GEOCHEMICAL FEATURES OF POPLAR LEAVES ELEMENTAL COMPOSITION IN URBAN AREAS (BY THE EXAMPLE OF BLAGOVESHCHENSK)

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Plants are an extremely important indicator to characterize the state of the environment. They are main producents. Their role in the ecosystem is difficult to overestimate. Due to the fact that the plants are attached organisms, the state of their body reflects the state of specific local habitats. Plant availability and ease of collecting material condition the ease of their use in research. Woody plants act as a universal natural filter, because they extract various elements and concentrate them in the tissues. An excess of certain elements can disturb important physiological and biochemical processes in the plant organism [4,6].

Plants have advantages such as ability to be toxically tolerant to pollutants; ability to concentrate pesticides; fast growth accompanied with high biomass yield, a deep root system, ease to harvest and so on [1].

Blagoveshchensk is an administrative center in the Amur Region on the China's border; it is located on the confluence of the Amur and Zeya Rivers. Its population is about 215 000 people within the area of 57,8 km². Blagoveshchensk heat electric plant, located in north-west industrial area, is the main source of air pollution. Its gross emission to the atmosphere is more than 33,000 tons, about 8,800 tons of which are solid contaminants. There is also a metallurgical plant, Amursky Mettalist, a plant of the conversion of gold- and iron-containing ores, working on bank protection, reconstruction and improvement of the embankment in the territory and so on.

The adverse effects on human health due to atmospheric particulate pollution have been studied in recent years [2,7]. Urban residents are at particular risk from certain anthropogenic sources such as traffic, and a rapidly increasing urban population worldwide gives these studies additional importance because growing number of people will be exposed to urban particulate pollution [5]. There are sedimentary, volcanogenic and intrusive complexes of acid composition in the investigated territory that determine the geochemical specialization of the territory.

The aim of research is to assess the ecological and geochemical conditions of the Blagoveshchensk area in terms of the study in the elemental composition of poplar leaves (Populus balsamifera L.)

Fourty samples of poplar leaves were collected in September, 2013 in a uniform sampling network, a sampling step being of 1 × 1 km. Leaves were collected from the lower outer part of the crown at a height of 1,5-2 m from the surface of the earth from approximately single-aged trees of two types: Populus suaveolens Fisch and Populus balsamifera L. regardless of their species specificity. Preparation of samples for analysis included drying at room temperature, grinding, weighing and ashing. The ashing of leaf samples was made by dry mineralization in accordance with the requirements of GOST 26929-94 [3]. We used an instrumental neutron-activation analysis method in the accredited Nuclear-Geochemical Laboratory at the IRT-T research reactor of Tomsk Polytechnic University in accordance with certified methods (analysts AF Sudyko and LF Bogutskaya) and electron microscopic analysis.

First of all, concentration coefficients were calculated and geochemical row were constructed. In these rows rare earths elements are allocated. Then, groups of element association were determined with the help of statistical processing which were represented by light and heavy rare earth elements (Fig. 1).

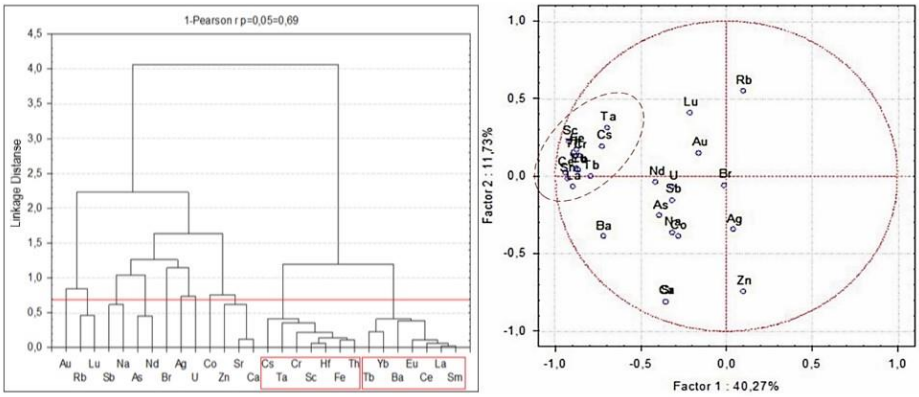

Fig. 1 A – Dendrogram of the correlation matrix of the geochemical spectrum elements in the ash of poplar leaves of Blagoveshchensk (1-r = 0,69); B – Factor loads on the total dispersion of the geochemical spectrum of elements in poplar leaf ashes

Figure 2 shows the rare-earth elements distributed almost throughout the study area. As a result, light rare-earth elements dominate. The identification of this spectrum of the elements may serve as an indicator of the petrogenic factor, which is due to the wind transfer of the material that enters the territory. The identification of this spectrum of elements is probably an indicator of the petrogenic factor, which is due to the wind transfer of the material that enters the composition of the territory.

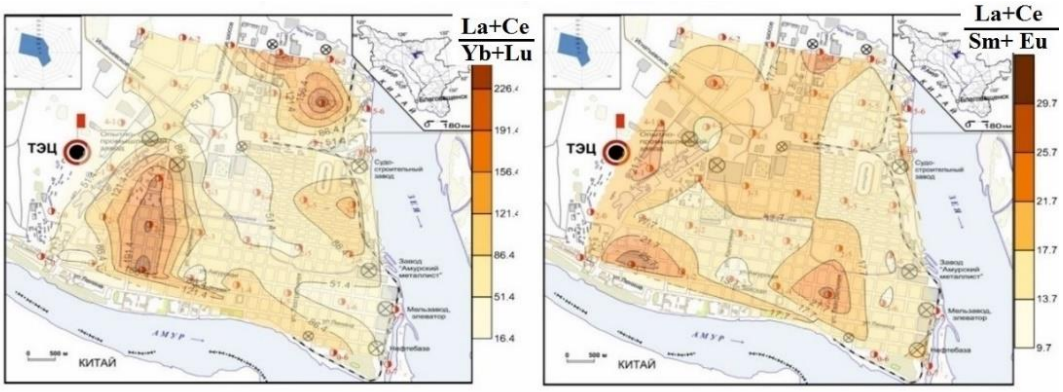

Fig.2 Distribution of ratios of rare earth elements on the territory of Blagoveshchensk City according to poplar leaf testing (ppm)

Finally, an integral estimation of the elements in poplar leaves was carried out with the help of an additive index. Firstly, the concentration coefficient relative to the median was calculated. Then, the concentration coefficients (≥ 1,5) were added together and divided by the number of elements for each point. After that, the circuit maps were built.

The maximum values of the additive index of Ag are localized on the shoreline along the Amur River. There are works on bank protection, reconstruction and improvement of the embankment in the territory, where influence of coastal shoals (wind spacing) is observed. High values are localized in the industrial zone in the north-west of the territory. Besides, high concentration is found in the area of residential development, because local residents use local low-quality coal. Aerogenic trail is present throughout the territory, which is associated with the geochemical specialization of the territory and the composition.

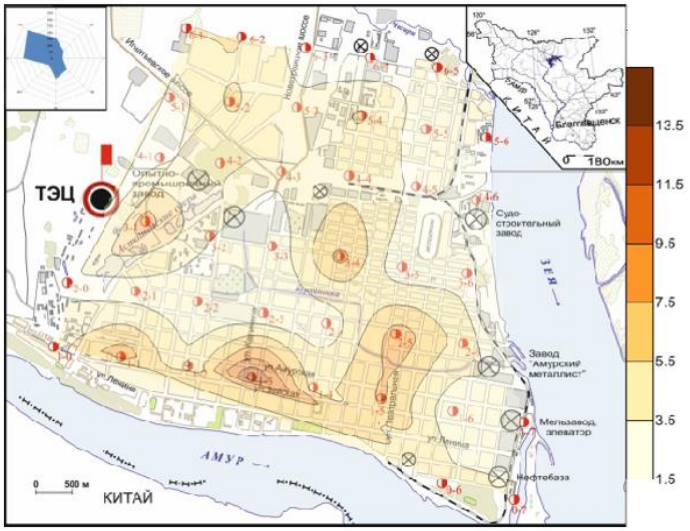

Fig. 3 Integral evaluation of the content of elements in poplar leaves

Therefore, in the territory of Blagoveshchensk there is an excess content of medium and light lanthanides of the cerium series (Sm, Eu, La, Ce, Nd), rare (Ta, Hf) scattered elements in the poplar foliage ash. These elements are likely to be indicators of the petrogenic factor. It is due by the wind transfer of material of volcanogenic and intrusive rocks of acidic composition that are part of the composition of this territory.

It was concluded that poplar leaves have indicating properties, which make possible to use them in biogeochemical monitoring to assess environmental pollution.

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THE INVESTIGATION OF THE ANISOTROPY OF FLOW PROPERTIES OF TERRIGENOUS RESERVOIRS

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In this paper we consider the problem of studying the anisotropy of the permeability in terrigenous reservoirs during the development of oilfields in Russia. In the conventional representation the anisotropy is the ratio of horizontal Kh and vertical Kv permeability, which reflects unevenly oriented heterogeneities in the texture of the rock. In addition, the magnitude of anisotropy is characterized by scale and the orientation or azimuth of the maximum permeability axis. The existence of anisotropy is confirmed by many studies around the world. In Russia, the most common way of development is waterflooding. Such oilfields at the late stages of development are characterized by high water cut of well and low value of areal sweep efficiency. These results are attributed to the presence of anisotropy and water movement along the selective directions of high permeability formations from injection to production wells [4]. The effectiveness of the very widely discussed method of directional fracturing (fracturing) depends on the direction of the cracks. This direction depends on the ratio of the radial and tangential stresses of the natural stress field in the layers, which in turn is determined by the presence of degree of anisotropy in one direction or another [8].

Thus, the importance of permeability anisotropy is that it can strongly influence the placement of injection and production wells to increase oil recovery, and its magnitude has a significant influence on the flow of hydrodynamic processes in subsequent stages of development.

It is believed that the nature of anisotropy in terrigenous reservoirs is due to the interaction of two or more sedimentation processes in the horizontal / vertical directions and subsequent tectonic impacts, leaching and carbonization processes. As a consequence, these facts lead to change in mineralogy, grain sizes and other petrophysical parameters [7]. Thus, the anisotropy of terrigenous reservoirs depends both on the orientation of the grains, and the presence of impermeable barriers or filtration channels. For comparison in carbonate reservoirs, the degree of anisotropy is determined by the intensity and different orientation of the fracturing, as well as the general processes of recrystallization of carbonate rocks with immersion to depth [2].

The identification and investigation of anisotropy is possible in several ways. The paper describes methods for studying the phenomenon on pre-oriented core samples, indicator studies (tracer analysis) and methods of well testing (well testing). On the basis of these methods, it is possible to estimate the actual anisotropy in the form of comparison of the quantitative characteristics of rock properties. Studies at the micro- and meso levels (cores and its sections) begin with a spatial orientation of the core using the paleomagnetic method. It is based on the ability of the rock, at the time of formation, to retain in its structure the direction of the planet's magnetic field in the form of a remanence vector. In turn, the remanent magnetization consists of the sum of the primary and viscous remanent magnetization. The last term reflects the influence of the modern magnetic field of the Earth. To eliminate the influence of viscous remanent magnetization, the sample is subjected to heating and alternating magnetic fields.

Thus, the core becomes oriented along the origin field of rocks and allows fix the ordering of the structure of rocks. Further study possibly as well as on the phenomenon of remanent magnetization and on the basis of the elastic properties of rocks. The result of these studies can be the construction of rose-diagrams reflecting the anisotropy trends according to the corresponding properties [5]. The investigation at the macro level can be conducted through tracer studies and well test.

The essence of trace studies is the injection into the reservoir of a liquid with an indicator through an injection well and recording the moment of its appearance in production wells. In this case, the following values are obtained: the average and maximum velocity of the indicator's movement and the time indicator appears. Since the permeability and velocity of the indicator are linearly dependent on each other, this makes it possible to characterize the heterogeneity of the interwell space [1,3].

One of the methods of well test, which makes it possible to detect anisotropy, is the well interference testing. The essence of this method consists in changing the selection of fluid in the disturbing wells and recording the moment of change in the level or pressure in the reacting wells. Further on the time of the wave of pressure wave between the wells, a relationship is established between the properties of the formation in the inter-wellbore space. The anisotropy in this case can be expressed in the absence or weak response of the reacting wells, which may indicate a weak hydrodynamic connection between the wells or its absence due to barriers [6].

As an example of the comparative characteristic of the anisotropy parameters, the results of the anisotropy studying in the northwestern block of the Krapivinskoye oilfield are considered.