Volume 3, Issue 12, December - 2025
ISSN (E): 2938-3781

Web of Agriculture: Journal of Agriculture and Biological Sciences
webofjournals.com/index.php/8

GEOCHEMICAL DISTRIBUTION OF CHEMICAL ELEMENTS IN CLAYEY SOILS AND THEIR COMPARATIVE ANALYSIS WITH CLARK VALUES

Sotiboldiyeva Gozalkhon Tolibjonovna
Associate Professor, Fergana State University, bffd (PhD)
E-mail: guzalsotiboldieva@gmail.comORCID : 0009-0004-7282-3062

Akromjonova Mashkhura Voxidjon kizi
Master's Student, Fergana State University
Mashhurasodiqjonova147@gmail.com

Abstract
This study analyzes the geochemical differentiation of chemical elements in irrigated clogged soils and compares their distribution with lithospheric Clarke values. The research evaluates the changes in physical-chemical and geochemical parameters driven by clogging and examines the migration and accumulation potential of major elements. A comparison of logarithmic Clarke values revealed Fe, Mn, Sr, and Ba as key indicators of clogging intensity. In weakly clogged soils, reduced concentrations of Cr, Ni, Co, W, and U reflect limited mobility. These findings contribute to understanding the geochemical genesis of clogged soils and serve as a basis for geochemical zoning.

Keywords: Colmatage, geochemical differentiation, Clarke value, migration, accumulation, rare-earth elements, Fe, Mn, Sr, Ba.

Introduction

The study of the distribution characteristics of chemical elements in irrigated landscapes is of great importance in assessing the soil-climatic conditions, geochemical processes and geoecological state of the region. The composition of elements and their characteristic migratory behavior in soils that have undergone the process of compaction are directly dependent on the geochemical basis of rocks, as well as the biogeochemical, geomorphological and filtration conditions of the region.

Scientific views on the study of the differentiation of elements in the lithosphere and soil have further developed with the formation of modern geochemical schools. The theoretical foundations developed by V. Fersman, A.P. Vinogradov, M.A. Lazovskaya, and A.I. Perelman are used as an important methodological direction in current research.

Volume 3, Issue 12, December - 2025
ISSN (E): 2938-3781

Web of Agriculture: Journal of Agriculture and Biological Sciences
webofjournals.com/index.php/8

Research Method

In studying the results of the research, the morphogenetic method of VVDokuchaev, the pedogeochemical methods of MAGlazovskaya and AIPerelman were used. Chemical elemental analysis of soils was carried out using the neutron activation method.

Scientific studies on the migration, accumulation, and differentiation of elements in the lithosphere have a recent history. The results have shown a connection between the lithosphere's clarkiness and their place in the periodic system of DIMendeleev.

The graph developed by Fersman revealed that the elements are a function of their ordinal number in the Clarke periodic table.

Using this methodology, we logarithmized the data on the 32 chemical elements we studied for the APVinagradov crust and irrigated weak, medium, high, and very high colmatized soils, placed the elements on the coordinate axes in increasing order, and plotted their logarithmic values to develop special graphs.

The relative change of elements can be estimated by taking the logarithm, with higher logarithms indicating higher accumulation of these elements in the soil, while lower logarithms indicate lower abundance or higher migration of these elements in the soil [1].

Research Result

Logarithmization of Clark values of elements in soils and their comparison with the lithospheric Clark values allows us to determine the migration rate, stability and accumulation properties of elements in the geochemical environment [2]. In the course of the study, the elemental composition of highly colmatized and very strongly colmatized oasis soils was analyzed based on the logarithmic spectra presented in Figures 1 and 2. The distribution lines of the elements in the graphs clearly reflect their geochemical stability and migration properties.

These graphs show the concentration changes of elements at different levels of soil compaction. In particular, the high values of elements such as B, Ca, Ni, Mo, and, conversely, the low logarithmic amounts of elements such as Au, Br, Cs, and Ce confirm the sensitivity of the soil to geochemical processes [3].

When we analyze the geochemical properties of highly colmatized soils **The spectrum in Figure 1 shows the state of elements in the topsoil of highly compacted soils relative to lithospheric clarke. As can be seen from the graph, element B is much higher than lithospheric clarke, which proves the sensitivity of this element to the compaction process and its active accumulation in the soil. The high accumulation of element B is associated with the abundance of organic residues, biogenic compounds, and clay fractions entering from irrigation systems.**

The element Na, on the other hand, is located below the lithospheric clarke, which confirms its easy solubility and water migration. The element K is very close to the lithospheric clarke, which indicates its relatively stable periodic behavior in the soil. The element K is strongly bound to soil colloids and does not suffer significant losses under irrigation conditions.

The closeness of the elements Sc, Cr, Mn, Fe, Sb, Ce, Nd, Sm, Hf, Th to the lithosphere clarke indicates that these elements belong to the category of geochemically stable elements. They are strongly fixed in the soil and, due to their low migration ability, are firmly retained in soil colloids [4].

Volume 3, Issue 12, December - 2025
ISSN (E): 2938-3781

Web of Agriculture: Journal of Agriculture and Biological Sciences
webofjournals.com/index.php/8

The closeness of the elements Ca, Zn, Ba, and Yb to the lithosphere Clarke indicates that they accumulate to a moderate extent, partly through leaching under the influence of irrigation waters and partly through absorption into siltation bodies. The element Fe has the highest Clarke value, confirming that this element is one of the main indicators for the siltation process.

Regarding the distribution of elements in very heavily compacted soils,**The data in Figure 2 show that in very heavily compacted soils, the amount of elements is quite stable. In particular, the location of the elements Th, U, Ta, Hf, Lu below the coordinate line indicates their biological and geochemical inertness, that is, they have very low migration activity [5,6].**

The element W, on the contrary, is characterized by high values, indicating good accumulation of this element in the siltation process. In particular, the lack of active accumulation of elements such as thorium, uranium, hafnium and tantalum in siltation masses indicates that the soil is less affected by technogenic anthropogenic processes.

The highest Co values between soil and lithosphere indicate that it has a high affinity for the colloidal phase. The predominance of Hf over Br and Nd indicates that the soils of this region contain a high proportion of heavy mineral fractions.

Geochemical differences due to changes in the degree of compaction**The results obtained show that different levels of compaction lead to significant differentiation in the distribution of elements in the soil:**

In weakly compacted soils Element B is most concentrated in the 0-16 cm layer; this layer is the zone where the main part of the new siltation products from irrigation water accumulates. Elements such as Cr, Ni, Co, W, U are found in small quantities due to their low migration..

In highly compacted soilsA significant increase in the elements Fe, Mn, Sr, Ba, Cu, and Zn was observed. These elements serve as the main indicators of the coalification process.

In very heavily compacted soils,Alkaline elements (Na, K) are easily soluble in water, so their logarithmic values are reduced. Rare elements such as Th, U, Ta, Lu, Hf have low values, confirming geochemical inertness.

If we focus on the migration and accumulation properties of elements, then water-soluble elements**Elements such as K, Na, Rb, Sr have high water mobility. Therefore, their logarithmic values in the soil are low or very close to the lithosphere Clark. In this, filtration of irrigation water plays an important role.**

Stable and accumulative elements The elements Fe, Mn, Cr, Ni, and Co are well fixed in the soil. The high logarithmic values of these elements indicate their geochemical stability.

Rare earth elements The very low logarithmic values of the elements La, Ce, Sm, Tb, Yb, Lu confirm their almost complete absence of participation in the coalescence process and their low migratory activity..

To elements with a mutable property Mo, Sb, Cs, Ba have different properties: some are washed away by water, and some are accumulated as a result of chemical absorption in the products of clogging.

There are upper and lower peaks in the geochemical spectrum of soil, and g**The spectra clearly show two distinct peaks: Upper peaks (Mn, Zn, Sr, Ba, Nd, Yb, Ta, Th) are stable, highly accumulative elements. Lower peaks (Sc, Cu, Br, Mo, Cs, Ce, Hf, Au, Hg) are water-soluble or low-migratory elements [7].**

Volume 3, Issue 12, December - 2025
ISSN (E): 2938-3781

Web of Agriculture: Journal of Agriculture and Biological Sciences
webofjournals.com/index.php/8

These peaks clearly reflect the gradual change in the clogging process

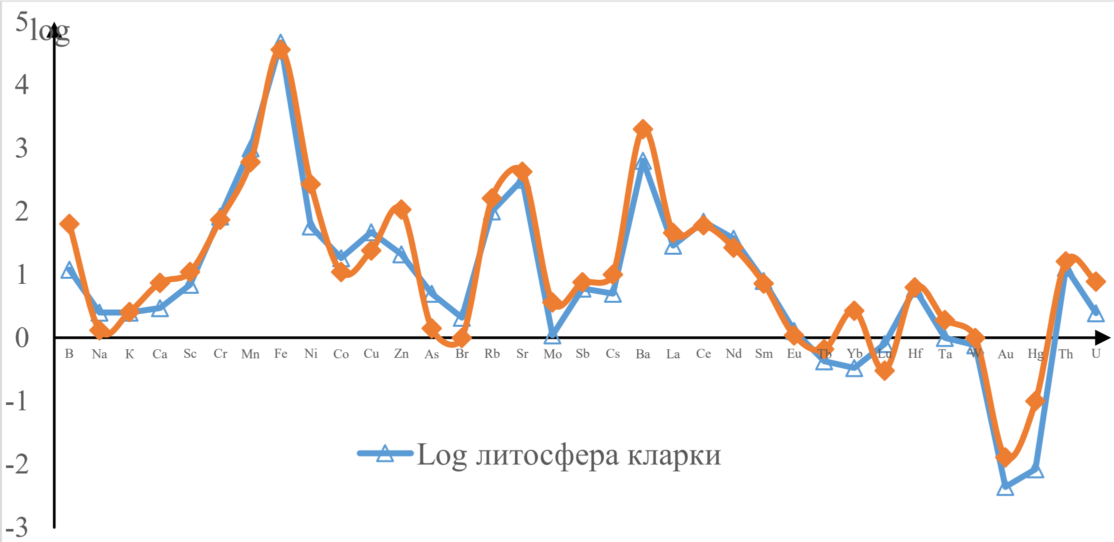

Figure 1.Soil and lithospheric Clarke logarithms of chemical elements in highly colmatized oasis soils

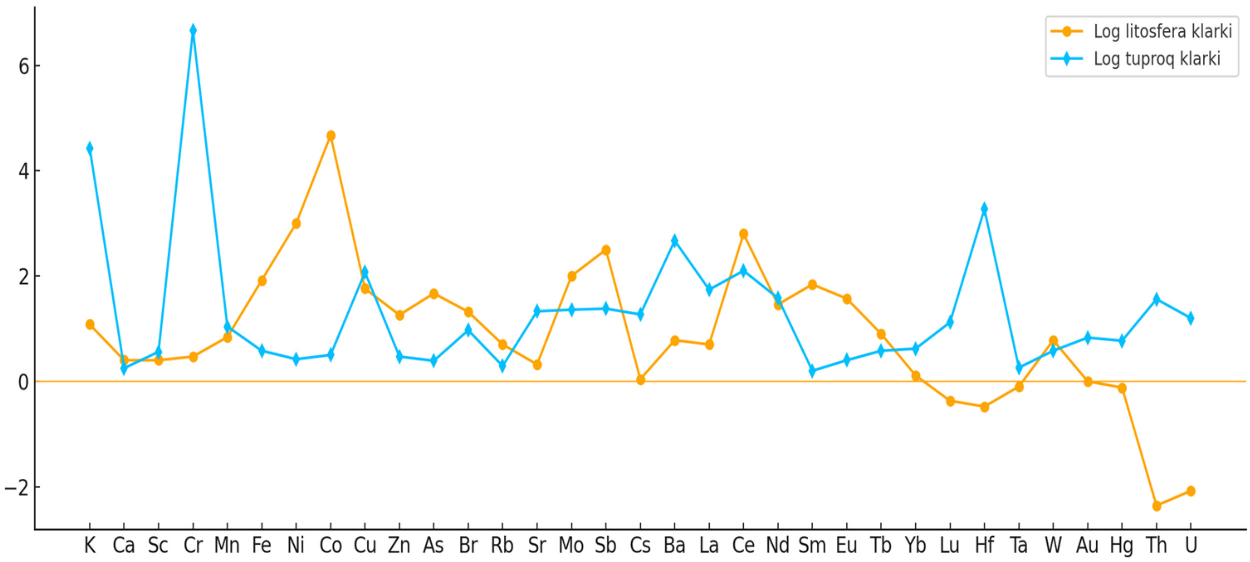

Figure 2. Soil and lithospheric Clarke logarithms of chemical elements in very heavily colmatized soils

Analyses show that the process of siltation fundamentally changes the geochemical structure of the soil. Differences in the distribution of elements are strongly related to irrigation conditions, filtration processes, colloidal composition and biogeochemical factors.

When comparing Figure 1 and Figure 2 Strongly compacted soils are saturated with stable (Fe, Mn, Sr, Ba) elements, while weakly compacted soils are dominated by easily migrating elements (Na, K, Br, Rb).

In conclusion, tThe results of the study showed that the processes of migration, accumulation and differentiation of chemical elements in colmatized soils are subject to complex geochemical laws. When comparing the logarithmic values of elemental Clark in the lithosphere with the logarithmic values of soils with different degrees of colmatization in oasis conditions, it was found that the distribution spectrum of elements is directly related to the soil-climatic, geomorphological and pedogeochemical characteristics of the area. In particular, as the colmatization process intensifies, the accumulation level of some elements (Fe, Mn, Ca, Na, Sr, Ba, Zn, Cu) in the soil increases, while, on the contrary, the logarithms of migratory elements (As, Br, Rb, Sr) decrease.

In highly colmatized soils, the high accumulation of elements such as Fe, Mn, Ca, Na is explained by their geochemical stability, the mineral composition of the soil and the content of small dispersed particles brought by water flows. In soils with a low degree of colmatization, humic components predominate, and the preservation of some elements in biogenic form reduces their logarithms. Also, the fact that rare earth elements (La, Ce, Sm, Tb, Yb, Lu) have almost low logarithmic indices proves their low accumulation during the colmatization process, that is, they have low reactivity in the soil-geochemical environment.

The upper and lower peaks identified in the study revealed the stratification of elements in the soil according to their geochemical behavior, migration characteristics and stability. The upper peaks correspond to elements such as Mn, Zn, Sr, Ba, Nd, Ta, Th, indicating their active accumulation under compaction conditions. On the contrary, elements such as Sc, Cu, Br, Mo, Cs, Hf, Au, Hg form lower peaks, confirming that they are highly mobile or unstable in the geochemical environment.

The results of this study once again proved the practical importance of VV Dokuchaev's morphogenetic approach and the pedogeochemical principles proposed by Perelman and Glazovskaya in the in-depth study of the geochemistry of colmatized soils.

By comparing soil Clarke values with lithospheric Clarke, it becomes possible to distinguish geochemical provinces. This approach serves as an important scientific basis for determining the geography of the distribution of elements across regions, assessing their pair genesis, and geochemical zoning.

In general, the study showed that the compaction process has a significant impact on the chemical composition of the soil, with differential accumulation of elements depending on their migration properties and geochemical stability. The results have important scientific and practical significance for in-depth study of soil-geochemical processes in irrigated landscapes, ecological assessment, monitoring of land reclamation conditions, and development of optimal management strategies for agriculture.

References

1. Sotiboldieva, G., Isomiddinov, Z., Topkanova, E., Toxirova, M., & Solijonova, D. (2022). КОЛЬМАТАЖЛАНГАН СУР-ТУСЛИ ҚЎНҒИР ТУПРОҚЛАРДА КАМЁБ КИМЁВИЙ ЭЛЕМЕНТЛАРНИНГ БИОГЕОКИМЁСИ. Science and innovation, 1(D8), 594-599.
2. Sotiboldieva, G., Isomiddinov, Z., Topkanova, E., Toxirova, M., & Solijonova, D. (2022). КОЛЬМАТАЖЛАНГАН СУР-ТУСЛИ ҚЎНҒИР ТУПРОҚЛАРДА КАМЁБ КИМЁВИЙ ЭЛЕМЕНТЛАРНИНГ БИОГЕОКИМЁСИ. Science and innovation, 1(D8), 594-599.
3. Юлдашев Г., Сотиболдиева Г., Абдухакимова Х. Farg‘ona vodiysi sug‘oriladigan yerlarida agroirrigatsion qatlamlarning shakllanishi va uning xossalari. NamDU Ilmiy axborotnomasi. 2025. 116-119 b.
4. Yuldashev, G., & Sotiboldieva, G. (2015). Formation of the absorbed foundations of the irrigated gray-brown soils of the Sokhsky cone of carrying out. Europaische Fachhochschule, (5), 3-6.

5. Hakimova, N., Abdukhakimova, K., & Sotiboldieva, G. (2024). RETRACTED: Formation and properties of agricultural irrigated layers of watered lands of Fergana. In E3S Web of Conferences (Vol. 549, p. 03020). EDP Sciences.
6. Hsueh YM, Wu WL, Huang YL, Chiou HY, Tseng CH, Chen CJ (December 1998). "Low serum carotene level and increased risk of ischemic heart disease related to long-term arsenic exposure". Ateroskleroz. 141 (2):249–57. doi:10.1016/S0021-9150(98)00178- PMID 9862173
7. G‘ Yuldashev, M.Isag‘aliyev “Tuproq biogeokimyosi”-Toshkent.: 2014. 55-56 b.