, located in the riverhead of Yenisei (Eastern Siberia, Russia). The combine has been working during the 1970 -1990 period. In 20 years of manufacturing activity more than 2×10^6 m^3 of tailings were accumulated.

Methods

During the field investigation of tailing pits, solid matter, pore waters and soils from adjacent territories were sampled. Laboratory studies consist of complete analysis on the macro- and trace-element composition, aqueous extracts preparation and its analysis for metals and arsenic as well as mineralogical analysis of secondary phases. Thermodynamic simulation was perfomed by means of the SELECTOR code to determine the species of As and metals in solution in equilibrium with their solid phases.

Results

The waste products is undergoing significant changes during storage. Contrast distribution in the vertical sections of sample pits, high contents of arsenic and metals (Co, Ni, Zn, Cu) in pore waters reflect an intensive processes of their migration under affecting of oxidizing and diluting factors. Redeposition of the secondary phases of investigated elements takes place mainly as a water soluble forms. Now share of this soluble forms is about 5 % from total As contents. Concentration of arsenic in the pore waters are limited by formation of metal arsenates, such as erythrite, annabergite, legrandite, $Ca_3(AsO_4)_2x4H_2O$.

The wind erosion is the greatest hazard to adjacent territories. The anomalies of arsenic and heavy metals in soils are located along the direction of prevalent wind, contents of As in the topsoil exceed maximum permissible concentration in 10-200 times, there is no sample with Zn content less than maximum permissible concentration.

Thermodynamic simulation shows that most stable minerals in the system under consideration are Ca, Cu, Pb arsenates, their precipitation may reduce As concentration in solutions to 0.5 g/l. In case of soil flushing by rain waters As could occurs due to Ca arsenate dissolution, while Cu and Pb arsenates will be stable in oxidizing conditions.

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References

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