

## CONSIDERATIONS ABOUT SOME MOUNTAIN SOIL PARENT MATERIALS

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**Abstract:** *In Romania the mountain soils are developed on unstratified parent materials such as recent deluviums-eluviums formed from direct weathering of the rocks, and on stratified parent materials, a clayey interglacial layer, covered by postglacial deposits. In the Central Europe soil parent materials are stratified, formed in cold periods by periglacial processes. There were identified and described three layers who differ by the rock fragments litology, texture, mineralogy and heavy metals content (Kleber, 1990, 1992, 1997); additional those layers could incorporate loess, by periglacial processes (Semmel, 1993). This study has shown a very close connection between the parent material litology and granulometry and the soil types developed on mountain areas. There were identified both monogenetic soils, developed in present day conditions (Humosiosols, Criptopodzols, Podzols, Prepodzols), and poligenetic soils, formed on stratified parent materials (Eutricambosols and Districambosols).*

**Key words:** *parent material, mountain soils, stratification*

### INTRODUCTION

The soil parent material is an important pedological factor who can determine genesis of some soils types (Andosols, Arenosols, Vertisols) and soil properties (texture, soil coarse fragments, mineralogy, acidity, degree of base saturation, soil moisture and air regime) (FLOREA et. al, 1968).

On the mountains the soil parent materials are deposits such as eluviums, deluviums and colluviums formed by rocks weathering and transport on slopes by different agents: water, air, gravity.

In the Central Europe soil parent materials are stratified, formed in cold periods by periglacial processes. There were identified and described three layers who differ by the rock fragments litology, texture, mineralogy and heavy metals content (KLEBER, 1990, 1992, 1997); additional those layers could incorporate loess, by periglacial processes (SEMMELE, 1993, MAIDANDER R. VEIT H., 2001). In Romania, the glacial periods did not have the same extension and amplitude like in the Central Europe, and the deposits resulted were thinner.

On the higher mountain level, the soil parent materials are postglacial, resulted from in situ bedrock disaggregating, but on the median level, uncovered with glaciers in the glacial period, the parent materials could be stratified, consisting on an weathered layer formed in the last glaciation and covered with postglacial deposits (RAPAPORT et.al, 1969, RASNOVEANU et.al, 1993).

### MATERIALS AND METHOD

In this paper was analyzed the granulometry data for mountain soils as Umbrisols, Spodisols and Cambisols, situated in different areas of the country: Bucegi Mountains, Parang Mountains, Apuseni Mountains, Obcine and Danube Defile (Iron Gates) (GLAVAN et.al, 1990).

It was used materials from the ICPA archive and was interpreted data published in the Proceedings of some National Conference (Azuga-Sinaia, 1969, Iasi, 1970, Suceava, 2000).

To classify the particle size the Atterberg system was used, with the following fractions: coarse fragments: > 2 mm; coarse sand: 2-0.2 mm, fine sand: 0.2-0.02 mm, silt: 0.02-0.002 mm and clay: < 0.002 mm. For each fraction the arithmetical mean has been calculated, for the typical horizon sequences: A-AB / Bv / BC-C in case of Cambisols and A-AB (E) / B (Bhs) / BC-C (R) in case of Spodosols and Umbrisols.

## RESULTS AND DISCUSSION

### *Granulometry and the soil coarse fragments*

#### I On the high mountains

According to the data, there is a very close connection between the parent material litology and granulometry and the soil types, which results for Humosiosols-Crotopodzols-Podzols-Prepodzols series (table 1, fig. 1 a-d).

These soils have coarse texture, uniform on profile. The percent of clay decrease in direction Humosiosols-Crotopodzols-Podzols-Prepodzols (21.5% - 11.1% - 8.5% - 6.5%) and on soil profile, and in the same direction the percent of sand increase (52.1% - 75.5% - 75.7% - 77.3%).

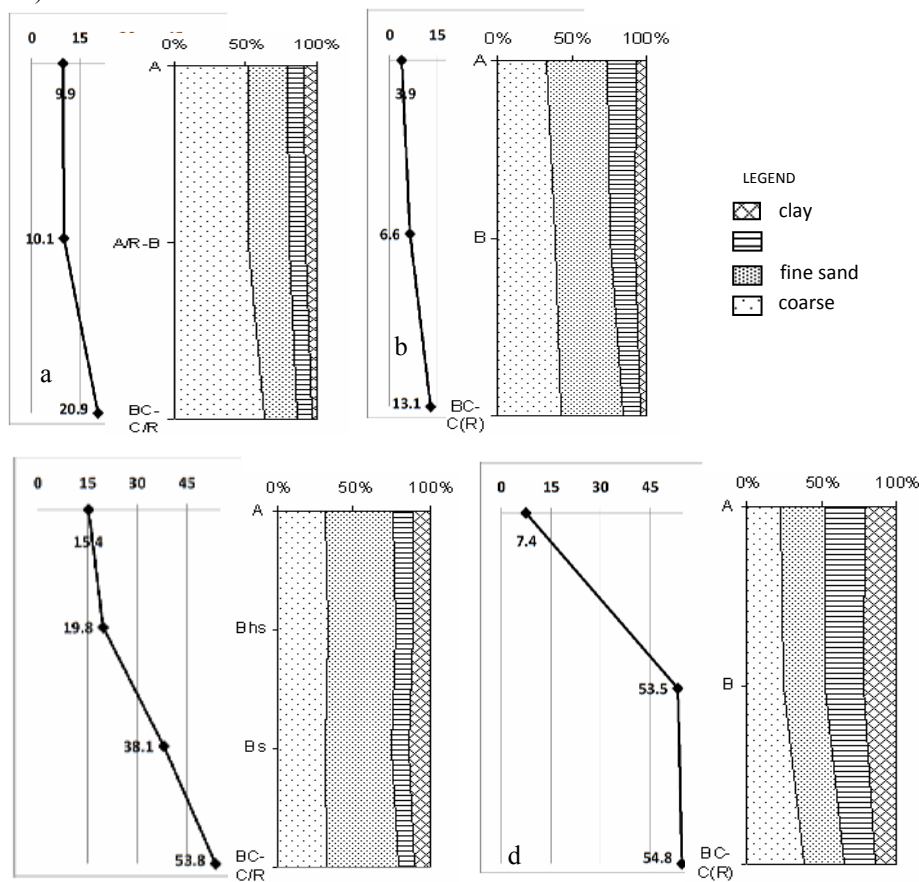


Figure 1. Granulometry and the coarse fragments for: a) Humosiosols and Regosols (alpine); b) Criptopodzols; c) Podzols; d) Prepodzols

In the case of the podzols, there are resulted two situations regarding the fine sand/coarse sand ratio: 1) for the soils developed on conglomerate (in Bucegi Mountains) the coarse sand prevails, and 2) for the soils developed on sandstones the fine sand prevails (the Podzols developed in Obcine, at 900-1100 m altitude is due to the acidity of the parent material).

The coarse fragments appear from the first layer at these soils and their percentage increase from the up to the down part of the soil profile (up to 50-60%). Also, the percentage of the coarse fragments is higher beginning with the Prepodzols and ending with the Humosiosols. From these observations it could be deduced that the parent material of these soils is a product of the in situ bedrock weathering.

Table 1

Granulometry of the Spodosols and Humosiosols

Soil	Texture	Horizons							
		A		Bhs		B		BC-C (R)	
		Values	Mean value	Values	Mean value	Values	Mean value	Values	Mean value
Prepodzols EP	coarse fragments	1,3-13,0	7,4			2,6-9,0	53,5	0-9,0	54,8
	coarse sand	17,9-28,5	22,0			11,5-48,8	24,3	19,1-68,2	37,8
	fine sand	10,9-46,9	30,1			11,5-43,5	27,8	7,3-39,7	26,9
	silt	25,3-27,9	26,3			7,1-28,3	24,3	6,3-25,3	20,8
	clay	7,8-35,3	21,5			9,5-27,9	22,6	8,7-27,3	14,4
Podzols PD	coarse fragments	0-30	15,4	4,9-30	19,8	5,1-60	38,1	0-80	53,8
	coarse sand	11,4-44,0	30,5	14,5-48,9	32,9	8,6-56,7	31,2	6,3-57,9	31,7
	fine sand	25,3-69,5	45,2	29,8-61,7	44,6	23,1-69,1	44,2	28,8-64,5	47,6
	silt	5,8-18,5	13,1	6,8-16,3	11,2	6,0-18,8	11,8	4,6-22,6	10,1
	clay	5,5-17,7	11,1	7,4-21,7	11,3	4,7-24,9	13,8	4,6-29,8	10,8
Criptopodzols CP	coarse fragments	0,4-5,6	3,9			0,4-13,6	6,6	5,3-17,5	13,1
	coarse sand	16,5-47,7	33,6			22,7-55,6	38,3	28,1-49,3	42,7
	fine sand	28,2-58,2	41,8			28,3-42,1	36,9	38,9-46,4	42,4
	silt	12,3-27,4	19,6			9,4-22,9	16,8	9,3-17,0	11,3
	clay	2,6-13,8	6,5			3,9-14,1	7,7	0,1-8,5	3,8
Humosiosols +Regosols (alpin) HS + RS	coarse fragments	0-25,0	9,9			1,7-28,4	10,1	13,5-28,2	20,9
	coarse sand	43,6-64,1	50,7			43,4-72,8	52,7	57,6-71,5	63,6
	fine sand	16,6-35,4	26,6			22,4-36,1	28,1	21,2-24,9	22,9
	silt	6,6-17,5	11,7			4,0-15,1	11,2	6,8-12,6	9,7
	clay	2,7-16,4	8,9			0,8-17,7	8,1	0,6-7,3	3,6

## II On the small mountains

The soil types and granulometry are influenced by the chemical and mineralogical composition of the parent material. A similar correlation, texture - soil type, has been observed also for the Cambisols. The following situations may occur:

- a) there are Districambosols formed on unstratified parent materials (fig. 2a,b,c), with:
  - *coarse texture* - sandy loam (9.7% clay and 67.4% sand to the upper part, and 11.0% clay and 69.7% sand to the down part of the soil profile); there are soils developed on parent materials such as: conglomerates, sandstones, crystalline schists;
  - *medium texture*, loam – sandy loam (clay from 20.6% to the upper part to 17.0% to the down part of the soil profile), formed on crystalline rocks (schist, mica schist) and uncarbonated sedimentary rocks.
  - *fine texture* - clay loam - (the percentage of clay is around 33-34% on the soil profile; their parent material is derived from weathering of the clayey sedimentary rocks (sandstones and marls) and the acid volcanic rocks (andesite), materials with lower degree of base saturation.

b) Districambosols formed on stratified parent materials, with medium texture on the surface, and clay texture to the down part of the soil profile (24.2% in the first layer to 37.7% clay in the C horizon) (table 2, fig. 2d).

c) Eutricambosols formed on unstratified parent materials (fig 2 f, g), with:

- *coarse texture*, uniform on the soil profile (12.9% clay and 68.9% sand in the A horizon to 14.2% clay and 78.4% sand in C horizon). There are medium basic soils, developed on parent materials resulted from weathering of calcareous rocks such as: Bucegi conglomerate, grey limestone, crystalline limestone, calcareous sandstones.

- *fine texture*, uniform on the soil profile (clay from 44.0% in the A horizon to 38.5% in C horizon); there are soils developed on clayey deluviale deposits resulted from sedimentary rocks (clay, marl, sandstone) disaggregating.

d) Eutricambosols formed on stratified parent materials with fine texture, who overlay an clayey material (33.1% clay to the upper part to 48.9% to the down part of the soil profile) (table 2, fig. 2e).

Table 2

Granulometry of the Eutricambosols and Districambosols formed on stratified parent materials

Soil type	Texture	Horizons					
		A-AB		Bv		BC-C (R)	
		Values	Mean value	Values	Mean value	Values	Mean value
Eutricambosols	coarse fragments	5-15	8.3	4-30	16.5	4.5-70	47.8
	coarse sand	0.0-12.3	6.1	0.0-15.5	7.3	0.0-13.2	5.6
	fine sand	13.1-47.2	27.3	18.1-18.8	25.9	2.3-40.5	17.7
	silt	16.3-39.1	31.2	16.0-34.9	27.9	21.1-43.3	27.3
	clay	22.1-46.3	33.1	27.9-51.8	39.9	29.0-58.2	48.9
Districambosols	coarse fragments	0.0-50	36.6	6.3-60	38.8	1.7-80	47.0
	coarse sand	4.2-20.5	10.7	3.5-32.8	11.7	2.5-20.4	10.8
	fine sand	22.5-49.7	32.8	12.0-37.4	27.9	10.3-36.1	19.9
	silt	25.1-38.2	30.7	18.1-39.1	30.2	23.0-39.9	30.3
	clay	14.0-33.2	24.2	24.1-42.3	29.7	29.3-46.2	37.7

The finer layer which appears to the down part of the stratified soil profile is rich in bases and influences the degree of base saturation of the soils directly or indirectly, through the soil solution which circulates gravitational on slopes enriches the soils from the slopes foot.

**Origin of the soil parent material**

For the soils developed on the higher mountain level, respectively for Humosiosols – Criptopodzols - Podzols – Prepodzols, the parent material consisting on eluviums-deluviums resulted from in situ bedrock disaggregating is unstratified. These are postglacial, monogenetic soils.

For the Cambisols, the unstratified parent materials are recent deluviums-eluviums formed from in situ weathering of the rocks; there are placed on highest slopes, with active erosion.

The clayey layer from the basis of the stratified profiles represents, according to some pedologists, an “weathered bed” remaining from a paleosol (B horizon) formed in the last glaciation. The above material it was accumulated, probably in Postglacial, by slope and aeolian processes. The stratification occurs generally at 50-60 cm dept, and corresponds with the lower limit of Bv horizon (BALACEANU et.al, 2002).

Sometimes, the clayey layer is a part of the present soil (is situated under the Bv horizon and is affected by the present pedological processes); in this situation, to the soil definition is added the term “cambiargic” (SRTS, 2003).

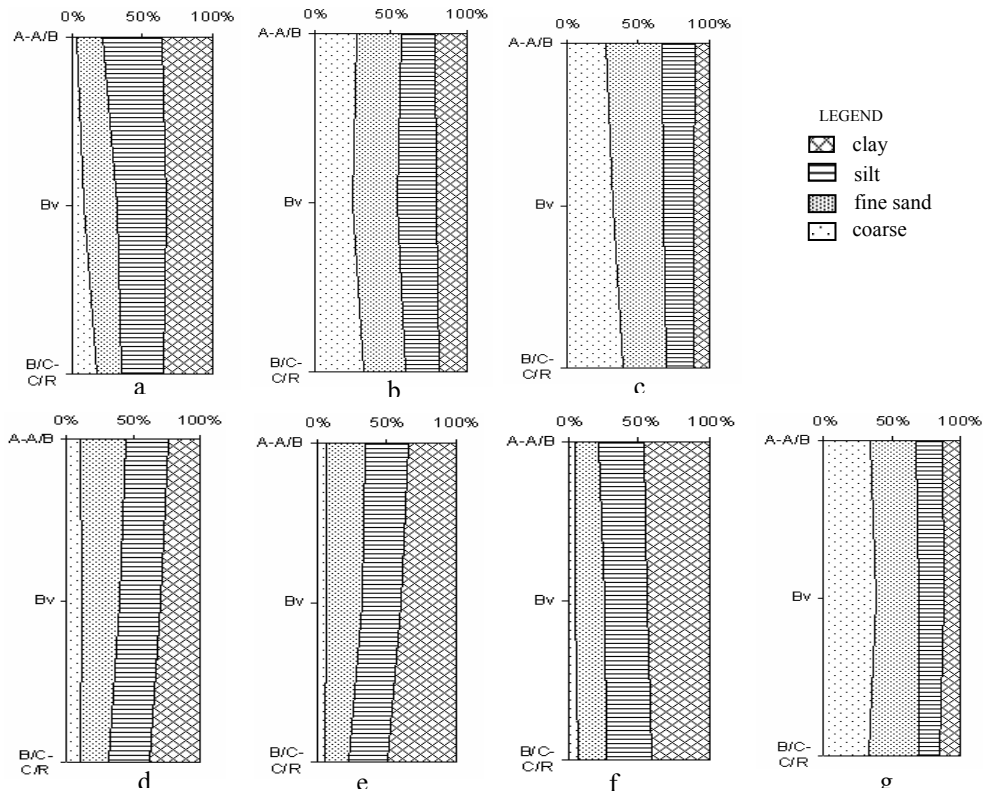


Figure 1. Granulometry for: Districambosols formed on unstratified parent materials with: a) fine; b) medium; c) coarse texture; d) Districambosols and e) Eutricambosols formed on stratified parent materials; Eutricambosols formed on unstratified parent materials with: f) fine; g) coarse texture

### CONCLUSIONS

The mountain soil cover composition is close influenced by the parent material properties. On the crystalline, massive rocks, disaggregating resistant, are developed coarse soils, with short profile, and on the rocks with lower resistance to weathering (clay, sand, marl, and sandstone) are developed deep soils, with various texture. On the slopes, the parent materials are formed by slope processes and, local by aeolian deposition.

There are soils developed on unstratified parent materials resulted from in situ bedrock disaggregating, postglacial, monogenetic, such as: Humosols, Criptopodzols, Podzols, Prepodzols, and stratified, polygenetic soils formed on a clayey interglacial layer, covered by postglacial deposits, such as Cambisols.

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