THE STUDY OF PEDOGENETICAL PROCESSES IN THE BARAOLT AND BODOC MOUNTAINS

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Abstract

The aim of this paper is the detailed knowledge of pedogenetical processes which are encountered in the Baraolt and Bodoc Mountains in order to study the forestry sites in this area as well as their reliability. Thus, the present paper is trying to support the reliability of beech forestry sites by means of ecological indices.

Key words: pedogenetical; forest area; processes; pedological factors, soil.

INTRODUCTION

Soils are formed in the surface layers of the lithosphere where they come into contact with the atmosphere, the biosphere and the hydrosphere. Any change that occurs in the course of time in the rock, relief, vegetation and fauna conditions leads to changes concerning the nature and intensity of the pedogenetical processes. The biocoenosis is a pedogenetical factor which influences the evolution of soils under the same circumstances. Thus, under the forestry vegetation, soils have some characteristics:

- The bioaccumulation is slow and continual and it occurs under the action of a specific vegetation and microfauna.
- The roots of the trees explore a large part of the soil, thus activating both the circuit of nutritious elements and the circulation of water at high depths.
- The chemical composition of the organic waste influences the speed at which the organic substance decomposes and the quality of the humus (the mull soil under the leaf-bearing forests in the fields and low hills areas, the mull-moder under the intermixture of leaf-bearing forests and moder or even gross humus under spruce forests ,juniper tree forests etc.)

MATERIAL AND METHOD

The purpose of this research is the analysis of pedogenetical processes and the description of the main soils in The Baraolt and Bodoc Mountains.

The main objectives of this research are:

• The description of the soil formation factors in the researched area (rock, vegetation, relief and climate), description which is based on bibliography and personal observations.

• The morphological characterization and the determination of ecopedological indexes of 45 types of soil. The present paper offers for exemplification the analysis bulletin for 3 representative soil types.

• The establishment of a correlation between the values of the pedological indices and the productivity level of the brush.

The research was carried out in the forest sites of The Baraolt and Bodoc Mountains.

The research methods involved were

- The bibliographic research.
- The observation completed with measurements and laboratory analyses to determine the value of the ecopedological indexes.

RESULTS AND DISCUSSIONS

The characterization of the pedological factors in The Baraolt and Bodoc Mountains

The Bodoc Mountains are quite old mountains, being preeminently made of sandy rudaceous flysch formations and marl-chalky of inferior cretaceous age in the west and of flysch marl sandstone of superior cretaceous age in the east. In the north, in the contact area with the Ciomatul massif, the volcanic agglomerates, also called volcanic-sedimentary formations, cover the formations of cretaceous age which are specific to the Bodoc Mountains on a more confined area. In the south there are visible Pliocene-Pleistocene deposits and alluvial formations which belong to the depression areas.

The Barolt massif is made of sedimentary formations of cretaceous and Pliocene-quaternary age. From a tectonic point of view, the cretaceous formations belong to the area of the Oriental Carpathians flysch which is made of a combination of anticlines and synclines.

The Pliocene deposits (Dacian-Levantine) are made of an alternation of grey marls, finely sandy, yellowish clays, carbonaceous complexes (lignite), fine and coarse sands rich in fossil residues (mammals and invertebrates).

The quaternary formations (Pleistocene-Holocene) appear under the form of terraces at the extremity of the Dacian-Levantine Piedmontan hills. Here and there they form slope deposits. Some quaternary formations cover even the remote endings of the anticlines in the south of the Baraolt Mountain, and the pyroxene basaltic andesites in the quarry area of the Olt Valley grant the Baraolt massif some features which allow it, at least partially, to be

framed within the moffetic aureola area (the moffetic emanations and mineral carbonated waters which exist as far up as Ilieni). (Bacaintan, 1999).

The Bodoc massif belongs to the category of low altitude mountains in the north of the Brasov depressionary area, in which it is visible the existence of a complex of erosion surfaces fragmented by a radial net of valleys and by neotectonic movements that have amplified the marginal faults, thus highlighting the horst character of the massif.

The lithologic, structural and tectonic elements have not created the favorable conditions for the appearance of a varied relief. For this reason the altimetric values are constant between 950 -1000 meters and the higher peaks appear only in the axle and in the northern part of the massif, peaks that are erosion witnesses, dominating the rest of the peaks: Carpinis (1241 m), Bodoc (1193 m) or Henter (1216 m).

From an altitude point of view, the Bodoc massif is considered a medium-height massif with average heights between 700 - 1000 meters which correspond to a complex of levels of Miocene Age, mostly fragmented by neotectonic movements in the second half of the Pliocene. This morphometric complex is different both from north to south and from east to west, that is from one crest to the other.

The climate of the Bodoc Mountains is characteristic to the average altitude afforested mountains. The yearly average temperatures are positive both on crests – The Carpinis Peak (1241 m) (4^{o} C) and at the foot of the mountains: 6, 7 ^{0} C (Cernat) and 7,6 ^{0} C (Sfantu Gheorghe). The coldest month is January with average temperatures between – 5, 3 ^{0} C (Carpinis); -5 ^{0} C (Micfalau) and -5, 2 ^{0} C (Cernat). The maximal monthly average is in July (13,5 ^{0}C Carpineni, 15,5 ^{0}C Cernat and Targu Secuiesc). The maximum nebulosity ranges from 6, 7 to 7, 0 and it is visible in March, November and December, and the lowest is in August. The number of sunny days ranges from 100 at the margin of the massif to 80 days within the massif.

The yearly average amount of rainfalls is 491, 7 mm in Targu Secuiesc and 964, 5 on the Carpinis Peak, thus showing a non - uniform territorial distribution. Average rainfall amounts of over 800 mm/year are recorded only in the north of the massif. The maximal monthly averages are in June in the centre of the massif and in July at the margin of the massif. The total of rainy days is of 100 – 113 days/year. The snow layer lasts for a relatively long period of time, 80 – 160 days and there is a delay in the process of melting of 3 – 5 weeks on the northern slopes. (Eigel, 1972).

The predominant wind is the one coming from the west and on the northern slopes there is Nemira, a type of Crivetz which blows in the massif with the same name situated in the Brasov Depression. Because of the

presence of the Persani and Baraolt Mountains, the western winds bring lower amounts of rainfalls, forming orographic rainfalls.
Because of the low altitudes and because of the shelter offered by the crest of the Persani Mountains from the general wind circulation, the climate of the Baraolt Mountains is milder than the one of the Bodoc Mountains. Therefore, the yearly average temperature of the air is 6 ^{0} C in the collinear area and 5 ^{0} C in the crest area. The isotherms of January show a value of – 4^0 C all over the mountainous area and those of July of 17 ^{0} C in piedmont and 15 – 16 ^{0} C within the massif. In the marginal depressionary area the yearly average temperature is 7, 8 ^{0} C at Baraolt and 7, 6 ^{0} C at Sfantu Gheorghe.

In the Baraolt Mountains area the winds coming from the north – west and from the west that is from The Transylvanian Depression, are predominant. During the winter the influence of the Nemira is felt on the low southern hills. On the eastern slopes of the Baraolt Mountains towards the Olt Valley, the so – called valley and mountain breezes appear. The Baraolt massif gets 600 – 800 mm of rainfalls yearly, the maximum amount being recorded on the crests. The rainiest time of the year is between May and July when the average monthly amount is 90 mm. The number of rainy days is 120 and the number of snowy days is 60 days/year. The water resources of the Braolt and Bodod Mountains are made of rich underground water resources and a dense drainage of surface waters. The underground waters are quartered in the sedimentary deposits such as the ones" in situ" or in the slope formations, evacuation cones. The surface waters are made of running waters and lakes. Both massifs have a relatively rich drainage. The density of the drainage ranges from 0, 35 to 0, 38 km/km^2, being influenced by altitude and a rich underground water supply. All running waters that spring from the Bodoc – Baraolt perimeter are attributed to the Olt river and the Black River, the two rivers being the main collectors in the area. The influence of the relief, the climate and the soil is evident in the vertical layering of vegetation. All throughout the region there are visible two main vegetation floors: the common oak floor and the beech floor. (Bacaintan; Kovacs, 1976).

The common oak floor (*Quercus petraea*): expands in both massifs up to about 700 meters altitude, forming pure woods or mixtures of beech and hornbeam forests. In some parts, the areas covered by common oak forests were replaced by secondary vegetation, such as the pine tree plantations *(Pinus sylvestris)* which cover quite extensive areas. Well preserved and compact oak groves can be seen on the slopes that go from east and west from the Bodoc Mountains to the Aitas basin, in the west part of Sfantu Gheorghe and in Arcus, Valcele and Haghic in the Baraolt Mountains. The beechwood floor (Fagus sylvatica): it is dominant in both

massifs where we find vast beech forests of exquisite beauty, especially in the Bodoc main crest area, Havad and the Belin Peak, Tecse, Gurgau and on Hatod. In the beech forests area there are vast pastures and clusters of old birch trees. The thermic inversion phenomenon is made evident by the beech forest distribution, which go down so far as the thalweg of the wet and cold valleys in some areas. (Danciu, 1974).

The pedogenetical processes and soils characteristic to the forest site of the Baraolt and Bodoc Mountains

The pedogenetical factors, which show a large variability, favoured the manifestation of the pedological processes which have generated a relatively large diversity of soils in the Bodoc and Baraolt Mountains forestry sites.

The largest spread pedogenetical process in the forests of the Baraolt and Bodoc Mountains is the formation of clays in situ along with the formation of the Bv horizon (cambic) of alteration.

Under conditions of wet climate and parent material made of flysch, there appears an intense alteration along with the formation of clayey minerals and iron oxides which give a rusty colour to the Bv horizon. At high altitudes and on parent materials which are low in calcic elements, districambosoils are formed.

At low altitudes in the mountainous area on parent materials which are rich in calcic elements such as marl-sandy flysch and chalky micro - conglomerates, eutricambosoils are formed. The two types of soils from the Cambosoils category occupy 6728, 6 hectares which represent about 54% of the total surface of the forestry site of the Baraolt and Bodoc Mountains.

The eutricambosoil has the biggest share in the production units II Sfantu Gheorghe and III Valea Crisului in the Talisoara Forest District as well as in the production unit III Bixad in the Sugas Forest District. Districambosoils occupy important surfaces in the Talisoara Forest District in all four production units. The pedogenetical conditions in the forest stand characteristic to the Baraolt and Bodoc Mountains favored the process of eluviation – illuviation which consists in the debazification of the adsorption complex, the dissipation of the clay and its migration in the crop in rotation condition in an inferior Bt horizon (argic). (Sparchez, 2011).

The accumulation of clay in the Bt horizon is accompanied by the iron oxides which give it a yellowish - reddish colour.

If above the Bt horizon an El horizon is not visible from a morphological point of view, then prelovosoils are formed and when an El or Ea horizon is visible, then typical or albic luvosoils are formed.

These two types of soils occupy 38% of the surface of the researched area, respectively 794, 4 hectares prelovosoils and 967, 5 hectares luvosoils. (Tarziu, 2004 et all).

Table 1

The ecopedological indexes of the researched soils

u.a., U.P., type, soil subtype Forest district	Horizon	Level (cm)	pH	Humus %	C / N	Bases exchange me/100 g sol	Hydrogen exchange me/100 g sol	Total exchange capacity me/100 g sol	Degree of base saturation(%) me %	Total N %	Fine sand ø = 2-0,2 mm %	Dust ø = 0,02-0,002 mm %	Clay ø□0,002 mm %	Texture
31 A, UP I Valcele, Typical Prelovosoil, Şugaş	Ao	0-20	5.18	2.4	10.69	7.2	9.2	16.4	43.90	0.13	-	-	-	-
	A/B	20-35	5.46	1.2	5.31	8.0	7.8	15.2	52.63	01.3	15,64	45,5	23,8	LP
	Bt	35-70	5.63	-	-	10.0	6.8	16.8	59.52	-	9,72	44,1	44,5	AP
35 G, UP II Sfantu Gheorghe, Luvosoil, Sugas	Ao	0-20	5,12	3,6	20,9	2,8	8,4	11,2	25,0	0,10	-	-	-	-
	El	20-35	5,54	-	-	13,6	8,0	21,6	62,96	-	23,75	33,95	39,3	LAP
	Bt	35-90	5,66	-	-	18,8	7,2	26,0	72,31	-	2,6	45,00	49,3	AP
	C	90-120	8,42	-	-	96,4	2,4	98,8	97,57	-	3,5	49,85	40,2	LAP
73 B, UP I Valcele, Typical Districambosoil, Sugas	Ao	0-20	4,99	3,84	18,5	3,6	8,0	11,6	31,03	0,12	-	-	-	-
	Bv_1	20-45	5,35	-	-	4,4	6,0	10,4	42,31	-	19,43	33,55	17,9	LP
	Bv_2	45-70	5,62	-	-	12,0	5,6	17,6	68,18	-	12,87	35,5	27,4	LP

Compartment unit 31 A is situated at 650 meters altitude, north – west exposure with an average slope of 28^0. The determined soil type is typical prelovosoil. The tested soil is formed on flysch marl sandstone, it has a silty loam texture in the A/B horizon and silty clay in the Bt horizon, granular structure in the Ao horizon and prismatic in the Bt horizon. It has a moderate-acid reaction and a base saturation higher than 53% in the Bt horizon. The soil is poor in humus and nitrogen. The soil has a medium trophicity so the existent 100 years old beechwood represents the 3^{rd} production class.

Compartment unit 35 G lies at 560 m altitude , north- east exposion with an average slope of 35^0. The determined soil type is typical luvosoil. The researched soil is formed of sandstone chalky, it presents a silty clayey loam texture in the El horizon and silty clay texture The researched soil is formed on sandstone chalky, it presents a silty clayey loam texture in the El horizon and silty clay texture in Bt. It has a crumbly structure in the Ao horizon, granular in El and angular blocky in Bt. It has a moderate- acid reaction in all the profiles. Because of the large edaphic volume, the moderate - acide reaction and a medium nitrogen content, it is very fertile for the beechwoods, in fact the stands in this experimental holding is 48 cm in medium diameter, 34 cm medium hight and it can be framed within the production class no 2.

Compartment unit 73B lies at 720 m altitude, north- west exposion with an average slpoe of 25^0. The determined soil type is typical districambosoil. The reasearched soil is formed on flysch marl, it presents a silty loam horizon in A/B and Bv, a granular structure in Ao and angular blocky in Bv. It has a moderate - acid reaction in all the profiles and a base

saturation lower than 53% in the Bv_1 horizon. The soil content is low in humus and very low in nitrogen and it has a medium trophicity so that the existent beechwood can be framed within the production class no 3.

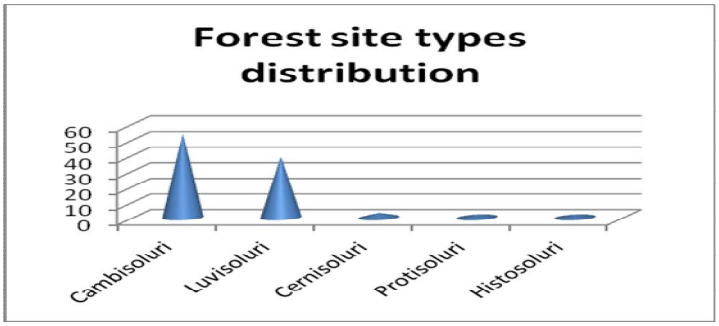

Figure 1: The forest site types distribution in the researched area

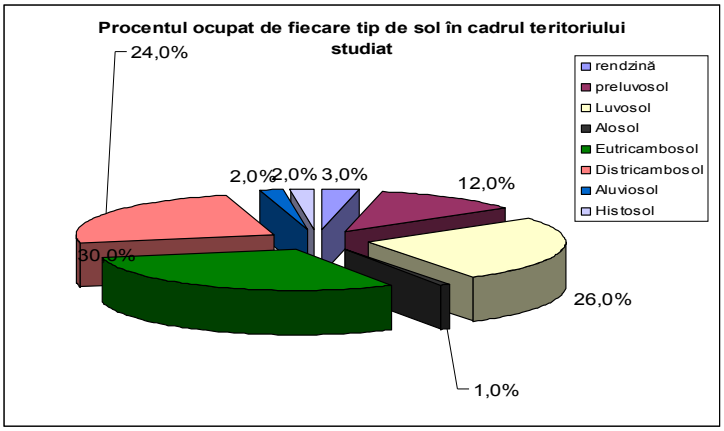

Figure 2: The soil distribution in the forest district characteristic to the Baraolt and Bodoc Mountains

CONCLUSIONS

The main pedogenetical process in the forestry sites of the Baraolt and Bodoc Mountains is the formation of clay in situ whose result is the formation of the Bv horizon (cambic) which is characteristic to eutricambosoils and districambosoils.

Another pedogenetical process is the eluviations – illuviation process which leads to the formation of the Bt horizon (argic) and, implicitly, of soils from the luvosoils category.

In the forest site in the Baraolt and Bodoc Mountains the most frequent types of soils are the cambisoils which are formed of eutricabosoils and districambosoils as well as the luvosoils which are formed of luvosoils and preluvosoils.

Within the researched area eutricambosoils represent 30% of the researched area, districambosoils 24%, preluvosoils 12% and luvosoils 26%.

From the soil samples tests table it is easy to notice the way in which clay moves from the superior horizons (A_0, E_l) and accumulates in the Bt horizon (argic).

There has been found a correlation between the edaphic volume of districambosoils and the production class of the beech stand.

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