GEOCHEMICAL BARRIERS IN IRRIGATED SOILS AND THE IMPACT OF THEM ON PLANTS

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Annotation: The article illustrated the geochemical barriers in the soils and the radial double-sided geochemical barriers formed in the irrigated meadow soils of Central Fergana. The migration and accumulation of chemical elements and substances in these barriers are illuminated on the basis of geochemical spectral formulas.
And also, the effect of geochemical barriers on the yield of agricultural crops (cotton) was studied.

Keywords: barrier, chemical element, geochemical, meadow reed, arzyk-shok, gypsum, carbonate, pedolite, cotton, crop.

1. INTRODUCTION :

Nowadays, despite the fact that most of the lands used in agriculture around the world are saline to varying degrees and composition, the area of such places is increasing to a certain extent from year to year. So, the study of migration and accumulation of chemical elements and substances in irrigated soils, as well as the study of geochemical barriers formed in their genetic layers is one of the current problems.

It is clearly, that the concept of geochemical barriers was submitted to science by A.I.Perelman, and barriers in soils, i.e. new formations in soil layers, salt accumulation, are included in microbars. They are formed due to a decrease in the migration rate of elements and substances in the soil layers. According to A.I. Perelman's classification, there are oxygen, sulfide or hydrogen sulfide, alkali, acid, acid-alkali, double, evaporative, sorption and thermodynamic barriers in nature.

According to the information of M.A. Pankov, salt accumulation in the soils of Central Fergana was mainly due to Na_2SO_4 and gypsum. The author explains that the formation of gypsum was one-sided, that is, it occurred only due to the exchange reaction between calcium bicarbonate and sodium sulfate. In fact that, the genesis of gypsum in the soils of this region is multifaceted.

In this regard, soils with a thin-horned layer with poor water permeability at different depths in Central Fergana were analysis.

Observation exploration ion our field, it was found that such soils still exist in the study area and samples were taken. Object and methods of research. The object of research was newly developed, newly and old irrigated meadow marsh soils with shallow, shallow-shallow layers formed at different depths on the alluvial and alluvial-pluvial deposits of Central Fergana, as well as the corresponding groundwater, cotton.

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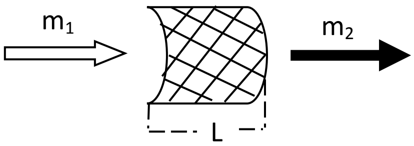
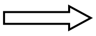
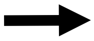
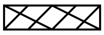
In the investigation of geochemical barriers it is expedient to approach on a comprehensive basis according to the principles of A.I.Perelman, B.B.Polinov, V.A.Kovda, V.V.Dobrovolsky. Systematic pedagogical and geochemical methods of M.A. Glazovskaya and A.I. Perelman were used in the researches. Soil-chemical analyzes were carried out on the basis of manuals "Methods of agrochemical, agro physical and microbiological research in irrigated areas" (SoyuzNIHI. T. 1963, 1977) and E.V. Arinushkina " Soil Chemical Analysis Guide" (1971). Elemental analysis of soils was carried out at the Research Institute of Nuclear Physics of the Academy of Sciences of Uzbekistan by neutron-activation analysis.

The results of Research. The saline soils of Central Fergana are mainly characterized by evaporative, oxygen, sorption and bilateral carbonate-gypsum, gypsum-carbonate and other barriers. In the second sided barriers are a series of lateral barriers, one side, i.e., the entrance to the barrier is acidic, the exit is alkaline, and vice versa.

The two-way barrier separated by A.I. Perelman (1989) is described as follows:



Picture 1. Geochemical image of barrier.

1.  - direction of movement of chemical elements to the barrier;
2.  - movement after the barrier;
3.  - concentration of elements in the barrier;

m_1 - is the description of the environment up to the barrier;
m_2 - description of post-barrier;
L - is the length of barrel.

Using these indicators, Perelman recommends calculating the barrier gradient (C_1), $C_1 = \frac{m_1 - m_2}{L}$.

In the group of radial barriers, double-sided barriers are separated by us, which are formed in the inner layers of the soil during its formation, that is, the formation of soil. Double-sided barriers are based on the concept of top and bottom, that is, the properties of the upper sides of the layer differ from the properties of its lower parts. For radial barriers, we describe this view as follows:

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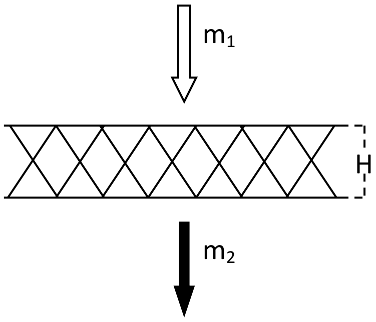
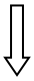


Picture 2. Image of radial two-sided barriers.

1.  - direction of chemical elements towards the barrier;
2.  - the direction of the chemical elements after the barrier;
3.  - accumulation of elements in the barrier;

m_1 is the state of the environment up to the barrier;
m_2 - condition of the environment after the barrier;
H - is the thickness of the barrier.

Perelman called the change in geochemical parameters along the path of chemical element migration a barrier gradient.

This condition we propose also remains with the name of the barrier gradient, but instead of L, that is the length of the barrier, the H-barrier thickness is assumed, and there is a small change in the formula, that is: $C_1 = \frac{m_1 - m_2}{H}$;

C_1 - barrier gradient;
H - is the thickness of the barrier.

We can see a number of changes in the bilateral barriers thus formed. That is, these barriers are taken in a radial direction, located at different depths of irrigated meadow reed soils, and the movement of elements and substances is from top to bottom and from bottom to top, is in ⇄ position.

A group of such layers formed in the irrigated soils of Central Fergana is 93-111 cm of irrigated, saline, grassland reed soils. (7A section), 32-55 cm. (6A section), 18-33 cm. (Section 8A) and the amount of carbonates and sulfates in them is as follows (Table 1).

Section 7A is 93-111 cm. This layer is worthless because the amount of carbonates in the layer is almost 2 times higher than in 24.3 gypsum. 6-5 inches 32-55 cm. also appears to be the case, so it is preferable to call these layers value-horned. 8-3 inches 18-33 cm. The amount of gypsum in the depths is more than that of carbonates, so it is better to call such layers horny-valuable layers, is cemented water-poor carbonates with more layers of gypsum than gypsum, gypsum-rich carbonates more horny-valuable layers.

These layers are dense, cemented, density, the degree of cementation is observed in the course of morphological features named In this context, we consider it appropriate to use this basic phrase.

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Table 1
Carbonate, sulfate salts of calcium and magnesium,%

Section т/р	Depth, см	CO_2	$CaCO_3$	$MgCO_3$	$CaSO_4 \cdot 2HOH$	$MgSO_4 \cdot 7HOH$
7A	Old irrigated arzyk-shok, saline meadow reed soils					
	0-28	7,50	7,30	6,30	5,80	5,30
	28-36	5,80	6,10	5,30	10,20	8,20
	36-93	6,80	6,10	9,40	10,20	10,10
	93-111	10,80	12,20	12,10	11,20	10,30
	111-140	7,60	6,10	5,10	13,10	12,20
	140-180	6,30	7,20	6,20	11,0	12,20
6A	New irrigated arzyk-shok, saline meadow reed soils					
	0-18	8,50	7,90	5,30	5,50	4,30
	18-32	7,60	6,20	6,30	13,20	10,20
	32-55	18,80	16,20	16,10	29,20	24,30
	55-80	7,80	7,10	6,10	14,20	11,10
	80-140	7,60	6,10	5,10	15,10	14,20
	140-200	6,10	8,10	6,20	13,00	13,80
8A	The newly developed surface is shokh-arzyk, saline meadow soils.					
	0-18	8,60	8,40	6,90	6,30	5,40
	18-33	10,10	9,30	8,10	44,10	27,20
	33-83	6,10	6,20	7,10	12,20	11,10
	83-121	7,80	7,10	6,10	12,10	11,80
	121-157	7,60	6,10	6,20	11,10	12,10
	157-202	7,10	7,10	5,90	10,10	13,20
9A	Old irrigated, saline meadow soils					
	0-40	4,50	5,50	5,40	3,50	2,20
	40-55	4,30	4,50	4,30	6,70	3,90
	55-89	8,10	7,20	8,30	11,70	10,30
	89-143	7,10	5,20	6,10	12,70	11,30
	143-212	7,10	5,20	5,50	13,00	13,40

It is clearly seen that irrigated meadow soils are carbonate and gypsum. They contain 6.1-18.8% of CO_2, 4.5-16.2% of $CaCO_3$, 4.3-16.10% of $MgCO_3$, 3.5-44.1% of gypsum, 2.2-27% of epsomite salt., Oscillates at intervals of up to 2%.

It should be noted that the high content of carbonate and sulfate salts corresponds to the stratified, horny strata.

From this point of view, as well as from the dictionary data on soil science and on the basis of classifications of gypsum and carbonates, we can see that in the 7A cross-sectional soils 93-111 cm. Due to the fact that the stratum belongs to the deeper group and the amount of carbonates is higher than that of gypsum and epsomite, the soil is called deep-saline, saline meadow swamp, which is irrigated from the old.

If we evaluate 6A cross-section soils on this basis, we can see that the amount of carbonates is sharply lower than gypsum and epsomite, and the impermeability layer is 32-55 cm. newly irrigated swamps can be called saline meadow soils.

8A the cross-sectional soils are also assessed in the same way. The content of sulfates in this layer is sharply higher than in carbonates.

The amount of gypsum, carbonates, and epsomite in the 9A cross-sectional soils is evenly distributed, albeit slightly 55-89 cm. more than any other layer in the stratum, indicating that it is a remnant of a stratum with poor water permeability, as well as a carbonate illuvial layer. It can be said that the stratum, which has been cultivating 9A cuttings for a long time, is in good condition, and the existing strata under the influence of high agro-techniques are slowly disappearing, albeit slowly.

Not forget that along with calcium, other carbonate salts begin to settle in the soil. Experiments have shown that carbonate, carbonate-gypsum layers can be formed at different depths. Sulfates of strontium, molybdenum and other elements accumulate together with gypsum. Including 93-111 cm in section 7A. It is characterized by a densely branched composition; it differs in the presence of carbonates in gypsum compared to gypsum. This layer is not very thick at this depth. But it can play the role of a barrier. We called this barrier S-Ca that is gypsum-carbonate barrier.

At this barrier, macronutrients accumulate in the following quantities and form the geochemical spectral formula.

S-Ca, 91-111 cm., Gypsum-carbonate, CC:

$$КК: \frac{Sr}{43,5} > \frac{Ba}{2,72} > \frac{Rb}{1,13} > \frac{Ca}{0,98} > \frac{Mg}{0,87} > \frac{Na}{0,69} > \frac{K}{0,67} > \frac{Fe}{0,58}$$

The description of the geochemical spectrum of microelements in this barrier is as follows. S-Ca, 91-111 cm., Gypsum-carbonate, КК:

$$\frac{Sb}{6,4} > \frac{As}{3,35} > \frac{Cd}{3,15} > \frac{Cs}{2,8} > \frac{Br}{1,67} > \frac{Hg}{1,25} > \frac{Au}{1,05} > \frac{Hf}{0,80} > \frac{Ni}{0,71} > \frac{W}{0,67} > \frac{Ta}{0,35} > \frac{Co}{0,30} > \frac{Sc}{0,27} > \frac{Cr}{0,21};$$

The spectrum of distribution of lanthanides and radionuclides on this barrier is as follows:

$$КК: \frac{Yb}{2,33} > \frac{U}{1,4} > \frac{Eu}{0,69} > \frac{La}{0,67} > \frac{Ce}{0,49} > \frac{Th}{0,28} > \frac{Nd}{0,19} > \frac{Sm}{0,15} > \frac{Lu}{0,09} > \frac{Tb}{0,06}.$$

It is clear from the given geochemical spectrum formulas that in these pedolithic strata, that is deep gypsum-carbonate barriers, the macro elements Sr are so concentrated that Ba, Rb are concentrated so that the remaining elements do not correspond to the genesis of this stratum and soil КК<1 that is 0,58-0,98 between This is typical for carbonate soils.

Sb, As, Cd, Cs, especially from microelements, Sb, As, Cd, Cs, Br, Hg from microelements accumulate in this layer. These elements form a separate association. Au does not accumulate from the remaining elements, is КК≥1. However, Hf, Ni, W, Ta, Co, Sc, Cr are not accumulated in this layer, their CCs are smaller than Br, Hg accumulates in this layer. These elements form a separate association. Au does not accumulate from the remaining elements, КК≥1. However, Hf, Ni, W, Ta, Co, Sc, Cr are not accumulated in this layer, their CCs are smaller than one.

Yb from lanthanides and U from radionuclides are present in this layer in anomalous amounts, 1.4-2.3 КК. The nature of the other elements indicates that they do not accumulate, as they belong to the group of scattered elements.

There are some differences in this case when we consider the migration of elements in the pedolithic barriers, such as carbonate-gypsum, gypsum-carbonate barriers, relatively high, described as shallow and surface barriers. It would be correct to call these strata deep, shallow, surface barriers, depending on the depth of settlement. For example, in sections 6A and 8A, 32-55 cm, 18-33 cm. The migration and accumulation of elements in the armature-horned, horn-valued, gypsum-carbonate, carbonate-gypsum barriers are not uniform.

In section 6A, such a barrier that is a pedicle of arc-horn, means that the gypsum-carbonate barrier is 32-55 cm. located at a depth of 93–111 cm. It is relatively dense, cemented, and therefore acts as a mechanical barrier, but is analyzed as a physic-chemical barrier. In this Ca-S barrier, macronutrients have the following geochemical spectra.

$$\text{KK: } \frac{Sr}{42{,}3} > \frac{Ca}{1{,}54} > \frac{Ba, Mg}{1{,}05 - 1{,}06} > \frac{K}{0{,}71} > \frac{Rb}{0{,}67} > \frac{Na}{0{,}52} > \frac{Fe}{0{,}50};$$

Microelements

$$\text{KK: } \frac{Au}{23} > \frac{Sb}{14} > \frac{As}{8{,}53} > \frac{Cs, W}{6{,}7 - 6{,}8} > \frac{Cd}{3{,}15} > \frac{Ni}{3{,}1} > \frac{Br}{2{,}76} > \frac{Hf}{1{,}43} > \frac{Hg}{1{,}25} > \frac{Sc}{0{,}70} > \frac{Cr}{0{,}52} > \frac{Ta}{0{,}49} > \frac{Co}{0{,}44};$$

Lanthanides and radionuclides,

$$\text{KK: } \frac{Yb}{5{,}75} > \frac{U}{1{,}76} > \frac{La}{0{,}99} > \frac{Th}{0{,}84} > \frac{Nd, Eu}{0{,}67} > \frac{Ce}{0{,}49} > \frac{Sm}{0{,}47} > \frac{Lu}{0{,}36} > \frac{Tb}{0{,}11}.$$

These cases are now 18-33 cm in section 8A. consider the condition of the gypsum carbonate barrier.

$$\text{Microelements KK: } \frac{Sr}{46{,}17} > \frac{Ba}{1{,}85} > \frac{Ca}{1{,}56} > \frac{Mg}{1{,}16} > \frac{Na}{0{,}78} > \frac{K, Fe}{0{,}70 - 0{,}71} > \frac{Rb}{0{,}67};$$

Microelements

KK:

$$\frac{Sb}{34{,}5} > \frac{As}{11{,}12} > \frac{Cs}{9{,}4} > \frac{W}{8{,}07} > \frac{Cd}{6{,}61} > \frac{Ni}{4{,}82} > \frac{Hf}{3{,}26} > \frac{Au}{3{,}25} > \frac{Hg}{1{,}25} > \frac{Co}{1{,}0} > \frac{Sc}{0{,}98} > \frac{Cr, Ta}{0{,}95} > \frac{Br}{0{,}48};$$

Lanthanides and radionuclides,

$$\text{KK: } \frac{Yb}{7{,}57} > \frac{U}{2{,}76} > \frac{Th}{2{,}22} > \frac{La}{2{,}0} > \frac{Eu}{1{,}31} > \frac{Nd}{1{,}05} > \frac{Ce}{0{,}97} > \frac{Sm}{0{,}85} > \frac{Lu}{0{,}49} > \frac{Tb}{0{,}17}.$$

If we compare the two barriers, S-Ca and S-Ca, in this respect, we see a number of similarities and differences in this case. For example, we see the state of accumulation of Sr, Ca, B, and Mg from macro elements, but it is not difficult to see that this accumulation process is relatively rapid in the surface barriers, that are in the horn-valuable layers. This condition is also repeated in micronutrients and lanthanides. This means that these barriers differ not only in location, but also in the accumulation and differentiation of a group of metals, but because they belong to the same group, that is physic chemical barriers, the difference is of the same type, that is sharp differences are not noticeable.

The flow of chemical elements in the soil plays the main role in their anthropogenic circulatory movement. The amount of Mo, Ba, Sr and other elements in the horizontal blocks has a serious effect on it. This effect is manifested in a decrease in soil fertility, deterioration of living conditions of agricultural plants, and others. Properties of chemical elements and geochemical landscape conditions determine them, which are the levels of migration, accumulation, differentiation of elements.

One of the main reasons for the rapid re-salinization of pedolithic soils is that during the saline leaching process, water-soluble salts are washed from the top layers and accumulate on the stratified, horny-stratified layer, which has poor water-salt permeability, these layers are not very deep.

Wheat planted in soils with shallow pedolithic barriers suffers even greater damage in May, i.e., salts quickly rise to 18–33 or 32–55 cm after irrigation. And immediately after the cessation of irrigation, the salts move upwards, in which case in some cases a temporary soda is formed in the sulphate-saline soils, and, although moist and sufficiently nutritious, the wheat grass first turns yellow in the form of spots and then dies. After determining the properties and characteristics of geochemical barriers during the study, we continued practical observations in field conditions in Kushtepa, Yazyovan, Ulugnor, Mingbulak districts and observed cotton yields in 2017, 2018, and 2019 in areas with gypsum-carbonate barriers formed at different depths.

In the farms of Kushtepa, Yazyovan, Ulugnor districts of Central Fergana region on the lands of irrigated soils with shallow and shallow and deep pedolithic layers, the production of mineral fertilizers per hectare with the same agro-technical processes, that is N_{200}, P_{150}, K_{90} were found to change as follows under the conditions of the experiment (Table 2).

Table 2

The effect of geochemical barriers on cotton yield,

options	The layer of Pedolite depth	Annual average			average	Excess yield compared to option 1
		2017	2018	2019		
1	-	27,5	28,6	29,1	28,4	-
2	18-33 см	31,2[x]	32,8	33,5	32,5	4,1
3	32-55 см	29,6	29,7	30,4	29,9	1,5
4	91-111 см	27,7	28,5	29,3	28,5	0,1

x) Determination of yield was carried out in 3 rounds by calculation on the basis of harvests in 25 cotton fields in small areas.

The information above shows that compared to option 1 (control), the average yield increased by 4.1 c / ha in 2 variants, 1.5 c / ha in 3 variants, and 0.1 c / ha in 4 variants.

At the same time, the pedolithic layers, located at a depth of 18-33 cm, 32-55 cm, acted as a kind of geochemical barrier and, along with mineral nutrients, prevented the passage of trace elements and water to the lower layers, which is migration. This means that the nutrients are mainly stored in 20-30 cm layers, i.e. where the bulk of the cotton root mass is distributed, resulting in a deeper supply of nutrients to the cotton during the growth and development phases, i.e. improved compared to the 91-111 cm pedolithic layered variant.

The amount of irrigation water is also saved, that is the deep 91-111 cm pedolithic layer is given the usual amount of 1200 m^3 / ha, the pedolithic layer at a depth of 32-55 cm is given 1000 m^3 / ha, the pedolithic layer at a depth of 18-33 cm is given. And irrigation water was used at the rate of 800 m^3 / ha.

II. CONCLUSIONS AND RECOMMENDATIONS :

Arzyk-shok, shok-arzyk layers are genetic layers of irrigated meadow reed soils called pedoliths, which are formed during the formation of these soils and lose their properties as a result of long-term use in agriculture that is under the influence of anthropogenic factors.
Barriers are 50-100 cm deep, shallow 30-50 cm, surface 0-30 cm. It is advisable to allocate. In some cases in the deep state, the effect of shallow barriers on agriculture and other plants whose roots do not go very deep is not noticeable.

The district agriculture and water management departments and farmers ‘associations use good levels of bio micronutrients for the driving layer of shallow, shallow, deep pedolithic soils, taking into account the root depth of the plant species planted when planning the planting of agricultural crops. It is recommended that the regional hydrogeological and

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reclamation expeditions carry out the calculation of the amount of water consumed in the implementation of saline washing, taking into account the depth of the waterproof layer.

It saves about 20-30% of irrigation water itself. In addition to this, saline leaching activities will reduce water consumption and increase the economic efficiency of water resources.

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