Element behavior in technogenic systems and methods of mine waste treatment

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A huge amount of waste has accumulated in the world during the last century as a result of industrial activity. Research of element migration in technogenic systems and their accumulation on geochemical barriers is the important fundamental problem of the environmental geochemistry. The purpose was to describe migration, distribution, and redistribution of heavy metals by the example of the old tailings of the Lead Zinc Concentration Plant and Ursk tailings of the Gold Concentration Plant (Kemerovo region, Russia). The waste products of the ore mining and processing industry can be oxidized by atmospheric oxygen and microbial activity, forming acid mine drainage (AMD), with high concentrations of SO_4^{2-}, Fe, Zn, Cu, Cd, Pb, and other elements. The result obtained about element species in the sulfide tailings and the bottom sediments, using modified sequential extraction procedure, explain the main features of element migration and redeposition. In the mine waste and technogenic bottom deposits, there is vertical and horizontal substance transformation with formation of following geochemical barriers: 1) the evaporative barrier where secondary species of element, especially water-soluble, are redeposited; 2) the lithological barrier (Hardpan) which reduce migration of elements, pore water and pore gases such as O_2 and CO_2; 3) complex organic-mineral barrier on which heavy metals coprecipitate/sorb with/on iron oxy-hydroxides, organic matter and clay minerals. On the basis of the sulfide waste investigation, environmentally safe and cost-effective ways of liquid and solid waste treatment have been developing using natural (peat, clay, limestone, etc) and modified materials (peat-humic agent, organic-mineral complex, etc.), for example: 1) complex organic-mineral geochemical barriers for binding and long-term retention of pollutants; 2) methods of acid rock drainage treatment; 3) methods of solid waste conservation; 4) prevention of eolian transportation of tailings particles; 5) new method of metal extraction from acid mine drainage. This research was supported by the RFBR (grant 03-05-64529 and 06-05-65007).

Reconstruction of the Atlantic circulation back to the last interglacial by a combined proxy approach

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The Atlantic Meridional Overturning Circulation (AMOC) plays an important role in the global climate system, due to the transport of heat and carbon. Theoretical studies and measured data suggest that the AMOC underwent different circulation modes and the transitions between these modes can be triggered by variations of freshwater runoff into the North Atlantic [1, 2, 3].

The purpose of this project is to trace these transitions by creating a high resolution data set of ε_{Nd} and $^{231}Pa/^{230}Th$ for the last interglacial (Eemian) and the following glacial. ε_{Nd} gives information about the water mass provenance, signal $^{231}Pa/^{230}Th$ serves for reconstruction of AMOC export. Thus, the combination of $^{231}Pa/^{230}Th$ and ε_{Nd} from deep sea sediments is a promising tool to derive the past paleoceanography.

First measurements of ε_{Nd} have been accomplished for the time range from 60 to 154 ka with a temporal resolution of in average 3 ka. The data display the presence of Southern Source Water during MIS 6 to MIS 6.4 and indicates an active deep water formation in the North Atlantic at the beginning of the Eemian Interglacial (MIS 5.5). The transition between these two different modes in AMOC is marked by a distinct drop in the ε_{Nd} values (-11.5 to -14). This is consistent with ε_{Nd} results obtained from the same core [4] and from a neighbouring core [5] at the transition from MIS 2 to MIS 1.1. The similar temporal behaviour of ε_{Nd} during Termination I and II implies recurring millennial-scaled identical processes converting the AMOC from a Glacial mode into an Interglacial mode.

[1] Rahmstorf (2002), *Nature* **419**, 207-214. [2] Rickaby and Elderfield (2005), *G*^{3} **6**, Q05001. [3] McManus *et al*. (2004), *Nature* **428**, 834-837. [4] Gutjahr and Lippold (2011), *Paleoceanography*, submitted. [5] Roberts *et al*. (2010), *Science*, **327**, 75-78.