PEDO-ARCHAEOLOGICAL INVESTIGATIONS IN TIMISOARA

D. DICU[1(3)], D. ȚĂRĂU[1(3)], Gh. ROGOBETE[2]

[1] Banat`s University of Agricultural Sciences and Veterinary Medicine from Timisoara
[2] Politehnica University of Timisoara
[3] Office of Pedological and Agrochemical Studies Timisoara
dicudanield@gmail.com

Abstract: *Timişoara, attested between 1000-1200 AD, is located in the lower subsidence plains of Timis, the alluvial material very diverse, from sand to clay, transported and re-transported by the changing courses of Timis and Bega Veche rivers. The area had until draining after 1716 AD large areas of marsh. The human impact has caused the emergence in the current area of Timisoara soil classes of Tehnosols and Anthrosols. Urban soils from Timisoara area and suburban area are strongly influenced by the human work. These soils are used for numerous purposes, including construction, industrial activities and transport, farming and parks, urban activities. The transformation in these soils can occur in a very short time, sometimes in just a few days, such as when making excavations for foundations, adding land leveling, construction to recreate the landscape. Soil samples were collected from Timisoara, Saint George Square in 2014, the area has been brought to the surface through archaeological work of the Banat Museum, part of what was the Grand Mosque which functioned until the end 1716. The physic-chemical analyzes of the samples were made by OSPA-USAMVBT testing laboratory in Timisoara. According to SRTS-2012, the analyses soil is an Tehnosol proxy-antro-placic-urbic. The layer of soil to a depth of 435-475 cm corresponds with foundation construction works brought to the surface through refurbishment of Timisoara. Alluvial nature of the materials that make up Tehnosolul from Square St. George is expressed by varying textures, the textures alternating silt, clay, loam to sandy-loam, clay content ranges from 22.1% to 49.8%.The most important features that highlight the strong anthropogenic influence are very high to excessive contents of phosphorus and potassium, particularly in the 260-300 cm layer. In this layer, mobile phosphorus levels are 175.89 ppm and potassium contents value of 2521 ppm.*

Keywords: *organic matter, excess phosphorus, potassium, copper*

INTRODUCTION

Urban soils from Timisoara area and suburban area are strongly influenced by the human work. These soils are used for numerous purposes, including construction, industrial activities and transport, farming and parks, urban activities. These are soils with a high spatial variability, which, over the centuries, many different materials have been included.

Evolution of urban soils is subject to the same pedogenetical laws, but the pace of evolution is accelerated and for the knowledge there are necessary an complex research methods, since the danger of pollution and damage to human health.

The SRTS urban soils falling within the Tehnosoluri and Anthrosols Class (4) that can be soils with agricultural and horticultural use (parks and gardens) or soils made as results of various construction materials (urbic, mixic, garbic, etc).

The transformation in these soils can occur in a very short time, sometimes in just a few days, such as when making excavations for foundations, adding land leveling, construction to recreate the landscape, etc.

The presence of these materials modify the properties of the soil, making it difficult even texture and accurate classification. The layers have specific vertical composition or

"memory" activities that were formed by the action of man. Soils contain a lot of historical information, the important role both for their development and knowledge for understanding the evolution of human society. Each layer of the soil profile contain characteristic products from a certain period of technological evolution of human society. Combining archeology with pedology, we can appreciate the location of pollutants (Pb, Cu, Zn) and their designation in the soil profile.

Currently, archaeological projects often include one or more specialists in soil science, working with geomorphology, geochemists, paleontologists, experts in dating methods (radiocarbon eg, optical luminescence) and other disciplines.

Archaeologists can bring her significant contributions in soil science as artifacts (pottery) that can determine the age horizons (5).

A knowledge of soil can find motivation deciding by a certain human community in the choice of location. Anthropic horizons have a high content of phosphorus fertilizer use as a result. The highest increases after human activity are found in organic matter, organic waste is made up of C, N, P, S and humus.

Because of its stability and mobility, phosphorus is used as a key to identify the area of human activities (3,5), in particular the surface horizons. Rich in potassium is an index of decomposition of animal bones and ash from burning wood and vegetation. Many heavy metals are used in archeology in the recovery and recognition to the processing of metals used in crops which iron, copper and other metals.

The study in the site Uivar (9), in which the conditions are very close to those of Timisoara (St. George Square), as it concerns the silt of Bega, allows some conclusions about the evolution of human Banat settlements, on analysis of samples using a range of complex analytical methods (sedimentology, geomorphology, paleologos, radiocarbon dating, etc), study that sets out the chronology of the settlement, from the alluvial deposits have stopped (6500 BP) and to abandon the site during the Early Copper. The youngest colluvium sediments at the base of the mound are about 1,000 years.

Uivar study was completed by a soil study at large scale (1:10.000) made by the authors of this article (11). The research revealed strong anthropogenic influence on soils of the Uivar territory expressed by numerous artifacts found in profiles at different depths (not just in the archaeological site) and phosphorus indicator.

Thus, in 21 soil profiles, the content of phosphorus was between 90-199 ppm, 200-299 ppm in 5 profiles, in 4 profiles was 300-450 ppm and in other 4 profiles values were between 500- 850 ppm. Note that these values exceed the upper limit of the content of phosphorus in the soil, which is regarded as very large values> 72 ppm.

Subsidence low plain is the newest form of relief, fleshed out with removing meadows from the flood influence. Due to tectonic pattern of crystalline foundation, this area is permanent sank by 0.5 mm / year in Timisoara and 1-1.5 mm / year Sânnicolau Mare. Timisoara belongs to the compartment called Timis Low Plain characterized by great unevenness surface- alluvial deposits of old and new, sand, loess materials, etc- and by the frequent appearance of clay materials lenses at different depths.

Due to tectonic pattern of crystalline foundation, the area is permanent sanking by 0.5 mm / year in Timisoara and 1-1.5 mm / year at Sânnicolau Mare. Timisoara belongs to compartment called Timis Low Plain characterized by great unevenness surface- alluvial deposits of old and new, sand, loess materials, etc- and by the frequent appearance of clay materials lenses at different depths.

In plain morphology it observed traces of intense digression, meanders and swamp surrounding flat or slightly raised.

Maximum altitude is 90 m, the overall slope is commonly 0.5 ‰, micro-depression are elongated, they were former meanders of Old course of Bega and its tributaries.

The main waters are BegaVeche, Canal Bega and Timis.

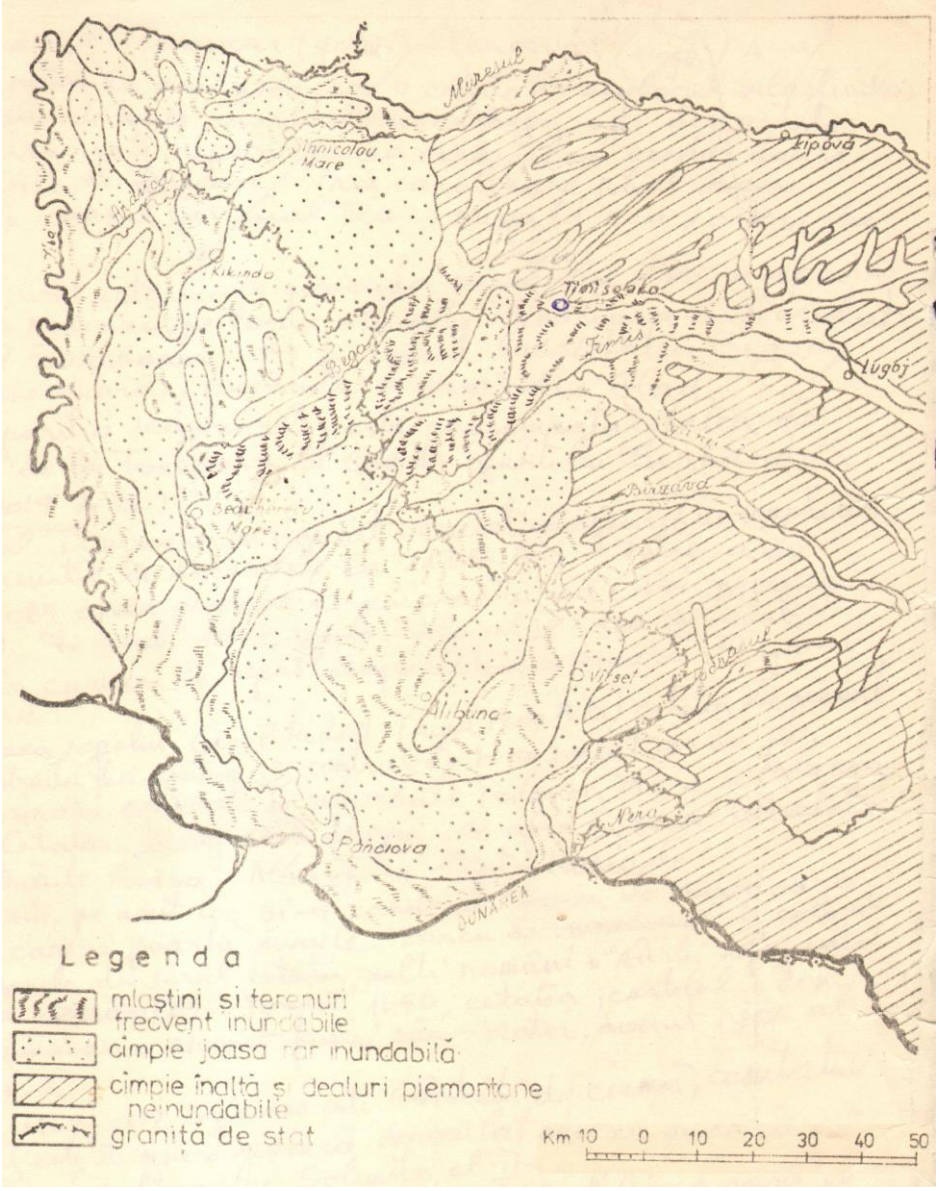

Fig. 1 Banat Map in the XVIII-XIX centuries

After 1717, major technical works have paved the drainage of wetlands, navigation and land cultivation. According to some historians, during the Dacian kingdom and then to the Roman period, on current place Timişoara existed Zurobara camp.

It would be followed Beguey town (Avar origin), residence of Prince Glad. After the appearance of Hungarians, is recorded in Timisoara city in the legend of St. Gherhardus (AD 1018.1019).

Timisoara county became Land of the Kingdom of Hungary and is mentioned in documents in 1177 AD. Between 1068-1089 Turkic peoples appear. In 1239, King Bela IV received 40,000 cumani in the kingdom, the most people sit around Timisoara.

At the time of King Carol Robert (after 1300 AD), the fortress was rebuilt in stone, builds a palace and ordered around streets in the suburbs Palanca Mare and Palanca Mica. The fortress surrounded by water, is the area bounded by actual streets Bocşa-Alba Iulia-Hunyadi Square.

Later, on this place has built Hunyadi Castle that bears his name. Hunyadi colonized many areas around the city Romanian and Serbian refugees from the Ottoman Turks. After 1496, the city, the castle and the county returned his son Matthew, King of Hungary.

Between 1509-1512 the region is haunted by pestilence, Timis county is largely depopulated. During Sultan Solemian II after Mohacs, in 1551, the city of Timisoara was besieged by Ahmed Pasha with an army of 80,000 men and Timisoara is, to 164 years, under Ottoman rule.

The churches are turned into mosques, such as Bosniaks church, Franciscan monks, located in the Turkish baths in Liberty Square. In 1660, Evliya Celebi, turkish traveler, describes Timisoara as having paved streets with boards and houses with shingle. St. George Church becomes the Grand Mosque, which is currently in Saint George Square and updated by the upgrading of Timisoara, conducted particularly in 2014.

In September 1716 start of Timisoara headquarters and Eugene of Savoy conquered the city, paving the way for Habsburg rule 200 years. Higher Commander of the town was named Claudius Flarimund Mercy, under whose leadership the city began rebuilding and expansion.

In September 1716 became the siege of Timisoara and Eugene of Savoy conquered the city, paving the way for 200 years of Habsburg rule. Higher Commander of the town was named Claudius Flarimund Mercy, under whose leadership the city began rebuilding and expansion.

It reconstructs Hunyadi Castle, it constructed Transylvania Barracks (1719 to 1730). The first cross is raised on September 12, 1719 on St. George church, the mosque reconverted into a Christian sanctuary.

Timis Plain colonization started in 1719 by predominantly german people from Bavaria, Brunswick, Alsace, Lorraine, Styria and the Czechs, Italians, French, Spanish.

Shortly after the Austrian occupation of Timis Plain, are brought the sewerage of Bega River, with navigation on 70 km to the west. The locks were built between 1901-1905. Bega-Timis connecting channels from Costei and Topolovăţ led to flood protection of Timisoara.

Great Mosque was replaced in 1754 by Jesuit church of St. George, but the building was never completed. Next to her was built the Jesuits house where, in 1806, it began operations the Roman Catholic Seminary, first institution of higher education in Timisoara.

MATERIALS AND METHODS

Soil samples were collected from Timisoara, Saint George Square in 2014, the area has been brought to the surface through archaeological work of the Banat Museum, part of what was the Grand Mosque which functioned until the end 1716. The physic-chemical analyzes of the samples were made by OSPA-USAMVBT testing laboratory in Timisoara.

RESULTS AND DISCUSSION

The results of physicochemical analyzes of soil profiles taken from inside the archaeological site, just below the layer of asphalt and concrete (below 30 cm depth first sample) are shown in Table 1. The compact asphalt layer is denoted by Ap order 0-30 cm depth.

Table 1

Analytical data-Saint George Square

Elements	Depth (cm)					
	30-50	250-260	260-300	300-375	375-435	435-475
Ng %	17,9	3,3	3,3	10,9	2,2	0,5
Nf %	35,7	18,5	41,2	36,5	53,6	45,7
P %	16,0	28,4	24,6	24,0	22,1	20,6
A %	30,4	49,8	30,9	28,6	22,1	33,0
Texture	LL	AL	LL	LL	LL	TT
$CaCO_3$%	4,66	1,06	3,60	5,30	2,75	4,28
N_{tot} %	0,11	0,10	0,58	0,24	0,90	0,38
P mobile ppm	18,47	32,66	175,89	90,60	93,60	25,40
K mobile ppm	467	2655	2521	2569	2196	536
Cu ppm	15,44	20,34	336,00	33,62	27,67	24,36
Ni ppm	14,59	8,58	11,39	25,38	12,60	14,32
Zn ppm	65,47	102,99	101,21	94,45	101,61	101,40
Pb ppm	15,18	5,53	8,62	1,40	5,09	8,34
Cd ppm	0,00	0,00	0,039	0,053	0,125	0,131
Organic matter %	-	-	-	-	-	35,12
pH H_2O	8,49	8,34	7,79	8,09	8,31	8,22

According to SRTS-2012, the analyses soil is an Tehnosol proxy-antro-placic-urbic. The layer of soil to a depth of 435-475 cm corresponds with foundation construction works brought to the surface through refurbishment of Timisoara. The characteristics of this layer are those of the existing marsh area in 1500-1600. The high content of organic matter is very close to the content and characteristics of the samples taken from the swamp of Satchinez.

The gleyc histic soil from Satchinez has in the first horizons the analytical data (Table 2) morphologically, physical and chemical similar layer from the drilling identified in St. George Square in Timisoara.

Table 2

Analytical data - Satchinez

Elements	Depth (cm)		
	0-20	20-45	45-65
Ng %	0,3	0,3	0,5
Nf %	63,2	46,6	45,7
P %	18,0	21,8	20,6
A %	15,5	21,3	33,0
Texture	SF	LL	TT
$CaCO_3$%	1,59	3,94	4,19

Organic matter %	38,69	13,6	11,3
Smectit %	62	54	63
Ilit %	35	41	33
Caolinit %	3	5	4
pH H_2O	7,50	8,45	8,30

According to Banat maps, in 1700, there is a swamp that covered a vast territory, from Timisoara to Satchinez and also in Alibunar from the Serbian Banat region.

Clays of the St. George Square, brought by the rivers of Timis and Bega, partially covered banks currently identified at depths greater than 400 cm.

Alluvial nature of the materials that make up Tehnosolul from Square St. George is expressed by varying textures, the textures alternating silt, clay, loam to sandy-loam, clay content ranges from 22.1% to 49.8%.

The most important features that highlight the strong anthropogenic influence are very high to excessive contents of phosphorus and potassium, particularly in the 260-300 cm layer. In this layer, mobile phosphorus levels are 175.89 ppm and potassium contents value of 2521 ppm. More over, in the layers between 250 cm and 435 cm, phosphorus and potassium contents of the cell have high or excessive values.

With regard to the heavy metal, the content is within normal limits with the exception of copper, which has a high value in the range of 250-435 cm and in the range of 260-300 cm is excessive.

Values of phosphorus, potassium and copper reflect the traces of human activities, the construction in that area, intense between 1400-1800 AD. Surely to achieve a breeding dwelling ground for the construction of the church, they were moved and mobilized earth materials that led to silt cover swamp. As a result of human activity is the high concentration of mobile phosphorous and potassium, copper and even total nitrogen in the layer of 260-300 cm deep.

CONCLUSIONS

Timişoara, attested between 1000-1200 AD, is located in the lower subsidence plains of Timis, the alluvial material very diverse, from sand to clay, transported and re-transported by the changing courses of Timis and Bega Veche rivers. The area had until draining after 1716 AD large areas of marsh. The human impact has caused the emergence in the current area of Timisoara soil classes of Tehnosols and Anthrosols.

Soil samples collected from the St. George Square are included at Tehnosol proxy-antro-placic-urbic. The texture is radically altered by human intervention to the layer at 435-475 cm, at the Great Mosque Foundation brought to the surface of the preparation of the center of Timisoara, similar to swamp Satchinez layer.

Chemical analysis reveals a very high content of phosphorus and potassium, with peaks in the 260-300 cm layer depth, due to human activities. The heavy metals, excessive copper content (336 ppm) at 260-300 cm depth.

BIBLIOGRAPHY

1. BARNA BODO, 2009, Cronologie de istorie locală, Ed. Marineasa, Timisoara
2. DELESEGA GYULA, 2011, Ghidul Timișoarei, Ed. Tempres, Timișoara
3. DRAȘOVEAN F., 2004, Naturraum und fundbild in der umgebung von Uivar, Prahist Zeitscher 79:147-148

4. FLOREA N., MUNTEANU I., RUSU C., DUMITRU M., IANOS GH., DANIELA RADUCU, ROGOBETE GH., TARAU D., 2012, SRTS, Editura Sitech, Craiova
5. HILLEL L., 2005, Civilisation, role of soils, Ed. Elsevier, Oxford
6. HAMBURG J., 2005, Archeology in relation to soils, Enciclopedy of soils, Elsevier, Oxford
7. IANOS GH., 2005, Paleogeografia cuaternarului, Edit. Univ. de vest, Timisoara
8. IANOS GH., ROGOBETE GH., PUSCA I., BORZA I., TARAU D., 1994, Evolutia Campiei Banatului de la faza submersa la starea actuala, Lucr. Conf. Nat. de Stiinta solului, nr 28
9. FADEREIT ANNETTE, 2006, Chronology of Holocene environmental changes at the tell site of Uivar Romania and its significance for late Neolithic tell evolution in the temperate Balkans, Z Geomorph., vol 42;19-45
10. ROGOBETE GH., TARAU D., 1997, Solurile si ameliorarea lor. Harta solurilor Banatului, Ed. Marineasa, Timisoara
11. ROGOBETE GH., TARAU D., BERTICI R., DICU D., 2011, Soils in relation to archeology at the tell site of Uivar in the south-west of Romania, Factori si procese pedogenetice din zona temperata, vol 10, Edit. Univ. Al. Ioan Cuza, Iasi, 51-60
12. ROSCH M., FISCHER E., 1999, A radiocarbon dated Holocene pollen profile from the Banat mountains, Flora, 195.