Proceedings of International Educators Conference
Hosted online from Rome, Italy.
Date: 25th December, 2022
ISSN: XXXX-XXXX **Website:** econferenceseries.com

GEOENERGETIC FEATURES OF MACROELEMENTS OF IRRIGATED SOILS

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Abstract

The paper presents the geoenergetic and geochemical features of some macroelements in irrigated meadow saz pedolitical soils of Central Fergana, also gives the dependence of the accumulation and migration of trace elements from their atomic weights and geoenergy properties.

The content, Clark concentration of trace elements in the studied soils and their genetic horizons, was determined, the background number of trace elements for these soils was calculated.

The obtained data for the contents of macroelements in irrigated soils of the Central Fergana it can be used in determination of regional background content heavy metals and control of soils of these territories.

Keywords: geoenergy, geochemistry, macroelement, migration, accumulation, Cartleg potential, arzyk, shokh, pedolite, irrigated.

Introduction

Currently, in the world, thousands of hectares of land fall out of agricultural use as a result of the soil degradation of cultivated areas, desolation and waterlogging, water and wind erosion, salinization and pollution.

At the same time, the study of chemical and geochemical features from the pedogeochemical point of view of saline soils with poor water and air permeability is one of the urgent problems of agricultural practice in irrigated areas.

The irrigated, saline, formed in Central Fergana, having arzyk-shokhovye, shokh-arzykovy horizons of soil at different depths, require a systematic study from a pedogeochemical point of view.

At one time, M.Pankov [1] drew attention to the genetic-geographical patterns of distribution and morphological features of saline soils in the Fergana Valley, which pointed to carbonate horizons in these soils.

P.N.Besedin, K.Sh.Shadmanov and others [2] exploring the genetic horizons of the soils of the Fergana Valley indicated that sodium and calcium sulfate salts accumulate in the genetic horizons of the hydromorphic soils of Central Ferghana, besides, he also indicated that the place of arzyk-carbonate-gypsum soils is difficult to agree with.

The maximum concentration of Cu, Zn, Mn is observed in the arzyk-shokh layers, therefore, in the arzyk-shokh horizons of the hydromorphic soils Cu, Zn, Mn accumulate [3].

In modern scientific literature, the origins and properties of the soil in other regions provides an analysis of the cenopopulation and tissuese element composition of the medicinal caper plant Capparis spinosa L. distributed in Calcisols formed on eroded alluvial-proluvial rock-gravel rocks in the south of the Fergana Valley and other soils are discussed. Most of the macroelements are characterized by a slight differentiation up the profiles of soils and the increase in their content in the lower horizons [4, 5, 6].

Methods and object of research. The morphogenetic, comparative-geographical method of V.V. Dokuchaev was used as the main method, besides the basis pedagogical methods of M.A.Glazovskaya [7], A.I. Perelman [8] were used as the basis of our research. Soil chemical analyzes were carried out according to the description of “Methods of agrochemical, agrophysical and microbiological studies in irrigated areas” and “Guidelines for chemical analysis of soils”. Elemental analysis of the soil conducted by the neutron activation method.

The object of the research is newly developed, newly-watered, old-irrigated meadow sazovy soils of Central Fergana formed on alluvial, alluvial-proluvial sediments, saline, having arzyk-shokhovye, shokh-arzykovy horizons at different depths.

Research results. We have studied the chemical elemental composition and their associations in soils and individual horizons, which can hardly be called soil. The arzyk-shokh and shokh-arzyk horizons lack a number of soil properties, such as humus, structure, animal world, etc. In addition, these horizons cannot perform the

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functions of soil and soil cover, they almost turned into a natural ecosystem complex. In some cases, it is investigated as non-soil bodies. According to I.P.Gerasimov [9], these horizons can be called pedoliths.

One of the difficult questions of the study of micro and macro is the correct diagnosis of real traces of migration, depending on the properties of soils and elements. For example, the migration of trace elements depends on a number of their geochemical properties (Table 1) [1].

Table 1.

Chemical and geochemical features of macroelements

Properties	Na	Mg	K	Ca	Fe	Rb	Sr	Ba
Serial number	11	12	19	20	26	37	38	56
Atomic mass	23	24,3	39	40	56	87	87,6	137
Valence	+1	+2	+1	+2	+2	+1	+2	+2
Radius of ion, A °	0,98	0,74	1,33	1,04	0,80	1,43	1,20	1,38
Potential Cartlegja	1,02	2,70	0,75	1,92	2,50	0,70	1,67	1,45
Energy constants	0,45	2,10	0,36	1,75	1,125	0,30	1,53	1,35
Energy share in the crystal lattice, kJ	482,28	2250,65	385,83	1875,54	1205,71	321,71	1639,76	1446,85

Ionic radius according to A.E. Fersman; $J = \frac{W}{R}$ Cartledge potential; Energy constant according to A.I.Perelman; Energy added to the conditional crystal lattice U=ek·1070.74;

x-Calculated by the author.

As can be seen from the table, with an increase in the ordinal numbers of the elements, their atomic mass increases. However, their valence in most cases ranges from +1 to +2. Their appearance is reflected in the ionic radii and potential of Cartling.

A number of geochemical and energy features of these elements are also associated with their valence and ionic radii.

So, in our soils, Rb, Na, K exhibit typical properties of alkali metals. KP is in the range of 1-3 and exhibits alkaline earth metal properties, while higher states exhibit non-metal or amphoteric properties [10].

As can be seen from the table, the lowest values of the energy constant correspond to alkali metals, which in turn indicates that the contribution of these metals to the structural energy of minerals in the soil is small, therefore, it is relatively inactive. The smaller the energy constant, the higher the solubility of the salt or mineral formed by that element. The energy constant and the migration ability of elements are inextricably linked. So, 482.28 kJ. and 385.83 and 371.52 kJ. Na, K, Rb are in the crystal lattice with an energy of 2250.65 kJ, 1875.54 kJ. and the migratory properties of other elements are inferior to others.

As mentioned above, the processes of accumulation, differentiation and migration, the elements in the composition of the soil are related to the properties of the soil. This can be seen, in certain cases, on the genetic horizons of the soil, especially in the pedolithic horizons, are shown in table 2.

Table-2 The number macroelements, % (n-6).

Section No.	Depth, cm.	Na^{+}	Mg^{+2}	K^{+}	Ca^{+2}	Fe^{+3}	Rb^{+}	Sr^{+2}	Ba^{+2}
7A - old-irrigated soil	0-28	0,92	0,81	1,38	1,39	2,57	0,0011	0,05	0,10
	28-36	1,02	0,92	1,62	1,42	2,56	0,010	0,05	0,10
	36-93	1,29	1,10	1,64	1,28	1,74	0,011	0,44	0,18
	93-111	**1,72**	**1,62**	**1,65**	**2,93**	**2,72**	**0,017**	**1,48**	**0,18**
	111-140	0,57	0,61	1,16	1,83	1,84	0,008	0,27	0,10
	140-200	0,70	0,50	1,16	1,86	1,85	0,008	0,27	0,10
6A - Newly irrigated soil	0-18	0,82	0,78	1,68	1,98	1,82	0,003	0,58	0,04
	18-32	0,86	0,81	1,51	2,15	1,91	0,004	0,60	0,05
	32-55	**1,29**	**1,99**	**1,78**	**4,55**	**2,32**	**0,011**	**1,44**	**0,10**
	55-80	0,63	1,63	1,37	2,59	1,91	0,003	0,63	0,04
	80-140	0,69	0,61	1,26	2,10	1,77	0,007	0,18	0,07
	140-200	0,70	0,57	1,15	1,72	2,23	0,008	0,30	0,10
8A - newly developed soil	0-18	0,87	0,81	1,46	1,39	2,45	0,011	0,28	0,10
	18-33	**1,95**	**2,17**	**1,75**	**4,63**	**3,32**	**0,011**	**1,57**	**0,12**
	33-83	0,96	1,81	1,51	2,46	2,33	0,010	0,19	0,10
	83-121	1,02	0,91	1,63	1,71	1,81	0,010	0,12	0,10
	121-157	0,85	0,87	1,35	1,70	2,43	0,010	0,07	0,10
	157-202	0,83	0,77	1,39	1,82	1,91	0,009	0,08	0,10
9A- old-irrigated soil	0-40	0,77	0,71	1,86	1,20	2,15	0,009	0,05	0,10
	40-55	0,91	0,73	1,81	1,23	2,10	0,009	0,08	0,10
	55-89	0,87	0,71	1,31	1,33	2,20	0,011	0,08	0,11
	89-143	0,91	0,81	1,37	1,60	2,31	0,008	0,11	0,11
	143-212	0,93	0,83	1,46	1,71	2,01	0,009	0,10	0,11
The average		0,96	1,0	1,48	2,05	2,19	0,008	0,39	0,10

If we take into account the number of macroelements in irrigated soils in the pedolith horizons, one can observe a significant difference between their quantitative indicators and their close proximity. When differentiating according to the genetic layers of the soil, this difference is also palpable.

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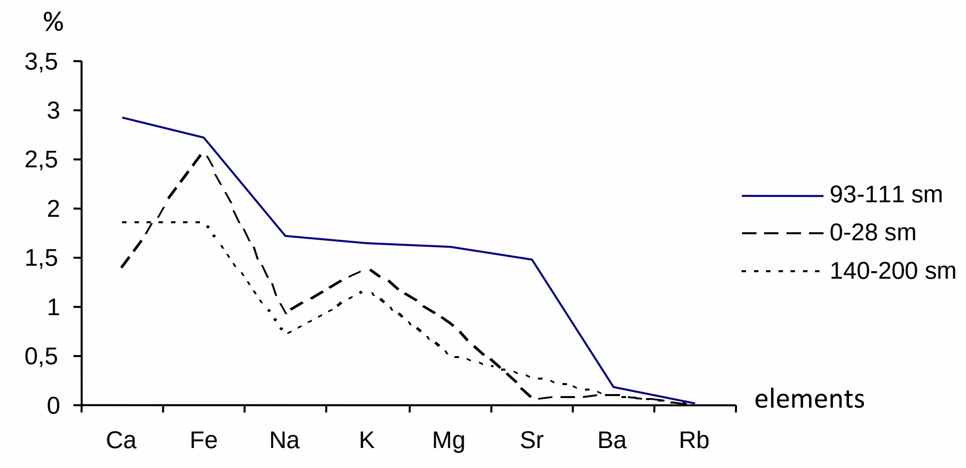

Figure 1. Section 7A. Geochemical spectrum of macroelements.

The studied elements are a special background for these soil layers, according to which they form the following numbers:

$$\frac{Fe}{2,19} > \frac{Ca}{2,05} > \frac{K}{1,48} > \frac{Mg}{1,0} > \frac{Na}{0,96} > \frac{Sr}{0,39} > \frac{Ba}{0,1} > \frac{Rb}{0,008}.$$

Conclusion

The processes of accumulation, migration, and differentiation of chemical elements in soil and pedolith horizons and soil-forming rocks occur with the joint participation of pedogenic, exogenous, endopedogenic, and technogenic factors. These streams of elements in turn affect the nature of the substrate, i.e. soil, pedolity and soil-forming rocks.

In increasing the fertility of pedolithic soils, their chemical elemental composition, migration and accumulation of the latter should be studied first. In the series indicated above, the destruction of pedolith horizons, which serve as a pedogeochemical barrier in these soils, is necessary.

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