

## RESEARCHES REGARDING THE MECHANICAL COMPOSITION IN DIFFERENT AREA OF THE FORMER BAUXITE QUARRY FROM ZECE HOTARE IN COMPARISON WITH LIMITROPHE BEECH TREE FOREST

Brejea Radu\*

\*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea;  
Romania, e-mail: rbrejea@yahoo.com

### Abstract

The paper based on the researches carried out in the Padurea Craiului Mountains in a skeletal calcareous preluvosol from beech tree (*Fagus silvatica*) forest and in the former bauxite quarry (erodosol argic decosol rhodic) and determined the following conclusions regarding mechanical composition: the coarse sand content on 0-60 cm depth in the profile from limitrophe beech tree (*Fagus silvatica*) forest was significant statistically bigger than the values determined in the profiles from former bauxite quarry only in comparison with the value determined in the profile from hillside (2,8 % vs 2,0 %); the sand (23,5 %) and the silt (35,2 %) determined in the profile (0-60 cm depth) from limitrophe beech tree (*Fagus silvatica*) forest are very significant bigger than the values determined in the profiles from former bauxite quarry. The smallest values of the sand (10,63 %) and silt (14,6 %) were registered in the profile situated on the hillside of the former bauxite quarry; the value of the colloid content determined on 0-60 cm depth of the profile situated in the limitrophe beech tree (*Fagus silvatica*) area is of 38,5 %, very significant statistically smaller than the values registered in the profiles from former bauxite quarry, 72,77 % on the hillside, 65,9 % on the low levelled area and 64,7 % on the high levelled area.

**Key words:** former bauxite quarry, mechanical composition, clay, sand, silt.

### INTRODUCTION

The clay determines the properties concerning the water absorbtion and changeble absorbtion, too the concerning adhesion, plasticity, shirnhage, swelling; in comparison with the other texture components, the clay influence is much more in the water keeping, cohesion and in the capacity to form the structure by aggregation. The sand properties is in oposite with the clay but offers a good permeability and aeration. The silt occupies a place between clay and sand regarding the size of the particles and the soil properties determined (Domuța C., 2006,2007; Drăgan Bularda M., 1983; Nițu I et al, 2000). There are big differences between the properties of the land from former bauxite quarries and the soil from limitrophe area (Brejea R., 2008). The amelioration methods can improve the phisical, chemical and biological indicators generally and in the former bauxite quarry, too (Sabău N.C., 2008, ȘAndor M., 2007, Samuel A., 1999,). The paper prevents the differences between mechanical composition in 3 points placed in low levelled area, high levelled area and side of the quarry in comparison with the soil from limitrophe beech tree forest.

### MATERIAL AND METHOD

The researches were carried in 2008 in a former bauxite quarry from Zece Hotare, in the Padurea Craiului Mountains. This mountain is situated in the Apuseni Mountains, between the Crisul Repede River and Crisul Negru River. The bauxite exploitation from Zece Hotare quarry was made on the surface. The bauxite from the Padurea Craiului Mountain has varied colours, from grey to dark brown, mostly dark red. The chemical

composition is following:  $\text{SiO}_2 = 4,2 \%$ ;  $\text{TiO}_2 = 2,5 \%$ ;  $\text{Al}_2\text{O}_3 = 58 \%$ ;  $\text{Fe}_2\text{O}_3 = 22,8 \%$ ;  $\text{H}_2\text{O} = 11,7 \%$ ; the bauxite has a medium quality, determined by the high content of  $\text{SiO}_2$ .

The exploitation of bauxite ended in 1998 and in 2004 and 2005 very large were started for setting up the levelling and acacia tree planting on the levelled area as well as spruce tree on the slope area.

The acacia and spruce tree saplings were planted at 1 m distance on every row, and at 2 m distance between rows. The holes had 40 x 40 x 40 cm in dimension, and 6.0 kg of manure was used for each hole. In order to ensure a high rate of plant development, right after being put into the ground they were watered with 16.0 l water each.

On the hillside of the quarry, mattress was made out of oak stakes and beech rods at 2 meters distance in order to prevent soil erosion.

In order to determine the mechanical properties of the soil from previous bauxite quarry at Zece Hotare and the properties of the soil from the limitrophe beech tree (*Fagus silvatica*) forest (682 m altitude), 4 soil profiles were placed on the levelled area, on the high area (667 m altitude), on the low area (665 m altitude), on the hillside with 10 % slope (672 m altitude) and in the beech tree (*Fagus silvatica*) forest at 50 m distance from the edge. The determinations took place in the laboratory of the Agricultural Research and Development Station Oradea using the Kacinski method.

The soil from the beech tree (*Fagus silvatica*) forest is a skeletic calcareous preluvosol and in the former bauxite quarry it is a erodosol argic decosol rhodic argic.

The experimental data was processed using the variation analysis method. (Ross D.J. et al., 1992)

## RESULTS AND DISCUSION

### COARSE SAND

In average on the studied average (0-60 cm) the biggest value of the coarse sand was registered in the limitrophe beech tree (*Fagus silvatica*) forest 2,8 %. In comparison with this profile in the profile from high levelled area of the former bauxite quarry the coarse sand is smaller with 26 %, but the difference is insignificant statistically; the values registered in the profiles from low levelled area (2,38 %) and from the hillside of the former quarry (2,00) are significant smaller. In the all studied depths the sense of differences registered for every depth of the profiles from former bauxite quarry in comparison with limitrophe beech tree forest is the same like in average on the 0-60 cm depth (table 1).

Table 1

Coarse sand (>2,0 mm) in the land from different area of the former bauxite quarry from Zece Hotare in comparison with soil from limitrophe beech tree forest

Location	Depth - cm								Average 0-60 cm	
	0-17		17-30		30-40		40-60			
	Value									
	%	%	%	%	%	%	%	%	%	%
Profile 1	3,3	100	3,3	100	2,4	100	2,3	100	2,8	100
Profile 2	2,3	70	2,2	67	2,0	83	1,8	78	2,1	74
Profile 3	2,9	88	2,8	85	2,0	83	1,8	78	2,38	85
Profile 4	2,2	67	2,1	64	1,9	79	1,8	78	2,00	71

profile 1 – limitrophe beech tree (*Fagus silvatica*) forest DL<sub>5%</sub> 0,75

profile 2 – high levelled area from former bauxite quarry DL<sub>1%</sub> 1,46

profile 3 – low levelled area from former bauxite quarry DL<sub>0,1%</sub> 3,50

profile 4 – hillside area from former bauxite quarry

## SAND

The biggest content of sand determined on 0-60 cm was registered in the profile from limitrophe beech tree (*Fagus silvatica*) forest, 23,5 %. In the profiles from former bauxite quarry the sand content is very significant smaller, 13,4 % in the high levelled area, 12,5 % in the low levelled area and 10,63 % on the hillside; the relative differences are of 43 %, 47 % and of 55 %. The differences registered on the every depth of the profiles from former bauxite quarry have the same sense like the differences registered on the all depth (0-60 cm) of the profiles. (table 2)

Table 2

Sand (2,0-0,2 mm) in the land from different area of the former bauxite quarry from Zece Hotare in comparison with soil from limitrophe beech tree forest

Location	Depth - cm								Average 0-60 cm	
	0-17		17-30		30-40		40-60			
	Value									
	%	%	%	%	%	%	%	%	%	%
Profile 1	28,1	100	25,9	100	21,8	100	18,1	100	23,5	100
Profile 2	12,6	45	13,0	50	13,7	63	14,4	80	13,4	57
Profile 3	11,9	42	11,5	44	12,6	58	14,0	77	12,5	53
Profile 4	11,3	40	10,9	42	10,2	47	10,1	56	10,63	45

profile 1 – limitrophe beech tree (*Fagus silvatica*) forest DL<sub>5%</sub> 1,30

profile 2 – high levelled area from former bauxite quarry DL<sub>1%</sub> 2,96

profile 3 – low levelled area from former bauxite quarry DL<sub>0,1%</sub> 5,12

profile 4 – hillside area from former bauxite quarry

## SILT

The biggest content of the silt on the 0-60 cm depth, 35,2 %, was registered in the limitrophe beech tree (*Fagus silvatica*) forest. In comparison with this profile, the values registered in the profiles from former bauxite quarry are smaller, very significant statistically; the smallest value 14,6 %, was registered in the profile situated on the hillside; 19,8 % was registered in the high levelled area and 19,22 % was registered in the low levelled area of the former bauxite quarry. The differences registered on the every depth studied have the same sense like the differences from 0-60 cm depth. (table 3)

Table 3

Silt (0,02-0,002 mm) in the land from different area of the former bauxite quarry from Zece Hotare in comparison with soil from limitrophe beech tree forest

Location	Depth - cm								Average 0-60 cm	
	0-17		17-30		30-40		40-60			
	Value									
	%	%	%	%	%	%	%	%	%	%
Profile 1	33,9	100	32,7	100	32,7	100	41,3	100	35,2	100
Profile 2	19,5	58	22,9	70	21,1	65	15,7	38,0	19,8	56
Profile 3	19,8	58	21,5	66	20,6	63	15,0	36,0	19,22	55
Profile 4	15,6	46	14,9	46	14,7	45	13,2	32,0	14,6	41

profile 1 – limitrophe beech tree (*Fagus silvatica*) forest DL<sub>5%</sub> 2,12

profile 2 – high levelled area from former bauxite quarry DL<sub>1%</sub> 3,76

profile 3 – low levelled area from former bauxite quarry DL<sub>0,1%</sub> 6,12

profile 4 – hillside area from former bauxite quarry

## COLLOID CLAY

In the profile from limitrophe beech tree (*Fagus silvatica*) forest was registered the smallest colloid clay content, 38,5 %. The values determined in the profiles from former bauxite quarry are very significant bigger, 72,77 % on the hillside, 65,9 % in the profile from low levelled area and 64,7 % in the profile from high levelled area. The relative differences are of 89 %, 71 % and 68 %. On the depths of the profiles, the biggest differences are registered on 0-17 cm depth: 104 % in the profile from hillside, 89 % in the profile from high levelled area and 88 % in the profile from low levelled area. (table 4)

Table 4

Colloid clay ( $< 0,002$  mm) in the land from different area of the former bauxite quarry from Zece Hotare in comparison with soil from limitrophe beech tree forest

Location	Depth - cm								Average 0-60 cm	
	0-17		17-30		30-40		40-60			
	Value									
	%	%	%	%	%	%	%	%	%	%
Profile 1	34,7	100	42,6	100	39,0	100	38,3	100	38,5	100
Profile 2	65,6	189	61,5	144	63,2	162	68,5	179	64,7	168
Profile 3	65,4	188	64,2	151	64,8	166	69,8	182	65,9	171
Profile 4	70,9	204	72,4	170	73,4	188	74,4	194	72,77	189

profile 1 – limitrophe beech tree (*Fagus silvatica*) forest DL<sub>5%</sub> 3,10

profile 2 – high levelled area from former bauxite quarry DL<sub>1%</sub> 4,36

profile 3 – low levelled area from former bauxite quarry DL<sub>0,1%</sub> 7,08

profile 4 – hillside area from former bauxite quarry

## CONCLUSION

The researches carried out in the Padurea Craiului Mountains in a skeletal calcareous preluvosol from beech tree (*Fagus silvatica*) forest and in the former bauxite quarry (erodosol argic decosol rhodic) and determined the following conclusions regarding mechanical composition:

- the coarse sand content on 0-60 cm depth in the profile from limitrophe beech tree (*Fagus silvatica*) forest was significant statistically bigger than the values determined in the profiles from former bauxite quarry only in comparison with the value determined in the profile from hillside (2,8 % vs 2,0 %);
- the sand (23,5 %) and the silt (35,2 %) determined in the profile (0-60 cm depth) from limitrophe beech tree (*Fagus silvatica*) forest are very significant bigger than the values determined in the profiles from former bauxite quarry. The smallest values of the sand (10,63 %) and silt (14,6 %) were registered in the profile situated on the hillside of the former bauxite quarry;
- the value of the colloid content determined on 0-60 cm depth of the profile situated in the limitrophe beech tree (*Fagus silvatica*) area is of 38,5 %, very significant statistically smaller than the values registered in the profiles from former bauxite quarry, 72,77 % on the hillside, 65,9 % on the low levelled area and 64,7 % on the high levelled area.

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