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Chronological Problems of the Szemlak Fossil Soil Profile

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In Transylvania, the buried paleosoil seqvences can be found on the terraces of major rivers, the Szamos, the Maros, the Olt. Of the exposures, the Szemlak seqvence is suitable for stratigraphic correlation.

The studied exposure is situated in the Quarternary fluvial deposits, five kilometers Southwest of Szemlak, on the right bank of the Maros (Fig.1). In the Holocene the flow of the Maros shifted further North, by-passed its own talus and occupied its present position North of the Vinga plain, in the Lippa-Arad depression. The bahada-type Vinga sediments also appear as enclaves on the right side of the Maros. This explains why the Szemlak plain of 110-114 m above sea level is surrounded by a lower (92-108 m) plain to the North, West and Southwest. West of Arad the Maros River filled the area with Levantean and Pleistocene pebbles alternating with clay and sand. This fluvial alluvium is covered by Eolithic dust and loose deposit. These latter formed the loess and red clay seqvences.

Examining the texture of the layers of the profile, cycles of alternating loess and red clay can be observed. The texture of the latter is finer as a consequence of the pedogenetic conditions during their formation and deposition. The texture of the loess and sludge seqvence reveals a typical loess texture in which the cementation of the finest particles resulted in 2-20 micrometer diameter aggregates. It mainly consists of clay (37.8%) and silt (28.8%). The proportion of the sand fraction is insignificant.

Red clays are usually fossil soils formed in humid climatic conditions, or can be considered as the "B" zones of these soils. Their textures are of a more varied compound: clay (38-51%), silt (24-29%), fine sand (26-30%), coarse sand (0.1-0.5%).

The humus content is low: 0.4-0.6 % in the buried soils and 0.15-0.4 in the loess pockets. The greatest part of the organic matter has oxidated.

The vertical distribution of the carbonate content is uneven. It is low in the buried soils, but high in their accumulation levels and in the loesses (10-16%). As a result of the climatic change during loessformation the carbonate content considerably changes within the loess pocket. The silt horizons can also be mentioned here, as they practically lack lime.

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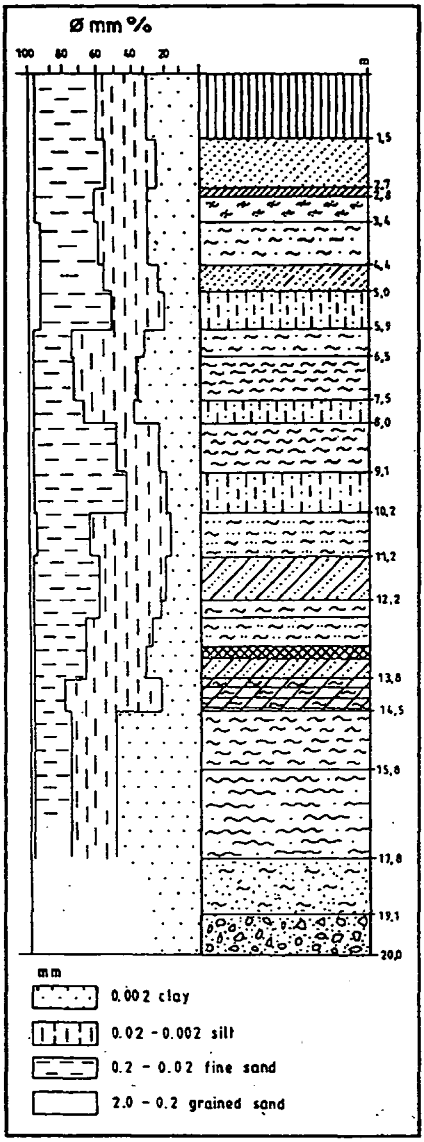

Description of the profile:

In a 16 m seqvence four red clays are alternating with loess:

0.0 - 1.5 m	weakly developed chernozem-type soil
1.5 - 2.7 m	loess
2.7 - 2.8 m	loess-like substance
2.8 - 3.4 m	light, clayey loam
3.4 - 4.4 m	yellowish brown clay
4.4 - 5.0 m	loess with lime concretions
5.0 - 5.9 m	brown silt
5.9 - 6.5 m	yellowish brown clay, containing manganese oxide
6.5 - 7.5 m	red clay, containing manganese oxide
7.5 - 8.0 m	compact silt with clayey texture
8.0 - 9.1 m	red clay, containing manganese oxide
9.1 -10.2 m	silt
10.2 -11.2 m	yellowish clay, not containing $CaCO_3$ concretions
11.2 -12.1 m	loess, with lime concretions
12.1 -12.6 m	red clay
12.6 -13.3 m	brownish red clay
13.3 -13.4 m	cemented lime accumulation level
13.4 -13.8 m	loess
13.8 -14.5 m	grey, very dense substance
14.5 -15.8 m	red clay, containing lime and manganese oxide spots
15.8 -17.8 m	purple clay
17.8 -19.1 m	sandy clay
19.1 -20.0 m	coarse sand and small pebbles

Figure 1 The Szemlak Fossile Soil Profile

Conclusions

A widely accepted explanation for the alternating buried soils and loess seqvences is that the former substance formed in the interglacial and the other in the glacial phases (Popovat, M. et al. 1964; Fotakieva, E. 1972). Others (Florea, N. et al 1965) argue that the soils formed in the humid glacial and the loess in the dry interglacial (interstadial). The formation of a soil or soil complex cannot always cover a whole interglacial or interstadial. These prove the presence of erosion gaps in loess exposures in spite that "older loesses never display an unbroken layer sequence." (Pécsi M. 1991)

Concerning the climatic conditions of soil formation, the exclusive consideration of the research results lead to the conclusion that the drier the climate and the closer the original location of the substances carried away by the wind, the coarser the texture of the eolican layers. The high proportion of the carbonates also points to a dry climate. The chernozem-type soils form under the influence of dry climatic conditions, while the formation of well-developed B level forest soils and the reddish loam soils require humid climatic conditions. Characteristic of the humid and cold climate are the podzol-type soils and the frost phenomena (which are more prominent in the loose sandy-pebbly sediments because of the high groundwater level.)

The formation of the permanent and successive soil and loess series is the result of the perpetual climatic instability. This basically reflects the glacial-interglacial phase changes of the end of the Quarternary. We can suppose that these young loesses and the fossil soils between them are the remainders of not only the Würm, but also the Riss-Würm glaciation and warming up. Compared to the earlier ones, these two glacials are more closely connected. The chronological periodization and correlation of the loess and the buried soils are disputed questions even today. The formation of the soils conform to the climatic types described as subtropical by Bacsák (Bacsák Gy. 1942) and as moderately oceanic by Barriss (Barriss, 1991). In contrast, the loess and silt horizons are characteristic of the glacial (Bacsák) and the strongly oceanic (Barriss) climatic types.

We can conclude that the Szemlak seqvence reflects the Quarternary climatic instability. Its presumed age is presented in Table 1. on the basis of grain size and pollen analyses and its geomorphological position.

Table 1 Paleographical interpretation of the data

depth	name Barris	climatic Bacsák	type	pollen content	presumed age	Ka
0.0- 1.5	weakly developed chernozem-type soil	SDP	st	Artenisis,Almus,Quercus,Pinus,Ulmus	Holocene	15
1.5- 2.8	loess	SO	gl	Compositae,Ulmus	Würm III	15-30
2.8- 4.4	brown forest soil	MC	st	Pinus,Quercus,Compositae	Würm II-Würm III	30-50
4.4- 5.9	silt	SO	sa	Tilia,Quercus,Compositae	Würm II_2	50-60
5.9- 7.5	brown forest soil with clay washed in	MC	st	Pinus,Quercus,Tilia,Compositae, Gramineae	Würm II_1-Würm II_2	60-70
7.5- 8.0	dense silt	SO	sa	Tilia, Fagus	Würm II_1	70-80
8.0- 9.1	brown forest soil	SDP	st	Tilia,Ulmus,Quercus,Juglans,Almus, Acer,Pinus,Gramineae	Würm II	80-100
9.1-10.2	lehm	SO	sa	Tilia,Quercus,Chenopodiaceae,Polygonaceae	Würm I	100-115
10.2-12.1	loess	SO	gl	Pinus,Acer,Alnus,Quercus,Tilia,Compositae	Würm I	115-120
12.1-13.4	forest soil	MO	st	Pinus,Quercus,Acer,Betula,Tilia,Compositae	Riss-Würm interglacial	120-150
13.4-13.8	loess	MC	gl	Gramineae,Tilia,Salix,Umbelliferae	Riss-Würm interglacial	150-160
13.8-15.8	forest soil	MO	sa	Tilia,Quercus,Pinus,Compositae,Gramineae	Riss-Würm interglacial	160-170
15.8-17.8	purple clay	-	-	-	pre Riss-Würm interglacial	-
17.8-19.1	sandy clay	-	-	-	-	-
19.1-20.0	coarse sand and small pebbles	-	-	-	-	-

Legend: gl = glacial; sa = subarctic; st = subtropical; SDP = small different from present;
SC = strongly continental; SO = strongly oceanic; MC = moderately continental;
MO = moderately oceanic

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