

HISTORICAL BANAT – LANDSCAPE AND SOIL EVOLUTION

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Abstract: Historical Banat is a region placed in the western part of Romania and has a total area of 28526 km², distributed as follows: 18966 km² (66,5%) for Romania, 9276 km² (32.5%) for Serbia, and 284 km² (<1%) for Hungary. The natural limits for Historical Banat are at the south the river Danube, at the north – Mures, at the eastern part a conventional line – Cerna – Godeanu – Tarcu and the Poiana Rusca Mountains, and on the western part the river Tisa. From the geological point of view, the Banat region belongs to the Pannonic Depression, formed in the Neozoic period. The Pannonic Lake will disappear at the end of Pleistocene period when the river Danube penetrates the Carpathian Arch. In a drilling pending 1.375 m depth at Giulvaz in the low plain, the deposits sequence reveals sediments from Levantine – Daciane and Pontiane periods, positioned on granodiorite. Beginning with the year 1718 ample hydrotechnics and land improvement works have been effectuated in these territories. In the year 1990, there are 473.000 ha with drainage in the Timis county, and more than 100 mill m.c spoil have resulted from the canals wich have a length of 13.000 km. Because the spoil is rich in salts and Na⁺, the soil cover is strongly gleyed and solonetzic. Consequently, the Hydric Soils represents 7.19 % (50.502 ha), and Solonets 6.05 % (42,495 ha). The ground water level has diminished after drainage with 1-3 m depth. At present, in the low plain there are only some wet places, like as the Murani Swamps, the Bird Reservation from Satchinez. There are presented in the paper the analytical data for two soil profiles of Gleysols (Satchinez) and Vertisols (Valcani)

Keywords: Pannonian, depression, drainage, Gleysols, Solonetz

1. INTRODUCTION

Historical Banat is a region placed in the western part of Romania and has a total area of 28.526 km², distributed as follows: Romania – 18.966 km² (66.5%), Serbia 9.276 km² (32.5%) and Hungary 284 km² (<1%).

The soil – landscape continuum develops in temperate regions in the glaciation period, which have eroded or buried existing soil and landscape.

Banat region belong to the Pannonic Depression, a tectonic unity which has been emerged during the Neozoic period, with 45 mill. years ago [9].

The most important transformations occurred in the Pontian – Pleistocene age, in which the Pannonic Lake disappear, drains by the River Danube [7].

After the tectonic movements from Pleistocene period, the Mediterranean climate favoured strong erosions, transport and sediment, making up table land, which later will be fragmented [2].

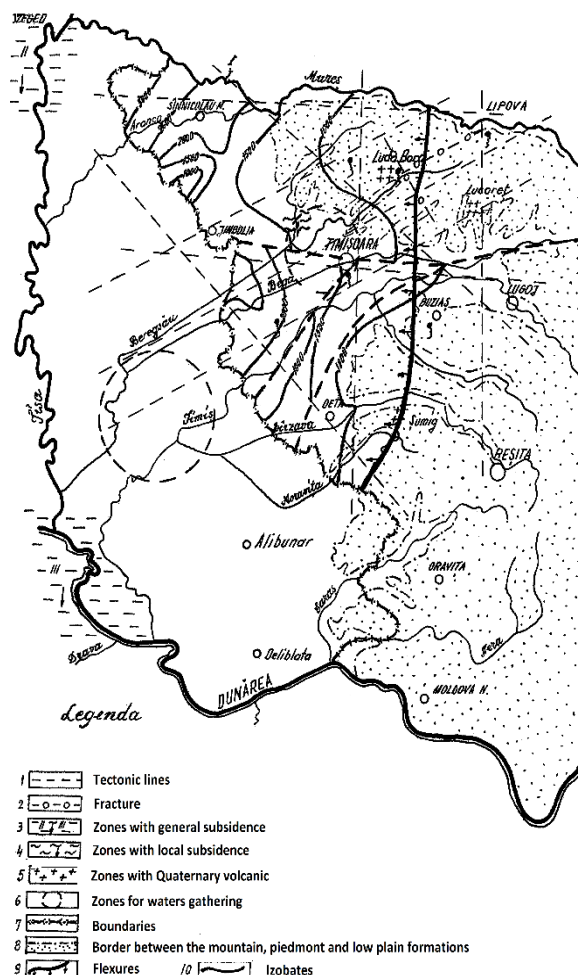


Figure 1 Map of the lines and neotectonic areas from Banat (Institut Geologic Bucuresti)

Legend

- tectonic lines
- fracture
- zones with general subsidence
- zones with local subsidence
- zones with Quaternary volcanic
- zones for waters gathering
- boundaries
- relief limits
- flexures
- izobates

The greatest part of the territory of Banat is covered with recently deposits (Quaternary), arranged above Pannonic Basin formations.

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2. MATERIAL AND METHOD

The purpose of scientific research consist in elucidation the natural and / or anthropic phenomena, which have followed after the water recession in the Quaternary Period from the Pannonic Basin [13] [14].

The researches have been focused on the soil and subsoil from the Banat Plain, by soil survey and geological drilling.

In two territories, which in the Griseleni map (1779) appear covered with water, have been made two soil profiles – the first in the Bird Reservation from Satchinez (Timiș county) and the second on an emerged territory from Valcani (Timiș county)

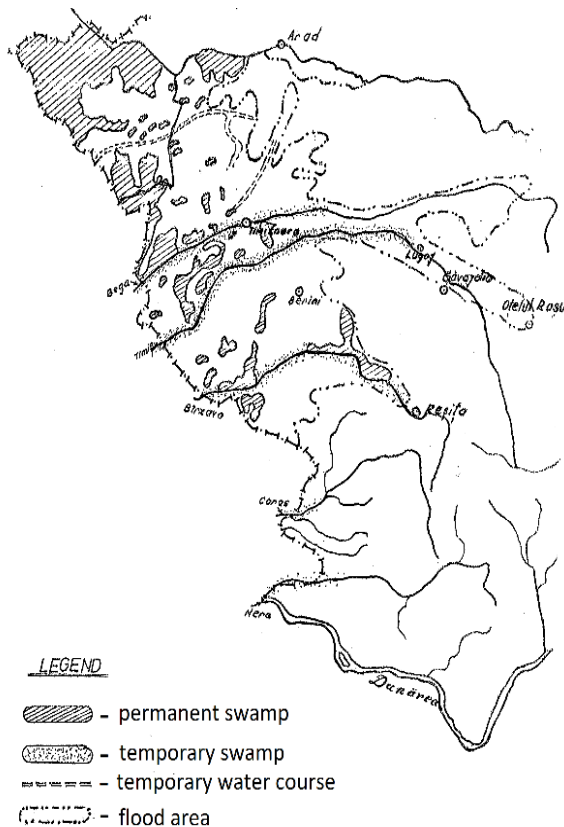


Figure 2 Banat map before hydrotechnics and land improvement

3. RESULTS AND DISSCURSION

The estimation on the landscape evolution has been made on the basis of the geological and soil survey. Rocks and soils samples have been detailed analysed, physical, chemical, mineralogical and pollenical.

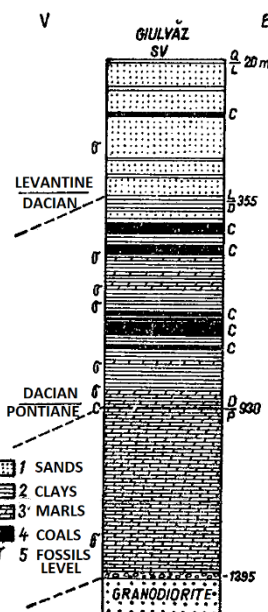


Figure 3 Deposits sequences at Giulvăz (Banat Plain) [9]

Paleosols are soils formed totally or partially on a landscape of past geological times, and having in its profile at least one horizon of Pleistocene age or older Paleosols [5].

The soils between Mureș River and Bârzava River are covered mostly by loess and loesslike deposits in which several Paleosols can be identified.

In a Calcaro - Calcic Chernozems from Vinga Plain we have been identified 5 Paleosols - a Quaternary deposit, Pleistocene - Superior and Middle, periods with Interglacial (+8°C) and Glacial Würm (-1°C - +4°C).

The complex soil survey at 1:10.000 scale effectuated during a long time (30 years) in the Low Banat Plain indicated a great influence of the water – logging to the soil cover. The vast majority of the soil types, like Chernozems, Phaeozems and Fluvisols are Gleyic or Salic / Sodic. A large area is covered with Gleysols (43,127 ha), Stagnosols (7,375 ha), Vertisols (71,223 ha) and Solonetz (42,495 ha). [14]

Beginning with the year 1718, ample hydrotechnics and land improvement works have been effectuated, mainly during the years 1970-1980, therefore in the year 1990 there are 473000 ha with drainage systems in Timiș county and more than 100 mill. m³ spoil, which have resulted from the canal network with 13,000 km length.

The spoil has been scattered over the soil cover, and because is rich in exchangeable cations, like Na⁺ and soluble salts, the soil cover is strongly gleyed and solonetzic.

Beside the positive effects, respectively surface drainage, internal and vertical drainage used for water logging removal, have existing some negative effects, for example an overly coming - down for ground water table, up to three meters depth. Consequently, the radicular system of the plants has lost an important source of water - capillary fringe.

In the paper are presented two soil profiles, which are representative for the low plain.

Table 1 Analytical data
Gleyic – Salic Vertisols from Valcani (Timiș)

Horizons Depth (cm)	Ay	ACy	Cy	II Cna	II Cna	II Cna	III Cna	III Cna
	0-40	40-60	60-80	80-120	120-140	140-160	160-200	-250
Clay	75,6	75,7	76,6	74,1	43,0	26,5	19,5	21,0
Silt	14,8	11,8	9,6	11,6	32,0	43,1	20,4	22,3
pH	7,89	7,98	7,96	8,35	8,80	8,85	9,85	9,05
Humus %	3,92	3,53	3,35	0,42				
CaCO ₃ , %	0,42	0,50	1,01	35,5	37,5	37,9	37,7	31,9
ESP, %	10,3	9,9	13,6	24,0	27,2	27,9	27,6	17,7
Smectite, %	80	82	79	6,7	62	59	52	55
Illite, %	19	17	19	28	33	35	41	38
Caolinite, %	1	1	2	5	6	6	7	7

For clay mineralogical analysis have been used three methods:

- DTA-differential thermal analysis,
- X-ray analysis,
- infrared analysis.

In fact, there are two soil types, the first is a Vertisols and the second a buried Solonetz. This

situation can be considered normally in Banat, especially in the low plain and Vinga Plain.

Locating the second soil profile has been made in a swampy place, part of the Bird Reservation from Satchinez, with belongs to Bega Basin, and has more than 194 ha, with about one hundred protected birds species.

Table 2 Analytical data
Histic Gleysols, from Satchinez (Timiș)

Horizons Depth (cm)	T	AGr	Gr	Gr	CGr	CGr ac C	GracC	GracC	GracC
	0-20	-45	-65	-85	-105	125	-155	-200	-300
Clay	18,5	21,3	33,0	30,7	26,3	22,1	27,2	27,9	27,4
Silt	18,0	21,8	20,6	24,0	22,5	24,5	26,7	25,0	24,5
pH	7,50	8,45	8,30	8,65	8,75	8,75	8,75	8,70	8,75
Humus %	9,42	2,90	2,73	0,63					
CaCO ₃ , %	1,59	3,94	4,19	14,4	19,8	20,3	24,1	24,5	20,8
ESP, %	4,48	2,54	2,25	3,44	4,92	6,36	11,4	7,72	7,85
Soluble salts, mg									
EC, mmho	300	195	150	120	120	126	150	105	120
Smectite, %	62	54	63	55	53	51	57	60	62
Illite, %	35	41	33	39	40	42	36	34	33
Caolinite, %	3	5	4	6	7	7	7	6	5

It can be seen that both in the actual Gleysols (0-105 cm) as well as in the Paleosols (105 – 300 cm), there is present the Gr horizon, but in Paleosols the degree of alkalinity (ESP>6) is greater.

The clay from the both soil types, Vertisols and Gleysols, are predominantly composed of Smectites, of course greater in Vertisols (79 – 82 %), so that the soils have expansive clays.

At present, in the Banat Plain there are only some wet places, like as the Murani Swamps, Pogăniș Meadow, the accumulation lake from Pișchia, the Natural Reservation of Mureș Meadow etc.

There is a close relation between the contents of clay and organic matter and the water content.

The loss of water by drainage brings phenomena like increase of the permeability, decrease in level (subsidence) crack formation and aeration of the soil. The loss of water comes about during summer. [11]

Subsidence of swamp soil after reclamation can be predicted using the formula:

$$T_2 = \frac{s \cdot v_2}{s \cdot v_1} \cdot T_1$$

T_1 – original thickness (cm);

T_2 – thickness after subsidence (cm);

$s \cdot v_1$ – original specific volume (cm³ per g);

$s \cdot v_2$ – specific volume after subsidence (cm³ per g).

Table 3 Calculating subsidence at Satchinez
- analytical data

Depth, cm	0-20	20-85	85-125
Clay, %	18,5	31,7	26,2
Humus, %	38,7	11,3	5,1
Water, %	33,9	36,9	28,1
s.v.1	1,10	1,37	1,02
s.v.2	0,81	0,78	0,67

The subsidence calculation has been made by sampling from a soil profile located near the swamp drained with a 100 years ago. The result obtained is 66.8 cm, which means the lowering of land level.

As a result of tectonic movements and reclamation works by drainage, the general land level decreased with significant values.

Clayey soils containing an above normal organic matter content show a higher amount of subsidence and for this reason Banat Low Plain has a waving relief.

4. CONCLUSIONS

Geological evolution of the Banat Plain was strong influenced by the tectonic movements.

The Pannonic Lake will disappear at the end of Pleistocene period when the River Danube penetrates the Carpathian Arch.

In the 20th century ample hydrotehnics and drainage works have been effectuated for watercourses regulation, drying up the lakes and swamps and draining the hydromorphic soils. The drained area was of about 473,000 ha in the 90th years.

The complex soil survey at 1:10.000 scale have been indicated a great influence of the water - logging to the soil cover.

Even soil types as Chernozems, Phaeozems are with surplus of the humidity because of the high level of groundwater (about 2m). But in the droughty years this level descent to the 3-5m depth and the available water disappear.

Two soil types have been analyzed representative for wet zones: a Gleyic - Salic Vertisols (Valcani) and a Histic Gleysols (Bird Reservation Satchinez).

Actual soils, Gleysols and Vertisols have at the bottom Paleosols, and all the soil types are rich in clay, and the clays are predominantly composed of Smectites.

As a result of tectonic movements and reclamation works by drainage, the general land level decreased with significant values.

Owing to land improvement and soil reclamation, the adicultural land area has increased up to 79,73% from which 60,74% land in crop.

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