

Natural water contamination under chromite deposit mining

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For any chromite mining site there is a problem of ore waste burial. In our opinion for Aganozerskoe deposit (Russia, Karely) there are two possibilities for waste burial: to keep waste wet with water on the land surface or to put it in the nearest water reservoir (pool, lake). According to [1] the main factors which determine dissolution of minerals and migration of aqueous species are the following: (a) weight ratio of rock to water (R/W), (b) partial pressure of O₂ and CO₂ in the site atmosphere, (c) chemical and mineralogical compositions of the site rock, (d) temperature-pressure conditions of the water-rock system under study. Using these conclusions and computer simulation technique of water-rock systems the chemical reactions which are occurred between the rock minerals and water have been modeled to estimate the groundwater contamination.

The computer model of water - serpentinised ultramafic rock - atmosphere system that has been constructed is based on groundwater and rock chemical compositions of Aganozerskoe deposit. The system under consideration consists of H-O-Si-Al-Ca-Mg-Na-K-Ti-P-Mn-Cl-S-C-Cr-Zn-Ni-Co-V. The simulation code is HCh [2, 3]. The modeling shows that keeping waste wet on the land surface under the atmosphere oxygen access to the chromite ore and ore waste stores will result in chromite oxidation and aqueous chromium species migration in environment. The burial of ore waste in water pool decreases the influence of oxidizing dissolution of chromite. But it is necessary to keep the pool water isolated from landscape lakes. According to [4] the rate of oxidizing dissolution of chromite might be experimentally measured.

[1] Крайнов С.Р., Рыженко Б.Н., Швец В.М М.: Наука, 2004. [2] Шваров Ю.В. Геохимия. 1999. № 6. С. 646-652. [3] Шваров Ю.В. Геохимия. 2008. № 8. С. 890-897. [4] Oze C.J.-P. Ph.D.Thesis. Stanford University. 2003

Lead isotope composition variations in sulfides from hydrothermal fields of the Mid-Atlantic Ridge: High-precision MC-ICP-MS isotope data

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The high-precision MC-ICP-MS method of Pb-isotope analysis ($\pm 0.03\%$) with mass-bias correction to ²⁰⁵Tl/²⁰³Tl isotope ratio [1, 2 and others] have been applied for study of sulfides from 4 hydrothermal fields (HFs) in the southern part (12°58'–16°38' N) of Mid-Atlantic Ridge (MAR) spreading zone: Ashadze, Semenov, Logachev, and Krasnov.

Sulfide Pb-isotope ratios variation scale in the four studied HFs have been estimated: 0.04–0.09‰ for ²⁰⁶Pb/²⁰⁴Pb, 0.02–0.04‰ for ²⁰⁷Pb/²⁰⁴Pb, and 0.04–0.07‰ for ²⁰⁸Pb/²⁰⁴Pb, while analytical error was $\pm 0.03\%$. These variations are lower by a factor of 3–4 than was evident from the data previously obtained for HFs in MAR and Pacific Ocean by traditional TIMS, which are characterized by precision $\pm 0.1-0.2\%$. Using high-precision MC-ICP-MS method we did not reveal dependence of the Pb-isotope composition on the type of HFs sulfide mineral and total Pb concentration in it.

The results provide the following regularities [3]. (1) At small (close to 0.03‰) variations of the Pb-isotope composition of sulfides from individual HF, the latter differ significantly from each other by all isotope ratios. (2) Sulfides of HFs related to serpentinized peridotites have more radiogenic Pb-isotope composition by all isotopes (²⁰⁶Pb, ²⁰⁷Pb, and ²⁰⁸Pb) in comparison to HFs occurring on tholeiitic basalts. (3) On the evolutionary Pb-Pb isotope diagrams the Pb-isotope compositions of HFs sulfides discretely plot in the area of MAR basalts and are located exactly along the NHRL. The Pb-isotope characteristics of sulfides from MAR HFs permit participation of two mantle sources of Pb (DMM and HIMU) in their formation with prevalence of the first of them. Sulfides of MAR HFs are similar to MORB by the total range of the Pb-isotope composition; because of this, the data obtained do not contradict the idea that hydrothermal solutions and then sulfides inherit the Pb-isotope composition from underlying rock series. As above represented data show convective cells provide exceptional homogenization of Pb isotope composition for individual HFs.

[1] Rehkamper, Halliday (1998) *Intern. J. Mass Spec. Ion Proc* **58**, 123–133. [2] Chernyshev *et al.* (2007) *Geochem. Int.* **45**, 1065–1076. [3] Chernyshev *et al.* (2011) *Doklady Earth Sciences* **437**, 507–512.