GEOCHRONOLOGY AND GEOMORPHOLOGY OF THE KÖRÖS—MAROS INTERFLUVE PLAIN

BY M. ANDÓ

The plain surrounded by the rivers Maros, Tisza and Körös is a geomorphological region of 5000 km$_2$ area. Compared to the adjacent physico-geographical regions, it can be considered a „ridge". Therefore its other name, „Békés-Csanád Ridge", is also appropriate. Its present-day morphological pattern is the result of the accumulative action of the paleo-Maros. Nota bene, it is for the most part a fluviatile alluvial fan, the Maros alluvial Fan, that occupies the territory. In some places, its boundary can be drawn merely on the basis of convention (Fig. 1).

1. From the point of view of subsurface geology, the region represents a Neogene basin underlain by a Mesozoic basement. One of the Great Hungarian Plain's depressions, it was brought about as a result of the subsidence of the basement and of subsequent filling up. As shown by the ever growing information of wildcats for hydrocarbons, the basement relief is an outpost of the Apuseni inselbergs, Rumania, with the highest subsurface elevation at Battonya along the Battonya—Orosháza axis. This is surrounded by a wide, arched, deep trough which can be split up into a wider and flatter northern and a narrower, deeper western basin portion (J. SÜMEGHY, 1944, L. KÖRÖSSY 1967, V. DANK 1966, M. ANDÓ—L. JAKUCS 1967; Fig. 2).

Of course, the basin bottom is divided into additional, minor structural units. For instance, the basement surface is also likely to be patterned by minor depressions, crests, saddles, horsts, etc.

Pannonian subsidence led to the accumulation of about 1500 to 2000 m of marine sediment (Fig. 3). The Upper Pannonian sequence is constituted by highly calcareous clays, well stratified for the most part, the Lower Pannonian being, however, represented by another facies-grey clay-marls including sandstone layers. Both the stages were produced by marine sedimentation. The occasionally coarser-grained sediments of the Lower Pannonian are indicative of the high rate of subsidence as well as of a very strong abrasion of the coastal environment (J. SÜMEGHY 1944).

In the Levantine beds a marked coarsening of the sediment can be observed. In comparison to the Pannonian beds, these form structurally more differentiated depressions. The sediments in these are usually more porous and less consolidated, being characterized by frequent changes in the mode of occurrence and by the predominance of sands. Moreover, in

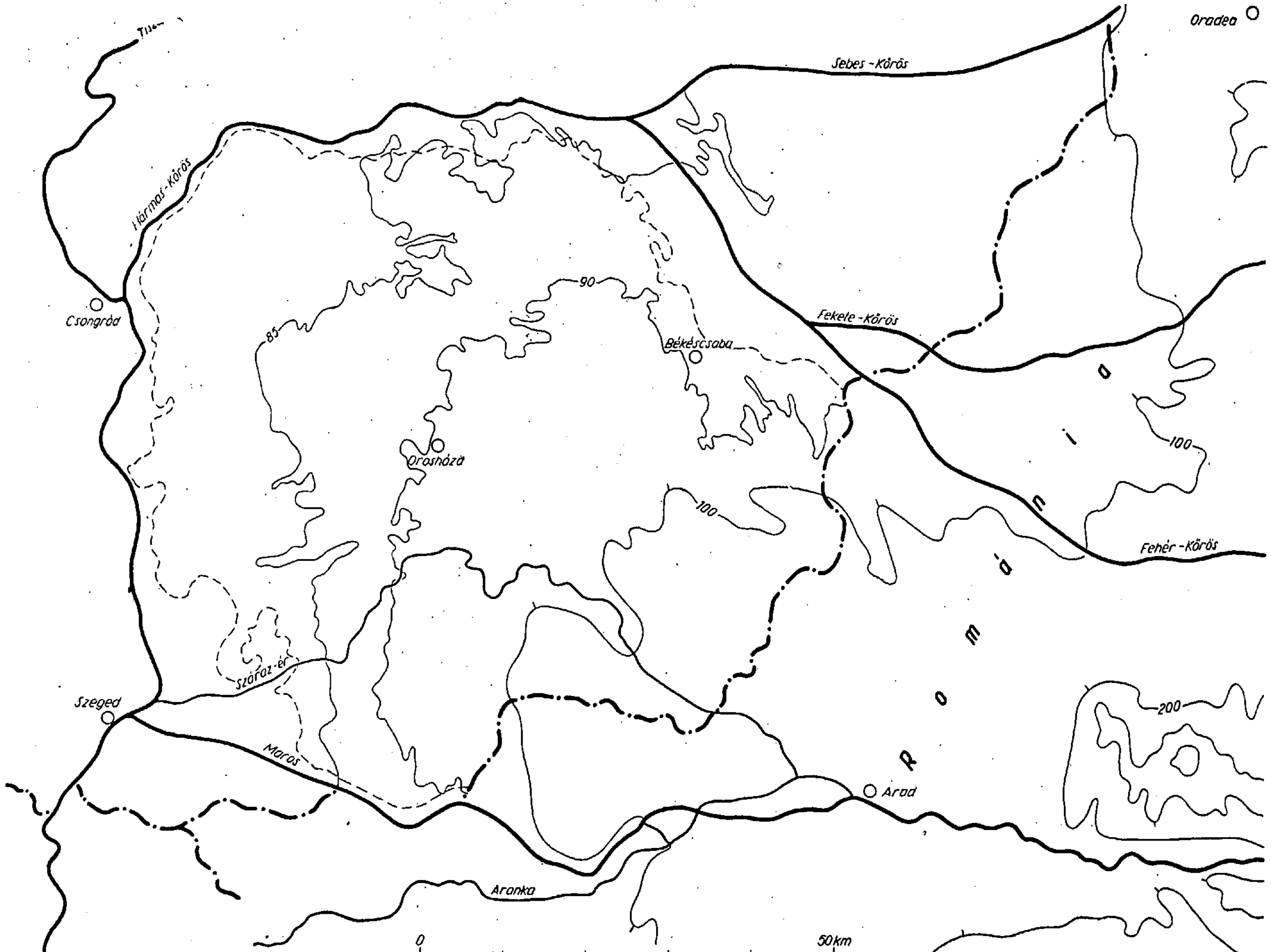


Fig. 1. Sketch of the Körös—Maros Interfluve Plain and its mountainous foreland.

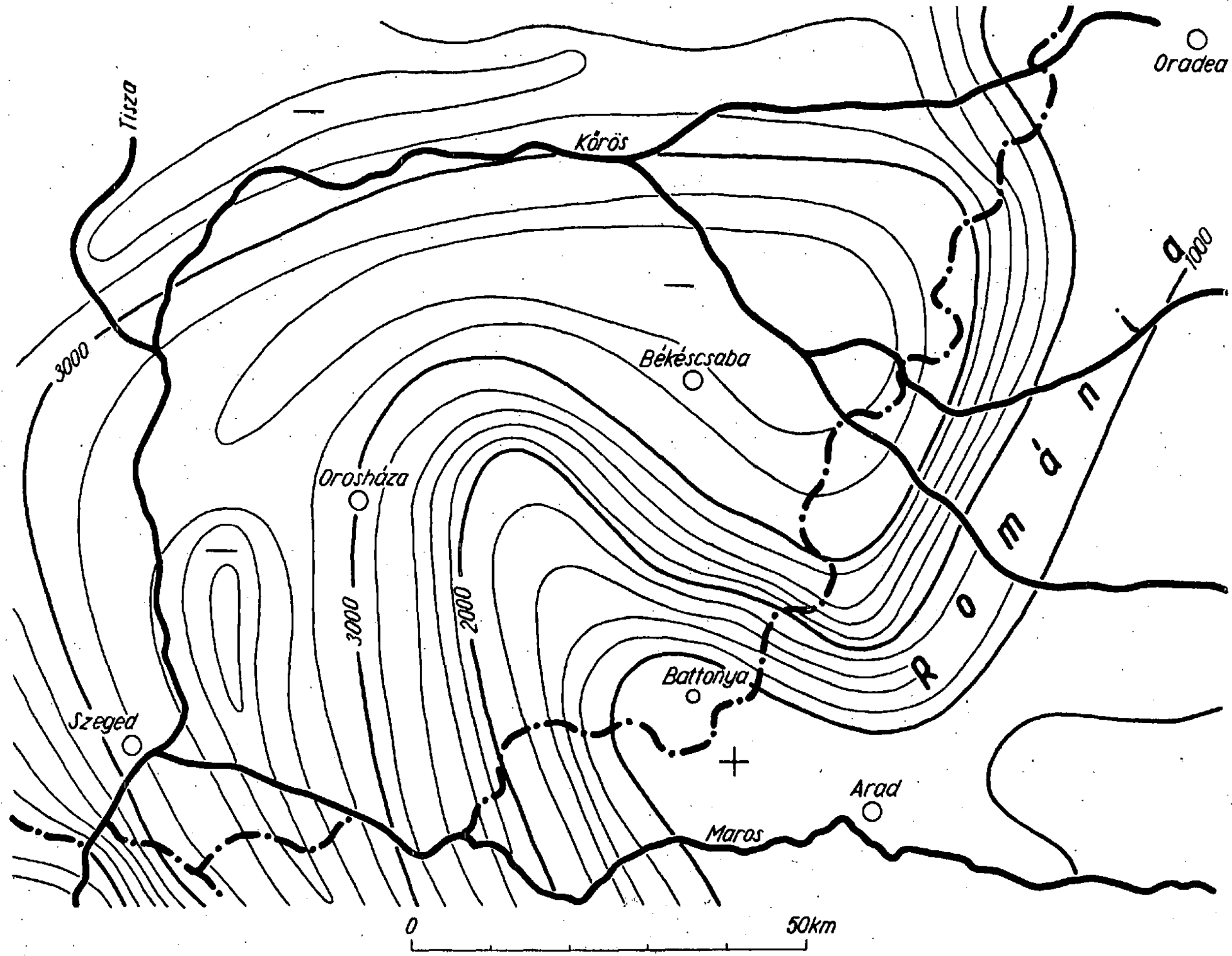


Fig. 2. Contour map of the pre-Tertiary basement (courtesy of V. Dank).

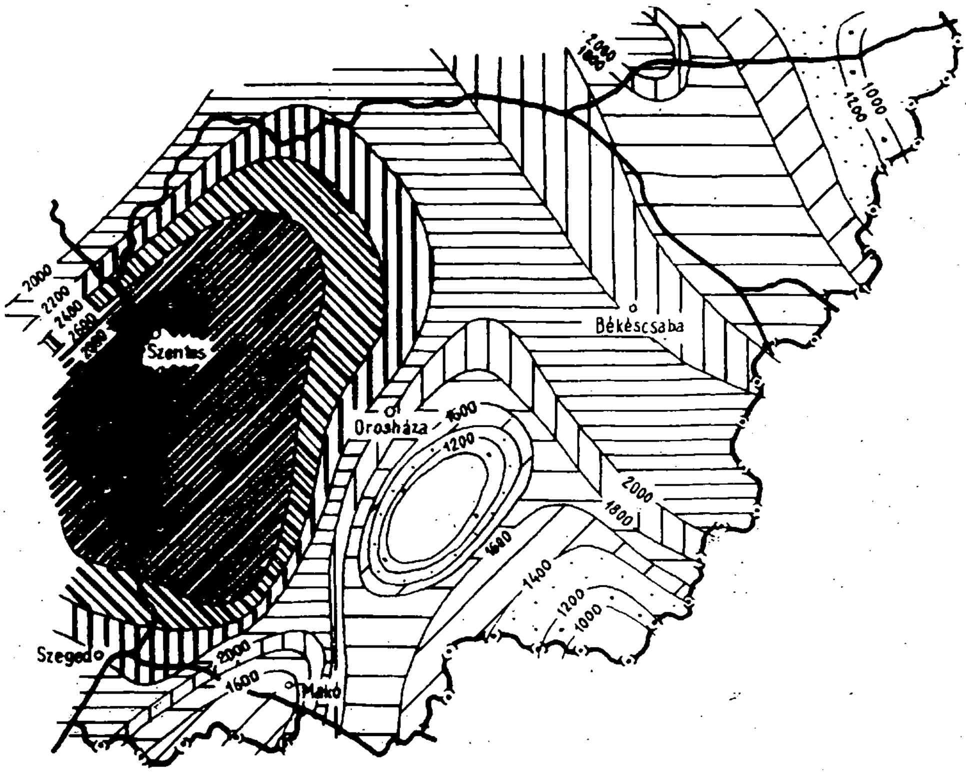


Fig. 3. Isopatch map of the Pannonian sequence of the southern Tiszántúl (territory east of the Tisza) (courtesy of E. R. Schmidt and G. Láng).

the foreland of the Apuseni inselbersg, the upper levels include some gravels, too (J. SÜMEGHY 1944, J. URBANCSEK, 1961, M. ANDÓ 1964). The gradually increasing ratio of sands and gravels as well as the lack of clay layers over much of the territory indicates that in Levantine time the territory subsided very rapidly and that the coarse sediment was transported by rivers.

2. The morphological evolution of the territory in the Pleistocene was connected for the most part with fluvial accumulation, even though lacustrine sediments were deposited at a considerable rate. The peak of the Maros Alluvial Fan of about 80 to 100 km radius is at Radna, at a height of about 130 m. Its marginal outcrop is 85 m high a. s. l. at Makó, 83 m at Hódmezővásárhely, 90 m at Orosháza, and 90 m in the vicinity of Békéscsaba. It is constituted for the most part by medium to coarse sands, sandy gravels and gravels. As shown by water-prospecting drilling, the fluviatile gravels occur, as a rule, down to 200 m depth with occasional occurrences at 500 m.

The coarse-grained sequence of the alluvial fan includes clay layers growing thicker from the ESE towards WNW. Whereas in the ESE the thickness of the gravels is 8 to 10 m, in the WNW it is as low as one-two m or so. The coarse-grained sediments are excellent aquifers.

Evidencing the work of the paleostream, the gravel deposits form three successive levels produced by three distinct stages in the evolution of the Fan. These gravel accumulation stages coincide with the rapid subsidence of the territory of the Fan and with the relative upheaval of the mountainous background. The alternation of coarse-and fine-fraction facies suggest, above all, intensive tectonic movement, climatic implications being of secondary importance. In the case of the territory under consideration, the increase in the slope of river bed due to the sinking of the base level enhanced the working capacity of the river and/or led to a change in its erosion-accumulation balance. On account of the resultant new conditions, with progressing accumulation, the pre-subsidence pattern of the relief was re-established, a fact evidenced by the decrease in the grain size of the transported detrital material, i. e. in the refinement of the sediment. Consequently, the above-quoted gravel-accumulation stages are separated by sediments becoming gradually finer upwards and ending with silts at the topmost level.

Gravels can be encountered in the upper horizons of the Levantine stage, too. This is an indication of the onset of fluvial accumulation. Gravel layers are known to occur in boreholes at 570 m (Kunágota), 320—326 m (Bánkút) and 320—322 m (Orosháza). This coarse sediment is overlain (following a stage of refinement) by a coarse, gravel sequence (Lower Pleistocene) which in the aforementioned boreholes was observed at 257 m (Kunágota), 200 m (Bánkút) and 175 m (Orosháza), respectively (Sümeghy 1944). As will be shown hereafter too, during the Pleistocene the accumulations of gravels was repeated several times, but the marrow of the alluvial fan as well as the most extensive alluvial fan form is represented by the sequences of the above two gravel accumulation stages. The formation of the third stage can be ascribed to the Lower/Middle Pleistocene boundary already. On the basis of water-prospecting drilling, this horizon could be identified at 180 m (Lőkösháza), 116 m (Bánkút), 170 m (Földeák), 120 m (Bánhegyes), respectively. The above three gravel horizons (between 300 and 570 m, 200 and 260 m, 100 and 180 m) prove the rhythmical, intensive subsidence of the Fan's area in Early Pleistocene time.

The uppermost 100 m are made up of gravels mixed with sands, showing a gradual decrease in grain size and gradually thinner stratification upwards. This sequence falls short of the older ones both with regard to thickness and to lateral extension. The alternation of different layers and the radius of the Fan are reduced, while the finer-grained sand facies gains predominance. An examination of this sand material allows its student to reconstruct the paleogeographic pattern of the territory. The main channel of the paleo-Maros can be traced, unlike the present-day one, in the vicinity of Lőkösháza—Battonya villages. The main stream and its tributaries flowed that time still northwestwards, towards the angle of the rivers Tisza und Körös and accumulated their sediments along this line. This statement is readily substantiated by Tab-

Table 1.

(Courtesy of B. Molnár)

Localyti	Grain size (mm)	Predominant magmatic minerals									
		Nypersthene	Other rhombical	Monoclinal pyroxene	Diopside	Green amphibole	Magnetite Ilmenite	Biotite	Apatite	Titanite	Zircon
1. (Lőkösháza)	0,06—0,1	12,9	2,2	18,3	2,2	6,7	25,0	1,8	1,3	1,3	0,5
	0,1—0,2	18,2	0,9	14,1	0,3	4,6	20,0	2,8	0,9	0,9	0,3
	0,2—0,32	12,1	0,4	18,5	1,9	2,3	15,4	1,5	0,4	—	—
	0,32—0,63	11,2	—	18,6	1,2	2,3	17,1	1,9	—	—	—
2. (Apátfalva)	0,1—0,2	16,2	2,3	14,8	1,6	5,2	15,7	1,3	1,6	0,3	—
	0,2—0,32	15,9	1,2	18,9	0,4	3,7	12,2	0,4	1,2	—	—
	0,32—0,63	6,9	0,5	11,2	—	0,5	16,5	3,2	—	—	—
3. (Deszk)	0,06—0,1	12,9	3,7	10,2	4,1	3,4	22,9	1,4	3,1	0,7	—
	0,1—0,2	17,8	1,5	15,2	1,9	4,5	15,1	3,4	0,4	—	—
	0,2—0,32	18,8	3,0	24,0	1,7	3,0	10,9	—	0,4	—	—
	0,32—0,63	2,7	1,4	12,9	0,7	1,4	25,2	2,0	—	—	—
4. (Deszk)	0,06—0,1	12,1	3,3	15,2	4,2	5,1	16,2	0,5	2,8	0,5	—
	0,1—0,2	10,1	1,6	17,0	3,6	11,7	8,9	3,2	1,6	0,8	—
	0,2—0,32	2,9	0,4	7,8	0,8	4,5	14,3	11,1	—	—	—
	0,32—0,63	1,6	—	3,1	1,6	1,6	7,8	32,8	—	—	—

Table 2.

(Courtesy of B. Molnár)

Locality	Grain size (mm)	Predominant metamorphic minerals								Other minerals				Diametre in mm
		Chlorite	Tourmaline	Zoisite	Rutile	Bluishgreen amphibole	Actinolite, tremolite	Garnet	Staurolite	Disthene	Calcite, Dolomite	Limonite	Weathered mineral	
1. (Lőkösháza)	0,06—0,1	7,6	0,5	—	—	6,7	—	7,6	0,5	—	—	1,3	3,6	
	0,1—0,2	9,8	—	0,3	0,6	5,5	0,6	10,7	0,6	0,3	—	0,3	8,3	
	0,2—0,32	12,5	—	—	—	6,8	0,4	7,6	1,1	2,3	0,8	0,8	15,2	2,5
	0,32—0,63	10,1	0,4	—	—	1,9	—	11,2	0,4	0,4	1,6	—	21,7	
2. (Apátfalva)	0,1—0,2	7,2	—	—	—	9,2	0,3	14,1	—	0,3	3,0	0,3	6,6	
	0,2—0,32	5,7	—	—	—	5,7	—	16,3	—	1,6	2,9	0,4	13,5	
	0,32—0,63	30,9	—	—	—	2,1	—	9,6	—	1,1	0,5	—	17,0	0,92
3. (Deszk)	0,06—0,1	0,7	0,7	0,3	0,7	7,1	2,0	18,0	0,3	—	0,3	1,4	6,1	
	0,1—0,2	4,9	0,8	0,4	0,4	10,2	0,8	13,6	0,4	0,8	—	—	7,9	
	0,2—0,32	3,0	—	0,4	0,4	8,3	—	8,3	0,4	0,4	0,4	0,4	16,2	0,45
	0,32—0,63	19,7	—	—	—	2,0	—	—	—	0,7	—	2,7	28,6	
4. (Deszk)	0,06—0,1	0,5	1,4	0,9	0,5	7,4	1,9	15,3	0,5	—	0,5	2,8	8,4	
	0,1—0,2	8,5	0,4	—	—	9,3	2,4	2,8	0,4	0,4	1,2	0,8	15,3	
	0,2—0,32	15,2	—	—	0,4	6,1	0,4	0,4	—	—	0,4	2,0	33,30	0,18
	0,32—0,63	42,1	—	—	—	3,9	0,8	0,8	—	—	—	—	3,9	

Table 3.

Chemical composition of sand samples from the Maros—Körös Interfluve (Courtesy of I. Mihåltz)

	Locality	SiO_2	Fe_2O_3	Al_2O_3	Total	Acid reaction	Mean grain diametre D 50 (mm)	Total heavy minerals weight %	128—250 mm heavy min. %	Magnetite of the same size range %
1.	*Orosháza* municipal sand pit	83.0	7.6	8.2	99'0	++	0.21	3.4	3.3	16.7
2.	*Orosháza* Sand pit of „Vörös Cs" co-operative fram	82,3	5,9	8,1	96,3	(+)	0,28	1,8	3,5	7,6
3.	*Orosháza* abandoned brickyard	76,6	9,0	10,2	95,8	(+)	0,22	3,5	5,1	11,7
4.	*Orosháza* lower railway station	79,3	9,5	6,4	95,2	++	0,25	3,1	4,1	9,9
5.	*Orosháza* upper railway station	76,2	6,1	7,7	90,0	++	0,17	3,8	4,8	7,5
6.	*Medgyesegyháza* Gyulai street	77,0	4,4	5,7	87,0	+	0,28	2,6	5,5	3,3
7.	*Apátfalva* between the Maros' levees	86,6	3,6	5,0	95,2	—	0,50	1,2	13,4	12,7
8.	*Deszk* Maros bank	78,0	7,8	5,9	91,7	—	0,15	4,2	1,5	6,0

les 1, 2, 3. It can be observed that the results of testing of samples taken along the Lőkösháza—Apátfalva line agree with the analyses of recent alluvial material from Deszk. The diverting of the Maros into its present-day bed has not been tectonically controlled, being the result of a gradual filling up of the paleochannel. With the filling up of the main channel the river migrated southwards to newer and newer channels until it has occupied its present-day bed. Left behind, its secondary channels got into a „hanging" position and died away, having been filled up by fine-grained sediment.

3. Involved in the constitution of geomorphological forms, the near-surface sediments are of fluviatile origin for a considerable part, though secondary accumulation by wind action has also been manifested.

Sands are one of the important near-surface sediments of the territory. They are represented by comparatively thicker near-surface accumulations in the higher parts of the Fan, being deeper-seated and thinner in the level areas. This pattern, however, is characteristic but in rough lines, so that no strict regularity can be spoken of.

On the basis of the analysis and comparative evaluation of bore samples and granulometric curves, respectively, it can be concluded that the abundances of the more sandy, coarser-grained sequences shows a direct relationship with the elevation above sea level of the territory. This relationship, however, can be regarded to be valid only statistically, since sandy facies occur in lower positions, too, even though these are linear and finer-grained for the most part. The above relationship is expressed by the following figure illustrating the character of strata arrangement and the relationships of the hypsometric elevations of the relief (Fig. 4).

It should be borne in mind, of course, that whereas the determined hypsometric levels show a large areal coverage, the associated frequency occurrences of sandy sequences remain linear, being manifested by linear statistics alone. Therefore, the boreholes and the associated morphometric evaluations allow one to draw up a true picture of the individual stages of paleogeographic evolution. The near-surface sands were deflated occasionally from dry channel stretches and then supplemented with redeposited (secondary) sand accumulations. Conclusions as to this process can be drawn from the degree of attrition of the grains. This is characteristic of the flanks of the Fan. In its southeastern part, however, only fluviatile, gravely coarse sands as well as medium to fine sands occur.

Clay has been largely involved in the constitution of the surface (Fig. 5). Near-surface clay layers play an important role in the kinetics of groundwaters (the uppermost subsurface water level), the deeper-seated clays do so in that of the aquifers. There occur silty, fine-sandy clays, but clays with traces of peat and humus are also common. Pleistocene clays are usually bluish-grey, rosty to yellow-brown, Holocene ones being black and greyish-black meadow clays. Occurring for the most part in the foreland of the Fan flank, they are also frequent in the Fan's higher-seated, waterlogged, Pleistocene depressions, showing sometimes an advanced alcalization.

Silts are also abundant near-surface sediments in the depressions of the Fan. On Pleistocene surfaces it is commonly sandy silts, on Holocene alluvium a more consolidated and fixed type of silt that are predominant. The first stage (Upper Pleistocene) corresponds to the alluvium-fanning phase of river action, a phase during which the rivers flowed over the surface in various directions and accumulated their fine-grained waste without incising a channel bed into the ground. During the second phase (Holocene) the secondary redeposition of the alluvium took place. In the Pleistocene the eolian accumulation simultaneous with the accumulative action of the rivers resulted in the development of a mixed, socalled infusion loess, sequence consisting of fluviatile and airborne dust sediments (B. BULLA 1937—38, I. MIHÁLTZ 1967, M. ANDÓ 1964 etc.).

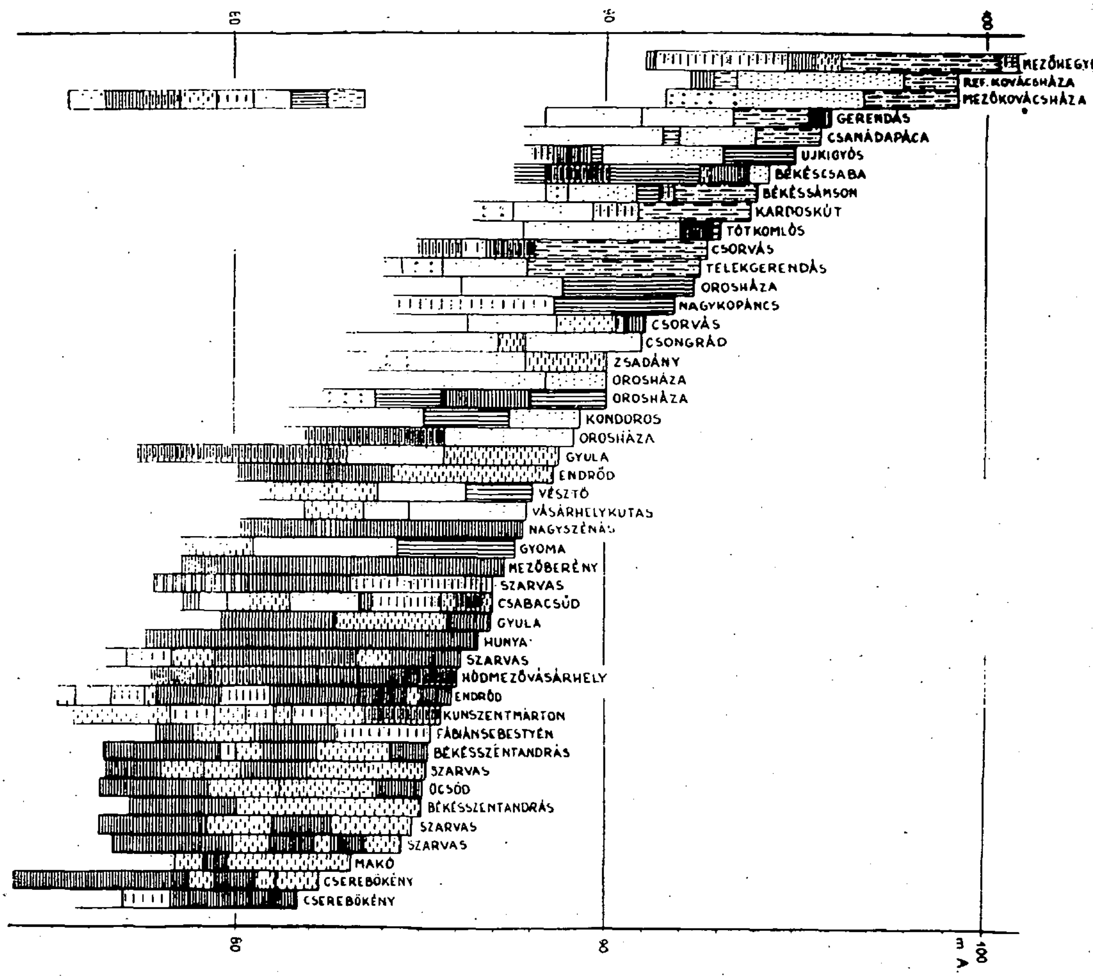


Fig. 4. Near-surface stratification characteristic of the hypsometric height of the surface of the Körös—Maros Interfluve Plain
1 = sandy loess, 2 = infusion loess, 3 = sand, 4 = silty sand, 5 = sandy silt, 6 = silty clay, 7 = clay, 8 = gravelly clay.

Typical loess is represented by traces. The infusion loess layer averages 1.5 to 2 m in thickness, though in the western part of the Fan (vicinity of Hódmezővásárhely) it is known to occur in a thickness of 7 m (Fig. 6). The accumulation of loess sediments in the first stage coincided with the accumulative action of the rivers. This is the reason why in the Great Plain loesses the ratio of river-transported sediment is at least as high (sand, silt) as that of airborne dust. It can be ascribed to those genetic circumstances that the loess sediments in the Körös—Maros Interfluve are not typical, but represent a largely mixed and altered loess-

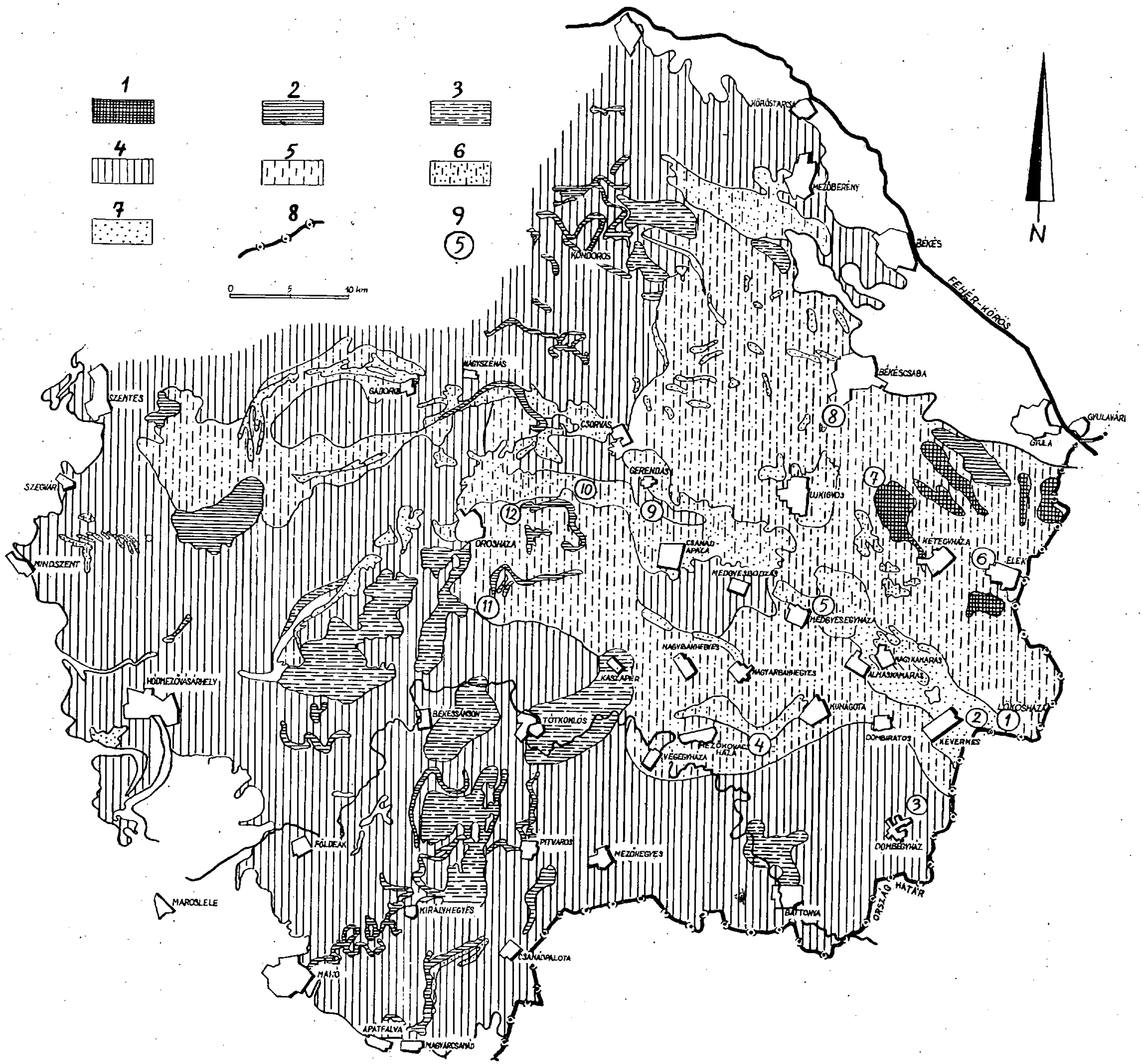
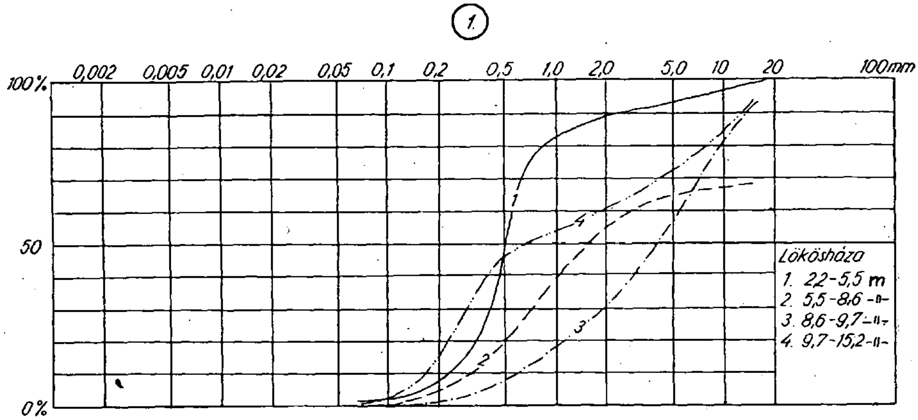


Fig. 5. Near-surface sediments
1 = alcalized silt, 2 = meadow clay, 3 = clayey, alcalized silt, 4 = infusion loess, 5 = sandy loess, 6 = loessic sand, 7 = fluvio-eolian sand, 8 = frontier, 9 = borehole points and granulometric curves.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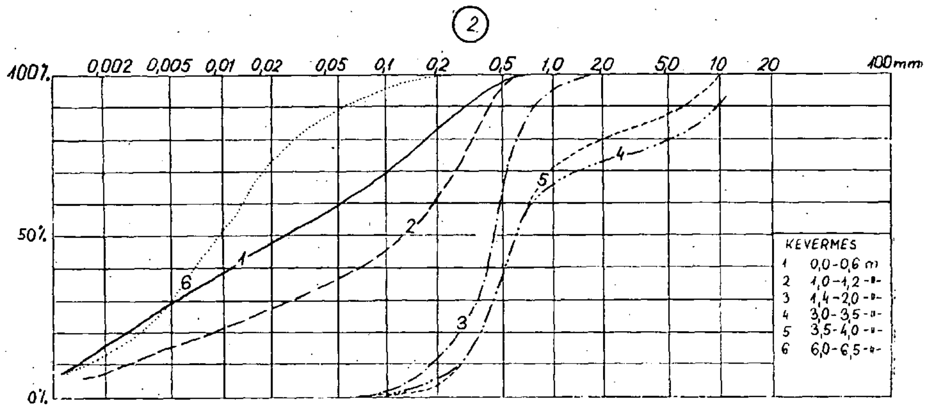
4. 9,7-15,2-"-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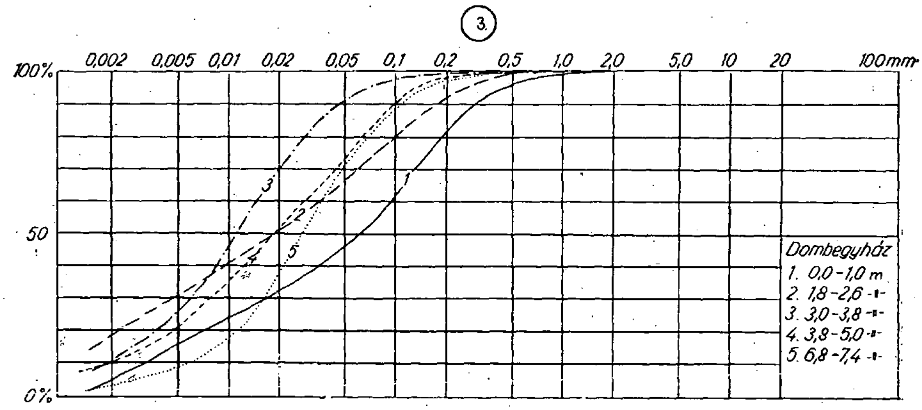
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4. 3,8-5,0 -"-
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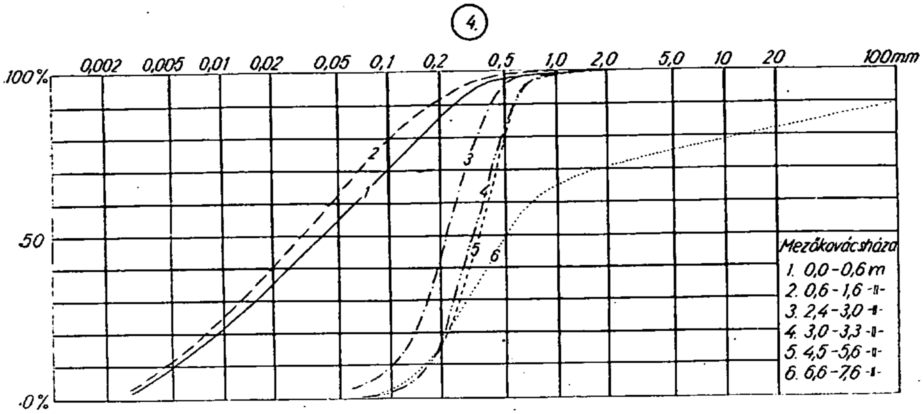
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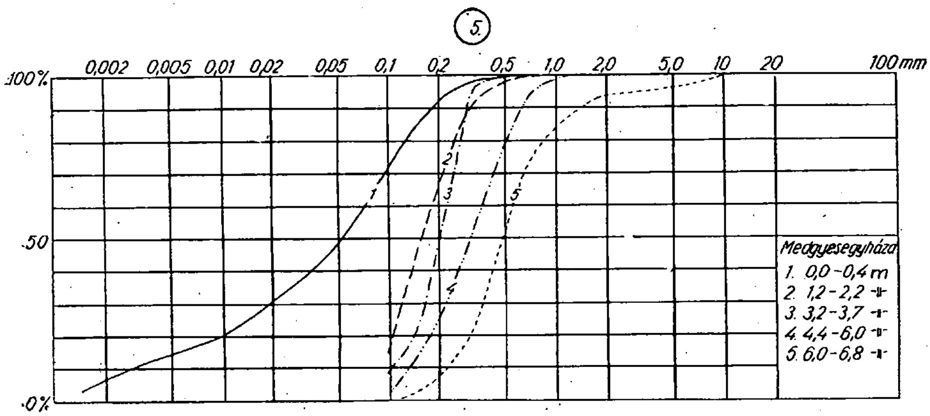
6. 6,6-7,6 -"-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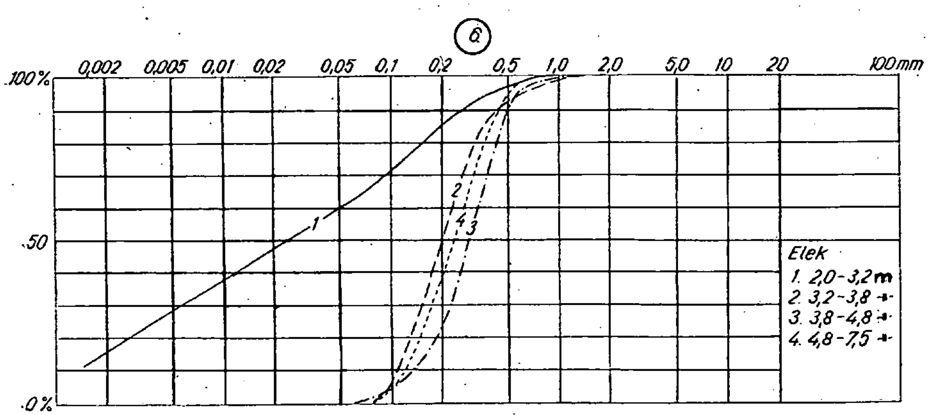
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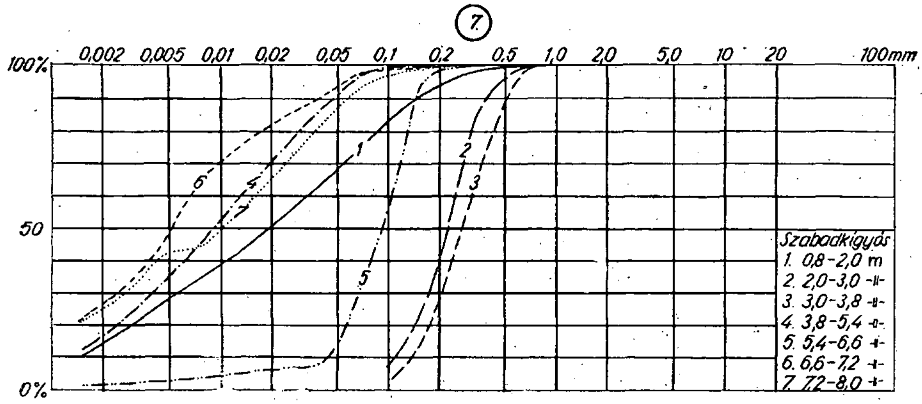
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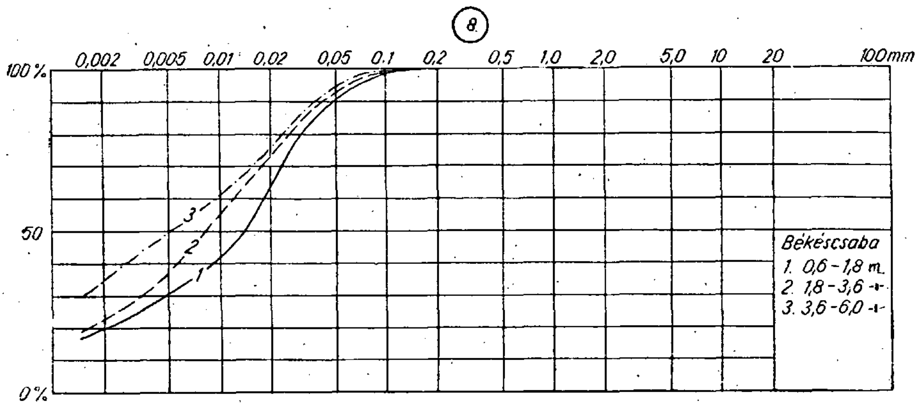
6. 6,6-7,2 -"-
7. 7,2-8,0 -"-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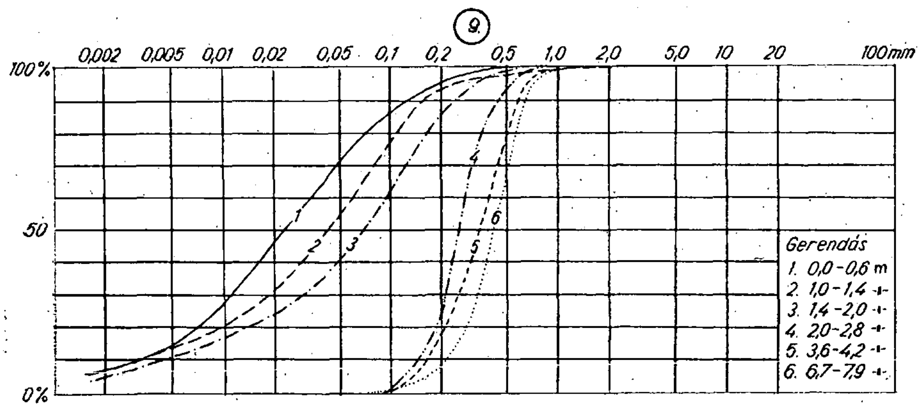
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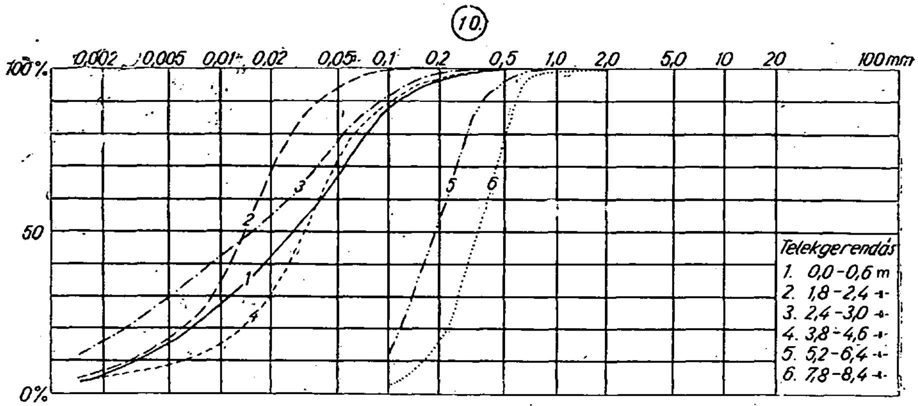
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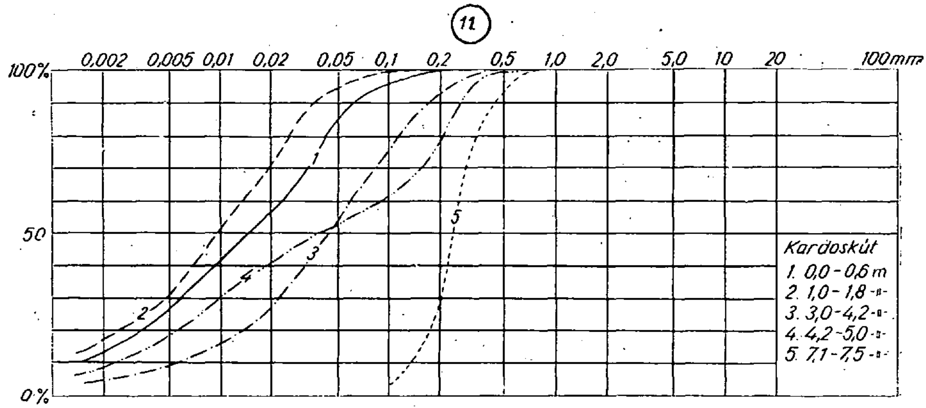
4. 3,8-4,6 "
5. 5,2-6,4 "
6. 7,8-8,4 "


11
0,002 0,005 0,01 0,02 0,05 0,1 0,2 0,5 1,0 2,0 5,0 10 20 100mm
100%
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1
2
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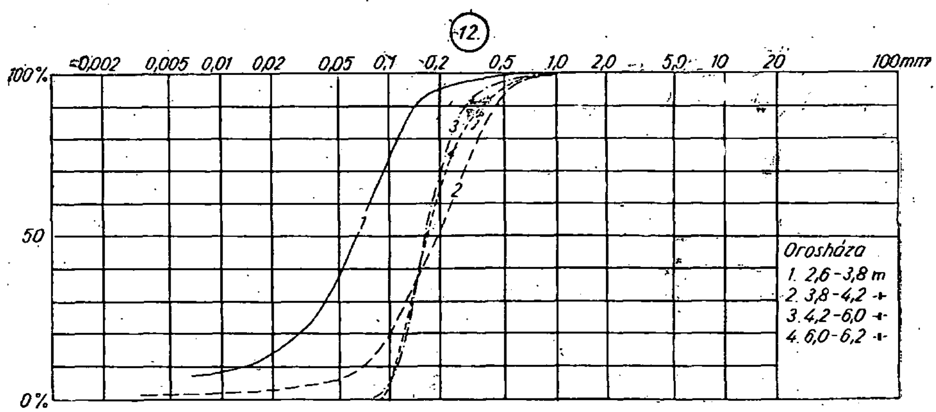
4
5
Kardoskút
1. 0,0-0,6 m
2. 1,0-1,8 "
3. 3,0-4,2 "
4. 4,2-5,0 "
5. 7,1-7,5 "


12.
0,002 0,005 0,01 0,02 0,05 0,1 0,2 0,5 1,0 2,0 5,0 10 20 100mm
100%
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Orosháza
1. 2,6-3,8 m
2. 3,8-4,2 "
3. 4,2-6,0 "
4. 6,0-6,2 "

infusion loess. The variety loess types responsible for the marked heterogeny of surface sediments were developed as early as during depisition. The eolian formation was particularly altered in the Holocene subsidences. Here accumulation and alteration have led to the formation of so-called loamy layers between lacustrine and fluviatile sediments, layers which are though close to the loess fraction, but which show a structure other than that of loess. For this reason, they cannot be called loess, of course.

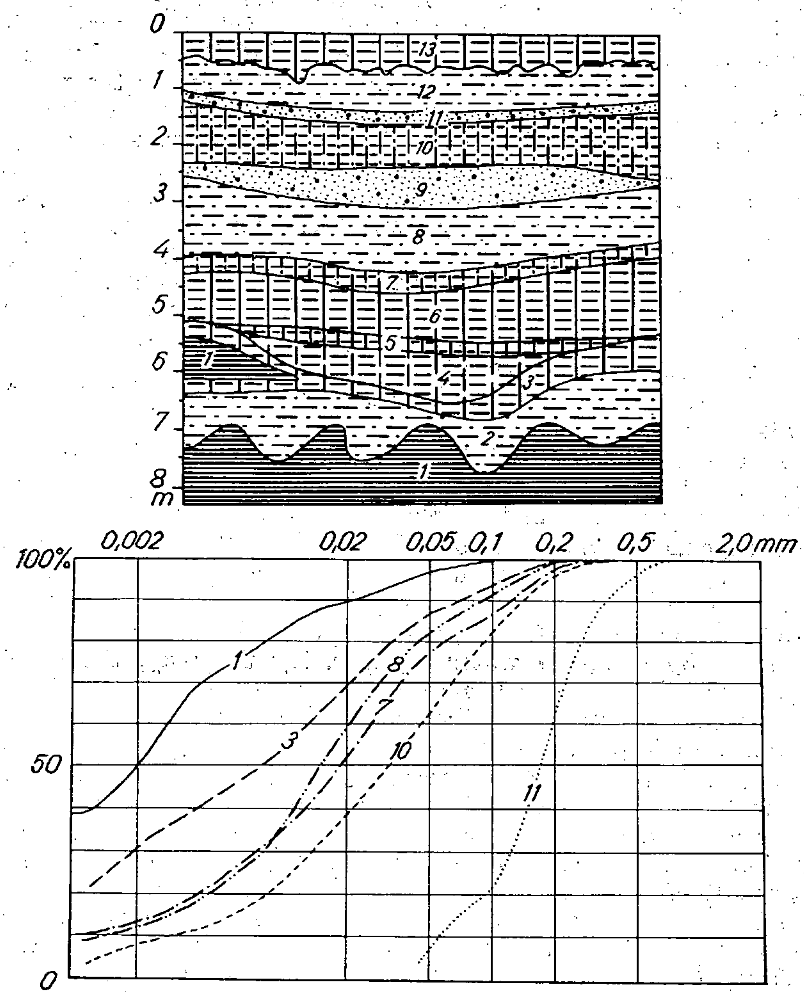

Fig. 6. Geological section of the clay pit of Hódmezővásárhely brick-yard and granulometric curves of the particular layers
1 = silty clay, 2 = largely loessic silt, 3 = clayey-loessic silt, 7 = loessic silt with fine sand, 8 = loessic, silty sand, 9 = small sand with fine sand, 10 = silty loess with fine sand, 8 = loessic, silty sand, 9 = small sand with fine sand, 10 = silty loess with fine sand, 11 = small to medium sand, 12 = loessic silt, 13 = humic, loessic silt.

In higher morphological position the mechanism of loess formation seems to have been different. Here the airborne dust, once settled down the surface, has remained in situ. However, a purely eolian accumulation cannot be spoken of here either, since the accumulative action of the river was also at work. Generally speaking, the loessic sediments of higher morphological position have been mixed with sands, while those of lower morphological position rather with silts and clays.

On the regional scale, the upward decrease in grain size is noteworthy in connection with the stratification of infusion loess sediments. This phenomenon can by no means be explained by a gradual decrease of eolian action, the progressive weakening of river water mechanism being rather apt to account for it. The structure and composition of infusion loesses can also be relied upon for conclusions as to the efficiency of morphogenetic agents. In case of airborne dust mixed with coarser sediment a comparatively more efficient accumulative action of river water, in case of silty and clayey admixtures, an accumulation by stagnant waters, can be supposed. Accordingly, two periods of eolian accumulation in the Pleistocene have been recorded. In the Körös—Maros Interfluve the afore-mentioned two loess layers are structurally well discriminable, being available in varying thickness from Hódmezővásárhely up to Békéscsaba throughout the territory.

Let us summarize now the most general characteristics of loess sediments:

a) in the Körös—Maros Interfluve influsion loesses show a heterogeneous areal distribution, being represented by numerous types in terms of grain size and structural features.

b) On surfaces, where infusion loesses are mixed for the most part with clays, surface erosion is more advanced than in areas of sand-and-loess mixtures.

c) On account of differences in quality, the various surfaces are characterized by different water regimes. By the way, the qualitative divergencies of the various chernozem soil types are accounted for, among other causes, by differences in the composition of the bedrock, this being one of the most important causes.

As shown in the above, the morphological forms of the territory have been shaped and modelled by river water and wind actions since the end of the Pleistocene up to the present time. Manifestations of periglacial frost action are rather sporadically observable in the uppermost 6 to 8 m of clayey silt of the Pleistocene sequence. River incisions have brought about a palaeostream system of NE-SW and NW-SE strike, with axes running mostly in NE-SW direction on the Pleistocene ridge facing the Tisza Valley (along the valley lines of the paleostreams) and in NW-SE direction in the zone facing the Körös rivers. This paleohydrographic pattern is closely connected with the uneven subsidence of the flank of the Maros Alluvial Fan, a process which seems to have been considerable in Late Pleistocene and Early Holocene times. In general, the peaks of the Pleistocene ridge of the Körös—Maros Interfluve indicate the extension of the Fan: the sands on the flanks of the Fan have been arranged

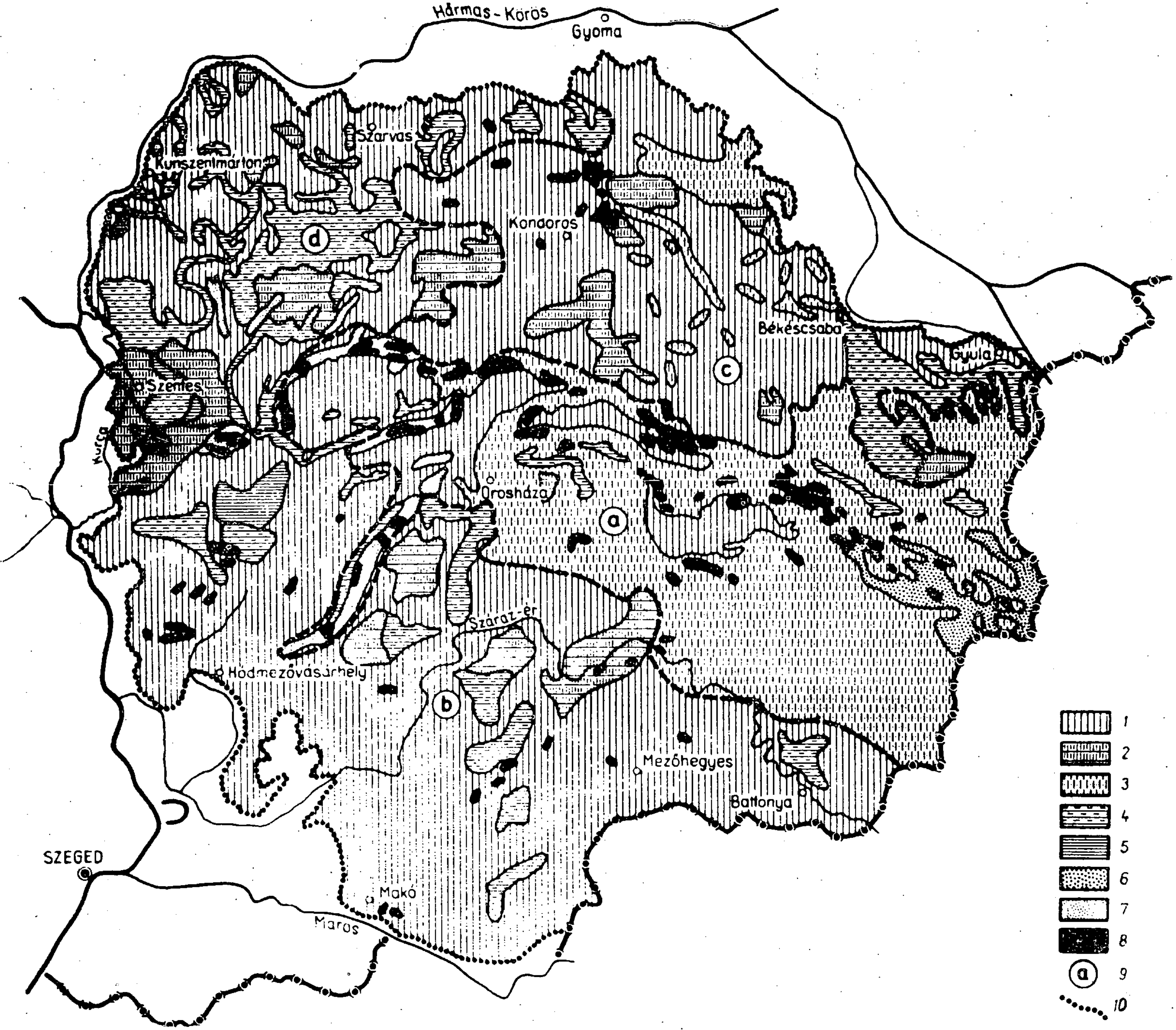

Fig. 7. Morphological sketch of the Körös—Maros Interfluve Plain (plotted by M. Andó)
1 = Large Pleistocene level surfaces covered by a thick layer of infusion loess, 2 = Surfaces which used to be waterlogged in Early Holocene time and which are presently covered by clayey loess, 3 = recent alcalized surface deposits of filled-up stagnant water ponds and rivers, constituted by clayey, sandy and loessic silts, 5 = meadow clay surfaces under high rate humification, 6 = river-deposited sand, 7 = near-surface wind-blown sand, 8 = lofty sand dunes as landform assemblages marking the extension of the alluvial fan, 9 = geomorphological micro-regions, 10 = boundary of geomorphological region.

by deflation into dune ranges. Two continuous sand belts can be observed. The outer belt runs from the vicinity of Nagyszénás to the west, towards Szentes and Mindszent. The inner belt can be traced from the southeastern frontier zone via Orosháza up to Hódmezővásárhely. The dune range is no always parallel to abandoned river channels. In other words, both river bank dunes and scattered minor dunes are available in the territory. Such are the sandy-loess-cavered sand forms occurring along the Kondoros—Mezőberény—Békéscsaba line and in the vicinity of Gyula—Kétegyháza. Not in all of the cases is the sand range the result of deflation and eolian accumulation. Nota bene, the sand layer sometimes comprises coarsegrained, well stratified fluviatile sands, too. Hence, these sand forms can be considered to be fluvio-eolian formations as well as erosion residues between one-time river channels.

During the Holocene the abandoned channels were filled up almost completely, so that now they are traceable just in some places, where they form shallow hollows. In the depressions, meadow clays, clay-silts, redeposited loesses are directly underlain by fluviatile deposits (sands) showing a gradual decrease in grain size northwestwards, along the river valley (ANDÓ—MUCSI 1969).

The Late Pleistocene to Early Holocene history of the Hungarian part of the Maros Alluvial Fan has been summarized in Table 4. In this the rhythm of accumulation in areas of morphologically „high" and „deep" position can be recognized. It seems probable that the Maros, which at the beginning of the Holocene lay 40 km away, flowed in a fan-like pattern in various directions over its alluvial fan (which was completely built up by the end of the Pleistocene), after leaving the valley floor of the Apuseni Mountains and that not until the end of the Holocene did it occupy its present-day channel. The Holocene rhythm can be split up into two phases: an Early Holocene, living river-water phase and a Late Holocene ox-bow and lacustrine phase with intermitting dry and waterlogged conditions of environment. Consequently, the variety of present-day geomorphological forms was brought about for the most part in Late Holocene time.

4. The Körös-Maros Interfluve Plain can be divided into geomorphological microregions (Fig. 7).

a) The central part of the Fan lies in the interspace of Orosháza—Dombegyháza—Elek—Csorvás. This is the highest portion of the Fan. The nearsurface sediment is represented for the most part by sands which are blanketed by sandy loesses. In this area sand dunes, river bank dune ranges and paleochannels (with axes of NW—SE trend) constitute very rich and regular form assemblages. The sand dune ranges run along the southeastern bank of the old Maros channel (Fig. 8).

In some places the sands crop out, being, however, covered by sandy loess over much of the territory. In the interspaces of dunes, in deeper-seated channels, clayey, silty sediments have been deposited as a result of poor drainage conditions which must have existed in Holocene time. The present-day drainage channels of the region are in the northwest

Table 4.

(Courtesy of Andó-Mucsi)

Altitude a. s. l.	Present-day morphological conditions	Surface under denudation (Pleistocene) "high" position			Surface under accumulation (Holocene) "low" position		
		material	age	facies	material	age	facies
— 105 m —		infusion loess	Würm	eolian (periodically water-logged)			
— 100 m —		"blue" clay			unsorted sandy silt	Bükk I. Bükk II.	ox-bows, periodically wet
		clayey silt	Würm	flood-deposited to marshy (with redeposited Upper Cretaceous pollen grains)	medium sand	Oak stage	fluviatile (parasitic channels)
— 95 m —					gravelly coarse sand	Hazelnut-Pine-Birch stage	fluviatile
					erosion "blue" clay, clayey silt	surface Würm	flood-deposited to marsch (with redeposited Upper Cretaceous pollen grains)
— 90 m —		slightly gravelly sand	Latest Riss/Würm interglacial	fluviatile (reduced amount of water)	slightly gravelly sand	Latest Riss/Würm interglacial	fluviatile (reduced amount of water)
— 85 m —		gravel, gravelly coarse sand	Riss/Würm interglacial	fluviatile	gravel, gravelly coarse sand	Riss/Würm interglacial	fluviatile

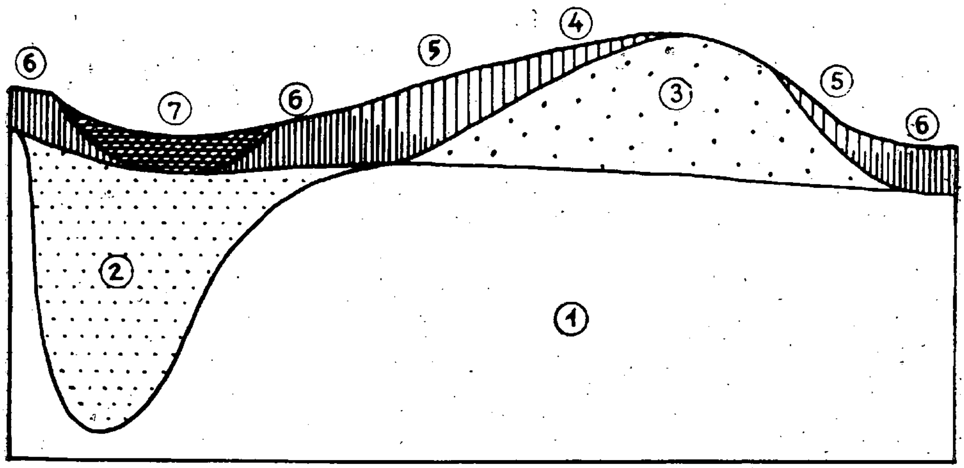

Fig. 8. Generalized profile of a river-bank dune
1 = Pre-incision deposits, 2 = palaeochannel filled up with fluviatile sand, 3 = river-bank dune sand deflated from fluviatile deposits, 4 = loessic fine sands, 5 = loess deposited on a dry surface, 7 = Holocene water stream channel, partly filled up with humic clay.

connected via Hajduér and Kórógy creek with the Tisza, in the southeast with Száraz creek.

b) The western flank of the Fan (Csongrád Plain). This is the area between Battonya—Orosháza—Mindszent and the Tisza—Maros rivers. The surface slopes slightly toward the Tisza Valley, being covered by an infusion loess blanket growing thicker westwards. In nearsurface position, the sand sequence occurs mostly just along the lines of paleochannels. Clays and silts covered by infusion loess occur frequently. This means that the surface forms a perfect plain covered by a thick infusion loess mantle. The western boundary of the west flank of the Fan is a Holocene surface brought forth by the floods of the Tisza and Maros. Morphologically, however, no sharp boundary is visible. The rather monotonous landforms of the region are offered by the level surface of the loessic platform patterned by erosion-carved depressions filled up with alcalized clays. The old river channels connected with Száraz creek now can be characterized as filled-up hollows conspicuous for different soil properties as compared to their surroundings.

c) The northeastern flank of the Fan (Békés Plain). This is an infusion-loess-covered level table-land lying between Békéscsaba—Gyoma—Csorvás, east of the source of Kórógy and Veker creeks. Its monotony is broken somehow by the meandering, deeply incised Hajdu valley as well as by the abandoned channel remnants in the vicinity of Kondoros in the southeast. A comparatively large surface depression has been developed only east of Kondoros, where the surface is covered by clay and alcalized loess. Structurally, the region is closely linked with the southern part of the Hármas-Körös foreland lying west of it.

However, the loess-like sediments, covering the surface, show a much more uniform composition here. The loess is underlain by a clay layer of considerable extension, intersected by the sand-filled belts of old river valleys, marking the tracks of Pleistocene paleochannels.

d) The southern foreland of the Hármas-Körös depression, extending up to the Nagymágocs—Kondoros—Mezőberény line, rises gradually from the Hármas-Körös valley towards the Fan. In this slightly sloping area, cutoff channels, ox-bows can be observed to lie at different heights. Properly speaking, this is the area of confluence of the old channels of the Maros and Körös-the socalled Körös Angle. The surface is mostly dissected by abandoned river channels, though 3- to 4-m-high mounds, the so-called „kunhaloms", are also frequent. (These latter represent anthropogenic features.)

Silty clays and alcalized clayey silts are common on the surface. Sands are uncharacteristic in near-surface position, but in deeper horizons thick sand layers can be found, particularly so near the rivers. In structural-morphological respect, the region can be divided into a young (Holocene) depression and an older, river-dissected Pleistocene marginal ridge of low relative relief. Whereas the former carries the Körös' valley system and latest flood-deposited sediments, the later is characterized by the old channel system of the Veker and Maros and the upfilling of these channels.

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