THE ROLE OF FLUVIAL SEDIMENTS IN THE FORMATION OF THE ARAL SEA DRIED BOTTOM SOILS

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https://doi.org/10.5281/zenodo.12107331

***Abstract**. The article describes the formation of soils on the dried bottom of the Aral Sea. The formation of soils in this area occurred directly due to the deposition of hard rocks brought by rivers for many years, and after they became dry, the soil groups, as well as salinization, were formed under the influence of groundwater. Also, the processes of desertification and degradation caused by drought of soil and climatic conditions, and intense exposure to solar radiation occur in this process at a strong level. The location of these soils is observed, standing parallel to the seawater reliction. As the water relicted, the area of the salt marshes expanded, and the formation of the landscape also changed in accordance with the desert conditions.*

***Keywords**: dried bottom of the Aral Sea, soils, fluvial sediments, mechanical composition, automorphic and hydromorphic soils.*

Introduction. Currently, a huge amount of land in the world exposed to degradation and desertification is largely associated with global climate change. As a result of the negative impact of human activity in the world, that is, the misuse of natural resources, significant changes have occurred in the environment. Climate change, various natural disasters, desertification and degradation processes are felt in all latitudes of the planet Earth. The annual damage from degradation worldwide amounts to 490 billion US dollars. 2.6 billion people in more than a hundred countries suffer from the effects of soil degradation and desertification, which in turn affects 33% of the Earth's surface. About 73 percent of pastures and 47 percent of rain-fed lands have been degraded. Therefore, it is necessary to improve, protect and restore the natural balance of genetic, ecological and reclamation properties of the emerging automorphic and hydromorphic soils in the areas of retreat of the waters of the Aral Sea. Among the urgent tasks is the implementation of Resolution No. 132 of the Cabinet of Ministers of the Republic of Uzbekistan dated February 15, 2019 "On measures to accelerate the creation of green spaces - protective forests on the bottom of the Aral Sea" and other regulatory legal acts related to this activity.

Purpose of the research. It consists in a detailed disclosure of the role of fluvial and lacustrine sediments in the formation of soils formed on the dried bottom of the Aral Sea.

Place of the research and methods of implementation. The research is the retreated (dried up) bottom of the Aral Sea, located downstream of the Amu Darya. The research was carried out according to generally accepted methods in soil science. The research used genetic-geographical, lithological-geomorphological, comparative chemical-analytical and profile methods [1;2], work on the chemical analysis of soils was carried out according to the guidelines [3;4] (Figure 1).

Results of research and their discussion. In conditions when the Amu Darya has been flowing towards the Aral Sea for a long time, solid rocks and sediments enter the sea along with a large amount of water. According to the researchers, the thickness of the listed alluvial deposits is on average from 10 m to 70 m. According to researcher I.F.Khakimov [5], mechanical particles of the Amu Darya waters are present in large quantities and occur in them from the smallest particles to large sand particles (Table).

Table

The long-term average level of siltation of the Amu Darya waters, kg/m^3, is given (According to I.F.Khakimov, 1989)

Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	annual
Water siltation	1,28	1,61	2,81	7,56	6,09	5,86	4,47	4,17	2,883	1,68	1,44	1,14	4,53

The period of the greatest siltation occurs in April-May, despite the large number of muddy rocks, in October-March there is a period of low siltation. Relatively high siltation during the irrigation period (April-September) reaches the average of 5.35 kg/m^3. The Amu Darya waters are characterized by the intake of medium dust particles (0.01-0.005 mm) with a predominant flow level of 57.8%, and particles less than 0.001 mm in size - 18.9%. Surface waters, the seabed are one of the main factors in the formation of soil-reclamation, soil-geochemical and environmental conditions, as well as soil cover, the role in combining the created and interrelated factors in the territory was great, since the hard rocks of the main channel generate the formation of the system of the above conditions. In the lithological structure of sedimentary rocks, seawater arises from various rocks coming from river deltas (Amudarya and Syrdarya), flowing from deltas (tributaries) and coming with circular flows. It was noted that the alluvial rocks that came through the riverbed freely penetrated into the sea, and many sediments in the lower coastal areas of the delta were filled with large sand particles.

The "former living" delta deposits of the Amu Darya are also visible in the interior of the sea, as in field studies it was observed that large streams of water delivered their effluents to remote inland areas and partially formed them in the form of embankments (hills) [6]. This situation arose due to the fact that the bed of the Kazakdarya, Erkindarya, Kuhnadarya rivers, which are considered to be the engineering channel or the old channel flowing through the southeastern part of Muynak city, was filled with alluvial deposits brought by the river, as a result of which the Amu Darya changed its course over the years. Some old (ancient) riverbeds (Kegeyli, Chortambay, Kuvanishzharma) have now been developed and become the part of irrigated lands.

Due to the influx of surface waters into the sea and the formation of soils, sediments are deposited in different layers, while the deltas of primary and secondary rivers play a great role. The main river deltas are 500-600 m wide, up to 100 km long and 4-7 m deep. During high tide years, large sand particles are deposited, and during low tide years, fine particles and dust particles are deposited. Riverbed sediments are divided into sandy, powdery and clayey. The coastal areas, which include the riverbed, are composed of layered loams (0.5-3.0 m). Their structure is due to the fact that the channel with a decrease in watercourses, that is, with a decrease in runoff, subsidence of smaller suspended rocks prevails (Figure 2).

Figure 1. Soil chemical analysis

Figure 2. Lowering of earthen embankments on the dried-up bottom of the Aral Sea

Secondary streambeds deviated from the main streambed, forming water depths and lakes, as well as passing through lowlands. They are about 1-3 m deep and extend 20-60 km wide. Its streambeds are 10-15 m thick, which is 1-2 m higher than the surrounding area. These are the ctypical features of these upper rises (shafts), they reach 1.5-2.0 m in height and 70-100 m in width relative to the perimeter and consist of sandy-loamy rocks, and the upper layers have a weighted mechanical composition. In our subsequent studies, it was noted that such cases occurred in the ancient riverbed (embankments) near the sea. Secondary channels are distributed on both sides of the delta and occupy large areas. On the sides of the riverbed there are riverbed shafts (elongated hills). They reach 2-4 m in height and 300-500 m in width. These embankments have a loamy-sandy mechanical composition, and as you move towards the end of the shafts, the mechanical composition of the soils becomes heavier [7]. However, the water permeability and water-salt regime of these riverbed shafts are somewhat better than that of riverbed bottom sediments, while salinization is mostly poorly expressed.

The works of I.P.Gerasimov [8] show the complexity of the aggregated differentiation of alluvial rocks involved in soil formation in the Amu Darya delta, lithologically very multilayered and their area (each layer) is up to 0.3-1.0 km. At first glance, this is true, but as a result of numerous soil-morphological, geomorphological studies in subsequent years, the territories occupied by alluvial deposits were clarified and the parent rocks forming each of the soils were studied. According to this, for most areas it was noted that the interfluvial marshes are composed of clay rocks, but valleys and embankments are composed of loam and sand.

The drained bottom sediments of the Aral Sea consist mainly of dust and fine sand, which flow through river waters. These listed rocks serve as the basis for the formation of soil covers in those parts of the sea that recede from the water. Since now, the process of primary soil formation has been going on, in direct dependence on the mechanical composition, properties, herbaceous-plant and soil-climatic conditions of rocks deposited with the help of marine waters. It is noted that sandy desert soils undergo stages of formation only in areas where marsh alkali soils and sandy rocks lie on the surface of rocks of heavy mechanical composition (clay) as a result of drying out of alkali (marsh) soils in areas adjacent to the sea and are highly susceptible to deflation processes, sandy desert soils undergo stages of formation [9]. The soil-ground covers formed on the seabed are characterized by the fact that the Amu Darya delta dries up, undergoing processes similar to soil covers, because at first, the process of soil formation began in the areas of water retreat, the water-physical properties of which were studied by some researchers. L.Tursunov [10], studying the rise of groundwater through capillaries, proved that grunt waters rise faster in dusty sands, and humidity increases at lower levels in soils with heavy mechanical composition. Lifting from various stratified rocks through capillary vessels is a complex process, and this process is disrupted in layered sediments. The properties of groundwater are closely related to the mechanical composition.

The process of soil formation under the influence of groundwater proceeds in a certain direction on the dried-up seabed, that is, it occurs when the soil and climatic conditions of sedimentary rock layers change, as well as when groundwater is exposed, sedimentary aggregates decompose, intensive processes of internal weathering occur, and this process is influenced by the flora. In particular, it was found that the rocks deposited at the bottom of the Aral Sea (sediments) consist of rocks of various thicknesses and mechanical composition, but, due to the relatively close location of the blue waters to the surface, as well as due to the strong heating of solar radiation throughout the summer season, evaporation occurs constantly, as a result the rocks of the seabed were subjected to varying degrees of salinity. In addition, dry soil and climatic conditions caused the degradation and desertification of the soil cover of the region.

According to researcher N.N.Khodjibaev [11], a small slope, heterogeneity of the lithological structure, as well as low water permeability led to a slow movement of waters of the common grunt (soil) in its delta part, forming a hydrogeological basin with generally different conditions. Currently, there is also the placement of grunt grunt waters in difficult hydrogeological conditions on land areas where the water recedes from the sea. There are sediments, depressions and tidal basins on the dried-up seabed, in which the influence of bluish waters, that is, the intensity of water evaporation, is noted. This suggests that they are directly involved in the formation of soils. The constant evaporation of grunt waters is one of the main processes of salinization formation. The process of soil formation on the dried-up seabed is currently at an intermediate level and in dynamic change, so soils can develop at the stages of their development, passing into completely new or different conditions [12;13]. In the conducted studies, it was noted that with the retreat of sea waters, the transformation of deposited rocks began, that is, at the first stage, the deposited rocks were formed under the influence of water and represent marsh alkali soils (groundwater is higher than 2-2.5 m), the soils of the second stage belong to the alkali soils (salt marshes) (groundwater up to 5 m), at the third stage – there are the soils of the desert range (groundwater comes to a depth of 5 m). The location of these soils is observed, standing parallel to the retreat of seawater. As the water receded, the area of the salt marshes expanded, and the formation of the landscape also changed in accordance with the desert conditions [14;15]. But the differences between individual soil allotments smooth out and disappear over time.

Conclusion. At the bottom, where the sea waters have receded and exposed, it is possible to observe flooded or sunken areas where the sizot waters are close to the surface, areas where brackish (halophytic) vegetation as well as reeds are currently developed. Due to the high content of toxic salts and easily soluble salts in holard, halophytic plants also did not develop in cortical and typical alkali soils (salt marshes). The role of isotopic and river waters in the formation of the soil cover of the area is noted, and currently only in swamped areas and in areas closest to the sea, hydromorphic soils are formed under the influence of sizot (soil) waters.

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