Mayorova O.A., Ginzburg L.N. Peculiarities of the ecological and geochemical monitoring of derelict mining territories

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key words: [monitoring, mining territories, element distribution in natural-technical systems (NTS), Be, Sn, Li, W]

The Orlovskoe tantalum rare-earth granite ore deposit is situated in the Eastern Transbaikalie within the Khangilaiskii intrusive. The mining territory was processed from the beginning of 60th years. The capacity of a factory in the end of 80th years was 660 thousands tons per year. Due to the economical situation, the Orlovskii mining-concentration plant (MCP) ceased the Ta mining in the beginning of 90th years. Now it resumes its work. Within the Orlovskii MCP on the area of several tens of square kilometers, the mine with spoil banks, ore and industrial concentrate storage, tailing dump, and village. This region is interesting for geochemical study because of the consequences of work of the MCPs, since during around 30 years, the technogenic supply and redistribution of elements within the environment occurred, and during last 10 years the redistribution of elements proceeds due to natural processes.

In order to estimate the environmental situation and organize the monitoring, the probing of rocks, soil, and vegetation was carried out (scale 1:100000). The probes were analyzed by the emission spectral analysis. Using the computer technology "ECOSCAN", worked out in IMGRE, maps of typical geochemical associations of elements in the probed media were constructed.

The soil and vegetal cover (birch leaves) on the most portion of the region are characterized by near-phonic contents. The polluted areas occupy up to 35 % of the region. It is important that elevated contents of the elements were not identified on the territory of the Novoorlovskii village. The natural-technical systems (NTS), where all the probed media (rocks, soils, and vegetation) show close typical association of chemical elements, are the NTS of the mine, the NTS of spoil banks (Li-Be-W), and the NTS of tailing dump (W-Sn). The objects for the monitoring are phonic and technogenically changed territories. Among the latter, the greater attention must be paid to the NTS both with elevated contents of elements and with the distribution of elements between the natural media, which is different from the phonic one.

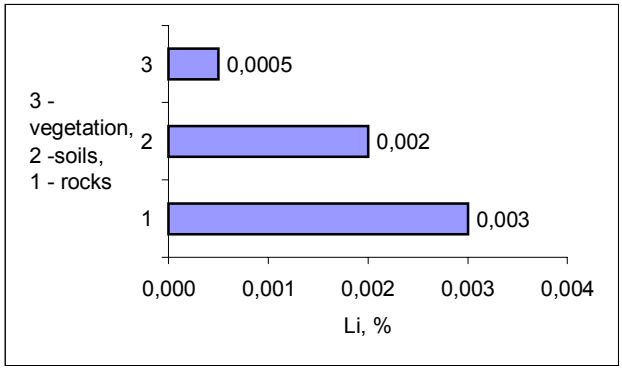

Fig.1. The Li content in the natural media on the phonic territories.

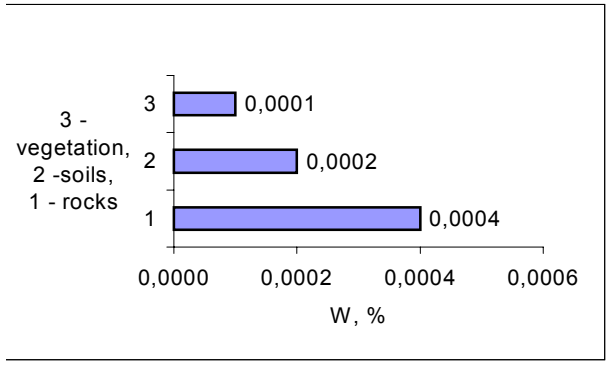

Fig. 2. The W content in the natural media on the phonic territories.

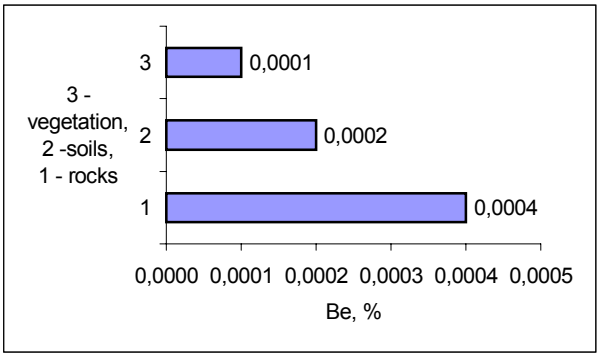

Fig. 3. The Be content in the natural media on the phonic territories.

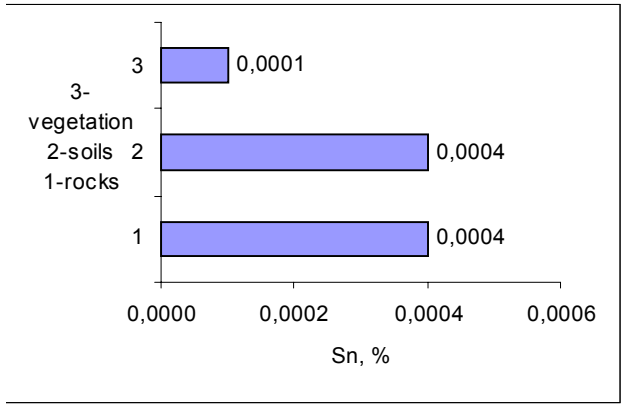

Fig. 4. The Sn content in the natural media on the phonic territories.

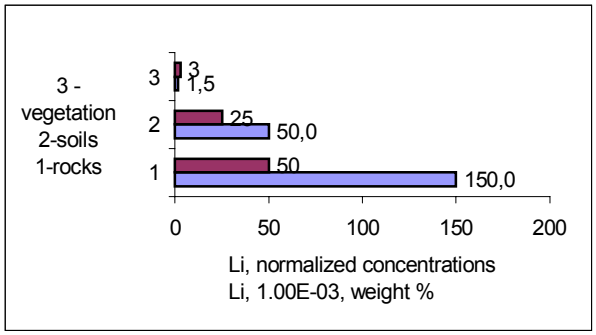

Fig. 5. The Li content in the natural media within the mine and spoil banks of the Orlovka deposit.

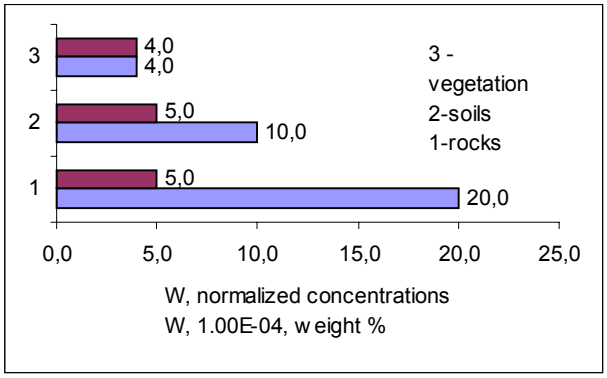

Fig. 6. The W content in the natural media within the mine and spoil banks of the Orlovka deposit.

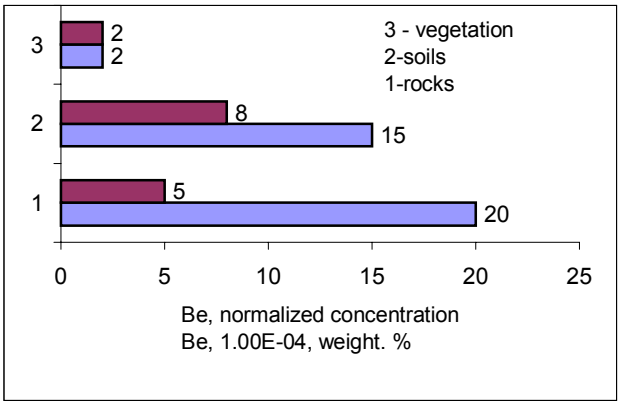

Fig. 7. The Be content in the natural media within the mine and spoil banks of the Orlovka deposit.

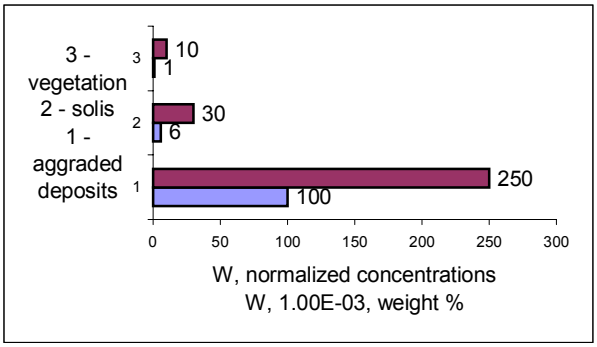

Fig. 8. The W content in the natural media within the tailing dumps of the Orlovskii MCP.

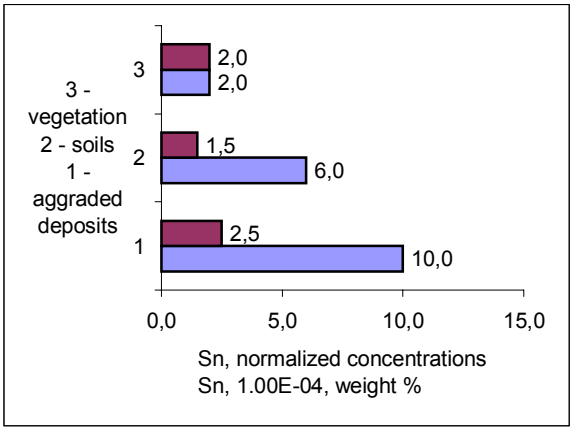

Fig. 9. The Sn content in the natural media within the tailing dumps of the Orlovskii MCP

On the phonic territories, the concentrations of Li, W, and Be in natural media differ by several times. The following sequence can be distinguished in the order of a decrease of concentrations: rocks>soils>vegetation (Figs. 1-3). The close concentrations of Sn are characteristic for rocks and soils, while it is lower in plants.

The concentration of Li are higher in the NTS of the mine and spoil banks with respect to the phonic in all the media. The distribution between the media is preserved. However, concentrations between rocks>soils>plants decrease by order of magnitude. The W concentration in the NTS of the mine are elevated by several times with respect

to the phonic concentrations, while the distribution between the media is the same (Fig. 6). The Be concentration in the NTS of the mine are elevated by several times with respect to the phonic concentrations, however, the larger accumulation is observed in soils (Fig.7). Although the distribution of Be between the media is the same, the behavior of Be in soils must be studied more scrupulously at the monitoring. The absorbing and the depositing abilities of soils with respect to Be are necessary to determine, in order to avoid the soils to be the secondary source of environmental pollution. These investigations are especially important, since the mine resumed its work, and the Be supply into environment continues.

The distribution of elements between aggraded concentration products, soils, and vegetation is studied in the NTS of tailing dump. The W concentrations in all media are elevated with respect to phone. The largest elevation is characteristic for the aggraded deposits, that is related to the ore features. The W distribution between the media is similar to the phonic one (Fig. 8). The Sn distribution between the media is similar to the phonic one. The least accumulation of Sn with respect to the phonic one (by 1.5 times) is characteristic for soils. The accumulation by 2-2.5 times is characteristic for the aggraded deposits and vegetation (Fig. 9). The aggraded deposits are enriched artificially during the ore processing, while vegetation is the vulnerable component of the NTS of tailing dump, accumulating Sn. It is important to study and control the influence of Sn on plants at the organization of monitoring.

During the ecological and geochemical monitoring of the NTS, the special attention must be paid to elements, whose distribution between the media is different from the phonic distribution. The media of the NTS, which are more vulnerable to the influence of these elements, must be intently observed. The most technogenically changed NTS of the mining territories are the NTS of mine and spoil banks and the NTS of tailing dump. During the monitoring of the NTS of mines and spoil banks of REE-granite deposits, the most attention must be paid to Li, W, and Be, especially Be in soil. During the monitoring of the NTS of tailing dumps, the most attention must be paid to W and Sn, especially Sn in vegetation. After ceasing of mining, the monitoring must be continued. The redistribution of elements between the NTS components must be studied and the further accumulation of elements in the most vulnerable components must be controlled.