ON THE METHODS OF REGION RESEARCH WITH SPECIAL REFERENCE TO THE SOUTHERN GREAT PLAIN OF HUNGARY

by

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During the last two centuries the forces of production of the socialist countries have experienced a great development as a result of planned cooperation. According to Mikhailov "effective and reasonable utilization of the natural resources has become an important task in the development of the different countries as well as of the whole socialist camp" (1). Consequently, *regional division* of the countries of *Central and Southern Europe* on the basis of common principles in an important task of the present and the nearest future.

Mikhailov attempts a comparative study of the regions and physical geographic regional division of the Soviet Carpathians and the Ukraine and of Hungary (1). The Soviet geographers theories on regions are well known. Through the works of Mikhailov and his associates we have had an opportunity, although only later, to get acquainted with the fundamental theoretical and methodical problems studied by the Ukrainian geographers. We think that these methods provide very good possibilities for the study of the physical geographic classification of our regions.

Some theoretical and methodological principles for the study of regions

Dokuchaev, Berg, Bulla, Zólyomi and their followers defined in their studies (on territorial units) the theoretical basis of physical geographic region research.

According to Berg the region is a physical geographic territorial unit, while Kalesnikov precises the definition by naming the dimensions. According to Kalesnikov the region is a relatively homogeneous area formed in a natural way in the course of its paleographic and historical development and differing from other regions in its structure, i.e. in the correlations and interactions of the different geographic factors, in the particular combination of the smaller territorial units constituting the region, and special features of the rhythm of the seasons (2). *The difference between two or more regions lies in their lithological characteristics, surface, climate, waters, soil, flora and fauna;* the physical geographic unit is determined by the particular structure and development of these elements.

However, the power of the different factors is different and so they can be classified. According to this classification the lithogenic and hydroclimatogenic factors are *strong*, the biogenic factors relatively *weak*. As lithogenesis is the most resistent, Isachenko's statement that "the period of existence of the region can be defined in geological terms" is correct According to Gerenchuk the geomorphological complexes can be defined from the types of soil and the flora; he suggests that delimitation of the regions should be made on the basis of the river valleys, and top [rock] formations (3).

The geological base is generally the same over the whole of the region; in the transitional areas different, modified geological conditions are found. Thus different formations occur already at the boundaries of the different regions. According to Solntsev the geographic region is a system consisting of smaller physical geographic spatial units developed according to the laws of nature and possessing morphological structure (4).

It has been demonstrated that the most important features of the region are expressed in the structure. The differences between two contiguous regions can be demonstrated with the help of the ratio of morphological differences. The morphological structure is visible and can be represented cartographicaly (3).

The Soviet region researchers, for instance, are investigating the area of southeast Ukraine in three morphological structures: facies, urochishche and mestnost'.

Facies is a smaller part of the region that develops in a particular area: identical *lithogenic composition, humidity conditions, microclimatic and soil conditions, and a particular flora* with its fauna.

The basic region unit as a facies may be determined by the vegetation, for different types of flora can be the dominant factor on the slopes, dry river channels, and terraces of the mesorelief. Human activity can influence first of all the biogenic factors. On the basis of changes of the soil and the vegetation cover, dominant and subdominant facies can be distinguished (4). In the course of studying the facies, mapping of the areas under investigation became necessary. For greater distinctness detailed maps, sometimes with 1 : 500 and 1 : 1000 scales, should be made.

The *urochishche* is the highest form of the mesorelief characterized by a particular *rock composition, type of soil* and *vegetation cover*.

According to some researchers the urochishche is made of genetically similar facies (3). Soviet researchers call the repeated urochishches *basic urochishches* that determine the basic structure of the region (4). The term *"dominant urochishche"* can often be used instead of "basic urochishche"; consequently the areas not ensuring the basic structure of the region are *"subdominant urochishches"*. Both types of urochishche have their own economic importance; these areas are well delimited by natural boundaries such as rivers, forests, foothills, etc.

Gerenchuk proposes anthropogenic boundaries such as plowfields, meadows, pastures, forests, etc. between the cultured areas and the areas in which no substantial or qualitative changes can be observed. They can be mapped well using a scale of 10.000 to 1000.000.

The *geographical mestnost'* is a new notion. It is a relatively larger, genetically uniform area of the region, characterized by a homogeneous geological basement, local climate, and identical formations (3). The regions in general contain several urochishches. Maps on the 25.000—100.000 scale are suitable to represent them.

The elements of region typology, the facies, the urochishche and the mestnost', are combined into a unit by their development history and their local natural processes. The units of the natural processes become the center of interest of the investigation on account of considerations, on the basis of which perhaps higher categories can also be estblished. We can mention here that the Ukrainian region researchers regarded the "oblast' " (geographic area), the "provintsia" (geographic province), the "zona or strana" (physical geographic region) as higher, larger units. *"Oblast' "* means a relatively large territorial unit of the region bound together by common historical development, climate, and vegetation cover. It must be mentioned at the same time that the Ukrainian region researchers use further differentiation within this territorial unit. The territorial units ara characterized by a common climate, identical soil,, and the same plant association. The combination of several physical geographic "oblast's" creates the (physical geographic) "provinces" which are larger territorial units than the "oblast' ". Here, too, investigations can be carried out by different methods; the basis of such investigations can be the particular geographic location, the climate, the vegetation, the horizontal position of the soil, and the vertical arrangement of various factors. Differentiated division obtains in this larger territorial unit as well as in the "oblast' ".

The physical geographic division and study of different regions at home and abroad is based on the principle of complex physical geographic characterization. Determination of different basic units is made on the basis of complex examination of the geographic factors (5, 6, 7, 8).

Delimitation of areas, division into regions, is based on the study of common physical geographic processes. No other special investigations working within such a narrow field could replace this study. While the different special disciplines investigate the single links of the complicated processes *the task of geography is to clarify and explain the structure and mechanism of the region* (5).

The distinctive *character of the region* is determined by its historical past.

The *genetic investigations* determine the age of the region and the phases of the development of its present form. The results of these investigations facilitate the classification of smaller units into larger territorial units.

The methods most recently used in region research are:

The *comparative method,* in which the elements of the physical geographic units are compared one by one. At the same time similar processes and the geographic laws prevailing in a given area are identified.

The *selective comparative method,* in which two or three important factors — temperature, humidity, etc. — are considered specially for comparison, and by means of which the geographic processes can be evaluated qualitatively.

The *method of dominant factors,* in which the dominant factors are ascertained and throughly studied. No comparison is possible because the dominant factors are different in different areas.

The boundaries of the territorial units can be determined by the factors that show the most characteristic features of the region under consideration.

In all cases it is necessary to *study the terrains* before defining the territorial units. This is followed by working up of the measurement data collected and finally the conclusions.

Various methods of investigation have been used for regional studies (1). Differently from the methods developed so far, in our work we have studied such connected elements in areas of different orders of magnitude as can be representative of cultivated areas conditioned by the now existing genetic soil types. The main genetic soil types as well as the different climatic elements are suitable for differentiating the basic region units or mosaics within connected areas and for delimiting physical geographic microregions.

As the characteristics structure of the regions is determined by its historical development, it is advisable to consider the present form of the region from the point of view of its stages of development. Therefore we are going to describe the surface — near layers of the Southern Plain in broad outline with special regard to the formation of region units.

From the point of view of the *development of the Pleistocene layers and the surface,* the Southern Plain is divided into: 1. the valley of the Danube; 2. the quisksand and loess plain in the Danube—Tisza interfluve; 3. the valley of the Tisza; and 4. the Trans-Tisza region (9).

From the point of view of the whole region system the influence of the surface-near layers on the development of the surface layers, their composition and settlement pattern, is of decisive importance.

For the sake of completeness we must mention in certain respects the deeper lying sediments of the basin. The bulkiest, about 2000 m thick sediment among the layers filling the basin of the Great Plain settled at the time of the Pannonic stage in the salt water of a landlocked sea (1, 2, 3). The composition of this basin is homogeneous, consisting of clayey marly layers. On the other hand the Levantine layers of the Pliocene are freshwater sediments. At the time of Levantine sinking, in consequence of the rapidity of sinking, the main mass of sediments was coarse fluviatile deposits that form the water reservoirs of the artesian layer.

After the Pannonic stage the southern part of the area sank unevenly. The center of the subsidence was in the area of Szeged where the Levantine layer can be found as deep as 1000 m. In all directions away from the center the Pannonic layer rises considerably (1). The subsidence and filling up of the Great Plain did not coincide with the movement of the Levantine layer. The Pleistocene layers are the thickest in the angle of the Körös rivers. This region was in the geological past the most intensely sinking area (13). It can be said of the whole of the Trans-Tisza region i.e. the plain east of the river Tisza, that its sinking in the Pleistocene was more considerable than in the other parts of the Great Plain. The sinking influenced the subsequent development of the surface-near layers.

To the surface-near formations belong the *uppermost Pleistocene* and *Holocene deposits.* The surface-near formations can be divided into two groups: surface formations and layers under the surface formations.

Under the surface formations there is *driftsand,* especially in the area of Kecskemét and southeast of it a wider expanse in the area of Kiskunhalas and south of the latter. *Gravelly sand* is found 30 km south of Békéscsaba, in the same latitude as Hódmezővásárhely, over an area of about 200 sq. km. *Fluvial sand* prevails over the larger part of the Trans-Tisza region with the exception of the areas of Hódmezővásárhely and Orosháza and a 30—40 km wide area south of the Körös where the soil layers contain *sandy silt.* In the Danube—Tisza interfluve, especially along the Danube and in its middle portion, loess, on the right bank of the Tisza a mixture of sandy silt and loess dominate (Fig. 1).

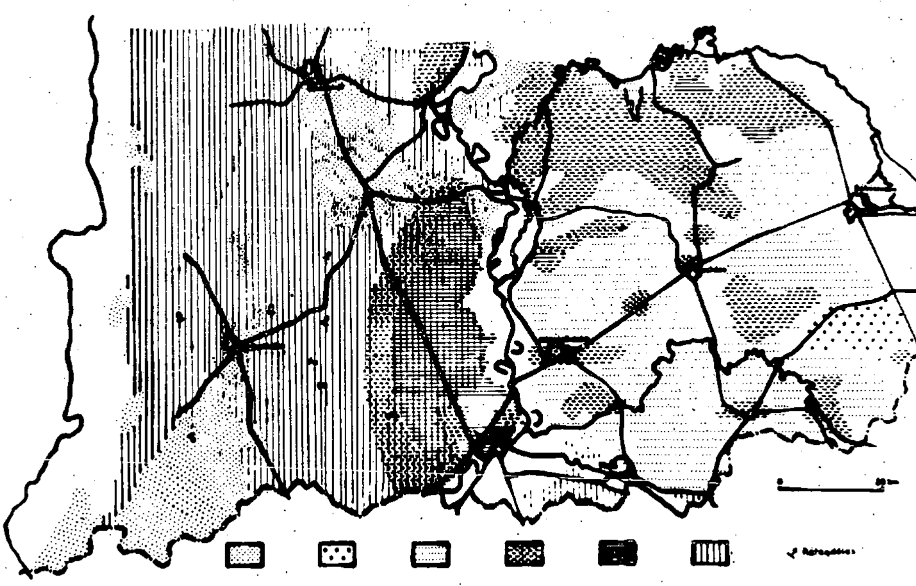

Figure 1. The geological map of the Southern Plain with the layers under the surface formations

As regards the surface formations, there is *dry-land loess* over the drift-sand of Kecskemét and Kiskunhalas, *loessial sand* over the gravelly area of the Trans-Tisza region, *infusion loess* and in places *silty and sodic* *loess* over the fluvial sand ant the clayey sand Over the loess and clayey silt of the Danube—Tisza interfluve *drift-sand* can be found where loess is concerned, and *infusion loess* where clayey silt is concerned (Fig. 2) (9).

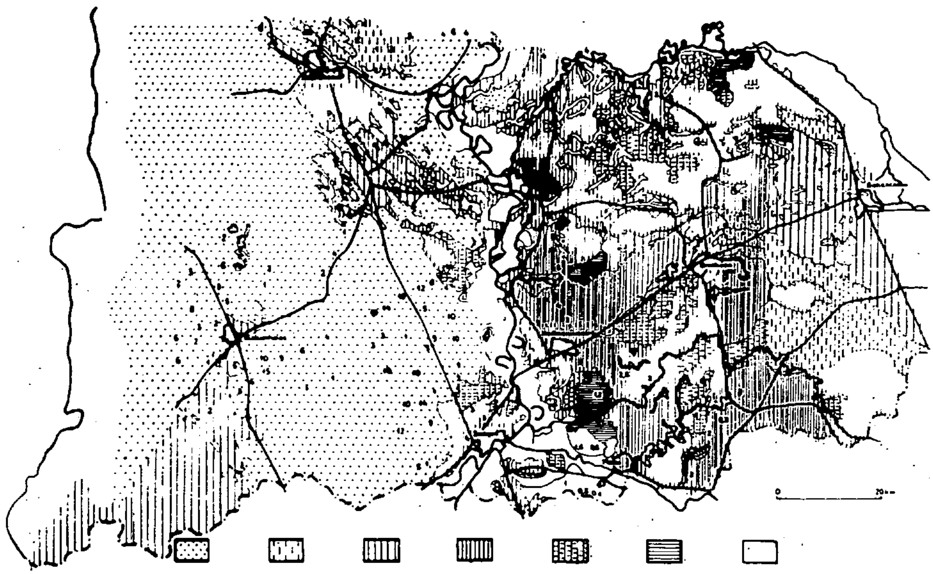

Figure 2. The geological map of the Southern Plain with the surface layers

In the study area the basis of the classification of the whole landscape system is the development of the Pleistocene layers and the layers under the surface formations.

The valley of the Danube

The valley of the Danube is a relatively wide tectonicerosive depression; from Dunaföldvár to Kalocsa it is narrow, widening suddenly further south; its average width is about 20 km. Miháltz and his coworkers demonstrated that the deposits are increasingly finer nearer the surface (Fig. 3).

The uppermost three meters generally consist of a mixture of *clay and clayey silt;* under this there is a 3—4 m thick layer of very fine sand and in some places *silty sand.* From 7—8 m depth down there is a 12 m thick layer of *fine-grained and medium-grained sand,* then below 20 m depth a 2 m thick layer of *silt,* and lower down a mixture of *fine-grained* and *coarse-grained sand* as dominant soil types.

The valley of the Danube is cut in the thick layer of medium-grained sand and filled up below by small and fine-grained sand. The steepness of the river-bed has developed not only under the influence of erosion but it is also tectonically determined. The present topmost aleurite layers of the valley that cover the surface to a depth of 1—2 m derive from the *Holocene* period. A large portion of the surface of the valley is covered by highly calcareous alluvial silt which is similar to loess, but the fraction

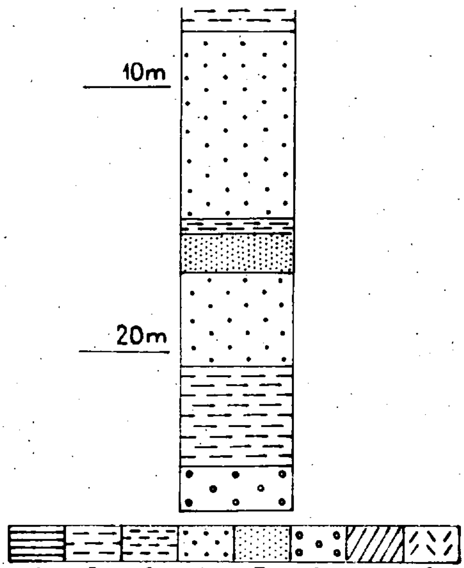

Figure 3. The layer seèuence of bores in the valley of the Danube (after Miháltz)

characteristic of loess cannot be demonstrated in it. Its water permeability is minimal: 10^{-7}—10^{-8} cm/sec. In the period of the Older Holocene, isolated drift-sand hills formed in some places, for instance in the area of Hajós. The area of Gyón is characterized by the division of the alluvial silt into two parts, while the final stage of the filling up of the riverbed near Kecel and Szabadszállás is attested by the formation of peat (14).

In the plains between the sand dunes Younger Holocene *alluvial silt* can be found which is younger than the sand. A few meters deeper there is in places also Older Holocene alluvial silt on which the drift-sand deposited.

The thickness of the silt layers generally varies between 2 and 8 m; in the higher lying places it may be 2—3 m, in the abandoned river channels 6—8 m. There are areas in which the depth of the silt layers does not exceed even the depth of tilling. Where the alluvial sand is near the surface, it makes irrigation farming possible because of its high water permeability.

The surface formation of *the alluvial silt of the Danube* is yellowish grey, in some places the inverse, which on account of its highly crumbly nature has been mistaken for loess, but the fineness of its grains has decided the question of its origin (15). In the deeper lying areas it has become alkalized, but in these places its surface forms a water-impermeable layer.

The platform of the Danube—Tisza interfluve is an area with diversified surface. It rises 30—40 m above the valleys of the Danube and the Tisza. Earlier the whole platform was considered to be the Pleistocene deposit of the Danube (B. Balla and J. Sümeghy). However, Mihăltz and his coworkers, on the basis of their investigations lasting several decades, drew the conclusion that there are no alluvial deposits at all on the platform of the Danube—Tisza interfluve (14, 15, 16). The whole area, excepting the lower lying parts near the rivers, consists of drift-sand, loess, and their modifications. Molnár and co-workers examined and analyzed the material gained from borings in the line of Baja and Szentes and found that all the bore materials indicated an eolic origin (16).

The maps made by the Geological Institute in 1950 show the Danube—Tisza interfluve accurately. The geological profiles of the bores show that down to 30 m in the western and central parts there are six *loess layers* separated from each other by drift-sand and humus-containing loam. In the eastern and southeastern areas the loess layer thins out, even disappearing in some places where Pleistocene drift-sand appears instead. In fact, the thickness of the drift-sand layer reaches even 10 m in some places between Kistelek and Pusztaszer.

The loess layer can be found not only in the profiles between Baja an Szentes but also in sample cores from the area of Kecskemét and Félegyháza (14, 15).

Sediments deposited by the Danube can be found in the valley of that river. The drift-sand layers also owe their origin to the Danube because the west winds have drifted the sand of the Danube on to the territory of the platform plain.

East of Kecskemét as far as Kécske alluvial deposits are found with silt on their western margins and clay on their eastern edges instead of the deeper loess and drift-sand layers. It can be demonstrated from the sand that these are deposits of the Tisza and its tributaries.

In the Danube—Tisza interfluve the Pleistocene sediments are divided into two parts: the larger, western part is an accumulation of wind-driven deposits, where there is drift-sand under the top layer of loess; the smaller area is the inverse of this. There is no water-impermeable layer in the whole area, with the exception of the limy parts. In the much lower eastern part bordering on the valley of the Tisza there is water-impermeable clay, clayey silt, or slightly permeable silt with fine sand under the loess. The extension of the clayey sediment under the loess is rather variable, e.g. in the area of Csongrád the loess based on drift-sand extends as far as the Tisza, while in the area of Szeged there are clayey sediments under the loess. The surface formation is drift-sand. There is a thick layer of Holocene drift-sand at the western edge of the platform plain as for example in the areas of Illancs, Kiskunhalas, Soltvadkert, Ágasegyháza, and Örkény. The Holocene drift-sand thins out in the eastern half of the platform but in some places it extends over the eastern edges of the Trans-Tisza region; such a surface can be found also between Cibakháza and Kunszentmárton. Loess can be found on the surface southwest of the Kiskunhalas—Kelebia line as well as in the areas of Kecskemét, Kiskunfélegyháza, Pusztaszer, Csongrád, and Szeged (9).

The oldest among the surface formations is the Pleistocene drift-sand which underwent rearrangement during the Older Holocene; the varieties of loess were deposited on this. The varieties of loess are the last formations of the Pleistocene on which the drift-sand of the Older Holocene settled (9).

The basic items of proof are the following: The situation of the flat settlements shows that a carrying medium of vast expanse, as for example air, can form such a flat area of a homogeneous material. Gravel and clay do not occur in the layers. The size of the grains, 0.02—0.06 mm, invariably indicates loess.

The notions of "blue clay" and "blue sand" can be explained in light of the examples by the fact that the layer that has got under the surface in time becomes bluish gray if it gradually sinks below the level of the subsoil water.

The grains of sand are classified according to the different degrees of abrasion on the basis of which their eolic origin can mostly be verified (Fig. 4).

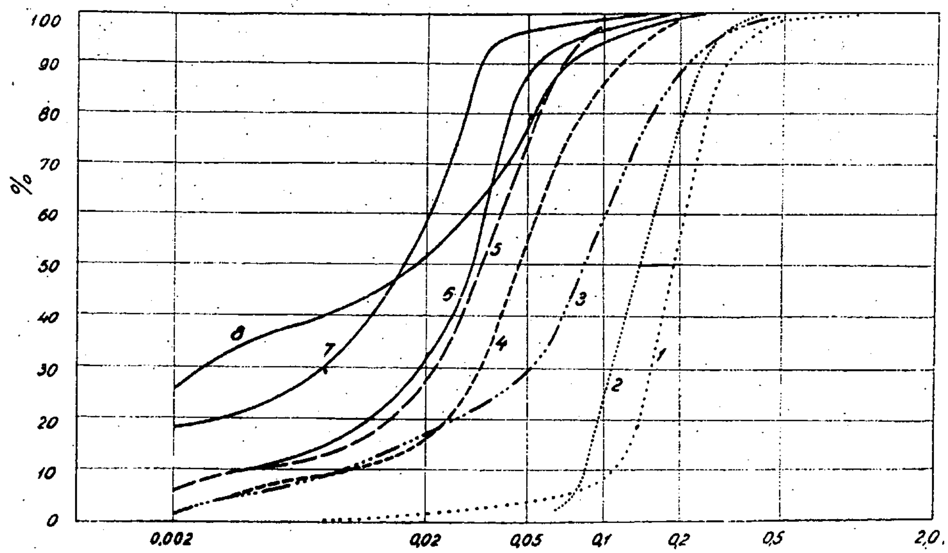

Figure 4. Graphic comparison of the grains of wind-blown sands and varieties of loess (after Mihåltz)

Andor Horváth demonstrated that only *ubiquitous land snails of groves* can be found in the sand layers of the Danube—Tisza interfluve. Not one fluvial kind can be found in the material of the samples. At the same time Miháltz's statements are confirmed by the results of Horváth's investigations (14, 17).

According to the detrital cone theory *the depressions in the territory of the platform* are remainders of one-time channels of the Danube. In this case their sand should be of fluvial origin or should contain sharp-edged grains at least in traces; in the absence of such features, however, an eolic origin can be proved. Furthermore it can be ascertained from several hundred bore samples taken by Miháltz and co-workers along a NW—SE line that there are eolic layers down to 150 m depth. The results of Artesian bores also support this.

The movement of the sand on the surface is controlled by the prevailing nortwestern wind. The composition of the platform plain suggest that the Danube may have inundated the lower — lying areas many times.

The flood — basins of the Danube and the Tisza can well be distinguished from the Pleistocene and Pliocene formations (16).

In the Older Holocene the drift-sand moved much in the territory of the platform. This phenomenon can be traced back to the warm and dry *hazel-nut phase.* In the depressions of the drift-sand deposition of carbonate brought from the higher-lying parts by the soil water is common. The covering humus-containing deposits can be traced back to beech phase 1 on the basis of pollen examinations, while more recent movements of the drift-sand can be traced in beech phase 2.

The Tisza River valley

The eroded depression sank till the last phase of the Pleistocene and then it was filled up mainly with fluvial deposits. It has been ascertained on the basis of Miháltz's core samples that the Pleistocene layers slope toward the Tisza. As a result of its structure, the high-lying part of the platform consisted to a considerable depth of eolic sediments, its lower part on the other hand was formed of fluvial deposits. The area is of varying extent. In the area of Tiszakécske the depression does not reach 5 km in width, while toward the south and the border of the country it extends gradually, reaching in places 25—30 km width.

In the lower parts the loess is often alkalized but in many places it is covered by flood mud. In the lower parts of the whole layer fine grains are common. On the edge of the platform a water-conducting sand layer stretches toward the Tisza valley in 15 m depth. The movement of the subsoil water is ensured, water-impermeable layers do not occur above 30 m depth. At smaller or larger distances the sand layer is in direct contact with the loess layer. The deeper layers also slope toward the river valleys (9).

During the Pleistocene period the Tisza river valley was constantly sinking, the river-bed was constantly changing, and its deposits were frequent. Further north the depression of the Tisza was about 20 m at Szeged, 15 m at Algyő, and 10—15 m on the average at the beginning of the Holocene. In the lower part of the washed-out depression there is a coarse, loose sand layer becoming finer upward, aleurite, clay, and finally meadow clay. The Pleistocene terrain of the Tisza River valley is covered by Holocene *alluvial silt* at the lowest places. The floods have deposited here a 1—2 m thick fine silt layer. Such a formation can be found in the area of Algyő. Here the width of the alluvial silt is nearly 3 km.

Occassionally the clay layer may be missing and the young alluvial silt may be sandy, especially near the river. On the basis of Miháltz's bores in the areas of Makó and Szentes it can be stated that "the thickness of the quaternary layers is at least 160 m at Makó and at least 200 m at Szentes" (14). There are also sunken loess and sand layers here buried under fluvial clay. The sand layers are of fluvial origin, the clay is generally of aleurite fineness with a high carbonate content, thus differing markedly from the other sediments.

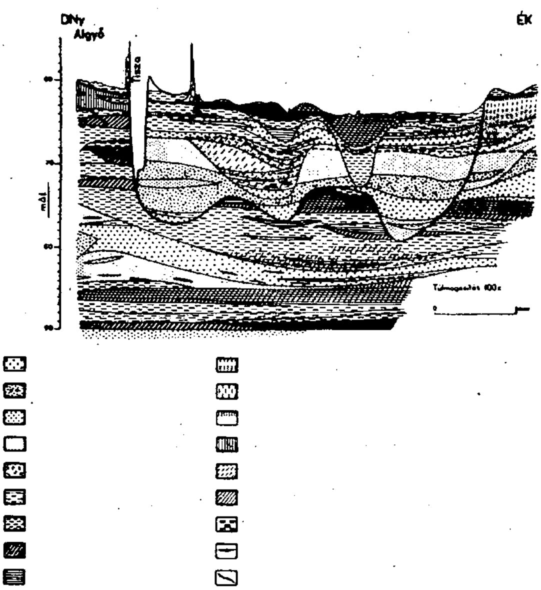

Figure 5. The hydrological profile of the Tisza River valley at Algyő (after Miháltz)

Farther away from the river, as in the case of the formations of the Danube-Tisza interfluve as well as in the area of Baktó and Sártó and extensive areas of the Trans-Tisza region, deposits of meadow clay over the loess are frequent.

The Tisza River valley was cut in the Pleistocene layers at the beginning of the Holocene epoch. The Tisza of the Holocene epoch eroded and filled up 5—10 km wide areas with its meanderings. In spite of this it is lower than the surrounding Pleistocene areas. Investigations prove that the Holocene erosion removed the Pleistocen layers to a depth of 15 m, and south of Szeged to a depth of 20 m (Fig. 5).

Filling up of the eroded valley began with smaller medium-grained sand (0.1—0.2 mm ∅). Higher up the ratio of fine sand, silty fine sand, and sandy silt increases. The youngest beds are filled with sandy silt, clayey silt and on top with meadow clay. Meadow clay covers most the areas near the Tisza in thinner or thicker layers. The meadow clay is sporadically replaced by sedimentary alluvial silt.

The development of a water-impermeable layer at the surface depends on the thickness of the meadow clay. It is of frequent occurence, however, that the meadow clay is covered by Holocene alluvial silt at the surface. It has been ascertained that neither the alluvial silt nor the meadow clay "fit into the closing accumulation cycle and was deposited owing to changed conditions" (9). The alluvial silt formed in the last phase contains more sand near the riverbanks; their structure is partly modified depending on their distance from the rivers. Yet the surface structure so formed cannot be said to be uniform because there are sequences of layers in the accumulation phase in which the clayey layers are missing and their place is filled by the silt deposited on the sand layer.

The Trans-Tisza region

The whole region cannot be differentiated from the Tisza river valley. Its surface slopes toward the Tisza; its surface is covered by loess and and fluvial sediments. The fluvial sediments are in part Pleictocene loess or the filling of abandoned channels.

The loess is generally wet land loess, in some places bog loess. The low-lying areas are often alkalized (Fig. 6).

Alkalized and loessial areas in the Trans-Tisza region

The thickness of the loess varies between 2—4 m. The fluvial filling up finished at the time of the formation of the valley with the erosion cycle. Fine sediments deposited which at the same time meant the end of the accumulation cycle.

The rivers arriving in the plain deposit coarse debris, on the basis of which the different layers can well be distinguished. The river water carrying the coarse sediment had a great power that was able to cause erosion even at the stage of filling up. At a later stage the occurrence of finer-structured parallel or lentiform layers is more frequent.

Mihältz distinguishes five cycles in the fluvial sediments of the Trans-Tisza region (18). Under the loess there is generally sand of varying composition. Besides the dominant role of wet-land loess there is dry-land loess to the north and northeast of Orosháza as well as at Makó, Szőreg and to the east of Mindszent. The dry-land loess was in all cases deposited on wind-blown sand. In the Trans-Tisza region in spite of the large amounts of surface loess there are remarkable qualitative differences which underline the importance of the investigation of the formations under the surface.

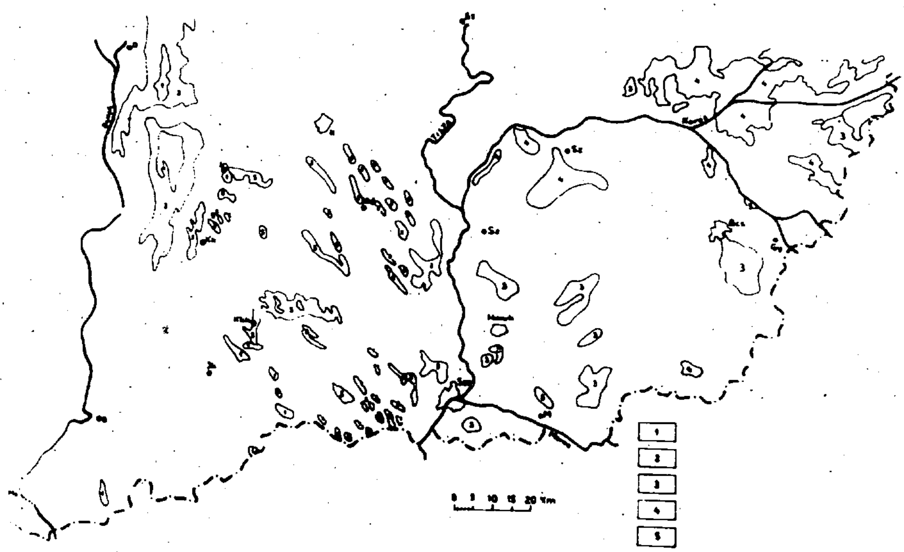

Figure 6. The angle of the Tisza and the Körös

The western half of the area cannot be distinguished structurally from the Danube-Tisza interfluve. The dry-land and wetland loess was deposited on drift-sand. This sand occurs also on the surface in the middle of the area. Under the drift-sand there is another layer of loess. In the eastern half of the area infusion loess occurs together with sodic soils which, however, play only a secondary role. Under these there are silt and clay layers.

The lowland south of the Hármas- (or "Triple") Körös

The larger part of the area is covered by silty loess; in the lower central parts sodic and clayey loess is dominant. The largest sodic areas of the Trans-Tisza region are there. The low-lying parts were mostly covered with stagnant waters already in the Pleistocene, more exactly at the end of the Pleistocene. Around the sodic areas at the time of the formation of loess the silt of floods mixed with the falling dust, the result of which was the formation of loesscontaining silt. Clayey flood silt of minimal thicknes deposited on the surface of the quaternary flood deposits. In the depressions of the river-beds there is meadow clay and humus-containing silt. Similar humic clay covers the surface of sodic soils. In the whole area *silt and clay* occur predominantly under the loess; only west of Szarvas and Kondoros is there sand instead.

The rolling plain of Békés and Csanád

The sand and the dry-land loess of the rolling plain have been transported here by the wandering rivers of the area. This means that the area bordered by the Tisza, Maros, and Körös rivers is an alluvial fan. Its highest part is the gravelly coarse sandy area between Kevermes and Kétegyháza. Near the Körös and the Tisza rivers silt clay layers are found. In the inner areas the there is a sequence of gradually finer layers under the loess. It should be noted, however, that an alluvial fan can also be found on the southwestern edge of the Tisza region which in all probability originates from the Maros and which was probably divided in two by the Holocene incision of the Tisza. The alluvial fan is generally covered by loess, partly by loess-containing fine sand, and partly sandy loess. The thickness of the covering layers which are exposed to constant change is highly variabla.

The plain of the region of the Maros

This plain comprises the area between Hódmezővásárhely, Orosháza, and Mezőhegyes. The underlying layer of the loessial part is sand or clay. The loess of the surface is wetland loess with sodic soils with no run-off in some places. In the region of the Maros there is dry-land loess, and toward the east in the area of Csanádpalota loess deposited on a long range of riverside dunes is found. The surface of the area is rather varied; in the lower-lying parts meadow clay of great expanse can be found which stretches from Deszk to Hódmezővásárhely.

The rolling plain of Békés and Csongrád

This is an area stretching from the Hódmezővásárhely — Békéscsaba line to the Szentes — Mezőberény line. The loess outcrops in two bands along the riverside dune ranges: one between Nagyszénás and Szentes, the other between Hódmezővásárhely and Orosháza. These ranges probably originate from the Maros (9). It has been ascertained that the Pleistocene river-beds were transformed by Holocene rivers in the places where the covering layer is mostly humus and meadow clay. Riverside dune sand can be found in large areas, but not on the surface but mostly with a covering layer of loess-containing sand or dry-land loess. Alkalization occurred in the riverside sand dunes. In the mineral composition of the underlying layer clay and silt can be found besides sand. In the lower parts between the sand dunes chiefly dry-land loess can be found (9).

The structure of the landscape can be studied on the basis of a short characterization of the soil layers at and under the surface revealing their distinctive character and geological past. The elements of landscape typology can be examined in terms of their historical development and natural processes; at the same time there is the possibility of differentiation within the areal units on the basis of their characteristics.

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