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The Modern Delta Of The Amudarya River And Its Orderness Forms Of The Soil Cover Structure.

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Abstract. This study discusses the issues of the ordering form of the soil cover structure of non-irrigated and irrigated zones of the modern delta of the Amudarya River. The relationship between soil and relief elements with structures has been studied comprehensively.

Keywords. Plastic of the earth's relief, elements and structure of the earth's surface, soil cover structure, collector basin, small deltas

1. INTRODUCTION.

The soil cover structure map is a special map representing the combination of soils of a certain territory by relief elements. It gives a visual representation of soils distribution on the ground. Also it reveals the features of their spatial occurrence. The authors examined the soil-geomorphological structure of the Amudarya Rivers' modern delta and concluded the

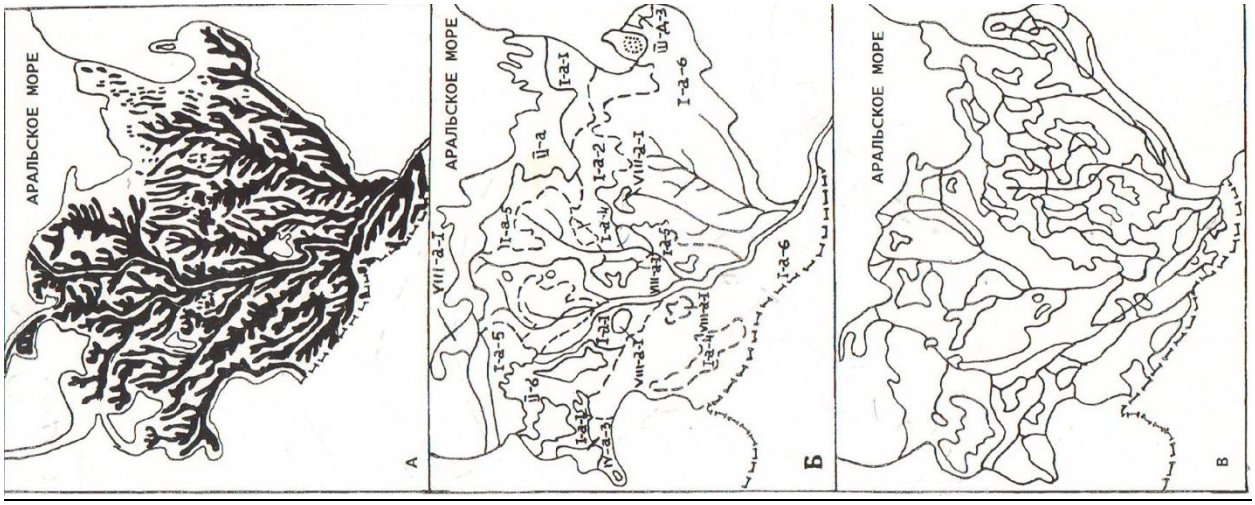
necessity to make a map of the soil cover structure showing the relationship between the properties of soils and the relief.

All geographical sciences study the regularity of the spatial distribution of their objects. Soil geography studies the patterns of soil distribution. These patterns can be studied in two ways. First way is to study the distribution of certain classification groups of soils (for example, gray-brown or gray soils) in connection with the conditions of their formation. It calls the geography of certain classification soil groups. Nowadays, new systemic approaches in soil science have revealed a second way of studying their objects. In the second approach, the object of study is the soil cover. This is a transition from classification units to territorial units (for example, the study of various forms of soil cover in delta geosystems or mountain areas). The development of systemic orientation in soil science formed the theory of the structure of the soil cover. Soil scientists have always considered the structure of the soil cover in relation to the topography. Scientist N.M. Sibirtsev believed that "most often, soil spots and ribbons are ... spots and ribbons of relief" (Sibirtsev, 1959). V.V. Dokuchaev was one of the first to draw attention to the relationship soils with relief. He studied the formation and development of the soil cover and came to the conclusion that the soil is a special natural body that arose as a result of the combined action of organic and inorganic factors on the earth's surface (Dokuchaev, 1953). His most important achievement in science is the theory of the structure of the soil cover. Another scientist, V.R. Volobuev (1948), when examining the soils of reclamation objects, studied the surface relief. Later he proposed an original method of analysis - relief plastics (Volobuev, 1948). A significant contribution to the study of the structure of the soil cover was made by V.M. Friedland (1972), I.N Stepanov (1986). M.A Glazovskaya (1969). They noted that "the structure of the soil cover of the Earth is a combination of soils according to relief elements" (Glazovskaya, 1969). V.M Friedland wrote that ... "the main factor in the formation of the structure of the soil cover is changes in the geological, geomorphological and biological components of the landscape, which are carried out in relatively small spaces within practically units of climatic conditions" (Fridland, 1972). I.N Stepanov mentioned: "The structure is a volumetric set relations (connections) and elements of the soil system. The soil structure is characterized by a large number of elements, their properties and the nature of their location in space. The latest is revealed using the apparatus of symmetry" (Stepanov, 1986).

2. METHOD

The role of relief in the soil formation of deltaic geosystems is very diverse. It affects the redistribution of moisture, water flows and soil formation on the earth's surface. Elementary landforms are genetically related to each other, naturally combined in a certain space and form the structure of the earth's surface. Relief structure is often understood as a certain set of relationships or connections between parts. All targeted analysis of soil cover structure is related to the topography studies. The modern delta of Amu Darya river is a relief of systemic flows. To study their spatial properties, we used relief plastics map of the Amu Darya river (Urazbaev A.K., 2020). Figure B and figure C we can compare fragments of maps for the same territory, but made by different methods. Our research analysis is to show that drawing the map of the soil cover structure more efficient from plastic maps. (Fig. 1, A) Other maps (Fig. 1, B, C) do not allow doing this, since their contours are too generalized. The map in Fig. 1, A shows all the rise and fall of the relief, creating geometrically correct patterns, which become evident after the implementation of abstraction.

Figure 1. Comparative assessment of the contour on the maps of the modern Amu Darya delta, compiled by different authors: A - methods of relief plastics (OG AN RUz, 1983); B - landscape with the use of aerial photographs (Uzgidroingeo, 1982); C - traditional method of drawing soil map (Uzgiprozem, 1970) (www.uz/undp/org/content/ uzbekistan.ru).

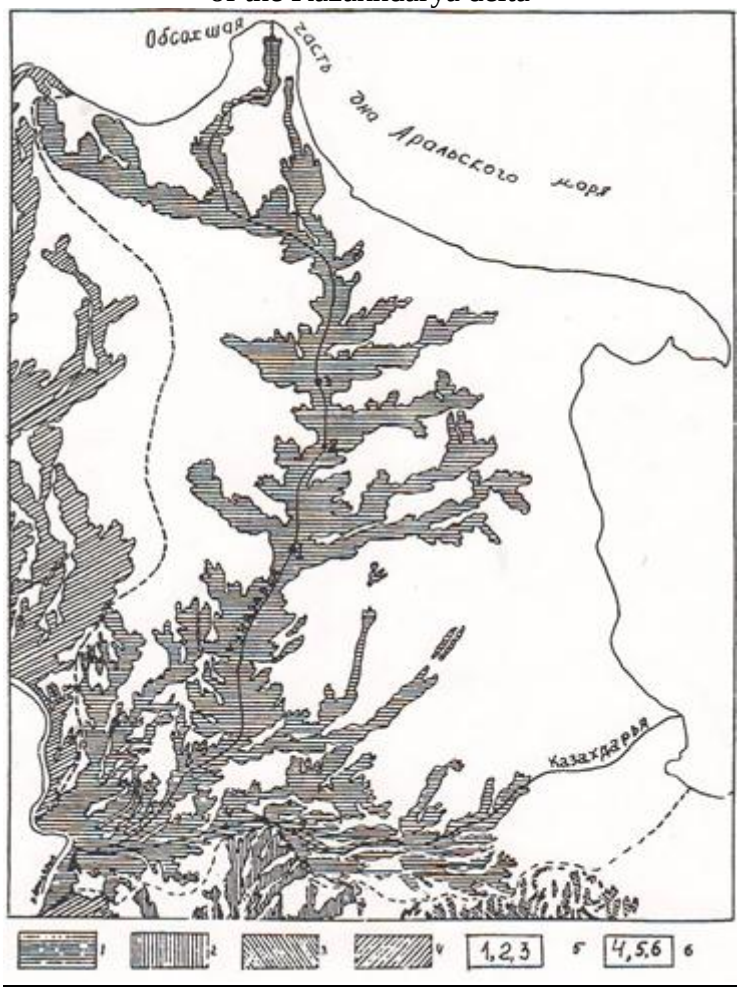


On the map of the plasticity of the relief the individual forms weren't highlighted. It shows the system of bulges and concavities. The essence of systemic plastics mapping is an identifying the order of succession of relief forms in these unified and integral formations based on a systematic approach (Urazbaev & Xursanov, 2017), (Khursanovв D.B., 2018).

Several small deltas have been identified within the modern Amu Darya delta, each of them has forms of structural integral system (Fig. 2). It can be seen from the figure that at the initial point (A) the systemic streams have a branching appearance and form two diverging large streams (Kunyadarya and Kazakhdarya) at an angle of 300. The Kunyadarya streams are mainly directed from north to northeast, and the Kazakhdarya to the east. They consist of systems of streams, which together represent an integral territory. They are characterized by specific geometric structures called branching. Kunyadarya forms larger river-bed elevations up to 1–2 km wide. This is due to the fact that Kunyadarya, when formed, had a more powerful force than Kazakhdarya. Branching points (1, 2, 3) are clearly defined in the Kunyadarya stream, from which system-forming streams are formed at an angle of 45-500 to the main trunk. The Kazakhdarya, in contrast to the Kunyadarya is smaller and shows near-channel elevations with a width of 0.5-0.8 km. From the bifurcation point (4, 5, 6) flows go at an angle of 25-300 to the main shaft of the system. And they have elongated shapes. The upper parts of the delta with its subsystems more favorable in terms of reclamation, than the lower ones. The structural integrity of the Kunyadarya-Kazakhdarya delta is the basis for mapping the structure of the soil cover of this object (Fig. 2).

The relief plastic map shows the contours of various soil types. During the study scientist must to know about the origin and development of soil species. It can be known by study the geomorphological evolution of the landscape and interaction of geomorphological soil-forming processes with nature.

Figure 2. Structural integrity of the Kunyadarya-Kazakhdarya delta:
I - Kunyadarya-Kazakhdarya delta; 2 - Erkindarya delta; 3 - Kyzketken-Chimbay delta; 4 - riverbed of the Amu Darya river; 5 - branch points of the Kunyadarya delta; 6 - branch points of the Kazakhdarya delta



It is important to note that the relief map depicts the structure of the earth's surface. A system of convexities and a system of concavities are distinguished on the map of the plasticity of the relief. Smaller forms of convexities and concavities are confined to them. The essence of systemic plastic mapping is the identification of the sequence of relief forms in these unified and integral formations on the basis of a systematic approach. The relief map is the basic base on which the contours of various types of soils are applied. It is necessary to know the reasons for the emergence and development of soil types when depicting the structure of the delta soil cover. In answering these questions, it is necessary to study the geomorphological evolution of the landscape and the nature of the interaction of geomorphological and soil-forming processes. The structure of the soil cover in the Kazakhdarya delta (non-irrigated massif) is closely related to the mesorelief. This means that it changes from the top of the delta to the bottom. For example, meadow-takyr tugai and meadow-desert soils gravitate exclusively to the dead channel beds. They occupy elevated strips stretching along them, composed mainly of sediments of light texture. In other words, they are confined to autonomous landforms. Meadow-takyr soils are shared with meadow-takyr tugai and meadow-desert elevated riverbed strips. They also develop among wide inter-channel depressions. This is due to the fact that meadow-takyr soils can develop on sediments of

various textures: on riverbed shafts composed of sandy loam, and on loams or clays of inter-channel depressions.

3. RESULT

On the soil map of the Kazakhdarya delta, compiled by relief plastics (Fig. 1), there is a clear relationship between the configurations of soil contours and the relief structure. This connection was pointed out by scientist V.V. Dokuchaev. He recognized the role of relief in the formation of "normal" - that is, watershed, "transitional" - slope, and "abnormal" soils, that is, soils of depressions (Dokuchaev, 1953). When discussing this issue, it is important to keep in mind the theory of litho-morpho pedogenesis (Borovskiy & Porebinskiy, 1958). It says that the processes of formation, development and spatial differentiation of soils in deltas occur in accord**a**nce with litho-morphogenesis (Urazbaev & Xursanov, 2017). In short, the integrity of this process in the delta is the result of above-ground water flows (Xursanov, 2019). Therefore, we propose to use a relief map when compiling a map of the soil cover structure of the Kazakhdarya delta. Its pedo-system of non-irrigated massifs is closely connected by “tree-like” structures of small deltas. Conjugate analysis of various maps shows that the use of the relief plastic method increases the reliability, accuracy, validity and objectivity of the boundaries of soil structures. This simplifies their coordination for adjacent administrative territories, facilitates the generalization of cartographic materials from different years. Thus, the compiled maps of soil structures show that soil sections in all territories of the present Amudarya delta are combined with the forms and structures of the earth's surface. On a large and medium-scale topographic map, the main forms and relief elements are preserved in the form of contours of relief plastics, as a background. It is not individual relief elements that are reduced and generalized, but the “relief pattern” as a whole. This allows the original land cover pattern of the large scale map to be retained on a medium scale map. The experience of detailed and large-scale soil surveys in irrigated regions suggests that the structure of the soil cover of irrigated areas is closely interconnected with the internal structure of the reservoir basin (Urazbaev & Xursanov, 2017). Using the example of the basin of the discharge collector-1 (DC-1), we studied the change in the structure of the soil cover within the irrigated and non-irrigated zones. The DC-1 take first place in terms of area among the collectors in the right-bank part of the modern Amudarya delta.

The internal structure of the reservoir consists of several small deltas. They are: the eastern part of the Erkindarya delta, the Churtambay delta, the western part of the Kyzketken-Chimbay delta, uplands (Kuskanatau, Krantau, Itkyr) and the sands of Turkmenkyrylgankum. There are two parts in the DC-1 pool: 1) an irrigated massif spread up to the heights of Kuskanatau and Turkmenkyrylgankum; 2) non-irrigated zone, which is located in the northern part of the Kuskanatau and Turkmenkyrylgankum uplands. In the lower and mouth parts of the reservoir basin, a natural automorphic soil-forming process prevails.

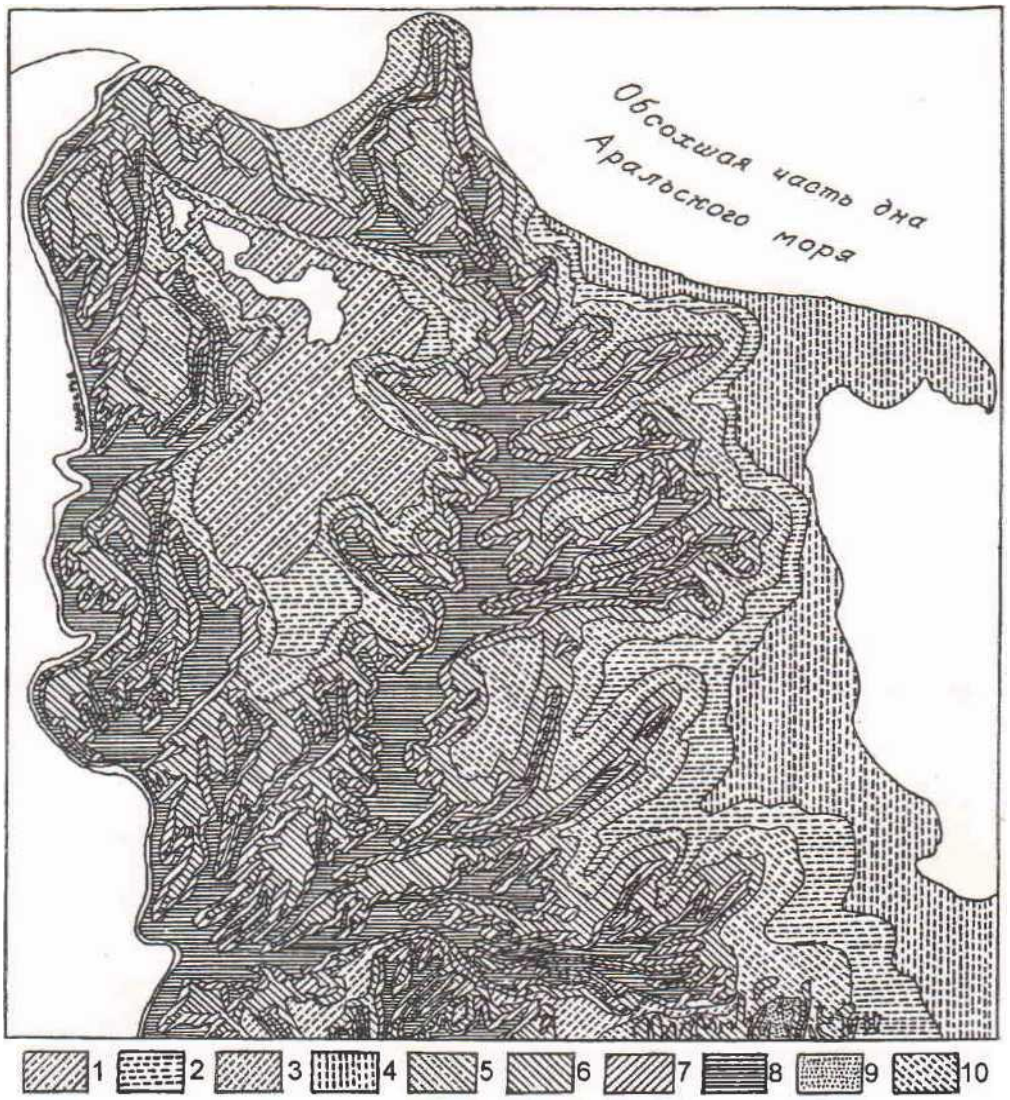


Figure 3 . The structure of the soil covers of the Kazakhdarya delta:

1 - swamp-meadow; 2 - typical salt marshes; 3 - meadow and typical salt marshes; 4 - seaside salt marshes (desert sandy soils and sands with typical salt marshes); 5 - meadow-takyr residual-bog; 6 - meadow-takyr; 7 - meadow-desert; 8 - meadow-takyr - riparian; 9 - typical residual salt marshes; 10 - meadow-takyr soils in a complex with typical saline soils.

At the beginning of the Erkindarya and Churtambay deltas, meadow-takyr tugai, meadow-takyr, meadow-desert soils prevail. In the end part of the Churtambay delta and in the contact zones between the Erkindarya, Churtambay and Kyzketken-Chimbay deltas with along the channel of the DC-1, bog-meadow, meadow soils and various types of salt marshes are common. Meadow soils on irrigated areas are widespread regardless of the land relief, and in non-irrigated areas they are confined mainly to depressions in the mesorelief. In the first case, the proximity of groundwater is maintained by filtration of irrigation water from canals and from irrigation fields. In the second case, due to its location in a low mesorelief. In terms of mechanical composition, meadow soils do not differ from other soils and are usually variably layered. Because of this, it can be assumed that meadow soils located among non-irrigated large tracts often have a weighted profile. This is also influenced by the fact that they are located in a low mesorelief. And meadow soils located among irrigated lands are varied in lithology, since their origin and position is less connected with the relief. A characteristic

feature of the DC-1 collector basin is an extremely small area of bog-meadow soils. The predominant part in the non-irrigated zone of these soils is confined to the mouths of the discharge collector (area Jaltyrba Lake). Few small spots of these soils are found in the lower parts of the Erkindarya, Churtambay, Kyzketken-Chimbay deltas, as well as in lowering irrigated areas. Salt marshes are widespread in inter-channel depressions, on the bottoms of dry lakes, in the coastal strip and in the contact areas of various channels. Complexes of typical salt marshes with meadow and irrigated meadow soils are found on an insignificant area. The main difference between meadow salt marshes is their high humus content. In terms of mechanical composition, they are diverse, but more often in this respect they tend to be heavy. Some part of the collector basin area (the area to the north of the Kuskanatau and Turkmenkyrylgankum Uplands) with deep groundwater is occupied by residual saline soils. The depth of groundwater (7-10 m and more) excludes the possibility of a modern saline process here. Residual salt marshes represent a relic of a long past hydromorphic period. Residual saline soils with takyr soils form a geomorphological region. These are riverbed strips of dead ducts in the southern parts of the delta and wide inter-channel plains of the peripheral parts of the region. They are developed on sharply layered sediments with a predominance of light sandy loam and sandy layers within the upper three meters. Irrigated meadow soils occupy the largest area of distribution within the collector basin (in the structure of the soil cover up to the Kuskanatau Upland). They are located in the middle and lower parts of the Churtambay delta, in the middle part of the Erkindarya delta and in the upper and middle parts of the Kyzketken-Chimbay delta. They are also the main land fund of the Chimbay oasis (Chimbay, Kegeilinsky, Nukus administrative regions). In terms of their mechanical composition, they do not differ in any way from other alluvial soils, as discussed above. It should be recalled the regularity common for all soils, that the depressions of the mesorelief are more often composed of heavier, and rises with lighter alluvial material. Irrigated swamp soils are formed as a result of the development of lowlands for rice cultivation. They are common on the territory of rice-growing farms. The soil is much layered. With a decrease in the level of the Aral Sea, the areas of semi-hydromorphic and automorphic soils in the lower parts of the Erkindarya and Kyzketken-Chimbay deltas expanded. And with the salinization of the substrate, the areas of salt marshes increased. There have been significant changes in the physical and chemical properties of soils, their fertility, and water-salt regime. All these factors make it necessary to study the relationship between the soil cover and relief elements with structures (Rana A. Ibragimova, Shavkat M. Sharipov, Uktam K. Abdunazarov, Mirali T. Mirakmalov, Aziza A. Ibraimova.).

4. DISCUSSION

Soil scientists and earth scientists are known to welcome the plastic method. They consider it necessary for widespread introduction into science and practice in order to improve the quality of thematic maps, including maps of relief structures and soil cover (Kovda, 1987). The merit of the authors of the collection, who showed the importance of the method of analysis of relief plasticity, is that they substantiated the legality of drawing the boundaries of soil maps by the Dokuchaev's method, proposed a detailed geomorphological analysis of large-scale and medium-scale topographic maps and proved its effectiveness (Kovda, 1987).

As noted earlier, in the method of relief plastics interesting approach is generalization of soil contours when compiling medium-scale maps of the structure of the soil cover based on large-scale maps. It is important to note that geographic generalization, that is, the operation of linking soil plots to the elements of the topographic base, is carried out in two ways: 1) mechanical photo reduction, when the connection between the relief and soils is lost at the

very first stages, and 2) systemic generalization by the method of plastics, when between large and medium maps scales established the similarity of geosystems up to individual riverside ridges, slopes, depressions (Urzbaev, 2017). Based on the similarity of relief patterns of different scale maps, it is possible to transfer soils from the original map to the final one without stages of generalization. Combined mapping of the relief and soils makes it possible to show naturally the structure of the soil cover of deltaic geosystems. They differ in the configuration of their contours from sandy territories. At the same time, the pattern of soil contours is very different, which means without reading the legend of the map, we can predict the relationship of soil with relief forms: rises and falls. The relief plastics method provides a uniform, thorough analysis of the structure of the earth's surface along the horizontal lines of topographic maps. Its advantage is that in this case, the areas of rises (bulges) of declines (concavities) invariantly associated with them are separated. The predominant soil method is based on the combination of soil plots according to the relief elements of the plastic map: near-river banks, transition zones (facies of spills and wandering channels), depressions (lacustrine facies). First, autonomous soils (convex soils) and subordinate soils (concavity soils) are distinguished along the main boundaries. Within these large communities, transitional soils are distinguished depending on the location of the study area. Generalization consists in the unification of near-river banks, with the formation of complexes (meadow-takyr tugai, meadow-takyr). The next stage is the generalization of the soils in the transition zones. In the Kazakhdarya massif (transition zone), meadow-takyr soils prevail in a complex with typical saline soils. At the very end, the soils of concavities of the relief are generalized into: meadow-boggy, typical salt marshes, meadow and typical salt marshes. Generalization of soils often found among irrigated areas of desert territories is carried out by the soil scientist himself. The soil scientist leaves the minimum area of the contours when the map is reduced and only those banded relief forms that he considers necessary. The lack of generalization rules led to the fact that cartographers began to exclude the soils of desert areas, which are common among the irrigated areas of the eastern regions of the studied area. Each cartographer excludes or leaves those desert soils that are convenient for him. Therefore, soil maps compiled on the same scale for the same territory by different soil scientists rarely have similar outlines. The method of relief plastics prohibits the soil scientist generalizing the relief condition by himself. It obliges to use topographic maps preferably on a large scale. In this case, generalization of the relief pattern will have nothing to do with mechanical simplifications of the contours. The details of the form will be removed. And the principle of the hierarchy of geomorphological levels will be observed. The results of cartographic work showed that with the generalization of the number of “branches” of “tree-like” structures of small deltas, the relief pattern of alluvial sediments remained the same. The essence of the relief plastics method is to outline all the convexities and concavities of the earth's surface, depicted by contours on a large-scale topographic map. Then by lowering the horizontal save only the sections of the bulges and concavities which means a plastic map. This fully corresponds to the content of a large-scale topographic map, since it is simplified and convenient for work in the field and in the laboratory. Personal initiative for the culling of relief and soil areas, so widely used in scientific and project organizations should be banned, since maps drawn up by eye, distort reality. Also, these maps of soil structures become incomparable and unreadable. The quality of generalization soil maps is assessed by the of similarity of the primary (initial) images with the generalized ones. Therefore, during generalization, they try to preserve the geometric shape of the primary sections as much as possible. It depends, firstly, on the quality of the compiled large-scale maps of relief plasticity, and secondly, on the compiled large-scale maps of soil structures, on which the drawn boundaries of soil sections naturally reconcile with the relief forms.

5. CONCLUSION

1. In delta geosystems, there are two forms of ordering the structure of the soil cover. Non-irrigated solid differ sharply in the structure of the soil cover from irrigated one. In non-irrigated zones, the structural integrity of small deltas is important for studying the relationship between the structure of the soil cover and "tree-like" structures of area. They regularly change from the upper part of the small deltas to the lower one.
2. Within the collector basin at irrigated zones of modern delta the Amudarya river, the most important factor in the formation of the structure of the soil cover is not the relief elements, but the internal structure of basin collector. In irrigated areas, the collector basin has an important integral characteristic - a systematic change in the structure of the soil cover from the watershed-riverbed to the lowest plots of land; and from the upper part of the basin to the lower one. The structural analysis confirms the validity of the separation of the soil cover at irrigated areas from non-irrigated ones. This comes from the fact that the ecological conditions of these territories differ markedly.
3. The map of the structure of the soil cover of non-irrigated massifs, compiled on the basis of the relief plastic method, shows the relationship between the soil and the “tree-like” structures of small deltas.
4. The main forms and relief elements depicted on the large and medium-scale topographic map are preserved during generalization in the form of relief contours as a background. This means that the “relief pattern” of the earth's surface is reduced and generalized. This allows the original land cover pattern of the large scale map to be preserved on a medium scale map.

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