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CONTENT OF DIFFERENT AND RARE ELEMENTS IN TYPICAL GRAY SOILS FROM THE OLD IRRIGATED FERGANA REGION, PEDGEOCHEMISTRY

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Abstract
The article studies the content of trace and trace elements in typical irrigated gray soils of the Fergana Valley.

Keywords: Agrochemical properties of typical gray soils, humus, amino acids, total nitrogen, phosphorus, potassium, granulometric composition of soils.

Under normal conditions, geochemistry studies the composition of the crust, called the earth's crust, 16-20 km thick. Pedogeochemistry studies the soil layer and its parent rock. Chemical elements, especially diffuse elements, are also found in soil layers in different qualities and quantities depending on the soil type, rhodium, family, and their properties. In the geochemical classification of chemical elements by VI Vernadsky, diffuse elements form a separate group. This group mainly includes 11 elements: lithium (Li), scandium (Sc), gallium (Ga), bromine (Br), rubidium (Rb), yttrium (Y), niobium (Nb), lanthanum (La), iodine (I), cesium (Cs) and thallium (Tl), which make up a very small part of the mass of the earth's crust (in trace amounts). VI Vernadsky noted that the elements of this group do not form their own independent minerals in nature, but are found in a dispersed form in the crystal lattices of other minerals in the form of isomorphic mixtures or free atoms. These microelements are also distinguished by the fact that, unlike the main soil-forming cyclic elements, they do not form closed geochemical cycles.

A characteristic feature of the elements of this group is that they have very few or no chemical compounds, says VI Vernadsky. There are ideas that Li, Sc, Rb, Cs, Nb, Ta are found in the deep layers of the earth's crust in the form of compounds. They quickly decompose on the surface, says VI Vernadsky. Their quantities are also very small.

On the contrary, the elements Br and J form compounds in the biosphere. The most interesting are Se, Ga, Y, Nb, In, Ta, which, according to Vernadsky, have not been studied in organisms. In the process of studying Scandium (Sc), Bromine (Br), Rubidium (Rb), Cesium (Cs) in irrigated gray soils and raspberry bodies, it was found that they can be present in soils and plant bodies, fruits. For example; Rubidium: atomic number 37, atomic mass 85.5. According to Vinogradov, the soil content is 100 mg/kg. AI Perelman [121; 1990. 176 p.] It does not have its own minerals. It is included in feldspars due to its small radius. It is also found in micas. Rubidium is a typical scattered element. It is found in acidic igneous rocks in an amount of 1-3%. Rubidium does not participate in biogenic migration like potassium, and biological processes do not create conditions for its accumulation. Its amount in living organisms and soil is low. It is absorbed by clay minerals.
It, i.e. the radioactive isotope Rb-87, is converted into strontium Sr87 by β-beta decay. Based on this, the age of rocks is determined using the rubidium-strontium method. Because its half-life is known, i.e. 5 1010It is a ubiquitous element.
As mentioned, rubidium, despite the soil Clarke being 100, has values around 54.3-59.4 mg/kg in the upper layers of gray soils, and therefore its Clarke is less than one, i.e., the KK values are 0.54-0.59, and the Clarke distribution is 1.68-1.71 (Table 1).

Table 1 Scattered and RareAmount of elements, mg/kg KK, KT

Element-Ents	Vinogra-dov clarke	Depth, cm			KK			CT		
		0-20	20-40	40-60	0-20	20-40	40-60	0-20	20-40	40-60
Scattered elements										
Sc^{21}	7	12.6	11.2	9.4	1.80	1.60	1.34	0.56	0.63	0.74
Br^{35}	5	5.8	5.3	5.2	1.16	1.06	1.04	0.86	0.90	0.96
Rb^{37}	100	59.4	54.3	58.6	0.59	0.54	0.59	1.68	1.84	1.71
Cs^{55}	5	7.1	7.2	6.3	1.42	1.44	1.26	0.70	0.69	0.79
Rare elements										
Ce^{58}	50	27.6	25.3	32.7	0.55	0.51	0.65	1.80	1.98	1.53
Nd^{60}	17	15.2	35.1	15.9	0.89	2.06	0.94	1.12	0.48	1.07
Cm^{62}	7	4.4	11.1	3.2	0.63	1.59	0.46	1.59	0.63	2.19

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Another of the diffuse elements detected in the soil is cesium (Cs), with atomic number 55 and atomic mass 132.9 g/mol. Lithospheric clarke is 3.7 10-4 % (3.7 mg/kg), and soil clarke is 5 mg/kg. It has the properties of a strong alkali metal, and is similar to rubidium in its chemical and biogeochemical properties. Its salts are slightly soluble in water, but this does not affect its migration. Its special properties in distribution were noted by Fersman. It does not exist as an independent mineral, but is present in feldspars and micas.

It is absorbed into clay minerals. Cesium is differentiated in typical soils almost uniformly in their profile, i.e., 6.3-7.2 mg/kg. It has a KK of 1.26-1.44 and a KT of 0.69-0.79. It does not accumulate in soils even in clay layers. The next group of diffuse elements is Bromine (Br). Bromine is a typical halogen-diffuse element, its atomic number is 35, atomic mass is 80. The lithospheric content is 2.1 10-4 %, and the soil content is 5 mg/kg. Therefore, its role in the soil and lithosphere is very small. Br does not have the property of concentrating, is a typical diffuse element, forms very small amounts of minerals, including AgBr. Although small accumulations have been detected in the biosphere.

It accumulates in the evaporative barriers like chlorine, but in very small quantities. Br was detected in typical gray soils at 5.2-5.8 mg/kg, its KK is 1.04-1.16, KT is 0.86-0.96. It was also detected in the composition of plant bodies and fruits. Scandium (Sc) is also among the diffuse elements, therefore its properties are similar to those of Br, Rb, Cs, that is, it is close. It is more widespread in water. Its concentration according to the soil clarifier Vinogradov is 7 mg/kg. It does not accumulate in gray soils, but compared with other diffuse elements, it is quantitatively behind rubidium and is 9.4-12.6 mg/kg according to the profile.

The KK values are 1.34-1.80, and the CT values are 0.56-0.74, meaning the dispersion coefficient is less than one.

In general, the geochemical spectrum formula for dispersed elements in soil layers takes the following forms:

By quantitative indicators:$0-20$ sm: $\frac{\text{Rb}}{59{,}4} > \frac{\text{Sc}}{12{,}6} > \frac{\text{Cs}}{7{,}1} > \frac{\text{Br}}{5{,}8}$;

$20-40$ sm: $\frac{\text{Rb}}{54{,}3} > \frac{\text{Sc}}{11{,}2} > \frac{\text{Cs}}{7{,}2} > \frac{\text{Br}}{5{,}3}$; $40-60$sm : $\frac{\text{Rb}}{58{,}6} > \frac{\text{Sc}}{9{,}4} > \frac{\text{Cs}}{6{,}3} > \frac{\text{Br}}{5{,}2}$;

It is evident that of the elements dispersed in these soils, the highest amount in the soil layers is in all cases rubidium, the lowest is bromine, and the remaining elements are in intermediate values.

There are KK and KT according to their quantities: ;$0-20$ sm : $\frac{Sc}{1,80} > \frac{Cs}{1,42} > \frac{Br}{1,16} > \frac{Rb}{0,59}$; $20-40$ sm : $\frac{Sc}{1,60} > \frac{Cs}{1,44} > \frac{Br}{1,06} > \frac{Rb}{0,54}$ $40-60$ sm : $\frac{Sc}{1,34} > \frac{Cs}{1,26} > \frac{Br}{1,04} > \frac{Rb}{0,59}$;

CT-Clark distribution: $0-20$ **sm**: $\frac{Rb}{1,68} > \frac{Br}{0,86} > \frac{Cs}{0,70} > \frac{Sc}{0,56}$;

$$20-40 \text{ sm}: \frac{Rb}{1,84} > \frac{Br}{0,90} > \frac{Cs}{0,69} > \frac{Sc}{0,63};$$

$$40-60 \text{ sm}: \frac{Rb}{1,71} > \frac{Br}{0,96} > \frac{Cs}{0,73} > \frac{Sc}{0,74}$$

It is clear that in quantitative indicators, geochemical spectra end in the Rb - Br state in all cases, in KKs in the Sc -> Rb state, and in KTs in the Rb -> Sc state.

The highest accumulation rates are for Rb, the lowest for Br, the highest diffusion coefficient is for Rb, and the highest KKs are for Scandium. This means that these soils have a small Sc accumulation capacity. Among the rare earth elements, Cerium (Ce), Neodymium (Nd), and Samarium (Sm) were studied in typical irrigated gray soils.

In the geochemical groups of VI Vernadsky, these elements include 15 elements, including La, Fr, Pr, Eu, etc., which make up 16.30% of the 92 elements. Scandium and yttrium are sometimes added to this group. These elements do not form minerals in the biosphere, but they are also present in the biosphere in a dispersed form. Some of them have been detected in living matter. Theoretically, VI Vernadsky says that these elements may have the same genesis, but there is no evidence in this area yet. The elements of this group are sometimes called “chemical fog”. They do not enter into chemical reactions with elements on the surface of the earth. These elements, like others, migrate in various ways in the biosphere, its blocks, soil, plants, and water. However, according to VI Vernadsky, they do not exist in water. The elements of this group are also known as Lanthanoids. They are very close to each other chemically and geochemically, that is, they have similar properties. This is expressed in the electronic structure of their atoms.

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Usually, the number of electrons in the outer (N) shell increases not in the P shell, but in the shell after it. A characteristic feature of this group of elements is that their ionic radii decrease with increasing atomic numbers and atomic masses. This makes them easier to exchange in minerals. Therefore, they are relatively easy to include in minerals. For example, cerium can be seen in uranium minerals. According to AI Perelman, rare earth elements have been identified in more than 300 minerals. They are often found in sedimentary phosphorites. Samarium isotopes are radioactive. As a result of the decay of samarium, neodymium is formed as the final product, says Perelman.

The geochemical formulas of these studied cerium, neodymium, and samarium elements form the following forms:

0–20 cm, quantitative: $\frac{\text{Ce}}{27{,}6} > \frac{\text{Nd}}{15{,}2} > \frac{\text{Sm}}{4{,}4}$;

$$\text{KK:} \frac{\text{Nd}}{0{,}89} > \frac{\text{Sm}}{0{,}63} > \frac{\text{Ce}}{0{,}55}; \quad \text{Kt:} \frac{\text{Nd}}{1{,}12} > \frac{\text{Sm}}{1{,}59} > \frac{\text{Ce}}{1{,}80}$$

20–40 cm, quantitative: $\frac{\text{Nd}}{35{,}1} > \frac{\text{Ce}}{25{,}3} > \frac{\text{Sm}}{11{,}1}$;

$$\text{KK:} \frac{\text{Nd}}{2{,}06} > \frac{\text{Sm}}{1{,}59} > \frac{\text{Ce}}{0{,}51}; \quad \text{Kt:} \frac{\text{Ce}}{1{,}98} > \frac{\text{Sm}}{0{,}63} > \frac{\text{Nd}}{0{,}48}$$

40–60 cm, quantitative: ; $\frac{\text{Ce}}{32{,}7} > \frac{\text{Nd}}{15{,}9} > \frac{\text{Sm}}{3{,}2}$

For 40–60 cm KK: $\frac{\text{Nd}}{0{,}94} > \frac{\text{Ce}}{0{,}65} > \frac{\text{Sm}}{0{,}46}$; Kt: $\frac{\text{Sm}}{2{,}19} > \frac{\text{Ce}}{1{,}53} > \frac{\text{Nd}}{1{,}07}$

The geochemical formulas cited also prove the scarcity of elements in this group. In quantitative terms, Cerium dominates in the upper and lower layers, and Neodymium in the lower layer of the upper layer. There is no significant difference in the concentration of Clark, which means that they do not accumulate in the genetic layers of these typical irrigated gray soils, as can be seen from the Clark distribution of these elements.

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