On regularities in accumulation and distribution of elements in living matter of natural and technogenic ecosystems

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The task of gaining information on element composition of living matter was set by V.I. Vernadskiy at the beginning of the last century. In spite of the long history of study in this problem, there is still a number of questions to be answered.

For this purpose we have revealed the regularities in accumulation and distribution of elements in living matter on the sites with various rates of natural-technogenic ecosystem transformations. The research is based on the results of up-to-date high-sensitivity analytical methods – instrumental neutron activation and inductively coupled mass-spectrometric plasma (ICP-MS).

Living matter is not homogeneous in its composition. The analysis of materials obtained by us attests the fact that in regularities of element mean content distribution in living matter the conformities of their accumulation are observed that correspond to general distribution laws for material objects: that of Mendeleyev-Clark on element distribution in different masses and Oddo-Harkins rule on element interchange with even and uneven numbers. It was revealed that in the zones of geochemical abnormities conditioned by geologic and metallogenetic features there is an increase in concentration of specific elements in composition of living organisms against the background of observing geochemical regularities. Element composition of living matter is subjected to significant transformation in the zones of technogenesis. In such zones the disruption in basic element accumulation regularities is observed. As a result it was stated that technogenic factor has an effect on organism of modern urban residents in the form of intensive accumulation of such elements as lead, gold and cadmium.

The results of research in living matter from different sites shows that the indicators of its internal changes under the influence of the environment are mostly the element relationships. The most informative is Th/U, as well as the relationship of rare-earth elements and some others.

Geochemistry of mineral springs ecosystems of Baikal region

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The Baikal rift area is characterized by a rich variety of mineral springs. The research of microbial communities has been started quite recently, but there is a lot of information showing the important role of microbial communities of hot springs in the evolution of life in the Precambrian [1].

The complex studies in thermal springs have shown that severe environmental conditions (high temperature, alkaline pH and high sulfide content) contribute to the development of specific microbial communities, having significant biodiversity and high intensity of biogeochemical processes, comparable to the microbial communities of neutral thermal spring. The main feature of these communities is the formation of microbial mats, often in collaboration with travertines [1].

The objective of our study is to identify geochemical features of different springs in the Baikal rift area. Thus, the mat samples were taken in several springs of the Baikal region in the summer of 2012. The chemical composition was determined by multi-element neutron activation analysis (Department of Geoecology and Geochemistry of Tomsk Polytechnic University, Russia).

The data shows that the mats of different mineral springs are characterized by absolutely different content of elements. Thus, mats of the tonic spring are characterized by the largest content of Na, the mats of methane spring – that of Ca. The mats of some springs are characterized by higher content of some elements. For instance, the mats of cold Arangatuy stream have higher content of Ba, Ce, Nd, Th, Tb, Yb, Ta, Sm. We should bear in mind the higher accumulation of the mats in the stream of U (177 mg/kg).

All this suggests that the mats help to assess biogeochemical role of microorganisms in ecosystems, shows an important role of microbial communities in hot springs in the evolution of life on the Earth, as well as taking an active part in the formation of travertine.

[1] Namsaraev *et al*. (2011) *Academic Publishing House "Geo"*. 302 p.

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