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STRUCTURE OF SOIL COVER ON DOLOMITES OF SAMOBOR AND ŽUMBERAK HILLS

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Soil on the dolomites of Samobor and Žumberak hills developed as a consequence of interaction of specific pedogenetic factors. The zone of saccharoidal Triassic dolomites is characterized by heavily dissected relief with tent-like crests with steep sloping sides and cut in "V"-shaped valleys, displaying a great density of valley network. Dolomite parent rock is poorly permeable with a shallow, fairly uniform zone of physical weathering into dolomite gravel, which results in a dominance of calcareous skeletal rendzinas on dolomite.

Introduction

The area of crystalline Triassic dolomites of Samobor and Žumberak Hills was systematically, pedologically mapped to scale 1:50000 during the production of the Basic Pedological Map of the Republic of Croatia (Kovačević et al. 1969, 1972; Kalinić et al. 1969; Mayer 1978, 1984). The forest-management unit "Plešivica" was mapped in more detail to scale 1: 10000, on the south-eastern part of Samobor and Žumberak Hills along the line Okić-Plešivica-Žitnica-Slavetić. The area is approximately 14 km long and 4 km wide, and refers only to a forest area totaling 1800 ha, of which 3/4 are located on the Triassic dolomites (Mayer et al. 1978). By means of these soil inventories extensive cartographic and analytic documentation has been collected, and

knowledge has been expanded to include the evolution, genesis, properties and distribution of soils on the crystalline Triassic dolomites of this area. Dolomites are the most widely represented lithologic member in the Samobor and Žumberak Hills. They are surrounded by Neogene marls, Mesozoic limestones with chert Paleozoic clastics and clastics from Cretaceous flysch with clayey limestones (Herak 1968, Šikić et. al. 1972). The most homogeneous dolomite zone is located around the Kupčina river basin in the west-southwest and the Bregana stream in the north-east. The relief is characteristically heavily dissected. Tent-like crests alternate with deeply cut "V"-shaped valleys at height differences of 200 to 400 meters. Morphostructure shows great density of valley network at 5-8 km^2 (Klein 1970) which is in connection with a poorly permeable, but physically on the surface easily weathering dolomite rock.

These dolomites mostly lack Karst phenomena, such as pockets and limestone cracks (rillenkaren), due to the fairly uniform surface weathering of rock, so that the depth of soil is also uniform on larger areas. Rockiness is rare and low, as well as stoniness, with the exception of very steep eroded sections of slopes. Increased erodibility of crystalline dolomites made possible deep scouring of rocky masses in the geological past in the same initial denudative basis, of which only scattered plateaus on crests remained. Climate is characterized by an average annual temperature of between 8° and 10° C and an average amount of annual precipitation between 1100 and 1250 mm. The highest precipitation occurs in June and October, and the lowest in March. The most important of the pedogenetic factors described are the parent dolomite rock and relief. This combination resulted in a distinct distribution of material and energy which is correlated to the inclination and exposition, having an essential effect on the soil cover structure, and with this on the composition of plant communities which followed. Apart from the influence of the aforementioned, the anthropogenic effect, which has been demonstrated in the recent past by the felling and devastation of forest, exploitation of pasture land and extensive agricultural production, is also important. The widely most represented plant communities are *Lamio orvalae-Fagetum* (Ht. 1938) Borhidi 1963 on the shady (not facing sun) slopes and deeper soils, and *Querco-Ostryetum carpinifoliae* Ht. 1938 on the sunny slopes and shallow soils (ef. Rauš et al. 1992).

Methods

In the process of mapping the Basic Pedological Map of Croatia to scale 1:50000 standard methods of field and laboratory investigations were applied (Kovačević and Jakšić 1964; Group of authors in 1967; Popovski and Racz 1975; Bogunović 1994). By the loop method the terrain was covered by a network of 4-9 pedological observations on 400 ha. For analyses of soil structure theoretical bases by Fridland (1972) were respected and worked out for our conditions in studies carried out by Ćirić (1975, 1982), Marti-

Tab. 1 RESULTS OF CHEMICAL AND MECHANICAL SOIL ANALYSES OF CHARACTERISTIC PEDOTAXONS UNDER VEGETATION OF SAMOBOR AND ŽUMBERAK HILLS

No. profile	Location, topografic section or compartment exposition	Depth of sample	Character code of sample	$CaCO_3$	pH		P_2O_5	K_2O	Humus	Total N %	C : N	Mechanical composition of soil determined in Na-pyrophosphate				
					H_2O	n-KCL	mg/100 gr. Al metoda		%			2.0-0.2	0.2-0.02	0.02-0.002	< 0.002	Texture category
												mm				
Rendzina on dolomite calcareous shallow																
0640	Plešivica, SZ, 29	0-15/20	Amo	30.9	7.5	7.1	3.8	17.3	24.4	1.10	13.2	4.4	46.2	25.7	23.7	Clayey loam
0686	Ivančići; J, 22	0-10	Amo	12.2	7.7	7.3	2.5	34.2	15.8	0.75	12.2	3.9	28.3	33.9	33.9	Light clay
0706	Japetić, J, 15	0-20	Amo	58.1	7.7	7.3	0.3	9.6	8.8	0.50	10.2	2.2	58.7	21.2	17.9	Clayey loam
19/73	Tihočaj, J, 6	0-10/20	Amo	39.0	7.6	7.1	0.9	12.0	11.4	0.49	13.5	12.9	25.1	37	25	Light clay
.7/74	Puškar, JZ, 2	0-20	Amo	40.7	7.5	6.8	2.3	17.3	12.7	0.70	10.6	4.7	46.9	27.8	20.6	Clayey loam
Rendzina on dolomite calcareous medium deep																
95	S3-D/2	0-35/40	Amo	6.9	7.7	7.3	3.3	7.6	8.5	0.49	10.0	7.6	65.9	14.0	12.7	Fine sandy loam
96	S3-F/2	0-40	Amo	68.0	7.6	7.3	1.8	5.8	12.5	0.58	12.6	25.6	22.8	27.4	13.2	Clay
0647/a	Tihočaj. SI, 28	0-35	Amo	67.6	7.6	7.2	4.1	6.9	8.9	0.56	9.3	7.9	59.8	15.9	16.4	Sandy clayey loam
0704	Japetić, S, 15	0-25	Amo	13.1	7.5	7.3	0.5	5.8	11.9	0.61	11.3	4.7	36.1	37.7	21.5	Clayey loam
		25-40	AC	55.4	7.8	7.4	0.3	3.6	6.8	0.32	12.2	23.4	29.9	31.2	15.5	Clayey loam
Calcocambisol on dolomite shallow and medium deep clayey																
0620	Plešivica, SI, 32	0-28	Amo	–	6.2	5.3	0.7	18.6	5.7	0.23	14.6	1.2	22.3	31.2	45.3	Heavy clay
		28-40	(B)rz	–	6.6	5.6	1.1	16.0	2.9	0.14	12.0	0.6	19.0	31.9	48.5	Heavy clay
0709	Japetić, I, 16	0-10	Amo	–	6.9	4.6	1.3	21.0	10.5	0.36	16.9	3.9	19.5	41.3	35.3	Light clay
		.10-30	(B)rz	–	6.7	5.2	0.3	9.5	3.3	0.15	12.7	2.5	13.5	28.3	55.7	Heavy clay
15/74	Goljak, SI, 4	0-20	Amo	–	6.3	5.1	0.6	9.9	3.8	0.17	12.9	0.7	19.7	37.5	42.1	Light clay
		20-50	(B)rz	–	6.3	5.1	1.7	11.3	2.7	0.12	13.3	0.4	16.3	34.3	49.0	Heavy clay
Luvisol on dolomite																
0646	Prekrižje, I, 28	0-8	Aoh	–	6.1	5.1	1.5	16.0	7.2	0.30	13.9	1.6	27.7	47.4	23.3	Silt clayey loam
		8-25/30	E	–	5.8	3.9	0	3.5	3.0	0.13	13.1	0.7	29.0	47.5	22.8	Silt clayey loam
		30-70	Bt	–	6.4	4.7	3.6	9.5	–	–	–	0.6	11.7	17.0	70.7	Heavy clay
0710	Japetić, I, 16	0-10	Aoh	–	5.2	3.8	1.8	12.2	8.5	0.33	14.9	3.6	32.0	42.1	22.3	Clayey loam
		10-40	E	–	5.1	3.8	0.6	3	–	–	–	3.4	20.1	46.8	29.7	Silt clay
		40-90	Bt	–	6.1	4.6	1.2	9.2	–	–	–	1.5	11.7	20.3	66.5	Heavy clay
17/73	Tihočaj, plateau 6	0-3	Aoh	–	4.4	3.3	5.7	17.8	16.3	0.50	19.0	–	–	–	–	–
		.3-30	E	–	4.9	3.7	0.8	3.2	2.4	0.09	15.5	0.6	30.6	44.8	24.0	Clayey loam
		30-60	Bt	–	5.1	3.8	0.4	5.4	–	–	–	0.2	27.2	38.7	33.9	Light clay
Terra rossa, Luvic																
118	S3-D/10	0-15	ApE	–	5.0	3.6	3.6	7.3	3.0	0.1	17.0	0.5	24.7	48.2	26.6	Silt clay
	Deserted plough-filed	15-65	(B)rz	–	4.7	3.6	0.5	14.2	4.6	0.15	18.0	0.8	10.4	20.0	68.8	Heavy clay
Colluvial calcareous skeletal and skeletoidal (less skeletal)																
0654	Vranadol,	0-10	A	11.6	7.5	6.3	2.3	13.9	7.7	0.37	13.4	4.0	26.8	33.3	35.9	Light clay
	depression, 26	.10-45	II	2.8	7.4	6.3	3.0	8.3	2.8	0.12	13.4	0.5	21.7	39.9	37.9	Light clay
		45-110	III	17.2	8.2	7.6	–	–	–	–	–	21.3	49.6	15.3	13.8	Fine sandy loam
12/74	Goljak,	0.30	A	37.2	7.9	7.2	3.1	11.6	5.5	0.30	10.6	4.0	49.5	25.4	21.1	Clayey loam
	depression, 26	30-53	II	60.5	8	7.4	2.2	5.4	0.9	0.06	8.3	13.3	60.0	12.1	14.6	Fine sandy loam
		53-80	III	44.7	7.6	6.8	8.3	6.6	5.7	0.27	12.2	13	39.7	26.0	21.3	Clayey loam
Rendzina on dolomite anthropogenized																
87	Jarušje,	0-25	Ap	28.4	7.7	7.0	25.3	63.0	7.9	0.40	12.4	7.8	26.5	25.3	40.4	Light clay
	plough-field	25-50	P	4.4	7.9	6.7	0.3	9.8	4.5	0.21	12.3	1.1	22.7	31.7	44.5	Light clay
	SI-J/13	50-75	A/C	3.5	7.3	6.5	2.2	12.6	–	–	–	0.3	14.4	21.5	63.8	Heavy clay
Calcocambisol on dolomite anthropogenized																
97	Hartje, plough-filed	0-21	Ap	41.6	7.7	7.1	3.0	22.8	5.9	0.28	12.2	2.1	26.4	36.2	35.3	Light clay
	S1-E/14	21-68	(B)rz	4.9	7.6	6.9	0.8	10.5	1.8	0.12	8.3	0.8	10.8	10.1	7.8	Heavy clay

Remark: Profiles 87, 95, 96, 97 can be found in pedological maps (OPK – Basic Pedological Map) Sections Samobor 1 and 3. others from the study on "Plešivica"

nović and Čolak (1975), Mayer and Rastovski (1982), Mayer (1987), Vrbek (1990, 1991) and Bogunović (1994). Every pedotaxonomic unit is analytically documented with one or more characteristic pedological profile. Apart from standard methods and procedures, specific qualities of each area were analyzed, which, on the dolomites, involved the recording of the soil cover structure by means of a pedogeotransect, detailed mapping of representative areas affected by excessive erosion, and determination of the degree of anthropogenization of arable areas (Mayer 1984). In the case of detailed pedological mapping of the Forest Management Unit "Plešivica", 131 profiles were analytically cut by the loop method, which surpasses all standards as one analyzed profile is taken on 14 ha. Consequently these cartographic materials are an especially valuable support of this paper.

Results

List and description of pedotaxons

The most widely represented pedotaxons on the Triassic dolomites of Samobor and Žumberak Hills are classed according to the classification of Škorić et al. (1985):

- Rendzina on dolomite calcareous shallow (depth up to 20 cm)
- Rendzina on dolomite calcareous medium deep (20-40 cm)
- Calcocambisol on dolomite shallow (depth up to 35 cm)
- Calcocambisol on dolomite medium deep (35-50 cm)
- Luvisol on dolomite
- Terra rossa luvic
- Colluvial calcareous skeletal
- Rendzina on dolomite anthropogenized
- Calcocambisol on dolomite anthropogenized

Table 1 presents a summary of the chemical properties and mechanical composition of soil samples from characteristic pedological profiles.

A sequence of horizons Ol-Amo-AC (or CR) -R under forest cover is characteristic of rendzinas on dolomite. The content of $CaCO_3$ is variable and often exceeds 50%, pH is weakly alkaline and textual composition changes from light clay to sandy clayey loam. The content of humus is very high and often exceeds 10%, physiologically active phosphorus is low, and physiologically active potassium is in quantities of rich supply. Rendzinas contain a finer sharp-edged skeletal of dolomite weathered material of gravel class (0,2-7,5 cm) because of which they are permeable to parent rock along which seepage water runs down the slope. In this way the surface water flow and the possibility of water erosion are considerably decreased. Forest productivity deepens on the ecological depth of the profile and the content of moisture in soil and therefore the shady (not facing the sun) slopes are exponents of high productivity for the beech. Calcocambisol on dolomite of Ol-Amo-(B)rz-C/R

horizon sequence is a non-calcareous soil of neutral to low acid. Physiologically active phosphorus is present in traces, and with physiologically active potassium the soil is richly supplied. The content of humus in Amo horizon frequently ranges from 5-10%. In the textural composition light and heavy clays prevail. Depending on the position in the relief and exposition of the slope these soils can contain considerable amounts of moisture and with it can achieve medium productivity for forest trees. Luvisol on dolomite under forest displays the stratigraphy of Ol-Aoh-E-Bt or IIBt-C/R horizon. IIBt indicates its two-layered characteristic in many cases when the upper part of the profile (Aoh-E) is of considerably lighter loamy mechanical composition which indicates loess-like material. IIBt is in fact a covered (B)rz cambic horizon formed by accumulation of insoluble remains of rock. These deep, cool, soils are of greater imperviousness, low acid and neutral pH in Bt horizon in contact with rock, and display high productivity especially in the depressions and shady (not facing the sun) slopes. In places they are found on gently rounded hill tops and plateaus on which terra rossa is also locally present being luvic and to a great extent analogous to luvisols by its physiographic and productive properties. This terra rossa was found in Slovenia near Grosuplje (Gregorič 1969) as "rdeče kraške ilovice", analytically related to the terra rossa from the continental area of the Dinarids.

Colluvial soils are positioned on the bottom of stream valleys and lateral depressions. They are skeletal especially on the cones of dolomite rock detritus. Their productivity depends on the content of gravel and fine soil and humus, as they are well supplied with moisture. Antropogenized rendzinas and calcocambisols are widespread on the flat surfaces of crests - remains of dissected flat ground. They are carriers of extensive agricultural production. In relation to the original soil type, the soil was homogenized by the ploughing depth (20-25 cm) or even deep ploughing in rare vineyards (vitisols). Application of fertilizers raised the level of physiologically active phosphorus, but the current trend of abandonment of small holdings leads to decreased fertility.

Pedocartographic units in the structure of soil cover

On the semi-detailed OPK maps (Basic Pedological Map) to scale 1:50000, on the crystalline dolomites of Samobor and Žumberak Hills, the following pedocartographic units (soil combinations) were selected:

Section SAMOBOR 2 (Kalinić et al. 1969)
- Rendzina and cambisols on dolomites (under forest and grassland)
- Cambisols and rendzinas on hard limestones and dolomites (arable surface)

For any these units there is no degree af heterogeneity (%).

Section SAMOBOR 4 (Kovačević et al. 1969)
- Rendzina and cambisol on dolomites

There is no designation of degree of heterogeneity.

Section SAMOBOR 1 and 3 and NOVO MESTO 2 and 4 (Mayer 1978, 1984)

- Rendzina-luvisol-calcocambisol on dolomite (65:25:10%) under forest and grasslands
- Calcocambisol anthropogenized-rendzina anthropogenized-vineyard soils (vitisols), on dolomite (50:30:20%), for arable surfaces on flattened crests.
- Fluvial-colluvial calcareous soils on depressions.

Within the framework of these investigations, in the Section Samobor I, quadrant J-10/11, pedological drawing of profiles was carried out for the purpose of recording the structure of soil cover in a cross-section from a very narrow valley over the ridge af the horizon preserved under forest, in the direction south-southeast-north-northwest, especially with the inclusion of pedotaxons on particular inclination classes. Total cross section: Rendzina on dolomite 65%, luvisol 25%, calcocambisol 10%. Northern slope: upper part of the slope; 20-25° inclination, shallow and medium deep rendzina 50% middle of the slope; 20° inclination, calcocambisol medium deep 15% bottom third of the slope; 20-25° inclination, luvisol 35%. Southern part of the slope ends in a very narrow valley, like a "V" shape; upper third of the slope; 45° inclination, rendzina shallow 45 % middle of the slope; 30-35° inclination, calcocambisol shallow, medium deep 15%, bottom third of the slope; 45-50° rendzina medium deep and deep 40%. On the places of excessive erosion on the southern slopes, beside the Kupčina stream, shallow rendzinas, lithosols and regosols, prevail (Mayer 1984). These places are alongside extended valleys in which settlements are located.

An estimate of erosion intensity on the soils above dolomites of the Žumberak-Plešivica part of the Kupčina river basin (Mayer 1988) is given in Table 2.

Table 2. Coefficients and categories of erosion on the soils above dolomites of Žumberak and Plešivica

Land use	Medium inclination degrees	Form of erosion	Coefficient of erosion	Category of erosion	Intensity of erosion process
Non-agricultural	30	1.50	1.60	I_1	excessive
Forest	30	0.30	0.30	IV_2	weak

The detailed pedological map of the Forest management Unit "Plešivica" to scale 1:10000 shows separate cartographic units on dolomite in Table 3, with basic elements of soil cover structure.

Discussion

From the description of pedotaxons and cartographic units it can be concluded that the parent material and relief are the central factors of the formation of soils on crystalline dolomits of Samobor and Žumberak Hills.

Analyzed pedocartographic materials give an insight into the structure of soil cover which is shown by a smaller scale 1:50000 and a larger scale 1:10000. Rendzinas on dolomites are a dominant pedotaxon. Shallow rendzinas of steep sunny slopes display a very modest forest production capacity, and in this respect a more moist ecological variety of the shady (not facing sun) slopes is more promising, including here the two lower thirds of the cut-in southern slopes with management stands of beech. Detailed pedological mapping has shown that significant areas with luvisols exist with a high production capacity, especially so on the shady (not facing sun) slopes and in depressions. A detailed and semi-detailed mapping showed something that has been separately recorded, namely because the dolomite zone in Samobor and Žumberak Hills is not entirely compact, in places it is interrupted by classic rocks of Cretaceous flysch (shales).

At the time when the aforementioned pedological maps were produced, i.e. in the seventies, it was established, by analyzing the aerial photographs, that the places of furrow-shaped scouring and dredge like erosion cover approximately 5% of the surface on the dolomites. Today, in the nineties, these surfaces have been further diminished in the first place due to the depopulation and deagrarization, and also due to successful biological remediation by planting Austrian Pine and Scotch Pine. Further investigations should analyze pedological-vegetational pairs, as advocated by Rauš (1994), and pedological-relief pairs by methods which were applied in the investigations of the soil cover structure at Macelj Hills, carried out by Vrbek (1990, 1992), as we are dealing with the matter of very similar geomorphological forms but on some other parent rock, i. e. sandstones.

Investigation results achieved by Komlenović et al. (1994) are interesting and important for the area of Japetić and Žitnica as they present the contents of heavy metals Pb, Zn and Cu in the surface layer of soil, range within natural values, although the highlands under consideration in other parts of Croatia are heavily exposed to the above mentioned pollutants from distant emissions, by dry and wet depositions.

Conclusions

The structure of soil cover of Samobor and Žumberak Hills is dominated by rendzinas on dolomite calcareous, shallow and medium deep. To a lesser degree calcocambisols shallow and medium deep, luvisols and colluvial soils are found.

Tab. 3. BASIC INDICATORS OF THE STRUCTURE OF SOIL COVER ON THE CHRYSTALLINE TRIASSIC DOLOMITES OF SAMOBOR AND ŽUMBERAK HILLS GIVEN IN THE DETAILED PEDOLOGICAL MAP OF THE FOREST MANAGEMENT UNIT "PLEŠIVICA" TO SCALE 1 : 10 000 (Mayer at al. 1978)

	PEDOSEQUENCE				LITHOSEQUENCE			TOPOSEQUENCE		PHYTOSEQUENCE				
No. of cartogr. ph. unit	NAME AND COMPOSITION OF CARTOG. UNIT OR SOIL COMBINATION WITH TYPE OF STRUCTURE AND LEADING FACTOR OF FORMATION	INDICATORS OF HETERO-GENEITY (ZK) %	PRO-DUCTI-VITY CON-TRAST (TZK)	CHARAC-TERISTIC SIZES OF ELEMEN AREAL OF SOIL (EAT)	TYPE OF PARENT MATERIAL	ROCKI-NESS %	STOI-NESS %	INCLINA TION DEG-REES	GEOMOR-PHOLOGY	FOREST VEGETATION*	CANOPY %	AVERAGE PEDOCLIMA TE	DOMINANT FORM OF EROSION	PRIMARY LAND USE
1	SEQUENCE LITHO-TOPOG. OF LITHOSOL OF REGOSOL OF SHALLOW RENDZINA	50 30 20	Small	Several sq. m.	Parent material of chrystaline dolomite sand and gravel	5-10	20-70	20-50	Eroted crests and southern very steep slopes	Low vegetation and shrubs in groups	0	Very dry	Larger places of rapid scoured and dredge-like erosion	Protection forest vegetation
2	TASCHETA LITHO-TOPOG. OF SHALLOW RENDZINA OF MEDIUM DEEP RENDZ. OF CALCOCAMBISOL SHALLOW	50 30 20	High	Several sq. m. up to tens of sq. m.	the same	1-2	0-5	10-45	Predominantly crests and sunny slopes	Interrupted-canopy thermophilic forest communities with Pubescent Oak Flowering Ash and Bitter Oak	60-80	Dry	Scoured alongside paths and tracks	Protection forest vegetation
3	SEQUENCE LITHO-TOPOG. OF MEDIUM DEEP RENDZ. OF CALCOCMB. MED. DEEP OF LUVISOL	60 30 10	Medium	Several sq. m. up 10 sq. m. / 10sq.m.>ha	the same	1-2	0-5	20-40	Cool slopes and depressions, bottom thirds of sunny slopes of "V" valle.	Beech stands	90-100	Fresh and moist	Normal surface erosion	Management forests
4	SEQU. & MOSAIC LITHO-TOP OF CALCOCMB. MED. DEEP OF MED. DEEP RENDZINA OF LUVISOL	70 20 10	Medium	Several sq. m. up to a few ha	the same	1-2	0-5	0-20	Rounded hill-tops (crests), plateaus of small inclination	Forest of Sessile Oak and Bitter Oak	80-90	Less fresh to fresh	Normal surface and less scoured	Possible management forests
7	HOMOGENOUS CARTO-GRAPHIC UNIT LUVISOL	–	–	Homogeneous cartographic unit	the same	0	0	0-25	Wider plateaus, depressions of smaller inclination, predominantly cool slop.	Forest of Beech Sessile Oak and Bitter Oak	90-100	Fresh and less moist	The same	Management forest
11	HOMOGENOUS CARTO-GRAPHIC UNIT COLLUVIAL CALCAREOUS SKELETAL	–	–	Elongated linear	Skeletal deposit of parent material of dolomite	0	10-20	2-15	Bottoms of depresions and lateral cones of rock derritus	Smaller groups of European Black Alder and Willow	–	Moist and wet	Frequent torrential flows and resettling of deposits	Possible exploitation of wood Grassland for recreation

* Exact vegetational investigations have not yet been performed

The leading factors in the formation of soils are the parent dolomite rock and its weathering material, including very heavily dissected relief, which redistributes material and energy. For this reason, on the steep sunny slopes in most cases shallow rendzinas, shallow calcocambisols and lithosols, are represented. In the bottom thirds of narrow moist depression deep rendzinas prevail on various expositions. On shallow soils forest production is low. They are covered by plant community *Querco-Ostryetum carpinifoliae* Ht. 1938.

On the shady (not facing the sun) deeper and cool soils prevail with medium depth rendzinas, calcocambisols medium deep and deep on which management forest of beech *Lamio orvalae-Fagetum* (Ht. 1938) Borhidi 1963 grows well.

Skeletal colluvial soils are found in narrow stream valleys and on lateral cones of rock detritus created by the process of accumulation of dolomite weathering material.

Soil combinations are mainly of a sequential type and consist of two to three pedotaxons. Homogeneous cartographic units cover larger areas of luvisol on detailed maps, including colluvials as well, although their internal properties are rather variable depending on their structure, amount of deposit and sedimentation of material. Further investigations should be directed to correlated pedological-vegetational and pedological-relief sequences.

References

Bogunović, M., 1994: Pedološko kartiranje. Skripta, Agronomski fakultet u Zagrebu, 1-87.

Borhidi, A., 1963: Die Zönologie des Verbandes *Fagion Illyricum*. 1. Allgemeiner Teil. Acta Bot. Acad. Sci. Hung. *9*, 259-297.

Ćirić, M., 1975: Iskorišćivanje i interpretacija pedoloških karata u šumarstvu. Akad. nauka i umj. BiH. Posebna izdanja 27, Odjeljenje prirodnih i matematičkih nauka *6*, 29-46.

Ćirić M., 1982: Iskustva i perspektive u primjeni teorije o strukturi zemljišnog pokrivača u pedokartografiji. Akad. nauka i umj. BiH. Posebna izdanja 62, Odjeljenje prirodnih i matematičkih nauka *10*, 5-16.

Fridland, V.M., 1972: Struktura počvenoga pokrova. Misl., 6-99, Moskva.

Gregorič, V., 1969: Nastanak tal na triadnih dolomitih. Geologija, Rasprave in poročila, knjiga *12*, Ljubljana.

Herak, M., 1968: Noviji rezultati istraživanja osnovnih stratigrafskih jedinica u Žumberku. Geol. vjesnik *21*, 111-116.

Kalinić, M., P. Kovačević, V. Pavlić, D. Stepančić, A. Stritar, B. Radman, B. Mayer, 1969: Pedološka karta sekcije Samobor 2. 1:50000, Osnovna pedološka karta Hrvatske, Zagreb.

Klein, V., 1970: Die Ergebnisse einer vorläufigen Analyse der das Talnetzes der Morphostruktur Žumberak. Bull. Scient. Sect. A, *15*, 7-8.

Komlenović, N., B. Mayer, P. Rastovski, 1994: Sadržaj teških kovina u tlima Jastrebarskog. Rad. Šumar.inst. Jastrebar. *29* (1), 111-121.

Kovačević, P., V. Jakšić, 1964: Priručnik za terenska pedološka istraživanja, Sarajevo.

Kovačević, P., M. Kalinić, V. Pavlić, M. Bogunović, I. Tomaš, 1969: Pedološka karta sekcije Samobor 4. 1:50.000, Osnovna pedološka karta Hrvatske, Zagreb.

Kovačević,P., M. Kalinić, V. Pavlić, M. Bogunović, 1972: Tla Gornje Posavine. Institut za pedologiju i tehnologiju tla, 182-183; 283-284, Zagreb.

Martinović, J., A. Čolak, 1975: Prilog poznavanju zemljišnih kombinacija vanjskih Dinarida. Akad. nauka i umj. BiH. Posebna izdanja 27, Odjeljenje prirodnih i matematičkih nauka *6*, 47-59.

Mayer, B. 1978: Pedološka karta sekcije Samobor 3. 1:50.000, Osnovna pedološka karta Hrvatske, projektni Savjet za izradu OPK Hrvatske, Zagreb.

Mayer, B., 1984: Tla sekcije Samobor 1 i 2, Novo Mesto 2 i 4. Tumač Osnovne pedološke karte Hrvatske, Projektni Savjet za izradu OPK Hrvatske, Zagreb.

Mayer, B., 1987: Karakteriziranje heterogenih pedokartografskih jedinica Istre na osnovi teorije o strukturi zemljišnog pokrova. Pedosfera Istre, Projektni savjet za izradu OPK Hrvatske, 161-168, Zagreb.

Mayer, B., 1988: Procjena intenziteta erozije na glavnim pedosekvencama sliva Kupčine. Erozija *16*, 91-97.

Mayer, B., S. Orlić, A. Dokuš, N. Komlenović, 1978: Studija tala šumsko-gospodarske jedinice "Plešivica" kao podloga za utvrđivanje mogućnosti unapređenja šumske proizvodnje. Šumarski institut Jastrebarsko, 1-42.

Mayer,B., P. Rastovski, 1982: Testiranje teorije o strukturi zemljišnog pokrova u okviru dijela rada na Osnovnoj pedološkoj karti SR Hrvatske. Akad. nauka i umj. BiH, Posebna izdanja 27, Odjeljenje prirodnih i matematičkih nauka *10*, 27-38.

Popovski, D., Z. Racz, 1975: Standardizacija podataka pri izradi pedološke karte SFRJ. 1:50.000, Savjetovanje o pedokartografiji, Ohrid.

Šikić, K., O. Basch, A. Šimunić, 1972: Osnovna geološka karta SFRJ. List Zagreb, 1:100.000, Savezni geološki zavod.

Rauš, Đ., 1994: Primjena fitocenologije u šumarskoj praksi. Šum. list *118* (9-10), 289-294.

Rauš,D., I. Trinajstić, J. Vukelić, J. Medvedović, 1992: Biljni svijet hrvatskih šuma. In: Đ. Rauš, J. Dundović (ed): Šume u Hrvatskoj, 33-78, Zagreb.

Škorić, A., G. Filipovski, M. Ćirić, 1985: Klasifikacija zemljišta Jugoslavije. Akad. nauka i umj. BiH. Posebna izdanja 78, Odjeljenje prirodnih i matematičkih nauka *13*, 1-72.

Vrbek, B., 1990: Izradba pedološke karte 1:25.000, s posebnom ulogom nagiba u šumsko-gospodarskoj jedinici Macelj. Rad.-Šumar. inst. Jastrebar. *25* (2), 385-418.

Vrbek, B., 1991: Primjena karte nagiba terena kod izdvajanja formi distričnog kambisola na maceljskim pješčenjacima. Akad. nauka i umj. BiH. Posebna izdanja 98, Odjeljenje prirodnih i matematičkih nauka *15*, 301-311.

Grupa autora, 1967: Metodika terenskog ispitivanja zemljišta i izrada pedoloških karata. Priručnik za ispitivanje zemljišta, knjiga *4*, JDPZ.

SAŽETAK

STRUKTURA ZEMLJIŠNOG POKROVA NA DOLOMITIMA SAMOBORSKOG I ŽUMBERAČKOG GORJA

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Tla na dolomitima Samoborskog i Žumberačkog gorja razvila su se kao posljedica interakcije specifičnih pedogenetskih čimbenika. Vodeći čimbenici postanka tala jesu matična dolomitna stijena i njena trošina te jako disecirani reljef, koji preraspodjeljuje tvari i energiju. Zbog toga su na strmim prisojnim padinama većinom zastupljene plitke rendzine, plitki kalcikambisoli i litosoli. U donjim trećinama uskih vlažnih uvala prevladavaju duboke rendzine na raznim ekspozicijama. Skeletni koluviji nalaze se u uskim potočnim dolinama i na bočnim konusima sipara nastalih akumulacijom dolomitne trošine. Na prisojnim strmim i vrlo strmim pristrancima, pod šumom *Querco-Ostryetum carpinifoliae* Ht. 1938 i njenim degradacijskim stadijima, prevladava plitka karbonatna skeletna rendzina, plitki i srednje duboki kalcikambisol i litosol na erozijom zahvaćenim površinama. Na osojnim pristrancima, pod šumom *Lamio orvalae-Fagetum* (Ht. 1938) Borhidi 1963 u strukturi zemljišnog pokrova prevladava karbonatna skeletna srednje duboka rendzina na dolomitu, kalcikambisol i luvisol. Na užim zaravnima hrptova nalaze se travnjaci i oranice na karbonatnim plitkim i srednje dubokim antropogeniziranim rendzinama i kalcikambisolima s lokalnim nalazima reliktne crvenice. Zemljišne kombinacije većinom su tipa niza, a sastoje se od dva do tri pedotaksona. Homogene kartografske jedinice obuhvaćaju veće površine luvisola na detaljnim kartama a također i koluvije iako su njihova nutarnja svojstva jako varijabilna ovisno o sastavu, količini nanosa i vremenu sedimentacije materijala.

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