



Simulation of cryogenic weathering processes of sulphides

T. Markovich (1), A. Ptitsyn (2)

(1) Institute of Geology SB RAS, Novosibirsk, Russia, (2) Institute of Natural Resources, Ecology and Cryology SB RAS, Chita, Russia

(mark@uiggm.nsc.ru / +7-383-3333112)

There is no doubt at present that active chemical interactions in the water-rock system are possible at negative temperatures. The specificity of sulphide deposits oxidation zones forming is conditioned by active sulphides oxidation processes which cause creation of aggressive sulfuric solutions (to pH under 1). Our experiments revealed new features of cryochemical processes in the oxidation zones of sulfide deposits.

The simulation of cryogenic weathering was realized on the patterns of Udokan sulphide ore (fraction - 0,063 mm). Ore leaching was performed in transparent polyethylene containers, in S:L proportions = 2.5:1 under two conditions: freezing temperature (- 20 C) and room temperature (+ 20 C). H₂SO₄ content in solution was 0.001; 0.01; 0.1; 0.5 M. Leaching period was 5, 15, 30, 60, 90 days. After full thawing and filtering solutions were analyzed by the method of atomic absorption spectroscopy.

The experiments revealed the following temporal characteristics of leaching. Sulfuric acid leaching of copper sulfide ores of the Udokan deposit at negative temperatures is more efficient than at positive temperatures. This can be related to the effect of cryogenic concentration of solutions, owing to which the H₂SO₄ concentration at 253 K reaches 2.9 M regardless of the initial concentration, which constrains the volume of nonfreezing solution and thus affects the leaching intensity. The copper concentration in the solution rapidly attains maximum values. Usually during the first days then one decreases with increasing run period presumably as a partial precipitation of the dissolved metal in the form of secondary mineral phases – basic cupric sulfates (antlerite and brochantite).

Acquired results can be applied to the development of chemical ore leaching technology (cryogeotechnology). Moreover results are closely connected with geoecology, since they allow to estimate mobility of heavy metals, copper in particular, and other contaminants on consequence of sulfuric-nitrous-acid leaching in zones of long term congelation spreading and seasonal temperature variation on the ground surface and their negative influence on the environment.