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A review Studies of Amudarya Delta (A case study of Karakalpakstan)

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ABSTRACT

This article describes the role of surface water flow in the stratification of landscapes, including delta landscapes, along with climatic factors, the big role of relief structure, how the formation of landscape species depends on the relief structure, the relationship of elementary landscape groups (alluvial, trans-alluvial, aqual, superaqual) to the tree structure of the delta. It has been revealed that the relief factor is leading in the formation of landscapes in river deltas.

KEYWORDS: *Fluvial system, Landscape, Relief, Delta System.*

INTRODUCTION

In the analysis of the structure of delta geosystems, it is important to know the geology of the history of relief (Akulov, 1960.). The natural structure of the relief of the present-day delta of Amudarya River appeared as the result of the Amudarya and its tributaries: Uldarya, Erkindarya, Shortomboy, Kazakdarya and others. As a result of long-term migration of branches, a "branched" soil-geological system was formed and the resulting "tree-like" relief structure formed the basis of soil types and mechanical composition. Therefore, the "tree-like" structure of the formed small deltas is the main factor in the stratification of delta landscapes. In short, the "tree-like" structure is an attribute of the small deltas, that is to say, the main feature. In general, according to the size, the relief structure of the current delta of the Amudarya River consists of a large "tree-like" structure, while its branches, small deltas are composed of small "tree-like" structures.

Figure 1: Location map of the present study area
Source: Google Earth

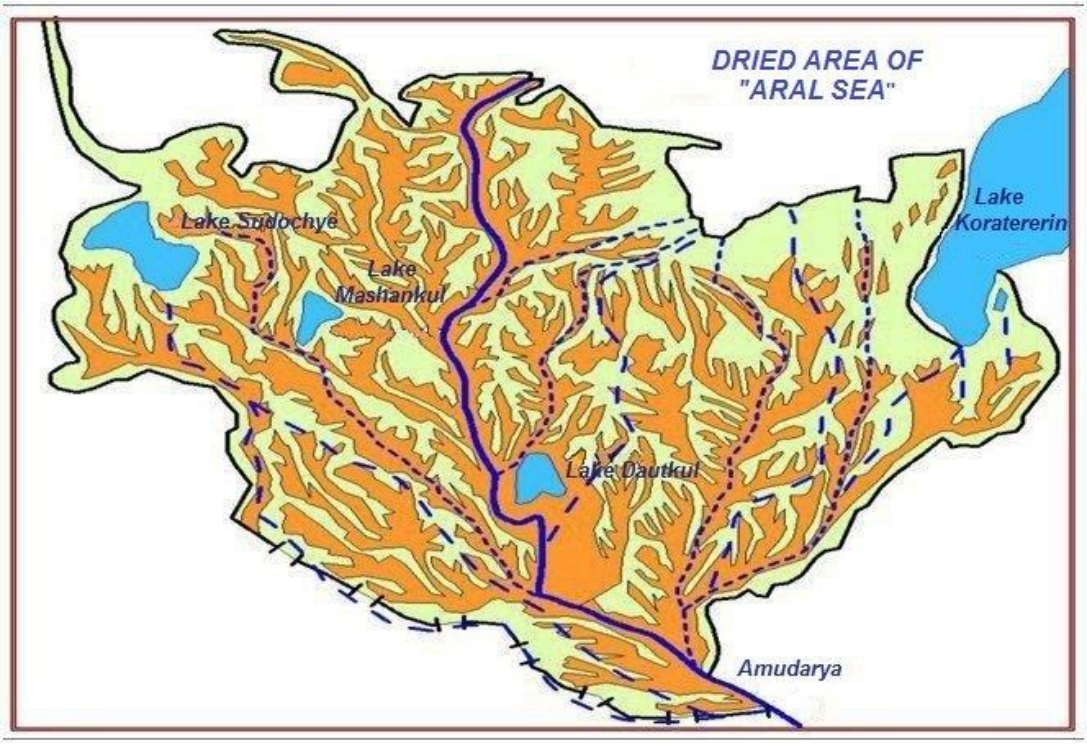

Figure 2: Overview of the Current Amudarya Delta

RESULTS AND DISCUSSION

Our researches in the current delta of the Amudarya show that the landscapes in irrigated and non-irrigated areas are drastically different from each other. Therefore, if we analyze the effect of relief structure in non-irrigated areas to the landscape stratification on the example of small deltas, we study the relief structure in irrigated areas on the example of collector basins.

We consider the impact of the relief structure on non-irrigated areas to the landscape stratification on the example of the small deltas of Kyzketken-Chimbay, Erkindarya and Shortomboy on the right bank of the present-day delta of Amudarya. In particular, the relief of the Kyzketken-Chimbay delta, although having a “tree-like” structure, differs from the small deltas of Erkindarya and Shortomboy with its internal structure. The Kyzketken-Chimbay delta ranks first in its area among the small deltas on the right bank of the present-day delta of Amudarya River [8; 3-40 p]. In addition, this small delta is the only delta on the right bank of the current delta of Amudarya River, extending from the outskirts of Nukus city to the 1961 border of the Aral Sea. Although the small deltas of Shortomboy and Erkindarya started from the north of Nukus city, they end around the edge of Kuskanatau, that is, their length is shorter than that of the Kyzketken-Chimbay delta. The length or shortness of these deltas is of course reflected by the effect of the relief structure to the stratification of the landscapes in the area occupied by the deltas. The Kyzketken-Chimbay delta is historically equivalent to the small deltas of the present-day delta of Amudarya, Shortomboy, Uldarya and small deltas and scientists say its age is 5,000 years (Lopatin, 1957).

The branching of the elevations in the small deltas is “tree-like” and according to Urazbaev A.K. and Ishankulov M.SH., the number of branching points or nodes depends on the energy of the branches (Ishankulov, 1986)

In the delta conditions, the relief structure formed as a result of surface water flow is appropriate to call the structure of "streams" (Urazbaev, 2002). The direction of each of the resulting

elevations and intermountain depressions is, of course, related to the activity of the surface water flow. In fact, as a result of deposits with a light mechanical composition, elevations of various appearances were formed. These elevations now determine the direction of surface water flow. If we analyze the structure of the currents in the example of the Kyzketken-Chimbay delta, while the elevations facing east from the highest plateau elevations are mainly in the northeast direction, the elevations facing west are mainly in the northwest direction. In other words, the surface water flow that forms the relief structure moves towards the lowest area. Furthermore, the formation of a relief structure depending on the surface water flow is related to the history of the formation of each small delta and longitudinal elevations of the same size are almost non-existent in different small deltas (Khursanov, 2018).

After the Turkmen-destroyed sands, the direction of the heights in the lower part of the delta was mainly to the north side and the surface water flowed towards the Aral Sea with the available energy. Therefore, the direction of the elevations associated with the direction of surface water flow is consistent with each other. Taking into account these processes, it is no coincidence that the relief structure is called the "Streams" structure, because the history of each elevation is related to the history of each water flow. In summary, the relief plastic map designed by I.N. Stepanov (1984) shows that the scientist is right in calling it a "Streams" map. The northward movement of the streams after the Turkmen-fractured sand was primarily due to the energy of the currents on the one hand, while the delta formation on the other hand continued to the north.

Each small delta, for instance, the Kyzketken-Chimboy delta consists of upper, middle and lower parts. Whether these parts are large or small in terms of area will, of course, depend on the energy of the network forming the small delta. If we analyze the Kyzketken-Chimbay small delta as an "ideal" object, then in the upper part there is mainly an alluvial elementary landscape or an automorphic landscape on water-geochemical order, trans-alluvial elementary landscape or semi-hydromorphic landscapes predominate in the middle part. The superaqual elementary landscape or hydromorphic landscape is at the bottom. The stratification of the aforementioned landscapes is mainly a legitimate change from the upper part of the delta to the lower part. The shift from the top of the small deltas to the bottom is the result of the natural fusion of the landscapes with the relief structure.

The structural stratification of landscapes is the automatic exchange of automorphic, semi-hydromorphic, hydromorphic landscapes of each elementary landscape group or water geochemical order from the upper part of the delta to the lower part or from the highlands to the west and east side. This is because the presence of this or that landscape group in a certain part of each small delta the presence of this or that landscape group in a certain part of each small delta occurs as a result of placement on the basis of legality. For example, if the area is not irrigated, then just as there is never a superaqual elementary landscape or hydromorphic landscape at the top of the small delta, there is never an alluvial elementary landscape or automorphic landscape at the bottom of the small delta. Therefore, before analyzing the stratification of landscapes in each sub-delta, great attention should be paid to the area dimensions of the upper, middle and lower parts of the sub-deltas, that is, there will be elementary landscape groups or landscape types that are legally present in each sub-delta. The suitability of specific elementary landscape groups or landscape types in the upper, middle, and lower parts of small deltas depends primarily on the relief structure.

If we analyze the landscapes of the Kyzketken-Chimbay delta from the highlands to the east and west side, they are radically different from each other. The elevations and lowlands facing east side from the delta highlands gradually merge with the lowlands around Lake Karateren in the east, in which case elementary landscapes or hydromorphic landscapes predominate. The eastern lowlands of the Kyzketken-Chimbay delta are the lowest areas on the right bank of the present-day delta of Amudarya River, and these lowlands are bordered on the east by the edge of Beltau. In essence, these lowlands are bounded on the one hand by the highlands of the Kyzketken-Chimbay delta and on the other hand, the salinization process predominates in hydromorphic landscapes as it borders the with Beltau edge. The salinization process, in turn, is related to the flow of surface water in this direction on the one hand, and to the natural flow of groundwater on the other. The activity of

the salinization process in these areas is related to the relief structure, which in turn determines the direction of surface water flow and the natural flow of groundwater.

In the west of the Kyzketken-Chimbay delta, this situation is not observed, for instance, the riverbed lowlands, which begin after the slopes of the riverbed highlands, occupy a short area. Then the riverbed highlands of the Shortomboy delta begin. The Shortomboy delta, in turn, extends to the edge of Kuskanatau. Thus, depending on the relief structure on the western and eastern sides of the Kyzketken-Chimbay delta, the stratification of landscapes differs sharply from each other. These differences are due to the relief structure, and hydromorphic landscapes are also uncommon in the western part of the delta, as riverbed depressions occupy a short area.

Sand dunes are located in the east side of the lower part of the Kyzketken-Chimbay delta, which in this part should, according to law, have a super aqual elementary landscape or a hydromorphic landscape. But the automorphic landscape predominates in this area. In our opinion, with the decrease of the Aral Sea level, the groundwater level in this region has also decreased. At the same time, the heights in the center of the lower part of the Kyzketken-Chimbay delta are connected with the lowlands around Lake Jiltirbas in this area. This is why this part of the delta is dominated by a superaqual elementary landscape or a hydromorphic landscape.

The stratification of landscapes in the small delta of Shortomboy is radically different from the Kyzketken-Chimbay delta. Since the heights in the upper part of the small delta of Shortomboy are connected with the heights along the Amudarya River, an alluvial elementary landscape or an automorphic landscape predominates in this area. Because the energy of the branch that forms the small delta of Shortomboy is much lower, this delta is several times smaller than the small delta of Kyzketken-Chimbay. Depending on the energy of the branch, the river bed high lands are very narrow and the area of the river bedlow lands is also very small. In addition to the upper part of this delta, the middle and lower parts are widely used in agriculture. Therefore, while the trans-alluvial elementary landscape dominates at the heights of the middle and lower parts, the super aqual elementary landscape or hydromorphic landscapes predominate at the lowlands. Although the delta's ridge elevations are very narrow, they are very visible on topographic maps. Thus, even in the small delta of Shortomboy, the stratification of landscapes is associated with highlands and lowlands and the predominance of semi-hydromorphic and hydromorphic landscapes in the middle and lower parts is mainly associated with nearby groundwater.

If we look at the history of the formation of small deltas in the present-day delta of the Amudarya River, a certain pattern is observed. The period of formation of the small deltas of Shortomboy and Kyzketken-Chimbayon the right bank of the delta is the same time, the formation of the small delta of Uldaryaon the left bank. After the formation of these small deltas, the river moves to the north and many branches separate from the river due to high water consumption, resulting in the formation of the Erkindarya small delta on the right bank and the Raushan small delta on the left bank. If we analyze the history of the origin of the Erkindarya sub-delta on the right bank of the present-day delta of Amudarya River, it is younger than the Uldarya, Shortomboy, Kyzketken-Chimbay sub-deltas situated in the south and is 2,500 years old (Lopatin, 1957).

To analyze the interrelationship of elementary landscape groups, the superaqual elementary landscape must of course be studied, for example, all chemical elements and salts leached from the alluvial elementary landscape accumulate in the super aqual elementary landscape. Given this process, if we analyze the lowlands of the present-day delta of the Amudarya, that is to say, the super aqual elementary landscape, they are located in the riverbed spaces, in the lower parts of the small deltas, and in the adjoining areas of several small deltas. However, the largest lowlands are found around Sudoche, Mashankol, in the area adjacent to Lake Karateren in the Kyzketgen-Chimbay delta, in the southern part of the Kuskanatau ridge, in the area adjacent to the Erkindarya, Shortombay, Kyzketken-Chimbay deltas, and between the Uldarya delta and the Kiyatjargan deltas and in other regions.

The lowlands, which occupy the largest area in the present-day delta of the Amudarya, are located around Lake Sudoche. Due to the constant movement of surface water flow and natural flow of groundwater towards Lake Sudoche, the area is dominated by a mostly super aqual elementary landscape or hydromorphic landscape. The analysis of the lowest areas in the delta is of practical importance for irrigated agriculture and land reclamation, and for extensive use of these areas in agriculture it is necessary to know the relief structure of the area, for instance, the irrigation and land reclamation are carried out on a large scale depending on the relief structure. In other words, the predominance of hydromorphic landscapes in these areas depends on the proximity of groundwater depths, which depends on the relief structure.

CONCLUSIONS

If we analyze the lowlands in the present-day delta of the Amudarya River, they are legally located in the confluence of various sub-deltas, in the lower parts of the sub-deltas, and in the interstellar spaces. The reclamation status of landscape species located in the lowest areas is directly related to the surface water flow or the natural flow of groundwater, which is directly related to the relief structure. Therefore, the formation of landscape species in the lowest areas is also associated with the relief structure, and the study of the reclamation status of these landscape species is of great importance for practical geography.

The river bed heights of the Amudarya basin are basically dominated by alluvial elementary landscapes or automorphic landscapes. Due to the strong energy of the Amudarya near the city of Nukus, the width of the river basins in this area in some cases is up to 5 km, that is, the formed river basins are still distinguished by the density of their vegetation cover. In addition to the alluvial elementary landscape, the trans-alluvial landscape is also widespread. The superaqual elementary landscape is almost non-existent.

The general shape of the riverbed highlands of Amudarya does not resemble a “tree-like” structure, but the relief structure descends to the west and east side from the highlands and joins with the riverbed depressions. At theriverbed highlands, for example, from Nukus city to Muynak city, due to the fact that the depth of groundwater is less than 7 meters, so almost all areas are dominated by automorphic landscape. However, their scale decreases from south to north side as they are associated with riverbed elevations. After the separation of the Erkindarya and Raushan branches from the Amudarya, the size of the riverbeds will sharply decrease, which means that this process will be associated with a sharp decrease in water consumption in the Amudarya.

The analysis of the relief structure of the heights of the Amudarya River basin shows that the size of the elevations decreases from south to north depending on water consumption. The general shape of the highlands of river basins does not resemble a “tree-like” structure, and their area decreases as they move away from the river and merge with the inter-river lowlands. In short, alluvial and trans-alluvial elementary landscapes or automorphic landscapes predominate in the highlands of the Amudarya basin. Even at the height of the Amudarya, the stratification of landscapes is associated with the relief structure, and as they move away from the river, they are replaced by superaqual elementary landscape or semi-hydromorphic, hydromorphic landscapes according to the law.

While stratification of landscapes in non-irrigated areas is associated with the “tree-like” structure of small deltas, landscape types in irrigated areas change according to a different pattern. In the current delta of the Amudarya is divided into six collector basins, namely, the Kungrad collector system, Aspantay, Ustyurt, KS-1, KS-3, KS-4. The stratification of landscapes in collector basins is related to the functional integrity of collector basins on the one hand, and to the internal structure of the collector basin on the other. In collector basins, the relief structure changes from the boundary of the basin on the one hand to the collector core, and on the other hand from the upper part of the basin to the lower part. Depending on the relief structure, the landscapes are stratified in the same order. For example, an alluvial elementary landscape is formed in the watersheds of the collector basins, a trans-alluvial elementary landscape is formed in the lateral slope of the watershed, and a superaqual

elementary landscape is formed around the collector core. In the same order, the landscapes change legally from the top of the collector to the bottom.

Just as the relief structure affects the stratification of landscapes in the area occupied by the collector basin, so does the collector, the long proximity of canals, the depth of groundwater, and the natural flow of groundwater. However, it should be noted that the passage of the canals through the heights, the passage of the collector through the riverbed depressions, the depth of the groundwater and its natural flow are also associated with the relief structure. Therefore, when analyzing the stratification of landscapes in the collector basin, we should not pay too much attention to irrigation and reclamation sectors, the depth of groundwater, that is, all these factors are closely related to the relief structure of the area.

Thus, the analyses of the role of relief structure in the stratification of landscapes in non-irrigated areas on the example of small deltas led to the conclusion that landscapes are associated with the (tree-like) structure of small deltas and legally change from the top to the bottom of deltas. In irrigated areas, the stratification of landscapes is associated with the functional integrity of collector basins, and the relief structure of small deltas in the basin defines landscapes. In short, in the stratification of landscapes in the deltas, it is expedient to take into account the magnitude role of river basin elevations, slopes of riverbed elevations, and intermodal depressions associated with surface water flow.

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