„Alexandru Ioan Cuza” University of Iaşi
Faculty of Geography and Geology
Doctoral School of Chemistry and Life and Earth Sciences

PHYSICAL AND CHEMICAL PARAMETERS OF SOILS FROM IAȘI MUNICIPALITY

PhD Thesis Summary

PhD supervisor:
Prof. univ. dr. Constantin RUSU

PhD student,
Diana NEGRU căs. ARITON

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Keywords: Urban soil, technosols, cambic chernozem, physical and chemical parameters, Iași, pedogenetical processes, anthropic materials, magnetic susceptibility, granulometric curves.

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CHAPTER I - PRELIMINARY ISSUES - includes urban land issues, a history of research and thesis objectives.

By 2050 the world is estimated that about two thirds of the world's population will live in urban areas. This forecast underlines that the particular importance will be given to global issues of urban ecosystems and in particular to soils from these environments. Soils in urban areas are not clearly defined and characterized in soil classification systems. As a general characteristic, these soils have a chemical-mineralogical, morphologic and functional heterogeneity.. This heterogeneity is manifested, both vertically and horizontally and chemical-mineralogical composition and structure is evolving very fast. From this view soils in urban environments is clearly distinguishable from other types of soils.

Unlike other soils that were formed by natural factors, urban soils were originally formed under similar conditions, but then evolved and turned exclusively from human actions. In the first instance, the soils in urban areas can be disturbed by a variety of human activities: stripping, excavating and compaction, mixing with construction materials and / or various wastes etc. [*J. Craul, 1992; Evans et al,.2000*]. Each of these activities affect the specific chemical and mineralogical properties of soils in urban environments, causing particular developments, often atypical of pedogenetical processes (more correctly, neo-pedogenetical - quoted by *C.V. Secu şi C.V. Patriche, 2007*).

Overall issue of soils in urban areas (definition of urban soils, and taxonomic classification, specific dynamics and pedogenesis processes of these soils, quality and rational management of soil resources in urban areas etc.) is currently a priority for research in the soil science (and other related sciences), both internationally and nationally.

For taxonomic classification of technosols, understanding and description of pedogeochemical processes is necessary to know both the data obtained from the analysis of the results of physical parameters and chemistry and mineralogy of soils studied. In this context, this paper tries to define the genetic and evolutionary couple of situations characteristic of urban soils in Iasi, where besides specific technosols (urbic and mixic) and anthrosols (Arica, Horta and eroded), there are also other regional soils or the ones falling outside the zonality.

Internationally studies on urban soils targeted specifically large urban centers: Minneapolis, USA [*HW Mielke et al., 1984*]; Berlin, Germany [M.*Birke and U. Rauch, 1994, 2000; Mekiffer B. et al., 2000*]; Aberdeen, Scotland [*E. Paterson et al., 1996*]; Wolverhampton, England [*P.J. Hooker et al., 1996; Bridgeet al., 1997*]; Birmingham, England [*I. Wang et al., 1997*]; Tallinn, Estonia [*L. Bityukova et al., 2000*]; Trondheim, Norway [*R.T. Ottesen and M. Långed, 2001*]; Karlsruhe, Germany [*S. Norra et al., 2001; S. Norra and D.Stuben, 2003*].

In recent years various aspects related to soils in Iasi and peri-urban areas were addressed by a significant number of researchers, studies covering a variety of issues regarding the soil classification [*C. Rusu et al., 2014; 2015; C.V. Secu et al., 2014*], the description of the physicochemical characteristics and quality of these soils [*IG Breabăn et al., C.V. Secu et al., Bulgariu D. et al., 2008; Bulgariu L et al., 2007 N. Buzgar et al.*].

Consistent with the priority directions of research addressed, both nationally and internationally in soils in urban areas, the main objectives targeted by the thesis were:

● taxonomic classification of soils in urban area of Iasi and finding new criteria to differentiate their type, sub-type and variety;

● to estimate the mechanisms and transport conditions and deposition of soil parent material source for the urban area of the city;

● to estimate the morphological and physical-chemical indicators of pedogeochemical differentiation of subtypes and varieties of soils in urban area of the city;

● linking the main physico-chemical state of soil quality in the urban area of the city;

● validation of property - quality relations with the natural productivity and soil quality classes in the urban area of the city;

● development of current methods used to determine the redox potential, the total content of soluble salts in soils of the urban environments.

As each objective, theme and overall, were addressed in an interdisciplinary manner by correlating and analyzing data integrated physical-geographical, soil, geological and chemical-mineralogical. In this way we tried taking a picture of synthesis of existing data or to supplement them with a number of new data mainly concern soil and their pedogeochemical processes of soils in urban environments (for the particular case of Iaşi), second aspect is rarely addressed in existing studies to date.

CHAPTER II - THE METHODOLOGY AND DATABASES include working methods and equipment used to obtain the results.

Stage I. Preliminary work - aimed at complex documenting by adding, selecting, structuring bibliographic material relating to the specific study area (Iasi), methodologies and experimental research to estimate the physico-chemical and chemical-mineralogical parameters of soils.

II.Field studies - consisted in :

(i) development of soil profiles for standard soil types, mainly in areas not covered by previous studies (were targeted especially soils from Antrisols class);

(ii) soil profile characterization and morphological description of soils;

(iii) soil sampling soil for conducting physico-chemical and chemical-mineralogical analyzes.

III. Laboratory stage was to determine the parameters set such as bulk density, density absolute porosity, high compaction, size composition, optical microscopy, magnetic susceptibility, pH, redox potential, electrical conductivity, the amount of bases exchangeable total capacity cation exchange content alkaline earth total carbon, total nitrogen, total phosphorus and mobile, mobile potassium and total chemical-mineralogical composition determination by molecular absorption spectrometry analysis in infrared, microscopic studies, determination of micronutrients and organic matter.

IV. Processing and interpretation of experimental data stage

Results from physico-chemical analyzes were represented in diagrams of discrimination and differentiation for the estimation of pedogenesis, classification or differentiation soils or in mineralogical-petrographic charts to determine the stability conditions and the tendencies of development of mineral components (carbonates, clay minerals, phosphates, soluble salts, etc.). To estimate pedogeochemical indicators used for differentiation of subtypes and varieties of soils, statistical correlations between physicochemical parameters and other parameters such as particle size classes, chemical-mineralogical composition and content of microelements were carried out.

CHAPTER III - PHYSICAL AND GEOGRAPHICAL ASPECTS OF THE STUDY AREA includes physical and geographical aspects of the study area of Iasi, namely: geographical location, geology, topography, climatic issues, hydrological regime, biotic issues, anthropogenic factors.

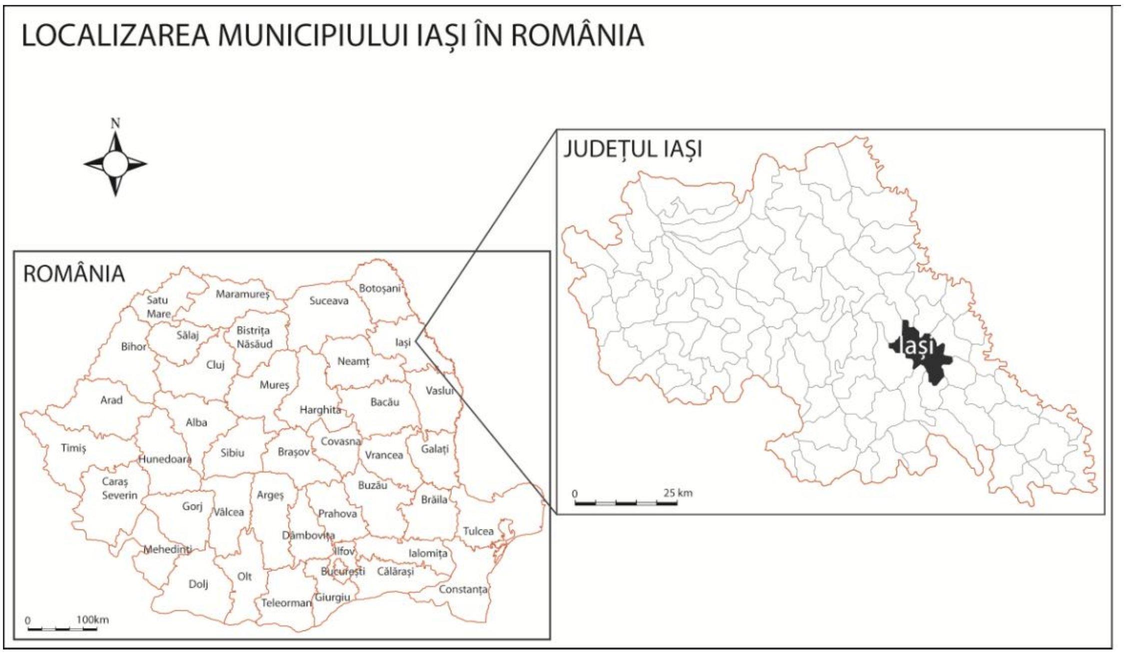


Figure III.1. The geographical location of Iasi (Iasi map)

CHAPTER IV - SOIL COVER briefly treats soil cover soil types encountered in the Iasi.

CHAPTER V - PHYSICAL PARAMETERS OF SOIL FROM IASI MUNICIPALITY- parameters such as absolute density, bulk density, porosity and compaction.

For soils of the studied profiles, absolute density ranges from 1.92 to 3.11 g / cm3, averaging 2.46 g / cm3, and the bulk density varies from 1.10 to 1.86 g / cm3, with a average of 1.44 g / cm3. As a general trend, both absolute density and bulk density decrease on profile with unsystematic variations and there is a poor correlation with size and chemical-mineralogical composition of the soil horizons.

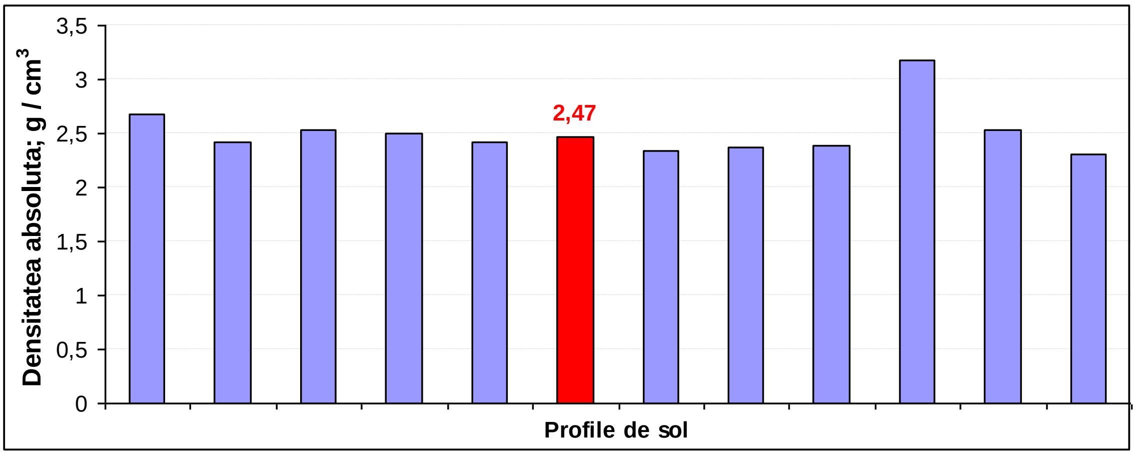


Figure V1. Mean values for absolute density for the studied soils.

As a general trend, porosity decreases on profile, but variations are random and inconclusive correlated with size and composition of chemical-mineralogical composition of the soil horizons. Generally, the porosity increases or decreases with the compaction degree from loam and clay soils in the sandy loam and sandy-loam. Existing data until now follows a certain dependence of the porosity (plus the degree of compaction) of soils depending on the nature and content of artifacts or how to use and degree of anthropogenic disturbance of the soil.

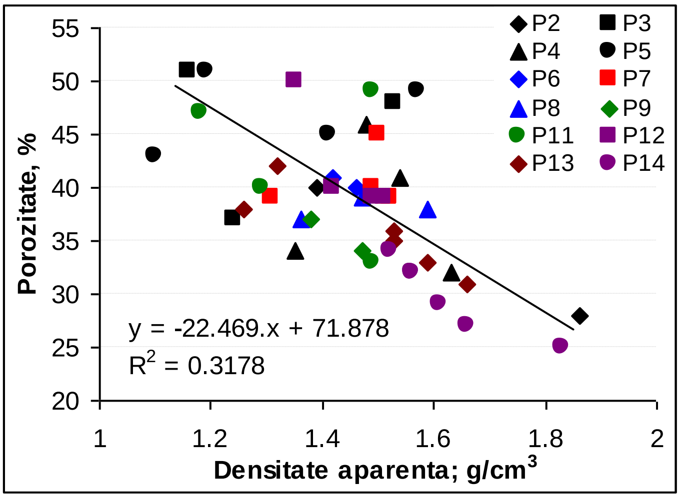


Figura V.2. The correlation between porosity and bulk density in the soil from the urban area of Iasi.

In principle, the decreases porosity and degree of compaction (compaction) is determined by the increase of the weight of paramagnetic soil fractions composition. In general, the studied soils present a profile variations and correlations with grain size fractions, chemical and mineralogical composition, nature and content of artifacts etc., for porosity, bulk density and absolute density are similar. However, physico-mechanical parameters does not always provide clear and reproductible information about the pedogenetical processes and the overall evolution of urban soils. Therefore these parameters cannot be used as such (singular) in the diagnosis and taxonomic classification of urban soils, but these are specific criteria for estimating the quality of these soils especially for civil and industrial use in construction and transport infrastructure.

CHAPTER IV - PHYSICO- MECHANICAL PARAMETERS approaches major particle size fractions, texture, soil skeleton and artifacts, magnetic susceptibility.

VI.1. Major particle size fractions

According to SRTS (2012) to fit into groups of textural classes, classes and subclasses we use major particle size fractions using values obtained for the main fractions of particle size, such as sand (coarse sand between 2 to 0.2 mm in size and fine sand 0,2-0,02mm in size), dust (dust particles ranging in size from 0.02 to 0.01 mm and fine powder size between 0.01 to 0.002) and clay (size below 0.02 mm).

VI.1-1. The sand (fraction size: 2.00 to 0.02 mm)

It may be noted a general trend of increased sand content in the respective horizons with coarse texture and a more subdued trend of increasing sand content at the level immediately above and below the horizons of coarse texture. Judging by unsystematic variation on profile and similar correlations with other fractions and after mineralogical-petrographic composition, the sand from the investigated soils has its origin from at least three sources: **(i)** mechanical additions (filling) imposed by prior and / or the current use of soil; **(ii)** sand resulting from the physico-chemical processes of degradation and alteration of soil skeleton and artifacts; **(iii)** possible "quasi-pedogenetical"sand of existing soils subjected to processes of human intervention - it is predominantly only in P7- Cambic chernozem profile.

The correlation study statistics show three important aspects:

(i) the existence of a genetic link between sand, dust and clay attributed to anthropogenic materials, the pedogenetical processes (ss. neopedogenesis) taking place in the specific anthropogenic urban soils generally different from "normal", non-anthropised soils. It is necessary in this case to achieve a differentiation between anthropogenic introduced sand and the sand originating from the degradation of anthropogenic materials.

(ii) Among the main grain size fractions, partly sand and clay from the studied soils predominantly come from anthropogenic sources, while dust originates most likely from anthropogenic materials and partly from wind deposits.

(iii) For the studied soil profiles, chemical and mineralogical composition sand is very diverse, both in terms of content and in terms of mineralogical-petrographical diversity.

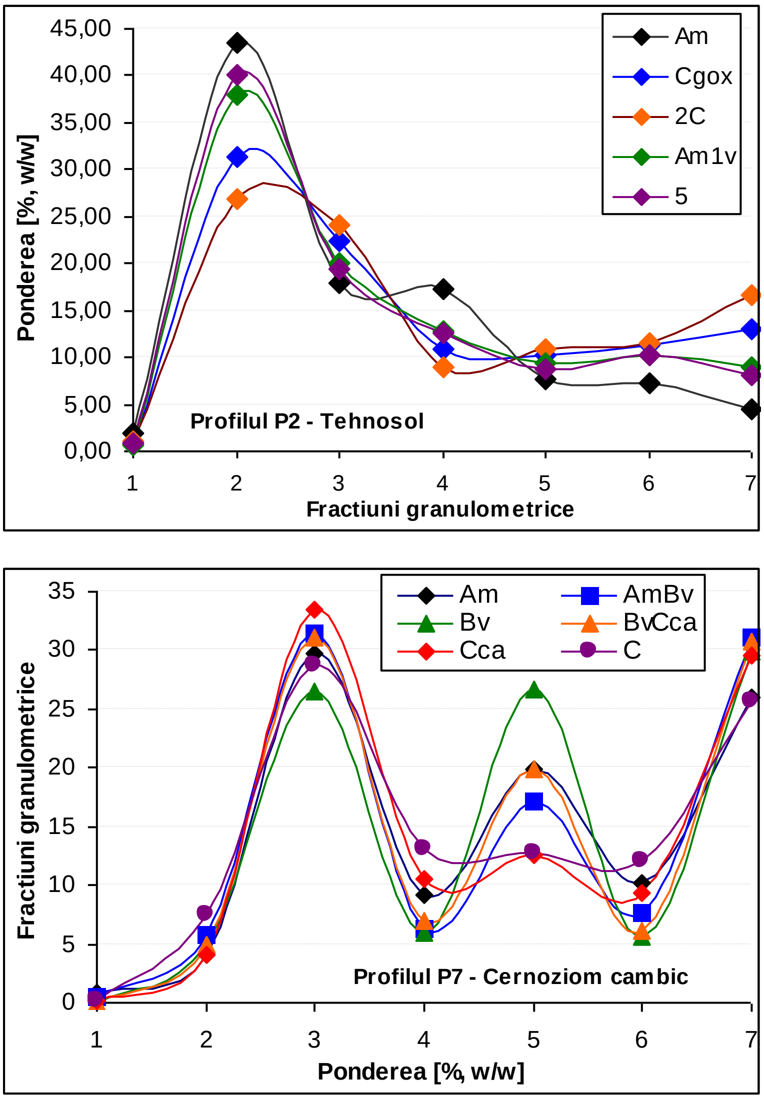
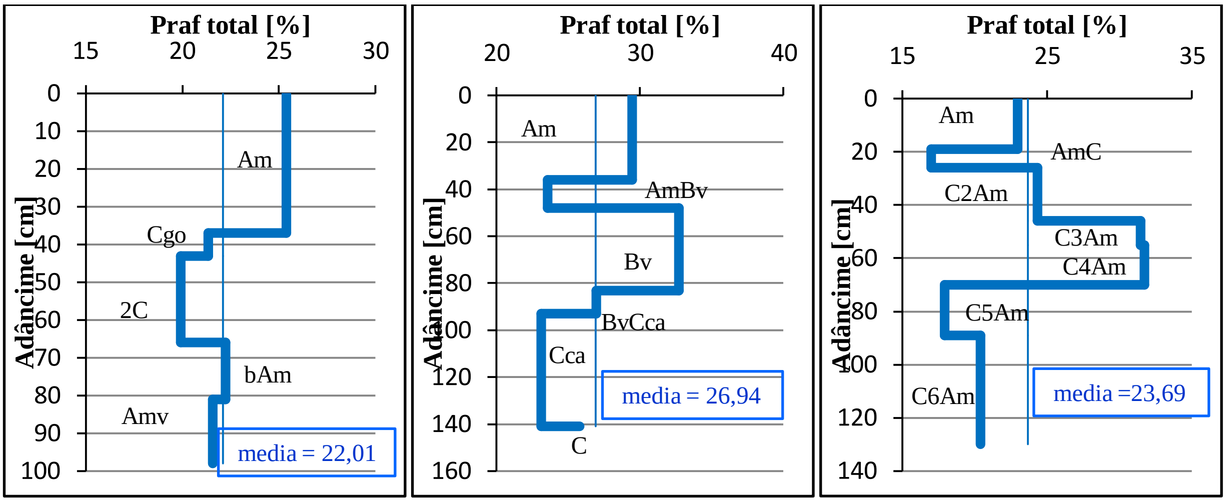


Figure VI.1. Profiles size distribution curves for P2 - P7 profile tehnosol compared urbica .Notaţii: 1-granulometric fraction > 2,00 mm; 2-coarse sand; 3-fine sand; 4-coarse dust; 5-fine dust; 6-coarse clay; 7-fine clay

VI.1-2. Dust (fraction size: 0.02 to 0.002 mm)

Dust variations on profile does not indicate a tendency to preferentially accumulate at a given horizon (or a certain depth), and the ratio of fine dust and dust coarse vary unsystematically on profile without setting a definite link with the type and content of artifacts, content skeleton and mineralogical-petrographical composition thereof.

In relation to total clay, dust presents two statistical populations, data showing two different types of correlations: (i) the first statistical population includes most of the soil samples studied; this corresponds to a strong negative correlation between total dust and clay total correlation showing the pedogenetical link between the two fractions; (ii) a second statistical population includes only strong anthropic disturbed horizons; this corresponds to a strong negative correlation between total dust and clay total correlation indicating the connection of the two fractions of particle size with anthropogenic sources of chemical-mineralogical material.



(P2 profile - *urbic technosol*) (P7 profile - *cambic chernozem*) (P13 profile - *urbic technosol*)

Figure VI.2. Variations on the total content of dust profile for P2, P7 and P13 profiles.

VI.1-3. Clay (size fraction <0.002 mm)

Judging after variations of total clay on the profile and after the correlations between clay and total other two granulometric fractions (sand and dust) the clay from our studied soils has many origins: (i) pedogenetical clay- inherited from background soils but who undergone human actions; (ii) "anthropogenic" clay introduced by technical and mechanical modified existing soil (stored stockpiles, binding); (iii) "neopedogenetical" clay formed under the soil based on their parental materials and anthropogenic input materials; (iv) wind clay deposit , most likely, in the surroundings of the city; it differs from other types of "clay" because of kaolinite content.

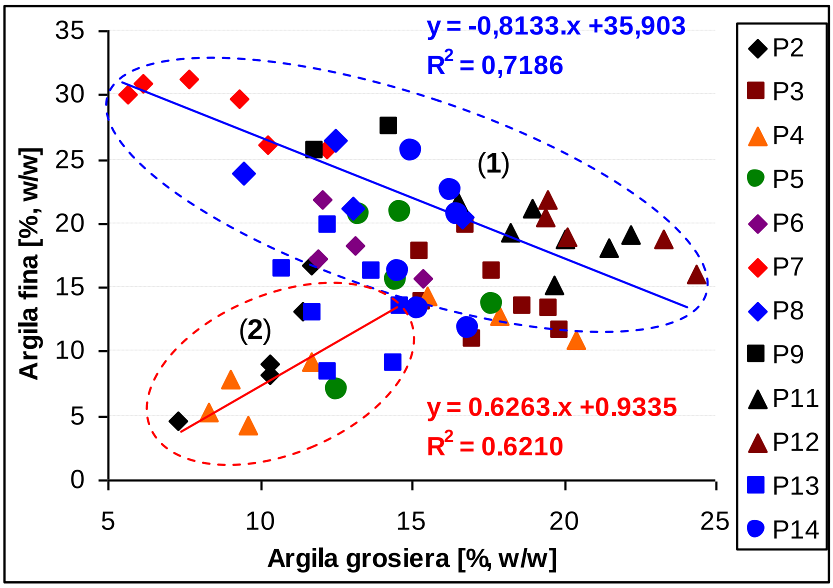


Figure VI.3. Correlation between fine clay and coarse clay studiate.

VI.2. Texture

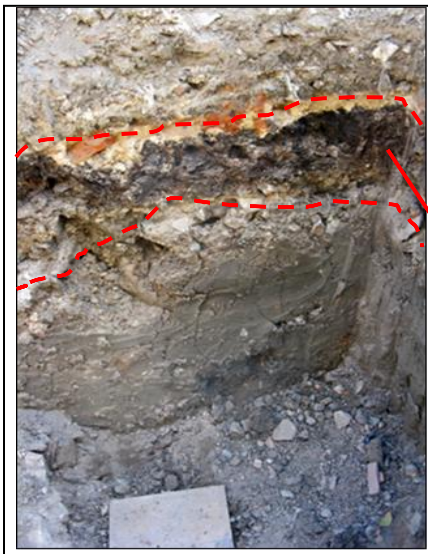
From the obtained data on soil texture, it covers the following:

(i) Soil texture is varied rather widely, from coarse texture (UG), to medium texture (SG, SS, MM, and LP) and fine textures (TT and PT). As dominant share are fine textured soils (48.64% of the soil samples analyzed), followed by those with medium textures (37.83% of the soil samples analyzed) and coarse textures profiles with a much lower procentage (13.50% of the soil samples analyzed). This indicates a relatively high textural heterogeneity of soils in the urban area of Iasi, heterogeneity observed both from the soil profile to another and from one horizon to another within the soil profile. The cause is related to natural conditions (soils unchanged or slightly modified anthropogenic - P7-Chernozem profile cambic case), but mostly by human intervention, which explains the wide variability of texturein techosols .

(ii) coarse textures are correlated with relatively high contents of artifacts and skeletal, especially with high levels of human intervention to soil horizons.

VI.3 Soil skeleton and artefacts

Artifacts are the most commonly through: (i) construction materials (concrete, brick, ceramics, concrete, lime, plaster, etc.) - with grit between 0.5-10 mm, in various stages of disintegration and physical alteration ; (ii) pieces of wood (and other cellulosic materials) - with a grain size of 0.5-5 mm, in various stages of decomposition; (iii) fragments of glass and ceramics (0.5-5 mm); (iv) metal fragments (with average size <1.50 mm) ferrous (Fe, Cu, Al, alloys etc.), generally very altered; (v) plastics and textiles; (vi) other materials: slag and ash, bitumen etc.



Poly aromatic hydrocarbons: 4,72 %
Higher aliphatic hydrocarbons: 3,93 %.
Polyphenols and higher aliphatic secondary and higher polyphenolic acids:1,26 %
Heavy metals:
Pb: 608,21 μg / g
Cd: 14,78 μg / g
Zn: 872,50 μg / g
Cr: 135,86 μg / g
Co: 39,06 μg / g
Physical and chemical conditions:
pH_{H_2O} = 9,11
E_h = -0,083 mV
CTSS = 1053,75 mg / 100 g

Figura VI.4. Ekranic technosol– Iaşi, Canta area, Fabrica de Ţigarete passage.

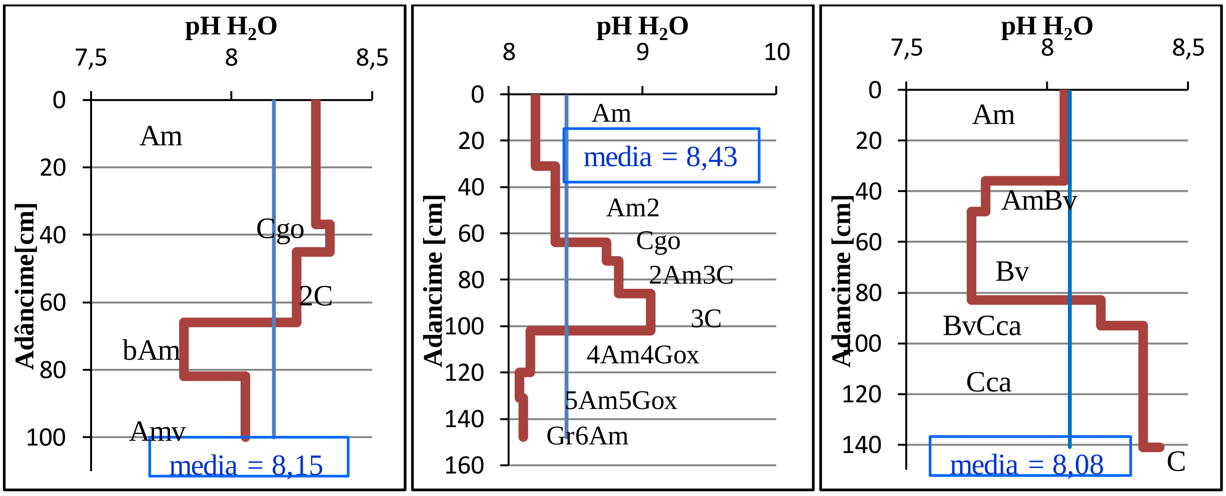
VI.4. Magnetic susceptibility

The magnetic susceptibility decreases on profile, the overall trend is disturbed only in anthropogenic altered horizons. At the level of these horizons magnetic susceptibility values (pulse) always appear very high caused mainly by the increase in value of Fe (III) / Fe (II) ratio content and mobile forms of occurrence of iron ions. Based on this observation we wanted to try to achieve a relative quantification of the degree of human intervention based on magnetic susceptibility values (size can be determined experimentally with high accuracy).

CHAPTER VII - PHYSICO-CHEMICAL PARAMETERS OF SOILS FROM IASI MUNICIPALITY analyzes soil reaction, redox potential and relative humidity and conductivity.

VII.1.Soil reaction

The reaction in studied soil is generally slightly alkaline to moderately alkaline, pH tends to decrease the profile. Changes in the pH values determined in aqueous solution and in saline are different (generally irregular and non-systematic) from one soil profile to another and from one horizon to the other.



(P2 profile - *urbic technosol*) (P7 profile - *cambic chernozem*) (P13 profile - *urbic technosol*)

Figure VII.1. Variations of pH determined in aqueous solution for P2, P7 and P13 profiles.

From the study of the correlation between the pH and coarse sand two statistical populations were separated: (i) the first statistical population contains the most studied soil samples and corresponds to a positive correlation indicating direct connection between the pH and the content of coarse sand; (ii) second statistic population is the only horizons of strongly disturbed anthropogenic profiles and corresponds to a correlation moderately negative which indicatesa link between pH and coarse sand of anthropogenic nature.

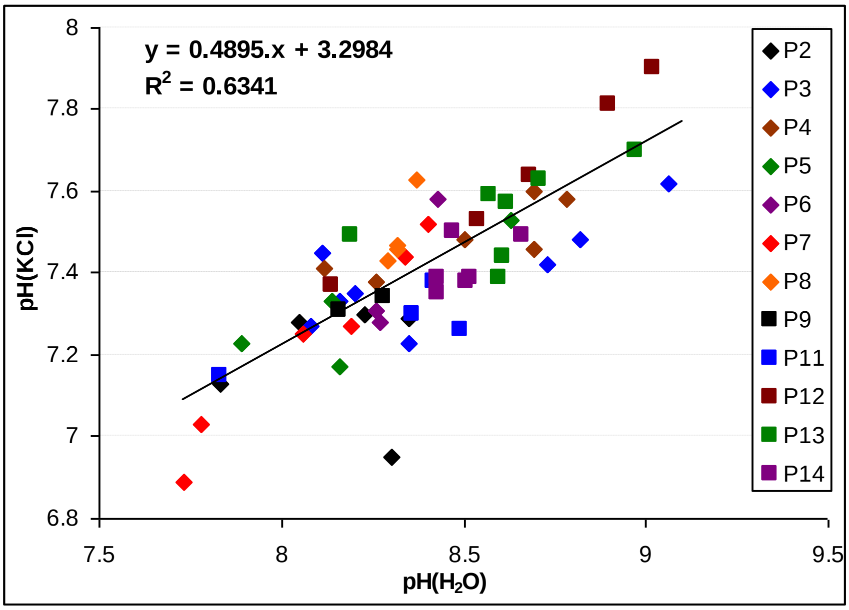


Figura VII.2. The correlation between the pH measured in aqueous suspension and the pH measured in 0.1 M KCl suspension of soils in urban area of Iasi.

VII.2. The redox potential and rH

For the investigated soils, redox potential ranges from 0.247 to 0.310 mV, with averages between 0.257 to 0.298 mV. The correlations between the redox potential and total sand are generally negative, but in some cases the correlation trend is uncertain. From the correlations between the redox potential and total sand two statistical populations were separated : (i) the first population has the most studied samples and corresponds to a strong negative correlation between the redox potential and total sand content; (ii) the second statistical population is made of the powerful anthropogenic disturbed horizons/

For the 12 studied soil profiles, rH varies between 15.46 to 18.12 (average 16.71). Rh profile variations and correlations with components of chemical and mineralogical follow roughly the same regularity as those observed pH and redox potential.

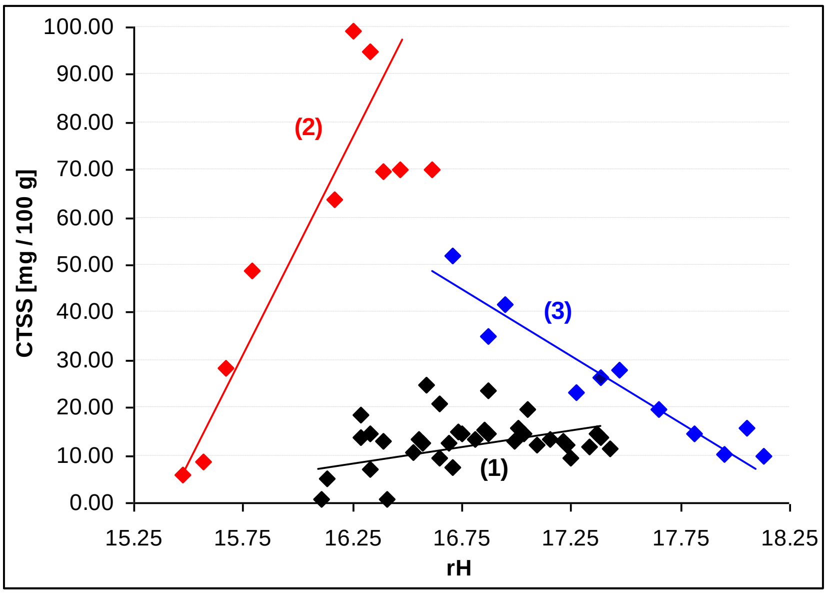


Figura VII.3. Correlations between rH and the total content of soluble salts in soils from urban area of Iasi.

Unlike the pH and the redox potential, which have certain correlations with the content of total soluble salts (CTSS) rH shows three trends in connection with CTSS: a positive correlation of the average, which corresponds to the low anthropogenic horizons of soil; a strong positive correlation corresponding to strong anthropogenic soil horizons and with a high degree of compaction; a strong negative correlation corresponding to strong anthropogenic soil horizons but with a reduced degree of compaction. Similar correlations were seen with clay minerals, oxides and oxyhydroxides of iron and some trace elements (Cr, Zn).

VII.3. Electrical conductivity

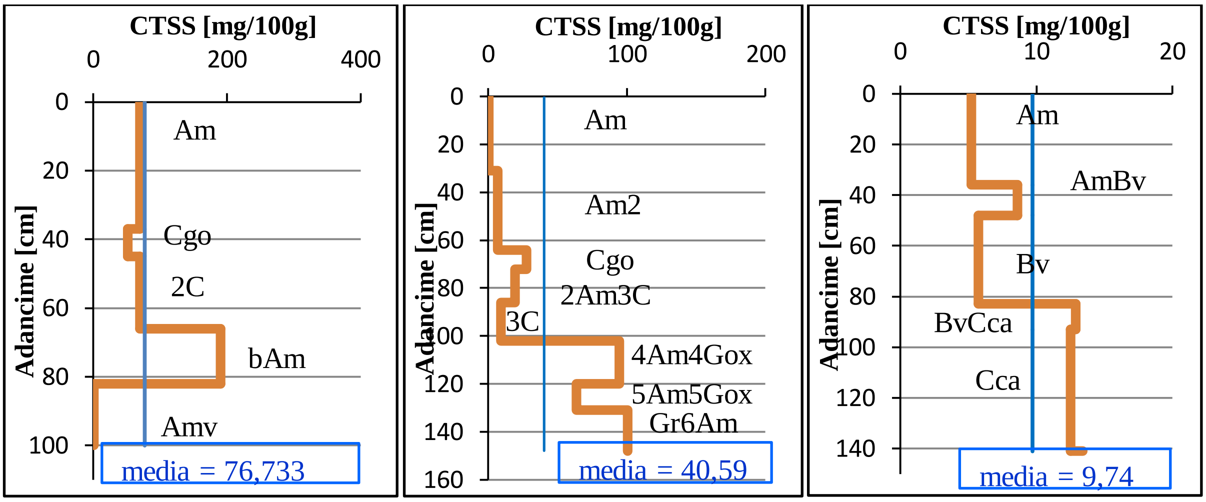
The electrical conductivity is a key parameter for the determination of total soluble salts based on empirical correlation equations determinations obtained by standard solutions, but also a way of determining soil salinity. This parameter evaluates the salinity of the soil in relation to the concentration of the solution of soluble salts of the soil and shows the real situation on the ground. For studied soils the electrical conductivity varies between 8.31 to 2060 mS, with averages between 105.16 to 828.26 mS. Electrical conductivitytends to increase on profile, but often it is atypical and presents irregular variation from one soil profile to another. It may be noted, however, that the highest electrical conductivity values were recorded in the middle and lower horizons, due to possible leaching of salts.

CHAPTER VIII - CHEMICAL PARAMETERS comprises the analysis of often used chemical parameters, as well as the total content of soluble salts, the composition of the aqueous extract, the ion exchange capacity, the content of base exchange and the degree of saturation of the base, the contents of N, P, K, organic matter, chemical-mineralogical composition, content of microelements.

VIII.1. The total content of soluble salts

The total content of soluble salts (CTSS) and electrical conductivity are two essential parameters used to assess soil salinity. Even if it directly expresses the salinity it does not reflect the environmental conditions of the soil because its values cannot be correlated with the concentration of soil solution, varying in texture and therefore salinity tolerance in plants.

For the studied soil profiles, the total salt content is between 0.76 - 190.84 mg / 100 g (average of 27.39 mg / 100 g) and different variations of a soil profile to another. In profile there is an increasing trend in total salt content and their tendency to accumulate in the middle and lower horizons, both for reference soil profile and for technosols. In general, the soils under study are not saline, with few exceptions, in the case of profile P2 (urbic technosol), P3 (urbic technosol) and P4 (urbic technosol), which a slight salinization is present in the lower horizons as reminiscent of buried bioaccumulative horizons.



(P2 profile- *urbic technosol)* (P3 profile- *urbic technosol)* (P7 profile - *cambic chernozem)*

Figure VIII.1. Variations on the profile of the total content of soluble salts

VIII.2. The composition of the aqueous extract

For our studied soils, Ca 2+ and Mg 2+ cations and anions Cl + and SO42-.predominate in aqueous extract. If in the P2 profile (urbic technosol) and in P3 (urbic technosol), the main anion is CO32- and is predominantly in the upper horizons, in the base horizons the predominant anion is SO42-, suddenly changing its position, with large increases content. These are due to the presence of buried bioaccumulative horizons.

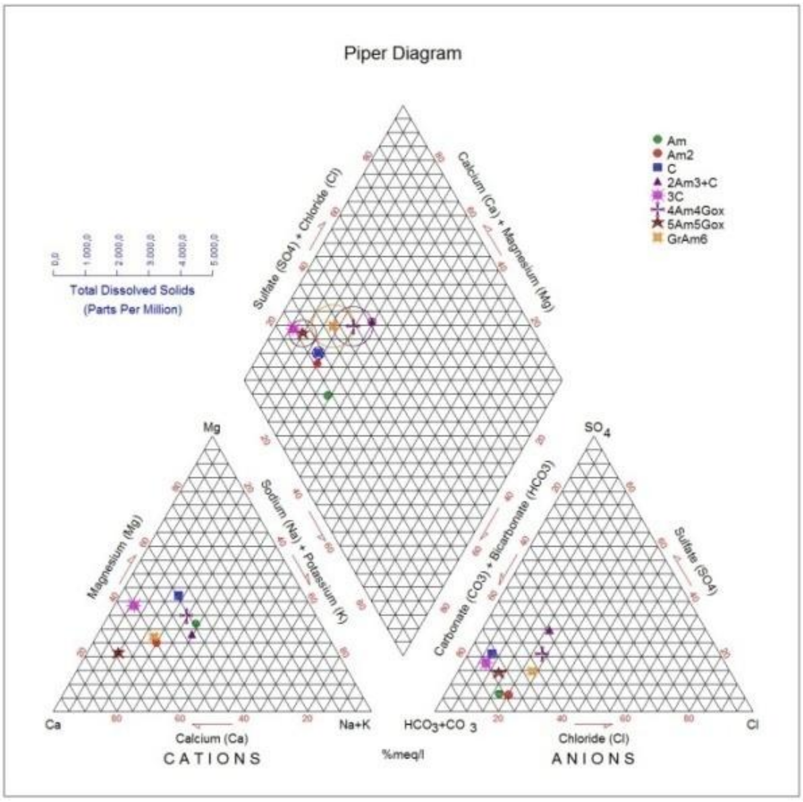


Figure VIII.2. Piper diagram for P3 profile (*urbic technosol*)

Piper and Durov diagrams from the analysis, it found that evolution of our studied soil profiles is based on a chlorite-sulfate facies.

VIII.3 The capacity of the ion exchange

Total capacity of the cation exchange is the concentration of all cations detained in the colloidal complex, namely those that make up the sum of base parts (Ca 2+, Mg 2+, Na +, K +) and the H +, possibly Al 3+. [C. Rusu, 1998]. In saturated bases soils T value is equal to SB aspect observed for the discussed soil profiles. For the studied soil profiles, the total cation exchange capacity is between 5.13 - 37.54 meq / 100g and presents different variations between the two sections of the soil profile. If in the case of P2 profile we observed a lowering of the capacity of the ion exchange is interrupted by a sharp increase in its order, in P3 profile we can observe a progressive decrease in the capacity of the ion exchange due to the presence of crystalline and amorphous clay minerals and artifacts in various stages of decay. According to the methodology, vol. III, we could fit results in cationic exchange capacity classes ranging from small classes in lower horizons to large in upper horizons.

VIII.4. The content of exchangeable bases and base saturation level

This indicator includes all base cation Ca 2+, Mg 2+, Na +, K + adsorbed in colloidal complex with the possibility of exchange in soil solution .The base exchangeable range from very small to large. As we have seen, the soils are saturated in bases due to parental materials rich in alkaline elements. With the results obtained from the analysis of aqueous extract, namely using anion Cl values, SO42, CO32-, HCO3- and the ratio Cl / SO42 we could estimate the alkalizing. Soils are entirely not alcalized, except the superior profile of P3 which are weak and may receive the name alkalized horizon.

VIII.5. The content of nitrogen, phosphorus and potassium

Total nitrogen content in studied soils is relatively small, with values that tend to decrease systematically on profile. Based on the methodology soil studies the determined nitrogen content is classified as lower-middle class with the highest content in the upper horizon.

According to the methodology, total phosphorus and mobile phosphorus are in high content class . Variations on the profile of the phosphorus content of the studied soil profiles are different from a profile to another and from one horizon to another. The supply of phosphorus is sufficient for all profiles, the content of its mobile ranges between 34.28 - 54.33% of the total phosphorus. According to the methodology potassium is in the very high potassium content class. The potassium content of the soil profiles studied presents different variations, its tendency is to increase the profile.

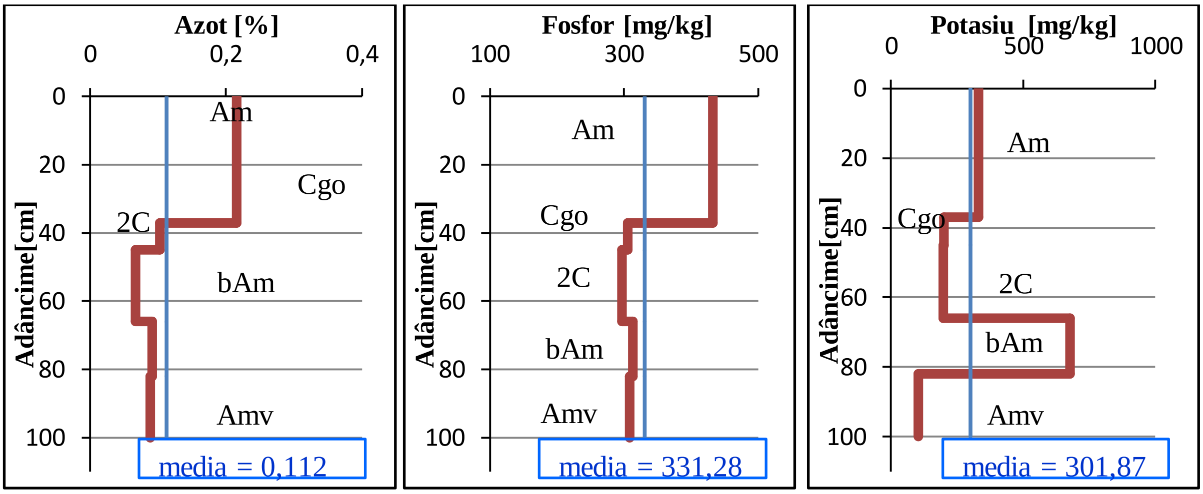


Figure VIII.3. Variations on profile for nitrogen, phosphorus and potassium content

VIII.6. Organic matter

VIII.6-1. The total content of organic matter evaluates the composition and content of organic matter in the soil profiles. For that, we considered first, pedogenetical total organic matter content, represented by humus, and anthropogenic organic matter. From the annexes we can see that the pedogenetucal organic matter predominates. This varies widely, the tendency is to decrease its profile and to accumulate in the upper layers.

VIII.6-2. Pedogenetical organic matter

Organic matter in our soils is representet by the humus content, fulvic and humic acids and non huminic organic matter. Of the two main constituents of organic matter to the soil profiles studied prevail humus or humic acids, non huminic organic matter nehuminică to follow. In general, these levels tend to accumulate in the upper and lower horizons of the profile, limits ranging from 0,83- 2,87% humus.

The studied soil profiles, amount of organic matter (humus) is low and by methodology the content falls in low-middle content class in upper horizons and verry low in lower horizons.

VIII.6-3. Non-pedogenetical organic matter

Regarding non-pedogenetical organic matter it can be an important indicator in assessing the degree of human studied soil horizons. By separating its other organic fractions we can estimate how much organic matter derived from human activities.

In soil profiles from Iasi, anthropogenic organic matter content is low and the trend is to decrease its profile, but in P3 (urbic technosol) systematically grow its values in the profile. The qualitative and quantitative analysis of the artifacts in P3 profile, there was a relatively high content of cellulosic materials in various stages of decomposition, which could justify to some extent unusual variation of anthropogenic organic matter.

VIII.7. The mineralogical composition of the soil

The mineralogical chemical composition is given by clay minerals, carbonates, oxides and oxyhydroxides of iron, silica and heavy minerals.

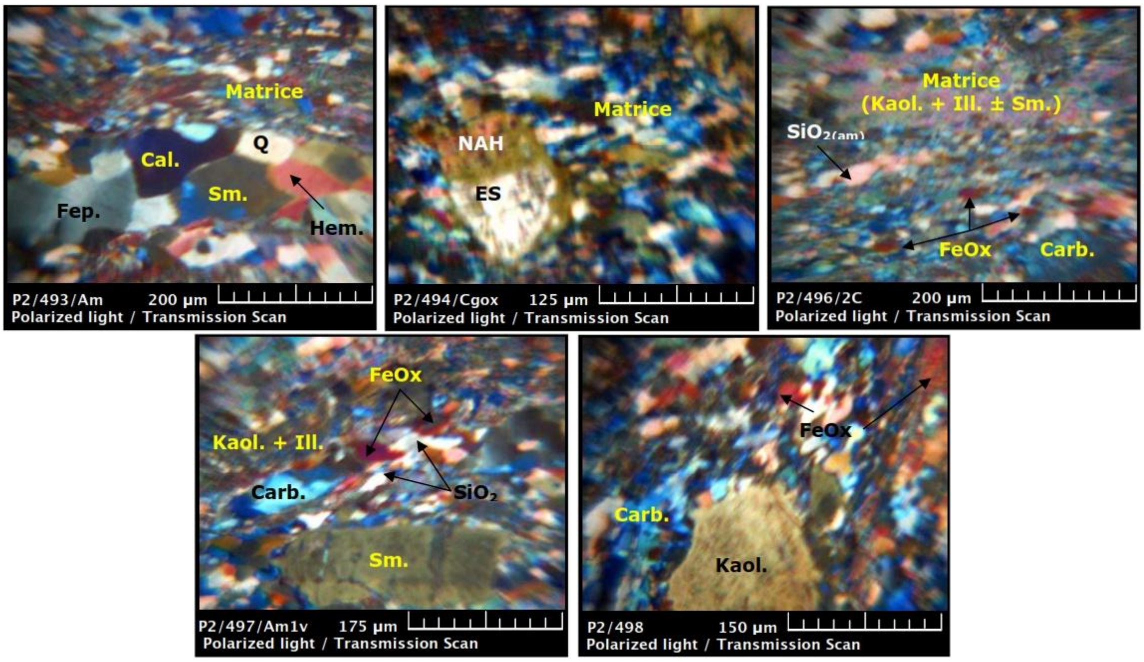


Figure VIII.4. Mineralogical composition for P2 profile (urbic technosol)

Clay minerals from our soils are represented by crystalline fraction represented in the profiles studied by montmotillonite and beidelite, smectits, illites and illites with hidromica, kaolinite, halloysite and dikit and amorphous represented by glauconite and vermiculite. Of the soil predominates smectites, followed by illite.Clay minerals content remain constant on profile and horizons tend to accumulate in fine textured, its variation is generally different from one horizon to another.

For our studied soil profiles predominates the crystal forms of carbonates are represented by calcite, dolomite, rhodochrosite, siderite, ankerite and amorphous forms of basic carbonates, in which Ca is substituted in variable proportions of Mg and Fe. In general, their content increase on profile and it tends to accumulate in the lower horizons.

For our studied soil profiles predominates the crystalline forms of iron oxides and oxidroxide are represented by hematite and magnetite and their amorphous hematite, goethite and limonite.

The predominant crystalline silica fraction is represented by allogeneic quartz and opal amorphous silicate and aluminosilicate and gels.

Heavy minerals are found in the form of apatite, biotite, chlorite, epidote, garnet, hipersten, ilmenite, magnetite, pyroxene, rutile, zircon etc.

VIII.8. Microelements

In our studied technosols the discussed microelements were fixed and mobile contents of Cr (Cr (III), Cr (VI)), Ni, Cu, Zn, Cd and Pb. The variation of trace elements was done in relation to their normal concentration in soils and alert and intervention thresholds for sensitive soils.

The total content of Cr (T) ranges from 27.95 to 73.15 mg / kg ,. In relation to the reference values for normal soils, the total is exceeded in most horizons but no results does not exceed the alert. The concentrations of Cr (III) and Cr (VI) tends to decrease profile, the reference threshold for normal soils but not the alert. Regarding mobile forms of chromium, which are present in a low concentration.

The total content of Ni (T) varies between 13.88 - 41.37 mg / kg. In relation to the reference values for normal soils, the total is exceeded in most situations but not when the alert threshold. The contents of mobile forms of Ni represents around 50% of the total but not a toxic hazard.

The total content of Cu(T) ranges between 18,33 - 64.29 mg / kg. Compared to baseline content for normal soils, Cu content is outdated, but the alert threshold is unattainable. With mobile content limit is 8.20 to 35.57 mg / kg and is constantly P2 profile but tend to accumulate in the lower horizons of the profile P3.

The total content of Zn (T) ranges from 89.42 - 155.39 mg / kg. In relation to the reference values for normal soils, the total is exceeded in most situations but not when the alert threshold. The contents of mobile forms of Zn within the range from 58.19 to 93.37 mg / kg and not exceed the alert thresholds.

The total content of Cd (T) ranges from 0.85 to 2.77 mg / kg, unsystematic and different from one profile to another. In relation to the reference values for normal soils, the total is exceeded in most situations but not when the alert threshold. The content of mobile forms are within the limits of 0.45 - 2.18 mg / kg and show the same trend of change in the overall shape.

The total content of Pb (T) ranges from 15.92 mg / kg, unsystematic and different from one profile to another. In relation to the reference values for normal soils, the total is exceeded in most situations but not when the alert threshold. The content of mobile forms are within the limits 3.75 - 13.95 mg / kg and show the same trend of change in the overall shape. To the municipality of Iasi, mean falling microelements discussed as follows: (i) Cd - range 0-15 mg / kg, (ii) Cr - 591.6 mg / kg, (iii) - range from 11 6 - 702.6 mg / kg (iv) Ni - between 13.5 - 349.6 mg / kg, (v) Zn - between 10.1 - 56.24 mg / kg, (vi) lead - range 4.5 - 1995.4 mg / kg. [*O.G. Iancu şi N. Buzgar, 2008*] As we have seen, total content of microelements discussed not exceed the alert thresholds for sensitive soils and falls within the normal area of Iasi.

CONCLUSIONS

In general, for our studied soil profile,s the variations and correlations with grain size fractions, chemical and mineralogical composition, nature and content of artifacts etc., for porosity, bulk density and absolute density are similar. However, physical parameters (as well as the physical and mechanical) does not always provide clear information about the processes and reproducible pedogenetical and the overall evolution of urban soils. Therefore these parameters cannot be used as such (singular) in the diagnosis and taxonomic classification of urban soils, but these are specific criteria for estimating the quality of these soils.

Soil texture is varies rather widely, from coarse textures (UG) to medium textures (SS, SG, LL and LP) and textures (TT and TP). This indicates a relatively high textural heterogeneity of soils in the urban area of Iasi, heterogeneity observed both from the soil profile to another and from one horizon to another within the soil profile. Coarse textures are correlated with relatively high contents of artifacts and skeletal, especially with a high degree of human soil horizons.

The sand in the soils studied from at least three sources: (i) mechanical additions required by prior use and / or current soil; (ii) sand resulting from the degradation and alteration processes physico-chemical soil skeleton and artifacts; (iii) possible and sand "quasi-pedogenetical" of existing soils subject to human intervention processes.

Variations of dust on profile indicates a tendency to accumulate preferentially at a given horizon (or a certain depth), and the ratio of fine dust and dust coarse vary unsystematically on profile without setting a definite link with the type and content of artifacts, content skeleton and mineralogical-petrographic composition thereof.

Clay from the 12 studied soils has several origins: human actions subject to existing soils; introduced by amending existing anthropogenic soils; urban soils formed under parental studied their materials and materials existing soil or clay deposit placed anthropogenic wind.

In profile there is a lowering of the content of the skeleton and artefacts, and an accumulation to the strong anthropic horizons, but this is no general rule.

The skeleton of our studied soils has several different sources depending on how much the profile is influenced by anthropogenic changes, chemical-mineralogical composition of the skeleton is strongly contrasting urban soils in land in the area outside the city.

The artifacts are represented by building materials, wood fragments, glass and ceramics, pieces of metal, plastic or textile or other materials such as slag, ash, bitumen etc. The strong pedogeochemical anisotropy and segregation is caused by artifacts including compaction in soil horizons, whom generates a number of private developments pedogenetical processes and physicochemical traits. Degradation and alteration of artifacts-releases a number of potentially toxic chemicals that can build up in soil mass and can disrupt the chemical-mineralogical balance.

The magnetic susceptibility decreases on profile, the overall trend is disturbed only where the horizons are disturbed.

The reaction of our studied soils is weak alkaline to moderately alkaline and strongly alkaline in anthropic horizons. In profile there is an increasing trend in total salt content and their tendency to accumulate in the middle and lower horizons. Soils are desalted except the buried horizons. Regarding the contents of nitrogen, phosphorus and potassium content the studied technosols have relatively small content of nitrogen but high content of phosphorus and potassium. The organic matter is represented by small and very small content. Trace elements are in limits.

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