

METALS FORMS DISTRIBUTION IN THE SURFACE WATERS OF THE KOLA NORTH UNDER DIFFERENT ATMOSPHERIC PRECIPITATION

Dinu Marina, Moiseenko T.I.

Vernadsky Institute of Geochemistry and Analytical Chemistry, Russian Academy of Sciences, Moscow, RF

marinadinu999@gmail.com

Keywords: atmospheric deposition, metal ions, metal forms, pollution

Introduction

Enrichment of surface water by metals is a result of both natural processes and human activities. The anthropogenic impact on the environment has increased dramatically over the last century, which is associated with the ever-increasing volumes of extracted metals and their dispersal with atmospheric precipitation. The form of occurrence of metals in natural waters is important information with implications to toxicity and are directly reflecting atmospheric deposition.

The aim of research was to investigate the metal distribution by the forms in lakes of the Kola Peninsula in terms of different anthropogenic load.

Methods

We investigated more than 50 lakes at different distances from industrial plants (Fig. 1).

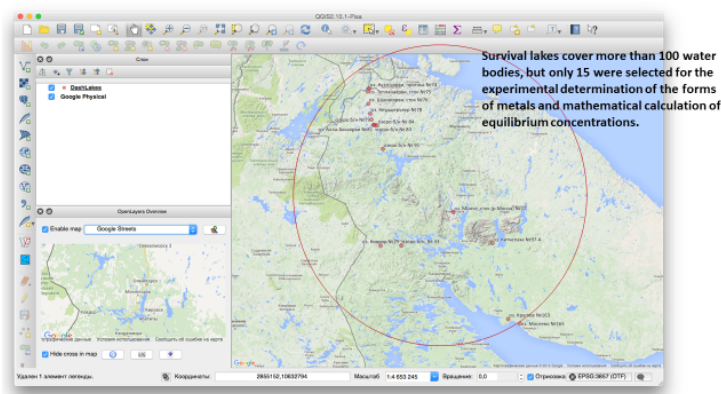


Fig 1. Location of investigated lakes

Water samples were collected in non-sorbing plastic bottles. In the field, the bottles were rinsed twice with lake water, then filled and placed in dark containers and kept at 4°C. The scheme of the sampling points, the principles of research and the methods of water sampling, as well as chemical analyses, are described by Moiseenko et. al. (2013). The total content of elements and dissolved forms, suspension and complexes with organic ligands forms were determined in sample (ion exchange resins, ICP-MS).

We use the following gradation of lakes: firstly, **location lakes** on the distance from the pollution source: 1. lakes without the direct source of pollution; 2. lakes near the source of pollution; 3. lakes on excision from the source of pollution. And we separate all chemical elements according their **chemical properties**: 1. alkali, alkaline earth metals; 2. subgroup of chrome; 3. subgroup of lanthanides, actinides; 4. ions of iron and aluminum; 5. subgroup of stanium

Selected results

Lakes without direct source of pollution

The distribution of iron and aluminum (Figure 2) forms showed an increase in the degree of binding to organic materials in water under the pH below 6 and color than 100. This is, firstly reduction and hydrolysis processes and secondly, different ratios of concentrations of iron and aluminum in system.

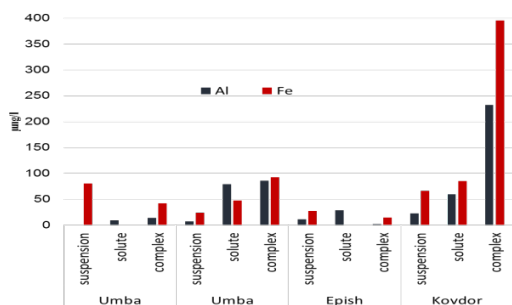


Figure 2. The distribution of iron and aluminum by forms

The data have allowed constructing the following series of activity of metal in complexation: pH < 6 Fe > Al > Y > Pb > Zn > Cu > Sc > Ni > Co > Cd and pH > 6 Cu > Fe > Al > Sc > Co > Ni > Zn > Pb > Y > Cd

Lakes with direct source of pollution

Chromium ions are characterized by sufficient complexing capacity (pH > 6.5) under high anthropogenic load due to an increase in their concentration as compared with lakes without direct sources. Manganese in such conditions has a high capacity to form suspensions. The complexation of heavy metals is modified as follows: zinc is complexed by more than 50% (more than in lakes 1 type), copper actively forms complexes with organic matter due to a significant increase in their concentration. The affinity of these elements to an organic substance as follows: Fe > Al > Zn > Ni > Cu > Pb > La > Ce > Co

Changing forms of finding metals with increasing distance from the source of pollution – Cu-Ni smelter (% of complex form)

Significant reduction of complexing forms of nickel and copper, as well as their total contents are indicating a decrease in aerobic pollution on some distances of source of pollution. But, the lower nickel ability to form complexes with compared copper is a consequence of greater affinity of copper to organic ligands. The distribution of metal affinity for organic substances should be Fe > Al > Cu > Ni > Y.

Conclusions

1. In lakes without a direct source of pollution complex forms of the elements are determined primarily by the content of organic matter. Suspended substances forms are determined geological characteristics of the territory.
2. The increase in the content of elements in the lakes near the sources of pollution determines a material balance impact on complexation with organic ligands: Al content greater in the lake near the source of pollution than the natural acidification lakes and the content of Cu and Ni complex forms are dominated in lakes near source of pollution. *Research was funded by a grant of Russian President № MK-7485.2016.5*

Reference

Moiseenko, T.I.; Gashkina N.A., Dinu M.I. (2013). Aquatic Geochemistry of Small Lakes: Effects of Environment Changes. *International Journal of Geochemistry*, 13, 1031-1148.